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"THE DETERMINANTS OF NON-PERFORMING LOANS' EVOLUTION IN THE EUROPEAN BANKING SYSTEM: THE ROLE OF CORPORATE GOVERNANCE"

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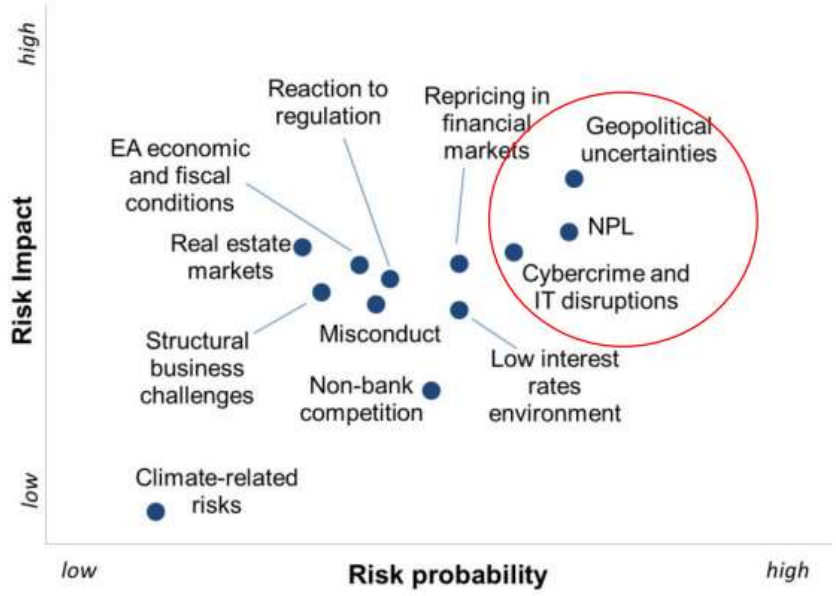
INTRODUCTION

The purpose of the present research is to investigate the empirical determinants of the non-performing loans' evolution in the European banking system.

The main aim of this introduction is to justify the production of additional research on a topic that has been in the limelight since the end of the last century. The stock of non-performing loans is still considered as a pan-European problem and a matter of great concern for the solidity of the individual banks, hence justifying further research projects aimed at assessing their determinants. If on the one hand the proactive behaviour of the financial industry over the last years led the magnitude and severity of the problem to diminish significantly in the majority of the European countries, on the other hand, the European regulator still assigns to the NPLs issue a central relevance. As a matter of fact, the SSM Risk Map[1] highlights *NPLs*, *geopolitical uncertainties* and *cycbercrime* as the top three risks considering both their probability and impact.

Figure 0: Key risks for SSM banks for 2019. SSM Supervisory Review and Evaluation Process (SREP) – Methodology Booklet. European Central Bank (2018)



This concern is mostly explained by the acknowledgment that the aggregate level of NPLs within the European industry remains elevated by international standards. Moreover, ongoing search for yield, along with still subdued profitability, might result in an excessive risk taking and consequently in future non-performing loans.

[1] SSM Supervisory Review and Evaluation Process (SREP) – Methodology Booklet. European Central Bank (2018).

The present work is organized as follows.

Chapter 1 provides a detailed description of the European perimeter of definitions concerning non-performing and forborne exposures. Innovations introduced by the new accounting standard (IFRS 9) are also taken into consideration. The descriptive part of the chapter is then enriched by the contextualization of the variable of interest within the European environment. The reader will be indeed provided with a trustworthy picture of the current situation in Europe in order to set a levelled playfield for the right comprehension of the size of the problem. Building on the information collected by the Risk Assessment Questionnaires (RAQs), we will finally identify the most relevant impediments to a complete resolution of the non-performing loans problem.

Chapter 2 discusses the most common practices employed by financial institutions in the management of non-performing exposures both from a theoretical and practical point of view. The dissertation is also enriched with the updated EBA Guidelines (2019) in the field of NPL management and linked to Chapter 1 as the most relevant perspectives to solve the bad loans problem are presented. In particular, paragraph 2.4 focuses on the projects of a united European secondary market for NPLs and of a pan-European bad bank.

Chapter 3 constitutes a broad literature review on the empirical determinants of non-performing loans. Macroeconomic, banking-specific and corporate governance determinants have been considered.

Chapter 4 presents in detail the empirical analysis performed. Since its early stages, this research project has been conceived with the strong ambition to highlight common patterns at a European level, rather than at a country-specific level. It is opinion of the author that the increasing convergence of the European regulatory and supervisory framework evidenced by Chapter 1 opens significant research possibilities to investigate banking-related issues on a European level. We decided to investigate the empirical effects of a set of corporate governance variables on the magnitude of the non-performing loans held. The focus on the role of corporate governance on the ability to manage exposures is precisely the main contribution of our work to the academic community.

CHAPTER 1 – OVERVIEW OF NON PERFORMING LOANS

1.1 Definitions and classifications

In the aftermath of both 2007 financial crisis and the most recent sovereign debt crisis, banks have witnessed a dramatic reduction of their assets' quality, caused by the increased share of debtors unable to meet their obligations when they came due.

Building on the horizon of a banking union, the lack of comparable and sound data on both forbearance transactions and exposures qualified as non-performing could have been an obstacle to the objective assessment of banks assets' quality. For this reason, and in the view of the Asset Quality Review[2] (AQR) exercise, the European Banking Authority (EBA) released its *final Implementing Technical Standards*[3] (ITS) on supervisory reporting of *Non-Performing Exposures* and *Forbearance* enclosing the harmonized definitions of forbearance (FBE) and non-performing exposures (NPEs). This normative intervention became necessary given the acknowledgment of two main problems:

- the recurring use of forbearance measures with the purpose of postponing loss recognition, thus covering up assets' quality deterioration;
- the lack of consistency among the assets' quality assessments across Europe, in particular with respect to the threshold employed by different jurisdictions in order to distinguish between *performing* and *non-performing* categories.

The harmonization of the definitions scheme on a European level is, together with the Council Action Plan (2017), the cornerstone that allowed European countries to address the problem of assets' quality deterioration in a decisive and effective way.

The proposed definitions for forbearance and non-performing exposures rely on the existing concepts of impairment and default in accordance to both International Financial Reporting Standards (IFRS) and Regulation (EU) 575/2013 (CRR[4]). EBA decided to avoid a rough replacement of those concepts in the national jurisdictions, following instead a more accommodating path. The harmonized definitions have been drafted after considering the *mappings* across international accounting standards and national common practices. These

[2] Together with the stress testing exercise, the asset quality review composes the second pillar of the assessment performed by the European Central Bank on the banks it supervises directly. These comprehensive assessments help to ensure that banks are adequately capitalised and can withstand macroeconomic and financial shocks.
[3] Published on 21st October 2013
[4] Capital Requirements Regulation – 2013.

mappings aimed at assessing to what extent it could have been possible to rely on already existing or similar concepts for the definition of forbearance and non-performing exposures. At the same time, the consideration of the *mappings* ensured consistency with the definitions and common practices already employed in Europe. This exercise revealed a twofold truth: the heterogeneity among the national definitions of forbearance and non-performing exposures and the common practice of having these concepts strongly linked to the notion of impaired and/or defaulted exposures. The latter statement, well describes the reasons why it has been decided to use the notions of impairment and default as building blocks in the definition of forbearance and non-performing exposures at a European harmonized level. As a result, the aforementioned definitions constitute *umbrella concepts,* meaning that they cover some of the existing credit risk-related concepts, without replacing them, allowing for a broader scope. Consequently, all impaired and defaulted exposures in accordance to IFRS and CRR will be necessarily NPEs[5], but NPEs can also encompass exposures that are not recognized as impaired or defaulted as defined by the aforementioned normative frameworks. A fitting example of this situation is the Italian environment, where categorizations of non-performing exposures inherited from the past are still used in parallel with the harmonized European categorizations.

It has to be highlighted that, within the scope of the regulation, "exposures" includes all debt instruments (*loans and advances* and *debt securities*) and off-balance sheet exposures[6] but held for trading exposures. The difference is relevant since in the continuation of the thesis we will refer mostly to non-performing loans, considering then only a subset, even though the most relevant one, of the broader concept of non-performing exposures.

In the continuation of the paragraph, the reader will be provided with the technical definitions of both NPEs and forborne exposures. Particular attention will be devoted to present the *discontinuation criteria* for both concepts.

EBA's Technical Standard defines non-performing exposures as: "those that satisfy either or both the following criteria:

a) material exposures which are more than 90 days past-due[7];

[5] Non-performing exposures

[6] Off-balance sheet exposures comprise the following revocable and irrevocable items: loan commitments given, financial guarantees given, and other commitments given.

[7] When any amount of principal, interest or fee has not been paid at the date it was due.

b) the debtor is assessed as unlikely to pay its credit obligations in full without realisation of collateral, regardless of the existence of any past-due amount or of the number of days past due."

As it is clear, the rationale of the definition is to determine the non-performance of an exposure in accordance with an objective days-past-due criterion, together with the assessment of the borrower's debt servicing capacity. EBA's ITS clarifies at paragraph 146 that the aforementioned definition shall apply despite the belonging of an exposure to the families of either defaulted exposures in accordance with Art. 178 of Regulation (EU) 575/2013 or impaired for accounting purposes. In categorizing non-performing exposures, the Technical Standard specifies how the entire amount must be considered, without taking into account the existence of any collateral. Furthermore, any exposure can be assessed as non-performing on an individual basis (*transaction approach*) or by considering the overall exposure towards a given debtor (*debtor approach*). The choice on which approach to follow is left to the discretion of the individual entity. However, the Technical Standard identifies the scenario[8] that requires a mandatory use of the *debtor approach*. EBA's ITS specifies at paragraph 155 that the mentioned scenario entails the consideration of the entirety of that debtor's on-balance sheet and off-balance sheet exposures as non-performing (*pulling effect*).

EBA furnished the NPE definition with a clear statement of the conditions, the achievement of which constitutes recovery from the non-performing status. According to the Technical Standard (par. 156), an exposure shall remain classified as non-performing until *all* the following three requirements are met in full:

a) the exposure meets the exit criteria applied by the reporting institution for the discontinuation of the impairment and default classification;
b) the situation of the debtor has improved to the extent that full repayment, according to the original or when applicable the modified conditions, is likely to be made;
c) the debtor does not have any amount past-due by more than 90 days.

Paragraph 157 states instead the discontinuation criteria to be met in full in order to allow a non-performing exposure on which forbearance measures was granted, to cease being non-performing:

a) the extension of forbearance does not lead to the recognition of impairment or default;

[8] In the case that the individual entity has on-balance sheet exposures toward a debtor that are past due by more than 90 days, the gross carrying amount of which is no less than 20% of the gross carrying amount of the entirety of all on-balance sheet exposures to the same debtor, the *debtor approach* becomes mandatory.

b) one year has passed since the forbearance measures were extended;
c) there is not, following the forbearance measures, any past-due amount or concern regarding the full repayment of the exposure according to the post-forbearance conditions. The absence of concerns has to be determined after an analysis of the debtor's financial situation. Concerns may be considered as no longer existing when the debtor has paid, via its regular payments in accordance with the post-forbearance conditions, a total equal to the amount that was previously past-due (if there were past-due amounts) or that has been written-off (if there were no past-due amounts) under the forbearance measures or when the debtor has otherwise demonstrated its ability to comply with the post-forbearance conditions.

In terms of forborne exposures, the harmonized definition identifies them as "debt contracts in respect of which forbearance measures have been extended". Forbearance measures consist of concessions towards a debtor facing or about to face difficulties in meeting its financial commitments (*"financial difficulties"*). Concessions may entail a loss for the lender and in particular they refer to either of the following actions (par.164):

a) a modification of the previous terms and conditions of a contract the debtor is considered unable to comply with due to its financial difficulties (*"troubled debt"*). Such modification is aimed at allowing a sufficient debt service ability and it has to be characterized by the fact that it would not have been granted had the debtor not been in financial difficulties;
b) a total or partial refinancing of a troubled debt contract, that would not have been granted had the debtor not been in financial difficulties.

At first glance, forbearance measures represent then changes to the terms of the original contract, granted by a bank to the customer, in order to address its objective condition of financial difficulty. In general terms, exposures are treated as forborne if a concession has been made, irrespective of whether any amount is past-due or of the classification of the exposures as impaired[9] or as defaulted[10]. It follows that there is the simultaneous existence of forborne exposures categorized either as performing or as non-performing depending on the achievement or not of the non-performing criteria cited above.

[9] In accordance with the applicable accounting standard (refer to IFRS)
[10] In accordance with Art. 178 of Regulation (EU) 575/2013

In parallel with the structure adopted in defining non-performing exposures, we now give evidence of the cases acknowledged by the Technical Standard to prove as events that cease the belonging to the forborne category (par. 176):

a) the contract is considered as performing, including if it has been reclassified from the non-performing category after an analysis of the financial condition of the debtor showed it no longer met the conditions to be considered as nonperforming;
b) a minimum 2 year probation period has passed from the date the forborne exposure was considered as performing;
c) regular payments of more than an insignificant aggregate amount of principal or interest have been made during at least half of the probation period;
d) none of the exposures to the debtor is more than 30 days past-due at the end of the probation period.

The forbearance classification of the exposure is discontinued when all the aforementioned conditions are met.

1.2 Current situation in Europe

In the scope of our empirical analysis, we deem of relevant importance the contextualization of the variable of interest within the European environment. In particular, the dissertation concerning banks' asset quality commenced in the previous paragraph, is now provided with concrete substance by the consideration of the utmost proxy for asset quality: *NPL ratio*. NPL ratio is hereinafter defined as the ratio between the stock of non-performing loans held by a bank and the total gross loan amount granted by the same bank in the same fiscal year. The ratio is usually expressed in percentage terms.

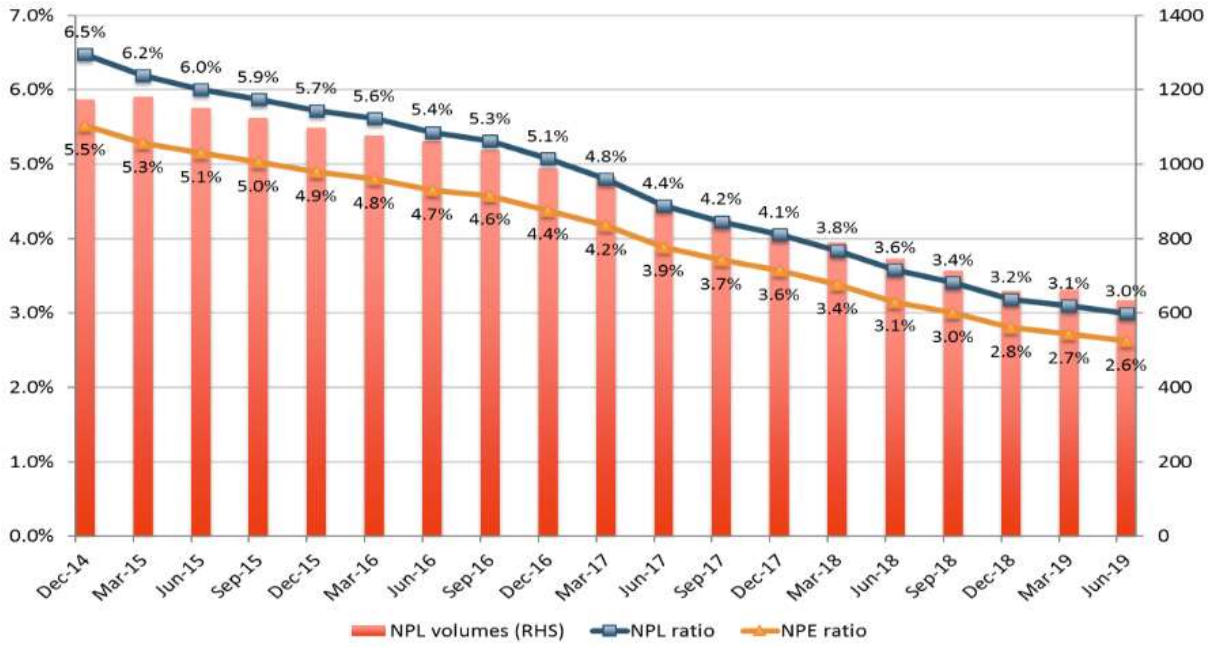
The following paragraph, mostly drawing from *EBA Report on NPLs (2019)*, will provide the reader with the most updated data on *non-performing loans ratios*, *coverage ratios* and *forbearance ratios*, proposed at different levels of aggregation.

In the attempt of depicting a trustworthy image of the current situation in Europe and of its recent past, the present section displays data regarding the four years between June 2015 and June 2019. Such a time-window is of particular interest since it follows the introduction by EBA of a harmonised definition of NPLs across European countries in 2014. It also includes the publication by the European Council of the comprehensive action plan to tackle NPLs dating back to July 2017.

The figures included in the subsequent paragraphs are based on a balanced sample of approximately 150 banks, coherent with the EBA risk dashboard, covering no less than 80% of the EEA[11] banking sector by total assets.

General trend in non-performing loans: The asset quality of banks in the Euro-Area as defined by the NPL ratio has significantly improved over the time-period hereby considered. As a matter of fact, the industry's NPL ratio weighted average currently lines up to 3,0%, down from the maximum of 6,5% in December 2014. The down-warding trend has been persistent through the years. Nevertheless, the pace of such a reduction has been slowing down in the recent years, signalling the difficulty of addressing those *legacy-non-performing-assets* that weight down banks' balance sheets. From an analytical point of view, the trend is mostly driven by the reduction in NPL volumes rather than by an increase of total loans (denominator). Figure 1.1 highlights how, on an aggregate basis, the numerator has halved over the four years considered: from EUR 1152 billion in June 2015 to EUR 636 billion in June 2019. On the other hand, loans volume increased by more or less 10% over the same time-period.

Figure 1.1: Quarterly trend in NPL and NPE ratios (%) and NPL volumes (EUR billion) — December 2014 to June 2019. Final EBA Report on NPLs (2019).

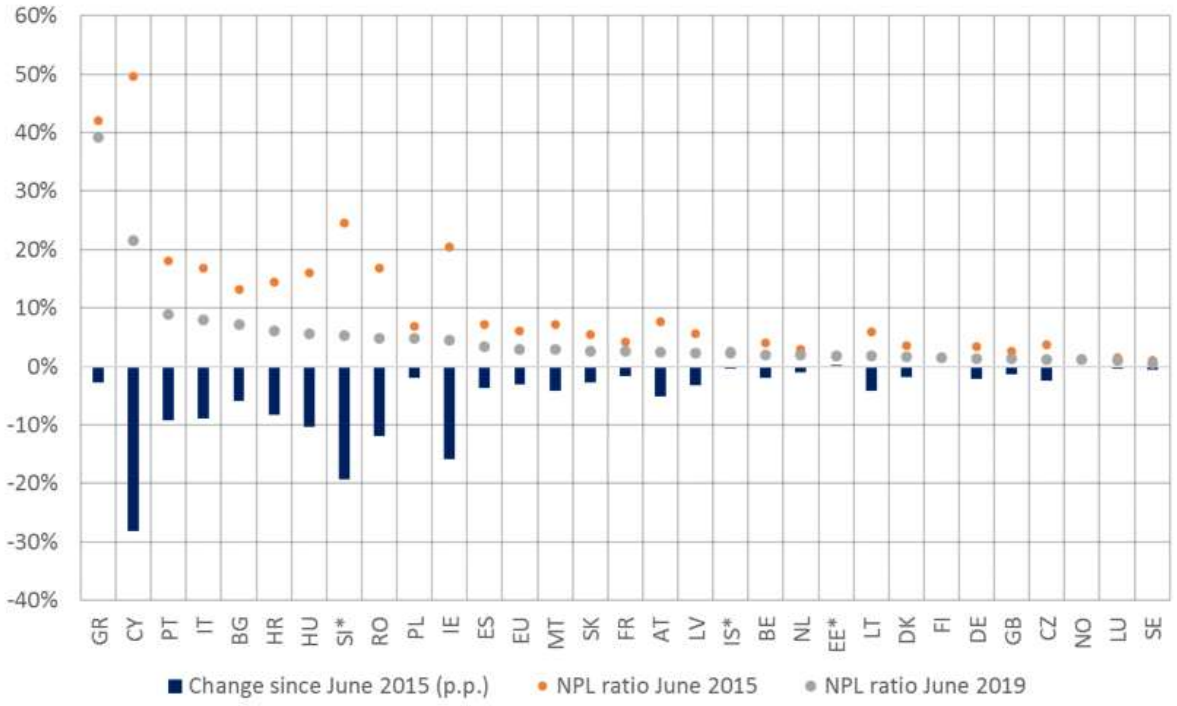


By investigating the ratios at a country-level we are able to spot those countries in which the developments have been more significant. Not surprisingly, banks in countries with high NPL ratios at the beginning of the period generally reported the biggest improvements. Those banks'

[11] European Economic Area

results are then the main drivers of the decrease at the aggregate European level. In the following graph (Figure 1.2) are displayed the NPL ratios at June 2015 and June 2019 at a member state level, allowing us to draw the attention on those countries that succeeded the most in reducing domestic volumes of NPLs. In particular, among the large economies, Italian and Spanish banks achieved a reduction of 9% and 3,5%, respectively. Still considering relative terms, even more significant results have been achieved by smaller economies such as Cyprus and Slovenia: here banks reported a reduction in NPL ratio close to 30% and 20%, respectively. Data on Greek banks may look odd at first sight; nevertheless the explanation of such a low change has to be found in the fact that NPL ratio of Greece peaked in September 2016, thus almost a year after the other European economies. Taking into consideration the peak of 47,1% (Sept.2016), Greek banks achieved a decrease on NPL ratio of 7,7%, a result comparable to the Italian environment.

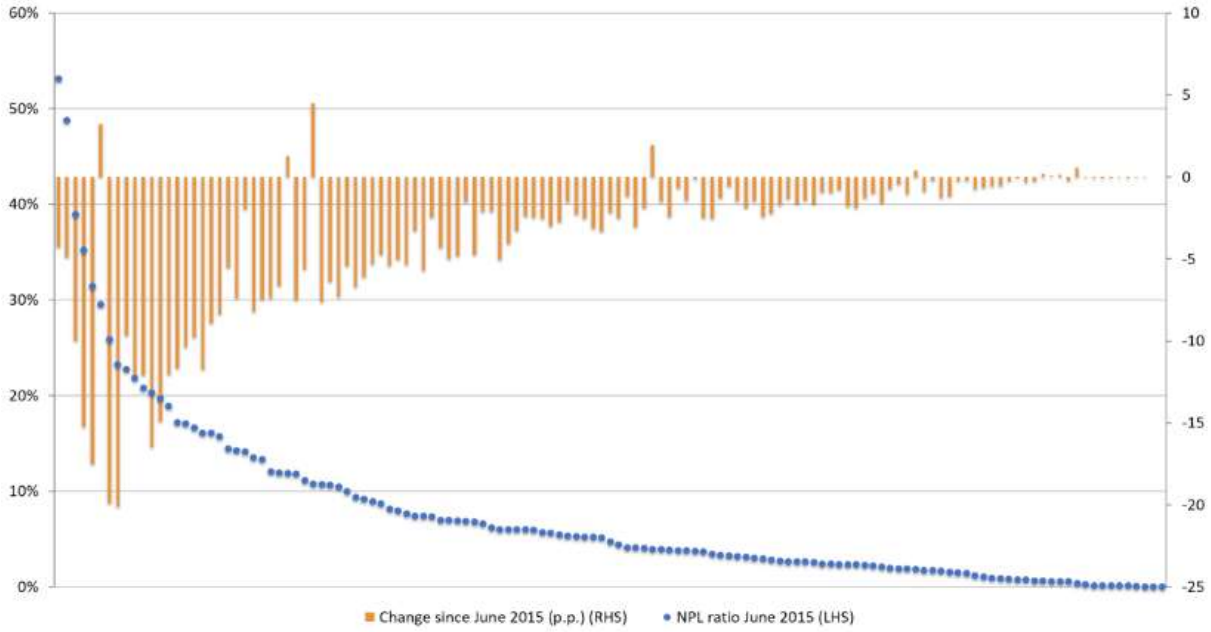
Figure 1.2: NPL ratios by country in June 2015 and June 2019 (%) and p.p. change between June 2015 and June 2019. Final EBA Report on NPLs (2019).



Data available at the most granular level are those at individual banks level. The evidences so far mentioned are confirmed also at this level of granularity. Specifically: a steady and generalized reduction of the ratios over the years, mostly driven by banks that reported NPL ratios higher than average in the years immediately following the Great Recession and the sovereign debt crisis (Figure 1.3). These actors indeed managed to outperform their peers

characterized by less-stressed balance sheets, achieving an average decrease of 8,7% versus the average 3,9% of the full sample.

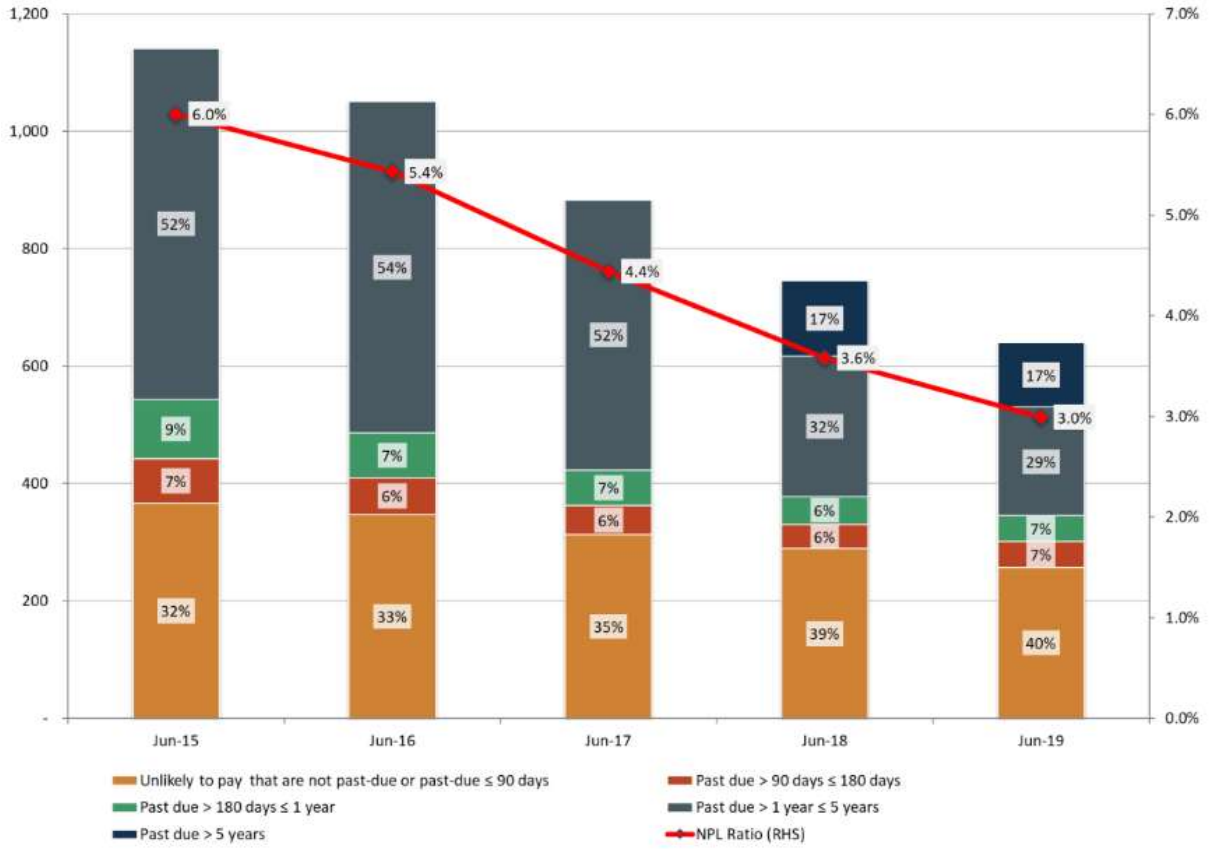
Figure 1.3: NPL ratio (%) by bank in June 2015 and the change between June 2015 and June 2019 (p.p.). Final EBA Report on NPLs (2019).



Non-performing loans by past-due category: In order to enrich the description of the European environment, it can be useful to consider the segmentation of non-performing loans by past-due category. Such a perspective provides to be crucial since there is evidence that older NPLs may be harder to cure and suffer of a significant depreciation. Countries with high NPL ratios have generally higher shares in past-due buckets of 1 year and more. Consequently, such exposures are of particular concern both for banks and for the regulator, and are then the ones on which most attention has been given during recent years. Such concern and attention allowed the bucket of past-due of more than 1 year to reduce, in relative terms, from 52% in 2015 to 29% in 2019. Such a reduction implicitly caused UTP[12] bucket to increase in relative terms from 32% to 40% while reducing in absolute terms.

[12] Unlikely to Pay: less than 90 days past due

Figure 1.4: NPL volumes (EUR billion) by past due category and yearly trend of EU NPL ratio (%) — June 2015 to June 2019. Final EBA Report on NPLs (2019).



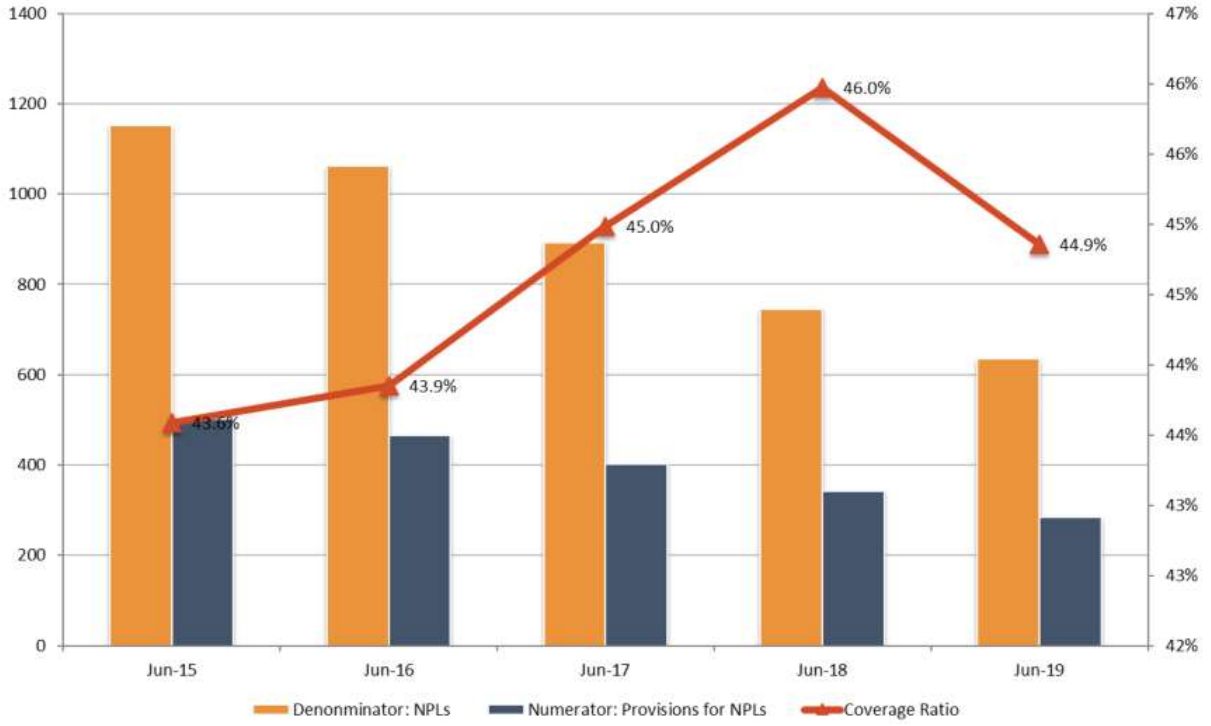
Non-performing loans by type of exposure: A further relevant point of view, useful to disentangle the evolution of NPLs in Europe, is to consider the types of exposure. As of June 2019, NPLs to non financial corporations (NFCs) stood at EUR 364 billion, down from EUR 705 billion in June 2015. A more flat reduction characterized the evolution of NPLs to households that indeed decreased from the EUR 396 billion of 2015 to the EUR 250 billion of 2019. A more granular description of the two aggregates goes beyond the scope of this work, still we would like to underline how once again the steepest reduction (NFCs) has been driven by the most distressed sectors: in this case the small and medium enterprises (SMEs) of high NPL countries.

The analysis of the data at the type of exposure level allows us to better understand the drivers of the coverage ratios of non-performing loans.

Coverage of non-performing loans: The coverage ratio can be roughly defined as the ratio between the provisions for NPLs put aside by the bank and the NPLs themselves. The banking-industry average coverage ratio of NPLs reported as of June 2019 was 44,9%, achieving an increase of 1,3% since 2015. This trend is driven by a faster decline in NPLs than in provisions:

both components have been following a down-warding trend, but at different paces. The coverage ratio peaked in June 2018 at 46% and then inverted the trend due to a significant fall in provisions that overcame the aforementioned steady reduction in NPLs. A set of reasons can be called on in order to justify the evidenced decrease in provisioning: first of all, we may recall the lower cost of owning risk allowed by the dynamics of economic recovery, secondly the general phenomenon of de-risking banks' balance sheets definitely played a role.

Figure 1.5: Trends in EU coverage ratio (%), numerator and denominator (EUR billion) — June 2015 to June 2019. Final EBA Report on NPLs (2019).



We shall now clarify that the coverage ratios data presented so far are intended to be averages on a European level. For sake of completeness, we shall mention that, beyond these averages, there is quite a significant dispersion on a country level, ranging from 26% for banks in Malta, Finland, Netherlands and Ireland, to 66% for banks in Hungary and Romania. The differences across countries in coverage ratios can be mainly explained by different exposures towards specific segments: for example, NPLs to large corporates attract a higher level of provisioning as compared to mortgages, since the latters have usually higher collateral. From here, we understand the usefulness of investigating non-performing loans also from an exposure-type point of view.

The magnitude of provisioning has direct consequences on distressed loan portfolios: banks that consistently apply appropriate provisioning policies from a quantitative, qualitative and

timing perspective are in a better position to manage NPLs. Given the centrality of this dimension in the management of asset portfolios, various European authorities, including the ECB and the Commission, have applied provisioning expectations and policies to enhance prudential treatment.

Forbearance. A last mention has to be made regarding those exposures characterized by forbearance measures. In Europe, contrary to the Anglo-Saxon environment, there is evidence of a banks' preference towards *loan restructuring* rather than towards *loan refinancing*. On aggregate EU level, 75% of the loans with forbearance measures used modification of terms and conditions, whereas only 25% were refinanced.

Forbearance ratios of the EU banking sector have been decreasing constantly since June 2015. The average forbearance loan ratio[13] (FBL) of the sector, as June 2019, stood at 1,9%, down from 3,7% in June 2015. The same trend also holds true for the forbearance exposure ratio[14] (FBE), which has reduced from 3,2% to 1,7% over the past four years. Besides the aggregated view, the aforementioned general trend is also confirmed on an individual-bank level: as a matter of fact, only 13 banks out of 150 have increased their FBL ratio within the time window considered.

If we consider performing FBLs as more vulnerable assets than performing loans, we might build up a more conservative index for distressed loan portfolios combining performing FBLs and NPLs ratios. The resulting index over-estimates the riskiness of loan exposures, a feature that may be useful in those contexts where under-estimation of risks is common practice. The EBA Report claims that the magnitude of such index stood at 3,7% in June 2019 (compared to 3% of "plain NPL ratio"), down from the maximum of 8,1% in December 2014.

1.3 Impact of IFRS 9

Beyond normative definitions, a crucial role in the framework of non-performing and forborne exposures is performed by the accounting standard regulating the treatment of such captions in the banking books. The rationale of the present paragraph is to provide the reader with an updated review of the accounting standard the banks have to comply with since January 1st, 2018: IFRS 9. The attention of the reader will be driven through the reasons that made a new

[13] FBL ratio is calculated as loans with forbearance measures (including both non-performing and performing) for loans and advances, over total gross loans and advances.
[14] Forbearance exposure include both loans and debt securities with forborne measures.

standard needed, the differences with respect to the past and the effects that such standard has on recognition and evaluation of impaired assets by European banks.

During the financial crisis, the late recognition of credit losses related to loans and other financial instruments, together with the high degree of subjectivity allowed regarding the identification of financial instruments at fair value, was identified as one of the major weaknesses in the existing accounting standard (IAS 39). The timing of the loss recognition had become a significant issue because the model describing such procedure under IAS 39 was an *incurred loss model*, i.e., a model that do not recognizes credit losses until a credit loss event occurs.

Building on the failure of IAS 39 in preventing the effects of the crisis to jeopardize banks' solidity, the International Accounting Standards Board (IASB) issued the final version of IFRS 9. The biggest development brought by the new standard is the employment of an *expected loss model*: a model aimed at a timely recognition of expected losses on credits, associated with a more useful and transparent disclosure of them. In other words, the difference between IFRS 9 and IAS 39 impairment requirements is the removal of the *incurred loss event* as threshold for the recognition of credit losses, i.e. it is no longer necessary for a credit event to have occurred before credit losses are recognised. On the contrary, banks shall account for expected credit losses on a financial asset since its initial recognition. Moreover, they retain the responsibility of adjusting, at each reporting date, the loss allowances amount in the event of changes in expected credit losses. These checks has to be made with the purpose of reflecting potential changes in credit risk, starting from the initial recognition of the asset. The standard envisages three different ways to quantify the amounts to set aside as a loss allowances or as provisions: the General Approach, the Simplified Approach[15] and the credit-adjusted EIR approach[16].

The guiding principle of the expected credit loss model as cornerstone of IFRS 9 impairment model, is to follow the general pattern of deterioration *(or improvement)* in the credit quality of financial instruments. The expected credit loss (ECL) is formally defined as the weighted average of the credit losses that the bank recognizes on the financial asset following the default event[17]. Credit losses are consequently defined as the present value of expected cash shortfalls. In particular, from an analytical point of view, the present value of expected cash shortfalls is

[15] Such an approach is either required or available as a policy choice for trade receivables, contract assets and lease receivables.

[16] Such an approach is used for purchased or originated credit-impaired financial assets.

[17] It has to be underlined how the Standard does not contain any definition of default, it simply specifies that the default definition has to be consistent with that used for internal credit risk management purposes. Nevertheless the standard provides the 90 days past due threshold as a rebuttable presumption of default event.

computed as the difference between the cash flows that are due in accordance with the contract, and the cash flows expected to be received, discounted at the original effective interest rate (EIR).

The amount of ECLs recognised as a loss allowance or provision depends to the extent of credit deterioration since initial recognition. IFRS 9 impairment model provides indeed the categorization of the financial assets into 3 stages *(staging allocation)* on the basis of their credit quality deterioration. The impairment model, in its General Approach, requires financial entities to account for credit losses over a time horizon of 12 months for financial assets that have not increased significantly the credit risk since the initial recognition (Stage 1). On the other hand, the time horizon is extended to the maturity of the financial asset if it has experienced a significant increase in credit risk since initial recognition (Stage 2) or if it results impaired (Stage 3). Stages 2 and 3 differ in how interest revenue is recognised. Indeed, after the staging allocation and the consideration of the appropriate time window in which to consider ECLs, the bank computes the interest revenues for each exposure. On the one hand, both Stage 1 and Stage 2 exposures consider effective interest rate on the gross carrying amount of the asset (i.e. gross of impairment deductions). On the other hand, allocations to Stage 3 prescribe a more conservative computation of interest revenues, thus considering effective interest rate on the net carrying amount (i.e. net of impairment deductions, amortised cost) only.

It falls within each entity's individual responsibility the assessment, at each reporting date, of whether the credit risk on a financial instrument has increased significantly since initial recognition. The migration from Stage 1 to Stage 2 is generally triggered at the occurrence of an increase, assessed through a relative criterion, of the default probability (PD) in relation to the one assessed at initial recognition. The Regulator also identified 3 backstop indicators that automatically entail the occurred increase in default probability and thus the migration of the exposure from Stage 1 to Stage 2. Such backstop indicators are: *payments 30 days past due*, *grant of forbearance measures*, *transferral of the exposure to a watchlist*. With regards to the migration from Stage 2 to Stage 3, the exposure had to have suffered an objective evidence of impairment. Appendix A of IFRS 9 provides a complete list of those indicators the occurrence of which constitutes objective evidence of impairment. Among these indicators we report the most recurrent ones being: a *significant financial difficulty of the issuer or of the borrower* and a *breach of the debt contract*.

The Standard also specifies that the measurement of expected credit losses must be the reflection of 3 main factors:

- an unbiased and probability-weighted amount that is determined considering at least two scenarios reflecting the possibility that a credit loss occurs (default) and that no credit loss occurs (no default);
- the time value of money, identified by the Standard as the effective interest rate (EIR) determined at initial recognition;
- reasonable and supportable information reflecting past events, current conditions and forecasts of future economic conditions.

The ECL model, as conceived by IFRS 9, is thus based on 3 parameters of risk: *marginal probability of default*[18] *(MPD)*, *loss given default*[19] *(LGD)* and *exposure at default*[20] *(EAD)*. Such parameters shall adjust to include forward looking information and macroeconomic scenarios as prescribed by the third point above.

For those exposures for which a 12-months expected credit loss assessment is required, the model applied is the following:

$$ECL_1 = MPD_1 * LGD_1 * \frac{EAD_1}{(1 + EIR)^1} \qquad (1)$$

For those exposures for which a lifetime assessment of expected credit losses is required, the model applied is the following:

$$LECL = \sum_{t=1}^{T} MPD_t * LGD_t * \frac{EAD_t}{(1 + EIR)^t} \qquad (2)$$

The definition of Stage 3 exposure, while resembling the IAS 39 definition of impaired, still does not overlie with the EBA's criterion of 90 days past due identifying a non-performing exposure. Within the purposes of the present work is thus important to underline how the 90 days past due criterion that defines an exposure as non-performing *prima facie*, does not necessarily mean Stage 3 classification.

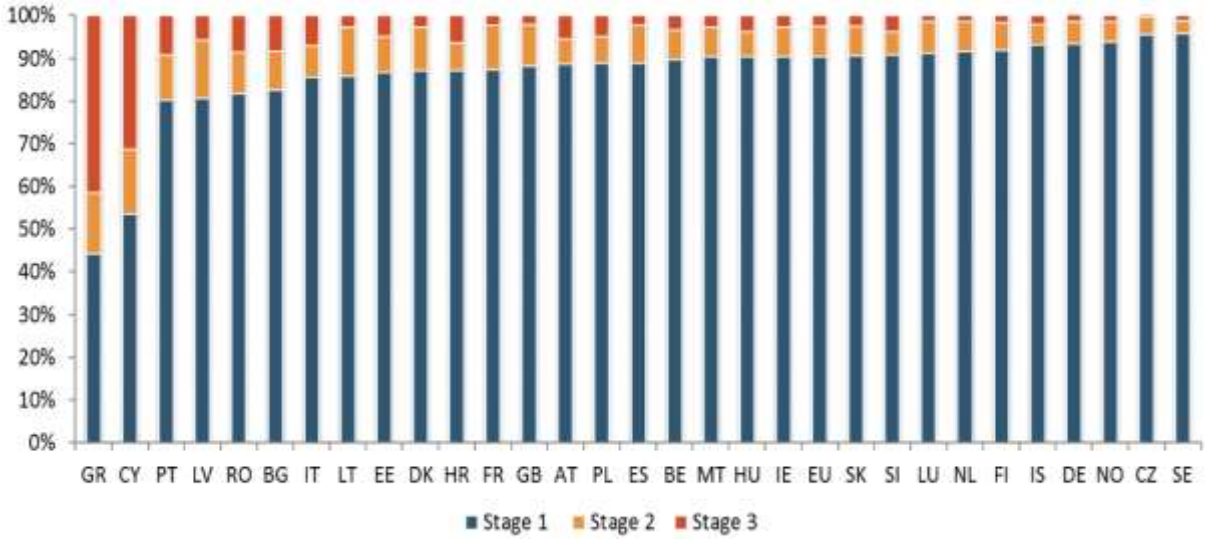
Drawing again from *final EBA Report on NPLs (2019)* we are able to give evidence of the current European NPLs situation considering staging allocation. As of June 2019, European banks allocated on average 90,4% of the loans and advances recorded at amortised cost in Stage 1, 7% in Stage 2 and 2,6% in Stage 3[21]. These allocations compare favourably with the only

[18] The marginal probability of default (MPD) is defined as the probability of the occurrence of a default event of the credit risk exposure at time t.
[19] The loss given default (LGD) is defined as the percentage of estimated loss at time t.
[20] The exposure at default (EAD) is defined as the measure of the exposure at the time of the default event of the credit exposure at time t.
[21] Final EBA Report on NPLs (2019).

other observation available[22]: back in June 2018 the proportions were 88,2%, 7,7% and 4%, respectively, with a significant unload of both Stage 2 and Stage 3 exposures.

We evidence the highest shares of loans and advances allocated to Stage 3 in Greece (41%) and Cyprus (31%). On the contrary, Czechia and Sweden were characterized by the highest share of exposures allocated to Stage 1 (more than 95%), followed by Norway and Germany. From a dynamic perspective, over the last 12 months, only 2 countries (Estonia and Luxemburg), reported an increase in the share of their Stage 3 loans and advances, thus confirming the consistent reduction of bad loans stock already evidenced in the previous paragraphs.

Figure 1.6: Distribution (%) of loans and advances recognised at amortised cost among stages 1, 2 and 3, by country — June 2019. Final EBA Report on NPLs (2019).



Data at a bank level show that as of June 2019, roughly 50% of the banks allocated a share of at least 10% of their assets either in Stage 2 or Stage 3, signalling a more or less severity of deterioration. The 10% share hides possible vulnerabilities in the asset quality of some banks' balance sheets.

In terms of coverage ratios computed on IFRS 9 – like exposures, the EU banking industry average in June 2019 stood at 46,3% for Stage 3, 3,5% for Stage 2, 0,2% for Stage 1. Coverage ratios slightly decreased in the 12-month time window regarding Stage 1, while remaining constant for Stage 2 and for Stage 3. Similarly to what pointed out for the coverage of NPLs, the coverage of Stage 3 assets shows a wide dispersion both on a country and on a bank specific

[22] Availability of data regarding "IFRS 9-like" exposures is very limited given its recent introduction (1st January, 2018).

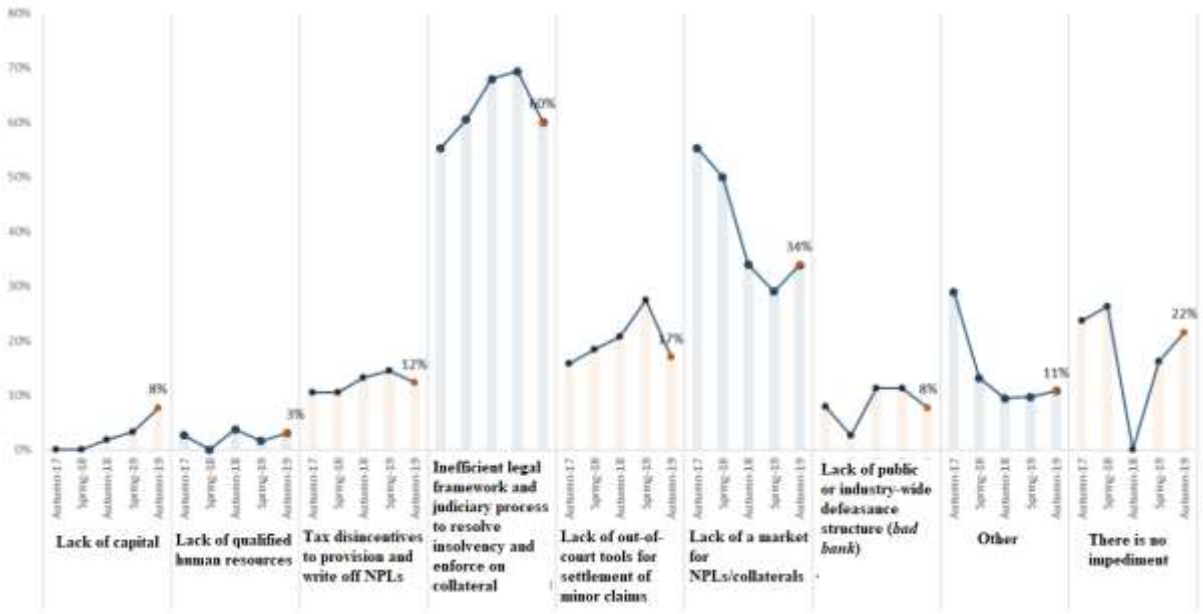
level, evidencing country-like and bank-like peculiarities in terms of foreclosures, collateralisation and provision policies, mostly.

1.4 Impediments to the resolution of the problem

The scenario outlined both in paragraphs 1.2 and 1.3 establishes a positive outlook for the future, achieved building mainly on the acknowledgment of the problem as a structural one and on the proactive behaviour of individual banks. Nevertheless, as evidenced in the previous paragraphs, the pace of reduction of NPLs has been slowing down in the most recent years and this has become a matter of great concern for the European banking system as a whole.

In order to address such a problem, the EBA included in its 2019 Report on NPLs, a dedicated section, reporting survey data gathered among European banks, collecting their views on the impediments to a further reduction of the problem. Data have been collected through the Risk Assessment Questionnaires[23] (RAQs).

Figure 1.7: Trend in impediments to resolving NPLs (%) — banks' RAQs, autumn 2019. Final EBA Report on NPLs (2019).



In autumn 2019, around 60% of the banks considered in the sample identified the lengthy and expensive judiciary process in cases of insolvency, together with collateral enforcement, as the

[23] The EBA conducts semi-annual Risk Assessment Questionnaires (RAQs) among banks and market analysts. Please note that results referring to 2019 considers 65 banks and 13 market analysts, an enlarged sample as compared to the previous ones: 53 banks in Autumn 2018 and 38 banks in previous editions. The 2019 sample is with no doubt better balanced among countries and it provides a more representative result across EEA, thanks to the inclusion of relatively smaller banks.

main impediment to resolve the NPLs issue on a deeper level. An important branch of literature studies such a relationship with Aiyar et al. (2015) being the seminal paper evidencing a strong negative relationship between NPLs and foreclosures. The lengthy of judiciary processes is, with no doubt, the biggest single obstacle, given the progressive resolution of the lack of a secondary market for NPLs. The perception of the latter as an issue has been decreasing significantly over the last 2 years. As a matter of fact, back in Autumn 2017, the lack of a secondary market for NPLs was addressed by banks to have the same relative incidence (approximately 55%) of an inefficient legal framework in slowing down the complete resolution of the NPLs problem. In Autumn 2019, only 34% of the banks reporting to RAQs address the lack of a secondary market as an impediment to a further development of the bad loans situation, such evidence witnesses the huge step forward that have been made in the development of markets for NPLs[24]. Of specific importance is the fact that banks from countries that have an NPL ratio below the EU average attach a higher relevance to the lack of a market for NPLs/collateral as compared to countries that have an NPL ratio above the EU average. This indicates that NPL investors focus on the regions with high NPL ratios rather than on "safer docks" in order to take advantage of lower valuations and increase returns. Corroborating the latter statement, the Italian market has been constantly the most active one over the last few years, as a report by Deloitte (2019)[25] confirms. The activity around the aggregate European loan portfolio stood at around EUR 100 billion per year from 2014 to 2016. Volumes traded increased significantly both in 2017 and 2018 reaching local maximums at EUR 153,3 billion and EUR 202,8 billion, respectively. The significant increase in loan portfolio activity has been driven by the Italian market mostly. Institutional investors has found in the Italian loan market their favourite floor to trade. Since 2014, Italy has been moving EUR 238,8 billion in loan portfolios, approximately the half of which only in the two years between 2017 and 2018. The second and third most active markets of the Old Continent are Spain (EUR 168,6 billion) and UK (EUR 129,2 billion), respectively. Italian market is characterized by a huge pressure on the sell side of deteriorated loan portfolios, thus confirming the intuition of the interest of institutional investors on countries with higher-than-average NPL ratios. This idea is corroborated by the ranks of the top sellers and top buyers since 2014 drafted by Deloitte (2019). On the sell side we highlight the presence of three Italian banks within the first 6 sellers: Unicredit with EUR 37,8 billion dismissed, Banca MPS with EUR 35,1 billion and Intesa SanPaolo with EUR 28,2 billion. On the other hand, the Italian presence on the buy side is negligible: the most active Italian buyer has been Banca IFIS with EUR 15,3 billion acquired

[24] Please refer to paragraph 2.4 for a thorough assessment of the topic.
[25] Deleveraging Europe – Deloitte (2019).

over 6 years. Such an amount is weakly relevant if compared to the EUR 102,9 billion acquired by the top buyer Cerberus Capital Management.

CHAPTER 2 – THE MANAGEMENT OF NON PERFORMING LOANS

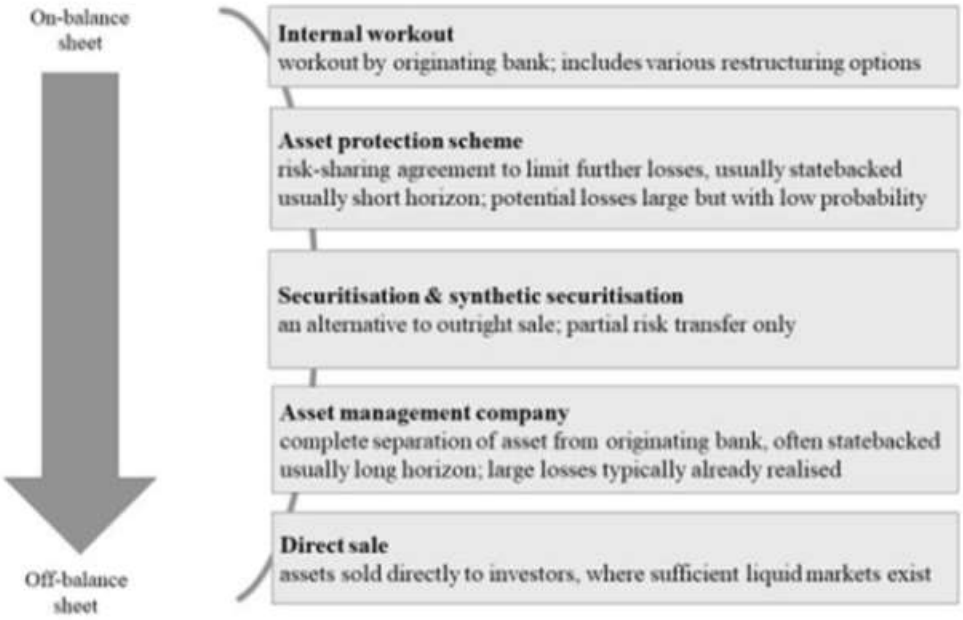
Deteriorated exposures, regardless of their formal and normative definition have to be managed. The latter is a decisive task to be performed by individual banks given the disruptive implications that distressed exposures have on banks' stability and profitability. The aim of the current section is to give evidence of the most common practices employed by financial institutions in the management of non-performing exposures both from a theoretical (par. 2.1) and practical (par. 2.2) point of view. The dissertation will be also enriched with the updated guidelines by EBA (2019) in the field of NPLs management (par. 2.3) and concluded with the most relevant new perspectives in deteriorated exposures management: the creation of a united European secondary market and of a pan-European *bad bank* (par. 2 .4).

2.1 Common practices to address the problem

The first paramount concept to clarify is that it does not exist a unique best strategy to address the distressed portfolios problem. The set of tools available is huge and individual banks choose the combination that better allows them to pursue their objective, namely the maximisation of the recovery value. We are thus entering a framework with a well defined goal, but with countless paths to be taken in order to achieve it. It is then up to the single bank to take the correct one, building a coherent strategy considering the peculiarities of each portfolio as well as those of the bank as a whole. Within the assessment of its internal characteristics, the bank shall assign to the following a prime weight: *size and organizational structure* in general, *availability of expertise* to deal with distressed exposures, *maturity of the internal control systems and of the IT infrastructure*. On the single portfolio level instead, the concerns shall be directed to a *truthful assessment of the different risk levels*, *perspectives of recovery* and presence of *guarantees*. The different features between private and corporate exposures shall also be always kept in mind.

In addressing the set of tools available in order to manage distressed exposures, we follow the setting of Fell et al. (2016). This paper identifies first a dichotomy between *on-balance sheet* and *off-balance sheet* approaches and then it enriches the set of options available adding more blurred solutions.

Figure 2.1 – A non exhaustive taxonomy of options for addressing NPLs. Source: Fell J., Grodzicki M., Martin R. and O'Brien E., Addressing market failures in the resolution of non-performing loans in the euro area, Financial Stability Review, November 2016.



The choice of either one of the two directions is not exhaustive: the best practices employed by the banks usually entail the use of a combination of the tools presented in figure 2.1 based on the characteristics of the single portfolio and of the bank itself. The complementarity of the options is the factor that gives strength to the presence of active management of NPLs portfolios within the banking industry: besides the more or less favourable macroeconomic environment, there is still space for the individual talent in managing such exposures.

The description that will follow takes into consideration the most common strategies employed by banks in order to tackle the NPLs problem, detailing for each of them the most relevant characteristics and implications concerning costs, returns and risks.

2.1.1. Internal management

This option usually tends to be preferred by large banks since it entails a huge effort both in terms of costs and of organizational restructuring. The first step in fostering an internal management strategy for dealing with distressed exposures is to develop a specific NPL working unit that encompasses the presence of individuals with the right expertise supported by an appropriate IT system. Beyond pros and cons, the in-house management solution implies a significant investment in human resources, organizational processes and information technology systems. In terms of processes, *screening and monitoring* become a core task of the unit with the purpose of reducing the migration of performed exposures towards the non-performing buckets. The screening process work in parallel with the lending office, assisting it in the selection of the borrower. On the other hand, the monitoring process is critical to assess

the quality of loans *after* they have been granted. It is then clear how crucial it is, from the individual-banks' perspective, the recognition of early signals that may foresee the deterioration of a particular exposure or portfolio. Early recognition allows the bank to act in advance, most likely avoiding the borrower from becoming non-performing. A clear task of the working unit is then the development and implementation of strategies and policies concerning the management of the exposures before their deterioration (i.e. *ex-ante management*).

Among the benefits of the in-house solution, we recall the possibility of developing and pursuing an independent recovery plan, allowing the institution to track its own records, possibly developing a *corporate best practice* to address the problem. This may enable the bank to maximise gross recoveries of loans owing to a better understanding and a longer history of dealing with distressed exposures. At the same time, through an internal management solution, the bank may be able to retain its customers allowing them to return to a performing status instead of writing them off.

On the other hand, the drawbacks of the in-house strategy are: the cost structure to sustain in order to develop the working unit and the deferred reduction in loan loss provisions.

2.1.2 Outsourcing

The outsourcing of the NPLs management to a specialized third-party is often the preferred path in the cases where a sufficient internal expertise is lacking. With the outsourcing solution, the third party becomes responsible for both NPLs management and related activities such as the relationship with the borrowers and credit recovery. This solution, if compared to the internal management, it can be intended as the symmetrical one on the spectrum of possible practices.

The outsourcing solution entails a three-sided set of benefits. First, the transferral to a professional third party allows the bank to exploit the expertise of a structure that, owing to its experience and know-how, can provide a more effective and efficient service. Second, this solution entails a different cost structure as compared to the internal workout. The latter envisages a fixed cost structure made of significant investments in both human resources and IT systems; the outsourcing strategy instead allows for a very flexible cost structure that turns out in a considerable reduction of the operating costs for banks[26]. By outsourcing the management of NPLs, banks are implicitly pegging their costs to the results obtained by the third-party hired. Please note that in the context of NPLs management, results are usually measured in terms of recovery rates achieved. Third, with no concerns regarding NPLs

[26] If compared to the fixed cost burden of the internal workout solution.

management, banks can redirect attention and resources towards their core business (i.e. lending activities).

The main concern for banks that decide to undertake the outsourcing strategy is the lack of a fair competitive environment among the third-party professional operators, thus the risk of being charged with *out-of-market* contractual conditions.

2.1.3. Asset Protection Schemes

In between the on-balance sheet management of which at paragraph 2.1.1 and the off-balance sheet management of which at paragraph 2.1.2, we identify a hybrid strategy: *asset protection schemes (APSs)*. They consists of an insurance-based government protection scheme with the purpose of sustaining individual banks with excessive NPL levels; it is a measure usually implemented during crises and in the aftermath of financial turmoil. The hybrid nature of the APS option can be easily understood from the fact that even though the assets formally remain on the banks' balance sheet, they are actually included in an internal work-out unit and managed separately from the bulk of banks' other assets.

The advantage that justifies the pursuing of such option is that banks can benefit from the state guarantee while avoiding to report losses since the assets are kept on-balance sheet instead of being sold. Still, given the individual-based reach of such option, and given the systematic dimension of the problem in the Eurozone, this strategy is not greatly employed.

2.1.4. Sale

Probably the most straightforward way to reduce the stock of NPLs is to sell the distressed exposures in the secondary market. This simple and naïve statement conceal a great number of implications of which we will give notice in the present paragraph.

As first intuition, we shall underline how the option presented in this section slightly differs from the outsourcing one (of which at paragraph 2.1.2) still acknowledging the multiple similarities. Within the scope of the outsourcing option, we refer to a contract that is expected to last over time, thus establishing an ongoing relationship between the bank and the third party professional NPL manager. When we talk of NPL sales, we are instead referring to a one time action, usually of significant magnitude, that still does not imply any further transaction.

The sale of non-performing exposures leads the bank to the achievement of a twofold set of benefits. Besides the possibility to refocus its core-business, the bank is able to achieve an improvement in both liquidity and capital adequacy position. The liquidity obtained by the sale of non-performing exposures can be used to grant new loans or to produce additional interest

income. The possibility to increase the lending activity is also pursued through the capital adequacy channel: the write-off of deteriorated exposures from the books allows the bank to get rid of the heavy weights in the determination of minimum capital requirements, thus freeing capital to undertake new risky assets (e.g. new loans).

In terms of disadvantages, the biggest drawback of the sale strategy deals with accounting issues and can be partially solved through the complete development of secondary markets for NPLs in Europe[27]. The sale of NPLs typically generates a loss for the bank due to the mismatch between the net value[28] at which the loans are recorded on the banks' balance sheet and its market value[29]. The abovementioned differenced is mainly justified by the different expectations on the recovery rates achievable from the management of the traded exposures. In compliance with the accounting rules, the loss caused by the sale transaction has to be recorded in the income statement of the year in which the transaction has been made. As a result, the pricing gap between the net value on the books and the market value has a direct and immediate negative effect on banks' income statement and thus on its profitability.

2.1.5. Securitization

According to Pilati (2017), the securitization is a useful asset and liability management tool and an efficient way to transfer risk. A complete description of the securitization process goes beyond the purposes of our work, for this reason we will provide only a brief description in order to make the reader aware of its implications on NPLs management.

As a first approximation, the securitization is a financial process aimed at allowing a given bank (*the originator*) to remove a set of distressed exposures from its financial reports. Such exposures will be grouped following a criteria of similarities, thus putting together exposures with comparable risk levels or time to maturity. The resulting portfolio is then sold to a special purpose vehicle (*SPV*) that issues tradable securities backed by the abovementioned assets and sells them to third-party investors. This sale implicitly funds the purchase of the distressed assets in the first place. Prior to the introduction to investors, the issuance of the SPV is tranched, meaning it is divided into categories with different risk levels and repayment priorities. The SPV also appoints an independent third party (*the servicer*) that holds the duty of collecting the cash-inflows generated by NPLs. Such cash-flows will be then used as payments of principal and interests of the asset-backed notes issued by the SPV itself.

[27] We encourage the reader to refer to paragraph 2.4 for a thorough dissertation on the matter.
[28] i.e. the nominal value of the debt minus the write-downs.
[29] i.e. the price investors are willing pay in order to purchase those assets.

The securitization option shares the benefits already seen in the sale paragraph, plus it enjoys the peculiar advantages linked to the tranching activity. By issuing different tranches of asset-backed securities, the SPV (and implicitly the originator) is able to enlarge the audience of investors, enclosing investors with the most different risk attitudes. According to Bruno et al. (2017), the securitization option, thanks to its risk sharing nature, represents the most effective way for banks to dispose of their NPL stock. The risk sharing nature indeed naturally reduces the gap between bid and ask prices, facilitating trades and increasing recovery rates. Furthermore, the securitized assets are suitable to obtain a broad range of guarantees[30] that enhance the attractiveness of the securities, consequently making them desirable by a larger sample of investors.

Among the obstacles to securitization, besides the significant fixed costs to sustain in order to set-up the structure needed, we can surely point at the onset of opportunistic behaviour by the originators. As a matter of fact, during the years that led to the 2008 financial crises, the use of securitization as a tool to conceal junk assets spiked, and the investors were the ones that took the loss. In order to try to find a solution to this problem, the European legislator has recently endorsed the development of a securitization market that has to be *simple, transparent and standardized (STS)*, hence increasing the degree of supervision on the quality of the assets securitized.

2.1.6. Asset Management Companies

A supplementary tool for managing non-performing exposures is the establishment of Asset Management Companies (AMCs) or *bad banks.* This solution consists in the creation of a separated company vehicle in which the toxic assets can flow-in. The company vehicle is created in the first place with the aim of purchasing, managing and disposing of distressed assets from banks, maximizing the recovery rates and spreading losses over time. The bad bank solution was born with the aim of solving the operational and management inefficiencies stemming from the contemporaneous presence of performing and non-performing exposures on banks' balance sheets. The establishment of a bad bank thus allows the adoption of focused policies and adequate resources for a thorough management of non-performing exposures' peculiarities. NPLs and their related risks are transferred to the brand new vehicle whose primary objective is to recover NPLs in a timely fashion, exploiting specialized human and organizational resources.

[30] The most relevant examples are the state guarantees systems as the GACS in Italy

An AMC can take several forms. As first approximation, we shall distinct between *centralised* and *decentralised* AMCs. The former represents a systematic solution intended to attract wholesale investors mostly. A centralised AMC is aimed at receiving all the distressed assets of a given country or market, thus establishing relevant economies of scale in terms of financial resources, expertise and know-how. On the other hand, a decentralised AMC offers tailor-made solutions to individual banks. With respect to the ownership structure, bad banks may be established either by public or private capital. The dichotomy is in reality not that strict given the common presence of both AMCs partially publicly-owned and private AMCs that benefits from state-level guarantees.

In terms of benefits, the separation between good and bad bank allows, especially when the latter achieves a systemic dimension, the exploitation of synergies and of professional management of NPLs. Furthermore, relieved from the burden of a high stock of NPLs, the banks are able to re-focus their processes towards their core business, accelerating the return to profitability. In conclusion, the centralization of assets from several banks to one AMC (*centralised bad bank solution*) may also attract a larger audience of potential investors, interested to larger quantities offered for sale.

The biggest concerns associated to the Asset Management Companies deal with the difficulties in assessing the quality of the assets transferred to the bad bank together with the fact that typically banks has to record loss when transferring any distressed exposure to the AMC.

2.2 Applications: evidences from Italy

In this section we will be drawing from Martino P. (2019), and provide an on-hand approach discussing real NPLs management examples. The focus of this paragraph is on the Italian framework given its unique level of activity over the recent years. The analysis of Professor Martino is based on hand-collected information from banks' annual reports covering the 2015-2018 time window. In terms of figures, the NPL ratio for Italy stood at 16,8% at the end of 2015 and it decreased to 9,7% as of June 2018. Such a significant, still not satisfactory, achievement is the result of an active management of the NPL stock, as it will be displayed for the cases of Unicredit and Intesa SanPaolo. The two major Italian banking groups are indeed the objects of analysis.

Unicredit

At the beginning of the time window considered, Unicredit's NPL ratio was 15,42% while its coverage ratio stood at 51,2%, consolidating the previous year figure. In addressing its non-

performing porfolios, Unicredit employed the sale solution with consistency. In particular, the sale of NPEs was carried out using a competitive auction mechanism whose effectiveness was determined via a full costing analysis. Within the spectrum of the alternative solutions employed by the Group we recall the creation of a specialised Distressed Asset Management Structure aimed at assessing and initiating strategies directed towards the sale of portfolios and individual exposures through the secondary market.

In June 2015, Unicredit signed a deal with Intesa SanPaolo and KKR Credit finalized at the creation of a platform for managing distressed loans. Such platform was intended as a foothold for the subsequent process of securitization of the assets collected. Unicredit exploited such agreement managing to securitize an overall nominal amount of EUR 288 million in the very first year.

During 2016, two main restructuring operations were implemented. First, the execution of the so-called project FINO: a de-risking project of EUR 17,7 billion in gross bad loans to be achieved through the securitization of the namesake portfolio. Second, the execution of project PORTO regarding a significant increase in the provisioning levels on NPLs. Specifically, while FINO project detailed as a huge securitization process implemented over a couple of years, PORTO project addressed a series of management actions and measures aimed at improving the management of NPLs and finally the increase of recovery rates. Although the negative impact of PORTO project on net results for 2016, the partial disposal of FINO portfolio had a primary role in allowing a recognition of EUR 21,5 billion less in gross impaired loans, as compared to previous year. As a result, the NPL ratio at the end of 2016 stood at 11,78% on a consolidated down-trend.

During 2017, Unicredit accomplished the first step of FINO project by selling the entirety of the receivables included in such portfolio and by the issuance of ABS securities by the appointed SPV. Phase 2 (the progressive sell down to third-party investors) has been implemented in 2017 and eased by the presence of the GACS guarantee[31] on the senior tranche issued. Further actions in terms of organizational structure were undertaken. In order to strength the effectiveness of the risk controls, the corporate governance, in accordance with the Chief Risk Officer, established the *Group NPE structure* and *the Group NPE Governance Committee.* As a result of the initiatives mentioned, together with a generalized active management of distressed exposures, NPL ratio decreased in 2017 reaching in December the level of 10,15%.

[31] By MEF Decree of 20th December 2017.

The greatest highlight of 2018 is the conclusion of the FINO project with the accomplishment of its phase 2. As a consequence, the NPL ratio stood at 8,74% as of June 2018, down from the 15,42% of 2015. The Group coverage ratio at 30 June 2018 confirmed the improvements made, reaching the level of 60,89% in comparison to the 51,20% of the 2015.

Intesa San Paolo

At the end of 2015, Intesa San Paolo reported an NPL ratio of 16,51% and a coverage ratio of 47,6%. Intesa San Paolo is characterized for a strong corporate culture towards the active management of distressed exposures that express itself in the strong role acknowledged to corporate bodies on the matter, together with the organization of several projects aimed at a timely and proactive loan management.

Starting from 2014, ISP activated a new *Proactive Credit Management process* aimed at structuring a new work method based on the need of identifying in a timely fashion performing positions with early signs of stress and thus implementing the most suitable recovery process for such exposures. In terms of monitoring, Intesa San Paolo employs a method of ratings that summarise the counterparties' credit quality, implicitly reflecting their likelihood of defaulting on a one-year horizon.

Since 2015, the Group has employed a new organisational model, according to which the new bad-loans flows are managed by the *Loan Recovery Department*. This corporate body relies on its own specialised units in order to manage recovery activities for loans entrusted directly to it. With the purpose of identifying the optimal strategies to be implemented for each position, the department examines costs and benefits of every solution, also considering recovery times' estimated financial impacts.

Starting from 2016, the credit quality ratios has begun to show clear signs of improvement, mainly due to high volumes of disposals and securitizations, while containing the upcoming of new bad loans. ISP proactive credit management reflected in actions such as: monitoring of customer positions, prompt identification of situations at risk, immediate activation of measures to keep or reposition customers in performing status, anticipating or immediately resolving the deterioration of credit quality. As a result, at the end of 2016 the NPL ratio stood at 14,72% with 23.817 businesses completely recovered from a distressed status over the year.

In March 2017 a 3-year NPL Plan was approved with the aim of achieving an NPL ratio comparable to pre-crises level (approximately 10,50%) by the end of 2019. It is interesting how such a programme entails mainly recovery via internal management. Significantly, during 2017, Intesa San Paolo sold non-performing exposures for a total of only EUR 226 million making

use of the securitization tool, signalling the willingness to empower their internal management unit. Within the same year, the banking group also launched the Retail Early Warning System (REWS) in order to strengthen and develop the assessment processes for counterparty risk together with the consideration of a thorough set of impairment triggers adapted to retail exposures. At the end of 2017 ISP achieved the rehabilitation of 21.000 businesses from a distressed status and a remarkable decrease in NPL ratio (11,87%), mostly by containing the insurgence of new non-performing loans.

In 2018, Intesa San Paolo disclosed its Business Plan for the subsequent three years. Such Plan identified a significant de-risking as key priority, setting the level of 6% as NPL gross ratio as the goal to achieve by 2021. The Plan envisages a strengthening of internal organization together with the sale of significant bad loans portfolios as main drivers to achieve the NPL ratio target. Nevertheless, the highlight of the year is the deal signed with the Swedish firm Intrum. The deal concerned the creation of a unique and leading NPL servicer that unites the capabilities of the two firms. The deal in particular involved two transactions. First, the creation of a leading servicer in the Italy's NPL market thanks to the integration of Italy's platforms of Intesa and Intrum. Second, the disposal and securitization of a sizeable non-performing portfolio of the Italian bank totalling EUR 10,8 billion of gross book value. The Group also undertook other de-risking initiatives during the year that, taken together, have contributed to the improvement of the bank's asset quality. As a matter of fact, the NPL ratio achieved as of June 2018 was 9,33% with a coverage ratio of 53,4%. We recall that the 2015 figures of NPL ratio and coverage ratio were 16,51% and 47,6%, respectively.

In the second part of this chapter, it is aim of the author to give evidence of the regulatory and supervisory framework that characterizes the NPL management in Europe. In particular, there will be analysed three decisive aspects of the abovementioned framework: the guidelines provided by the European Banking Authority, the project of a European Asset Management Company and the requirements for a productive establishment of cross-border secondary markets aimed at non-performing exposures trading.

2.3 EBA: Guidelines on management of non-performing and forborne exposures

As mentioned in paragraph 1.1, in addition to the adoption of a harmonized set of definitions, the second building block in addressing the non-performing loans problem in Europe has been the Action Plan drafted in 2017 by the European Council. The Council stressed how the only

path to be taken in order to systematically address the problem was a comprehensive approach consisting of a mix of complementary policy actions, both at national and European level. In this regard, the European Banking Authority (EBA), among others, was invited by the Council to contribute to the Action Plan primarily by offering new guidelines concerning management strategies aimed at reducing NPEs on banks' balance sheets. This paragraph is then aimed at giving evidence of the highlights of the *EBA Guidelines* as new European benchmark in the field of management of non-performing and forborne exposures, especially in relation to those credit institutions carrying a significant stock of distressed exposures. As it will be seen in the following, the development and operationalization of an *NPE strategy* is the core building block of the document drafted by EBA.

The objective of the Guidelines is to encourage and drive the convergence of NPE and FBE management practices across EU Member States building on the evidences of the Asset Quality Reviews conducted prior to their publication. The Guidelines also provide the supervisors with guidance regarding the assessment of banks' risk management practices, policies, processes and procedures for managing distressed exposures, as part of the Supervisory Review and Evaluation Process (SREP).

Before addressing thoughtfully the contents of the Guidelines, we shall recall how these do not have any binding legal power *stricto sensu*: they are indeed a supervisory tool that clarifies the expectations of the supervisor in terms of NPL identification, management and measurement. Still, they have been applicable since 30th June 2019 to those credit institutions with a gross NPL ratio equal or greater than 5%[32] using 31st December 2018 as reference date[33].

NPE Strategy

The development of the *NPE strategy* as conceived by the EBA Guidelines should be finalized at a reduction of NPEs over a realistic but sufficiently ambitious time horizon. The Strategy shall detail the approaches and objectives to be pursued in order to maximize recoveries and reduce NPE stock while being compliant with the provisions aimed at protecting consumers[34]. The development and implementation of the NPE strategy (par. 25) should lay its foundations on the following key steps:

a) assessment of the operating environment and external conditions;

[32] The 5% threshold is aimed at ensuring a minimum level of transparency, on the contrary it is not intended to indicate any optimal level of NPLs that credit institutions should aim for. It should not be considered an automatic quantitative target to be implemented in management strategies.

[33] Competent autorities may extend the application of the Guidelines to those credit institutions that, even if not reaching the 5% threshold, display signs of progressive deterioration of assets' quality.

[34] Directive 2014/17/EU, Directive 2008/48/EC, EBA Guideline on arrears and foreclosure.

b) development of the NPE strategy over short, medium and long term horizons;
c) implementation of the *operational plan*;
d) full embedment of the NPE strategy into the management processes of the credit institution, including regular review and independent monitoring.

The assessment of the operating environment (point a) refers to the need for the credit institution to take into consideration the *internal capabilities* towards the management of NPEs, the *external conditions* and the *capital implications* of the NPE strategy during its early stages. In terms of internal capabilities, credit institutions should run a comprehensive self-assessment to evaluate the current internal situation and the consequent steps required to address the gaps potentially observed. The assessment has to have an annual frequency and shall investigates strengths and gaps in the understanding of: the magnitude and drivers of the credit institution's NPEs, the outcomes of NPE actions taken by the credit institution in the past and the operational adequacy in relation to the various steps involved in the process. In the early stages of the planning, credit institutions shall also consider the current and future external operating conditions and environment. The specific areas of concern will be then: the macroeconomic conditions, the market expectations[35] with regard to acceptable NPE levels and coverage, the demand for NPE-related investments, the maturity of the NPE servicing industry and the regulatory, legal and judicial framework. Once the reduction drivers have been established, the credit institution should draft a detailed assessment of the impact of such drivers on capital, risk exposure amount, profit or loss and impairments. The assessment should be performed in accordance with the RAF as well as with the ICAAP.

The development of the NPE strategy over different time horizons (point b) has to be structured in a sequence of well defined moments: the *choice of the options to implement the strategy*, the *setting of targets* and the *definition of an operational plan*. Before addressing each of these moments, we shall underline how the NPE strategy in general, and the operational plan in particular, has to be defined and approved by the management body of the credit institution, who also holds responsible for its review on an annual basis. The Guidelines suggest a number of non-mutually exclusive *implementation options*[36] to apply to different portfolios and under different conditions. In the cases where the options proposed are not considered to grant sufficient NPE reduction, the credit institution should envisage for that exposure or portfolio a timely impairment or write-off approach. The second phase in the development of the NPE

[35] Including but non-limited to the views of rating agencies and market analysts.
[36] Hold/forbearance strategy, active portfolio reductions, change of type of exposure or collateral, including foreclosure, debt to equity swapping, debt to asset swapping, collateral substitution, legal option (insolvency proceedings or out-of-court solutions).

strategy is the *setting of adequate targets*. Credit institutions should include, at minimum, clearly defined, realistic yet ambitious quantitative targets in their NPE strategy (par. 42). The targets should lead to a concrete reduction, both gross and net of impairments, in NPEs, at least in the medium term. Interestingly, the Guidelines specify that the credit institutions shall not rely on expectations about changes in macroeconomic conditions to be the sole driver of the NPE reduction targets established. Such a statement gains a primary importance in the scope of the present work since the core of the research is directed to the establishment of determinants of NPLs other than the macroeconomic ones. Credit institutions shall establish targets by time horizons, by main portfolios and by implementation options. Nevertheless, the targets shall be referred to an overall reduction of NPEs as much as to a reduction focused on individually relevant portfolios. The conclusive part of the development process of the NPE strategy is the rationalization of an *operational plan* defined, approved and periodically reviewed by the management body, aimed at supporting the strategy itself. The operational plan should clearly define how the credit institution will operationally implement its NPE strategy over a period of time of at least one to three years. Among others, the operational plan should have specific attention to internal factors that may jeopardize the successful realization of the NPE strategy.

With regards to the implementation process (point c), the Guidelines claim how the operational plan should rely on suitable policies and procedures, clear ownership and appropriate governance structures, further incorporating tailor-made changes in management activities and organization in order to embed the NPE workout framework as a key element in the corporate culture.

Point d of the abovementioned list refers to the need of integrating the NPE strategy at all levels of the organization since its success depends on many different areas within the credit institution. The Guidelines thus require a consistent integration of the NPE strategy as a whole over the entire corporate functions, addressing to this requirement as prerequisite for the achievement of the targets set. A decisive task to be performed is the definition of roles, responsibilities and formal reporting lines for the implementation of the strategy. Staff and management involved in NPE workout activities should be provided with clear individual or collective goals and incentives geared towards reaching the targets established by the NPE strategy and operational plan. The incentive scheme that follows has to take into consideration remuneration policies, career development objectives and a transparent monitoring framework. The incentives on the other hand have to discourage excessive risk taking behaviour.

Finally, the NPE strategy should be coherently incorporated in the risk management framework, from here a special attention should be paid to the alignment with the following: ICAAP, RAF and Recovery plan.

NPE governance and operations

The definition and implementation of the NPE strategy and of the operational plan surely have implications on the governance and operations area. This section sets out the fundamental elements of governance and operations with respect to the NPE workout framework, covering in particular:

a) steering and decision making;
b) the NPE operating model;
c) the internal control framework;
d) the NPE monitoring processes.

In terms of steering and decision-making procedures, the Guidelines identifies a set of responsibilities that fall under the management body scope, among others we may recall: the approval, implementation and regular review of both the NPE strategy and operational plan considering the corporate's overall risk strategy. Furthermore, the management body is also accounted responsible for a quarterly monitoring of the progresses made compared to the targets established, as well as for ensuring sufficient internal controls over the NPE management processes.

The structuring of an NPE operating model (point b) calls for the further definition of the NPE working units (NPE WUs) as crucial entities aimed at tackling the distressed exposures problems avoiding any possible conflicts of interest. Credit institutions are indeed required to assemble such working units ensuring their independence from the loan origination procedures. This separation of duties encompasses not only client relationship activities but also the decision making processes. Banks should set up different NPE working units coherently with the different phases[37] of the NPE life-cycle in order to provide a tailor-made service. NPE WUs should address homogeneous portfolios, thus developing specialized processes for each category identified; the grouping of exposures is thus allowed and suggested.

Particular concerns are then directed towards the human resources area, in consideration of the possibility to witness moral hazard behaviours that can jeopardize the fair management of loans exposures. In particular, the mixture of managerial and monetary resources with other parts of

[37] The Guidelines identify the following phases: early arreas (up to 90 days past due), late arrears/forbearance, liquidation/debt recovery/legal cases/foreclosure, foreclosure.

the value chain such as loan origination, is highly discouraged in order to avoid the insurgence of conflicts of interests, as discussed above. Nevertheless, in accordance with the joint ESMA and EBA Guidelines on the assessment of the suitability of the members of the management body, the staff allocated to decisive NPE workout tasks shall be experienced and hold a specific expertise. Finally, the human resource area should be regularly appraised with particular concern towards the achievement of the institution's NPE targets but also towards qualitative indicators.

An internal control framework (point c) has to be implemented in order to guarantee full alignment between the NPE strategy and operational plan on the one hand and the credit institution's overall business plan[38] and risk appetite on the other hand. The management body is accounted responsible for establishing and monitoring its adequacy and effectiveness. Between the internal control functions and the management body there should exist a prompt exchange of information in the form of written reports, mainly regarding the identification of deficiencies on which the management body should require adequate and effective remedial actions. In accordance with the EBA Guidelines on internal governance[39], the internal control framework should be characterized by three lines of defence:

- *first line of defence controls*: it has to be embedded into the procedures and processes of the operational units (i.e. NPE WUs);
- *second line of defence controls*: its primary purpose is to perform controls on a continuous basis on the adequacy of the first line of defence controls. It follows that the second line of defence controls has to be characterized by an high degree of independence from the functions performing business activities such as the NPE WUs;
- *third line of defence controls*: it is performed by the independent internal audit office. It should have sufficient NPE workout expertise in order to perform periodic controls over the efficiency and effectiveness of both the NPE framework and the precedent lines of defence controls. The results of the period controls has to be transmitted to the management body together with the detail of recommendations proposed.

As discussed in the previous paragraph, the monitoring systems of NPEs (point d) should be based on NPE targets approved within the NPE strategy, rationalized in the operational plan and cascaded down to the operational targets of the NPE WUs. Crucial to a meaningful

[38] It is considered to include NPE strategy and operational plan.
[39] Guidelines on internal governance under Directive 2013/36/EU (EBA/GL/2017/11).

monitoring process is the selection of NPE-related key performance indicators (KPIs) to be used to set targets as much as to measure the progress made towards them. The Guidelines list a set of non-exhaustive indicators to be taken into consideration, providing further detail for each of them. A complete dissertation on each of them goes beyond the scope of the present research, then we will simply provide the reader with the macro-areas to which each indicator belongs: general NPE metrics, borrower engagement and cash collection, forbearance activities, liquidation activities, other (e.g. NPE-related profit and loss items, foreclosed assets, outsourcing activities).

Forbearance

Forbearance measures are intended as concessions that should allow the borrower to return to a sustainable performing repayment status[40]. In this section, we will outline the guidelines in terms of governance of forborne exposures provided by the European Banking Authority in order to create a harmonized set of practices among European credit institutions.

The first step each credit institution should follow is the consideration of a broad set of forbearance measures, for any given time horizon and for any possible exposure peculiarity. The first assessment has to be made with respect to the viability or non-viability of the measures themselves. Such assessment requires the consideration of a detailed set of factors, for example the objective expectation of full repayment and of resolution of outstanding arrears. On the contrary, the presence of multiple consecutive forbearance measures do not run in favour of the assessment of the concession as viable.

After having set the perimeter of viability, the Guidelines detail the features of the *sound forbearance process*. First of all, the forbearance activity has to be backed by a clear corporate policy which has to be regularly reviewed in order to acknowledge the outcomes of the monitoring processes. The latter is a process of the forbearance activity that has to be structured prior the acknowledgement of any concession and it is aimed at creating an assessment model that, by following the dynamics of a set indicators, is able to judge the efficiency and effectiveness of the forbearance activity itself. The metrics suggested to be considered by the Guidelines are portfolio and exposure specific and, in particular, they are: *forbearance cure rate*, *cash collection rate* and *incidence of write-offs*. Most importantly, credit institutions must ensure that the concessions linked to the forbearance activity are never employed as tool to

[40] As defined in Annex V to Commission Implementing Regulation (EU) No 680/2014 (please refer to Chapter 1).

delay the recognition of an exposure as un-collectable. The latter has become a paramount provision to be fulfilled, especially in the aftermath of the Global Financial crisis.

For the purposes of granting forbearance measures, credit institutions should invest resources in processes able to spot signs of possible future financial difficulties at an early stage. Then, the assessment of the financial situation of the borrower shall not be limited to exposures with *apparent signs of financial difficulties*[41]. On the contrary, such assessments should be conducted also with regard to borrowers who does not have apparent financial difficulties, but whose repayment ability may have worsened in relation to significant changes in market conditions. Moreover, the Guidelines recall how a fundamental feature of the assessment of the repayment capacity is that it has to be performed by disregarding any collateral or guarantee provided by third parties. The Guidelines prompt on the one hand the adoption of decision trees and thus of standardised forbearance measures for portfolios of homogeneous borrowers, while on the other they stress the importance of tailor-made solutions for more complex exposures.

For transparency and consumer protection (if applicable) purposes, the forbearance contracts should include unquestionably defined targets and a schedule for their achievement. Such targets should be credible, appropriately conservative and they shall take account of possible deterioration of the borrower's financial situation. The achievement of the targets detailed in the schedule, together with the general performance of the borrower, have to be monitored by the NPE WU responsible for granting the forbearance measure.

2.4. Secondary markets and bad-banks as pan-European solutions

As discussed in paragraph 1.4 on the impediments to achieve a complete solution to the NPL problem, credit institutions agreed to identify the lack of a strong and reliable secondary market to trade NPLs, as one of the greatest obstacles. Strictly related to the good functioning of secondary market is the proposal of creating a European bad-bank. In January 2017, Andrea Enria, the EBA's Chair at the time, in the context of a broad analysis of risks and challenges faced by European banking sector, proposed the creation on a single European bad-bank that should, among other things, address and solve the market failures evidenced in the functioning of NPL national secondary markets. Indeed, secondary markets have been populating the European scenario since the rise of the NPL problem, still they have never reached the maturity required to completely solve the problem. For this reason, we decided to discuss two possible

[41] When assessing the financial difficulties of a borrower, credit institutions should consider the following parameters: more than 30 days past due during the 3 months prior forbearance, increase in probability of default (PD), presence on a watchlist during the 3 months prior forbearance.

solutions, in chronological order: the proposal of Andrea Enria (2017) of a single bad-bank to solve the problem of the currently existing platforms and of the European Commission (2018) to introduce a new paradigm for NPL trade platforms.

This paragraph clearly lies in a limbo between the regulatory aspects (Chapter 1) and the management tools (Chapter 2) of distressed exposures. Nevertheless, we decided to embed the discussion of such a twofold perspective into this chapter in order to highlight its relevance as possible new standards of a better management of NPLs, in particular with regard of those legacy assets whose dismissal is still a matter of great concern.

A European bad-bank: the EBA's proposal

As it will become clear in the next section, the platforms that have been employed in the recent years for NPL transactions suffer from a twofold market failure that, according to the EBA's view, may be solved by the constitution of a European bad-bank. Such market failures regards the lack of incentives for banks to sell their NPLs at losses and the information asymmetry reducing the transparency on prices.

The EBA's proposal builds mainly on the consolidated presence and success of three national AMCs working in the Euro Area: the *National Asset Management Agency* (NAMA) in Ireland, the *FMS Wertmanagement* in Germany and the *Sociedad de Gestion de Activos procedentes de la Resstructuracion Bancaria* (SAREB) in Spain. Over the last 10 years, these entities proved their effectiveness in stabilizing the financial sector reducing the losses on legacy assets.

The proposal endorsed by Andrea Enria back in 2017 was aimed at removing billions in NPLs from the European banks' balance sheets and moving them into the EU AMC. This new entity should seek to sell the assets within a determined time horizon (e.g. three years) at their economic value; if it failed to do so, the original bank would have to absorb the difference. In such circumstances, the presence of warrants exercisable by national governments poses the first difficulty in the realization of the project since it would be in contrast with BRRD and State aid rules. By managing large amounts of NPLs, the European bad-bank may develop enough expertise to improve evaluations of loans' recoverability. At the same time, the critical dimension of the assets managed would ensure the achievement of a significant market power that strictly connects to the achievement of effective and fair transactions. As a matter of fact, according to Fell et al. (2017), the main purpose of a systemic bad-bank would be to provide a bridge for the pricing gaps that emerge when market prices for NPLs and the underlying collateral are temporary depressed: since the transfer price paid to banks by the AMC is usually

set at long-term (real economic) value, this avoids the fire sales that would result from NPL disposals into illiquid markets where the risk-premium required by outside investors is significantly high. This mechanism is believed to implicitly solve the first market failure mentioned above.

Besides the already mentioned possible problems related to the State aid discipline, according to BBVA Research Office, the most significant obstacle that prevented the creation of a single European bad bank is the heterogeneity of the continental scenario. Moreover, besides the different degrees of severity of the problem, some Member States have already employed national solutions such as the abovementioned NAMA and SAREB. Such national entities have proven to work very well, then it would be a no-sense replacing them and similarly it would be very difficult to imagine a side entity that works in parallel on the European playfield. Spain, Ireland and Germany set up *state-backed bad banks* after the 2008 financial crisis to deal with sudden increases in toxic bank debt. But since then, the EU has introduced the *Bank Recovery and Resolution Directive (BRRD)*, which restricts governments from setting up bad banks except as part of an official resolution process.

The debate among the creation of a pan-European bad-bank has regained strength in March 2020 over the concerns about the implications of the *coronavirus crises* on banks' asset quality. In March, the EC adopted a temporary relaxation of the state-aid rules and it has thus waved-through billions of euros in emergency government relief measures. Proponents of the bad bank idea hope to make it acceptable under state-aid rules by proposing that the toxic loans would have to be sold into the market after a fixed time period, with the power to recoup any losses from the lenders themselves.

European platform for Non-Performing Loans[42]

A European platform for non-performing loans would have to be structured as an electronic marketplace where banks and investors can trade distressed exposures creating an active, liquid and efficient secondary market. Currently, many private companies have organized similar structures. They offer though limited geographical scope and not standardized loan data, thus failing to achieve the greatest benefits of a pan-European platform. A platform structured in the ways that will become clear in this paragraph, would address the several market failures affecting the current (national) NPL markets. It would improve and harmonise information and

[42] Staff Working Document accompanying the document "Communication from the Commission to the European Parliament, the European Council, the Council and the European Central Bank: Third Progress Report on the reduction of non-performing loans and further risk reduction in the Banking Union". This paper has been drafted in 2018 and it reflects the views of staff members from the European Commission, the European Central Bank and the European Banking Authority.

data availability by making use of standardized templates, it could reduce transaction costs by reducing research expenses, hence improving price formation. Finally, it could reduce market entry barriers by attracting a wider audience of both buyers and sellers thus increasing competition and bettering the price discovery process.

The first concern of the present dissertation is to provide a clear definition of what has to be intended as *European NPL Platform*. In particular, an NPL platform would be an electronic marketplace where holders of NPLs *(sell-side)* and professional investors *(buy-side)* can meet to exchange information and to trade. The twofold purpose of this tool is then evident given its definition.

The organization and the features of the platform ensure the achievement of a broad set of benefits for all the market participants, namely: *investors*, *sellers* and *service providers*.

- *investors (buy-side)*: they will mostly benefit from the loan data harmonization process based on *EBA NPL templates*. Building on standardized and validated data, investors may accurately perform portfolio valuations and significantly reducing costs by targeting specific market segments and allowing the implementation of more complex strategies;
- *sellers (sell-side)*: they will mostly benefit from the creation, within the NPL platform, of a database of investors interested in the purchase of various types of NPLs. Such data availability would allow the creation of a pool of investors the buy-side may be interested to refer to, instead of approaching investors one to one.
- *service providers*: the 'seal of approval' granted by the platform, given its legitimacy power, constitutes a huge incentive for various ancillary service providers (e.g. loan servicers, data analytics providers, deal advisers and law firms) to supply their services within the perimeter of the platform itself.

The 'seal of approval' recognizes a compliant platform as a *European NPL platform*.

In order to maximise the abovementioned benefits, the platform should be set up as to provide each of the following functions:

- data warehouse function: it has to be based on standardised data and backed by the provision of a seal of data quality to investors;
- a creditor coordination function;
- a transaction-facilitating function and intermediation for further ancillary services.

Within the core organizational guidelines, the working staff document provides practical indication on the following aspects, considered to be the most relevant ones: *ownership, asset perimeter, services to be provided, centrality of NPL data templates.*

As already mentioned, a platform covering multiple Member States (pan-European scope) would have an advantage over purely national platforms in terms of the magnitude of the benefits achievable. The cross-border scope however, if on the one hand increases efficiency, on the other poses doubts regards the best *ownership and governance structure.* Insiders have considered several organizational models among which we recall: public ownership, private ownership and private ownership combined with standard setting and oversight by a third standard setting body. There is no clear-cut case for public ownership, then it may be more appropriate to endorse the private initiative, also fostering those already launched.

The success of any NPL transaction platform would largely depend on its capability to reach a sufficient critical size, thus achieving economies of scale and scope. For this purpose, besides aiming at a European scope geographically speaking, the NPL transaction platform should ideally host a broad range of *asset classes*: commercial real estate (CRE) assets, residential real estate (RRE) assets, SME or other corporate loans, unsecured retail loans, asset-backed finance, car loans, other/specialised NPLs.

In order to achieve the objectives advanced in the staff working paper, the private platforms would seek a 'seal of approval' by the industry body identified for the development of the industry standards. In order to be eligible for a 'seal of approval', the platform should, among other things, directly offer a minimum perimeter of *services*:

- data review and validation: the platform, at its end-stage, should provide data that are fully assured and subject to a three-fold set of validation checks.
- data warehousing operating thanks to electronic databases recursively updated;
- matching buyers and sellers on NPLs: allowing the convergence of bids and asks for selected NPLs or NPL portfolios is the key function of this kind of electronic transaction platform. Within this process, the platform would never provide settlement services, nor assume the ownership of the assets traded. In this way the platform can be considered not subject to counterparty risk;
- ancillary services provided by third parties but offered through the platform (e.g. intermediation of credit servicing and valuation services).

The last critical building block we will discuss is the *use of NPL data templates.* EBA NPL data templates are highly granular loan-level standardised templates. They are exposure-type

specific and they have been thought to fully represent the loan (portfolio) and to be used to perform financial analysis on it. The broad and common usage of the standardised templates ensures comparability, thus facilitating the analysis of investors both on a single exposure and on a portfolio level. The usage of common data templates runs of course in favour of the establishment of a data warehouse as well as of the data validation process. It is important to underline that the templates are not a supervisory reporting requirement: they can be used by banks on a voluntary basis for NPL transactions and may form the foundation for NPL secondary markets initiatives. To conclude, we recall how the idea of the employment of standardised documents in dealing with complex transactions is not new at all. Indeed, the idea of EBA NPL data templates builds on the consolidated practice coming from the derivative world where the usage of the International Swap and Derivatives Association (ISDA) model have been used since the aftermath of the 2008 financial crisis.

To the best of our knowledge, there are not *European NPL Platform* operating in the continent at current date. The process is likely to require a fair amount of time and it probably needs a higher degree of homogeneity among Member States from a normative point of view. Notwithstanding, an ambitious project has been launched in November 2019. *NPLMarkets* is a marketplace with data preparation, valuation and reporting. It is a cross-national platform for banks, investors and service providers to standardise data, analyse, value and trade non-performing loans connecting 22 different jurisdictions.

CHAPTER 3 – LITERATURE REVIEW

The literature review that follows is built using the work of Manz (2019) as primary source. Manz (2019) provides a systematic review of 44 papers regarding the determinants of non-performing loans published in the period 1987-2017 by the most influential journals. In particular, absolute precedence has been given to papers published by the Journal of Banking and Finance and the Journal of Financial Services Research. Besides the time coverage and the trustworthiness of the sources, the paper of Manz (2019) entails a categorization of the sources within three broad aggregate dimensions (*macroeconomic, bank specific, loan specific*), further decomposed into first and second order codes. In other words, Manz (2019) identifies three bodies of literature that point at *macroeconomic*, *bank specific* and *loan specific* factors respectively, as having the most important explanatory power in driving the evolution of non-performing loans. Certainly, it is not possible to imagine the three families of determinants as separated entities, rather, both in reality and in the econometric models, we witness a co-participation of the different families of determinants. In particular, scholars has focused mainly on macroeconomic and bank-specific determinants, given the difficulty of tracing the granular data needed to establish loan specific correlations. The same data availability issue with regards to granularity holds when we deal with aggregate non-performing exposures instead of specifying the type of exposure. As a matter of fact, very few papers investigate the determinants of non-performing loans on a disaggregated basis, specifically because of the difficulty in tracing data at such level of granularity. Among these, we will mainly discuss Gosh (2017) and Louzis et al. (2012). Literature of late 90's looked at aggregated time series data on bad loans, employing macroeconomic variables only to explain their dynamics. Technical progress and database enrichments allowed scholars to start considering data on a bank-level, thus pursuing a higher level of detail and granularity.

In the following, contrary to Manz (2019), we discard the categorization among macroeconomic, bank specific and loan specific determinants. We select instead a sub sample of the papers analysed and we provide, for each of them, an overall summary furnished with the indication of which body of literature may be predominant.

Published by the *Journal of Banking and Finance* in 1997, **Berger and DeYoung (1997)** is one of the most decisive and cited paper investigating the determinants of non-performing loans. The authors, building on prior empirical evidences, are most interested in determining the

intertemporal relationships between problem loans and cost efficiency[43] rather than establishing a causal relationship that was already clear mainly thanks to Berg et al. (1992) and Hughes and Mester (1993). Berger and DeYoung (1997) assess the direction of the causality between cost efficiency and stock of problem loans by testing, via Granger-causality techniques, four now-well-known hypotheses on a dataset composed of U.S. commercial banks in the period 1985-1994. Given the relevance these hypotheses have gained in literature over the subsequent years, we decided to present them in their extended form.

i. *bad luck hypothesis:* an increase in non-performing loans caused by external events such as a local plant closing, is expected to Granger-cause (i.e. temporally precede) decreases in measured cost efficiency;
ii. *bad management hypothesis:* poor management practices (not adequate loan underwriting, monitoring and control) are associated with low cost efficiency. Under this hypothesis, low cost efficiency is expected to Granger-cause an higher stock of non-performing loans[44];
iii. *skimping hypothesis:* under this hypothesis the direction of causation runs from measured efficiency to stock of problem loans as in the bad management hypothesis, nevertheless the sign of the association is the opposite (positive in this case) as there is thought to be a trade-off between short-term operating costs and future loan performance problems;
iv. *moral hazard hypothesis:* deviating from the relationship between problem loans and cost efficiency, this hypothesis claims that low capital would Granger-cause high non-performing loans given the incentives to raise the riskiness of the loan portfolio such a bank would be exposed to (moral hazard).

As it is clear from their presentation, the aforementioned hypotheses are not mutually exclusive. In a corner solution, all four could affect the same bank at the same time.

In terms of variables used, we recall that Berger and DeYoung (1997) employs the dollar value of loans that are either 90 days past-due or are no longer accruing interest, divided by the value of total loans *(NPL ratio)* to capture the level of problem loans. In order to give evidence of cost efficiency instead, the authors estimate a best-practice cost frontier for the year and measure the distance from it for each bank.

[43] Cost efficiency is measured for the individual banks as deviation, on a yearly basis, from the estimated efficient operating cost frontier. The frontier is specified and estimated for each year considered in the analysis.
[44] It is then clear how the bad luck and the bad management hypothesis prescribe the same negative association between non-performing loans and cost efficiency but the opposite temporal ordering.

Estimation results suggest that the intertemporal relationship discussed above runs in both directions. Data provide support both for the *bad luck hypothesis* and for the *bad management hypothesis*. On average, the latter is found to dominate the *skimping hypothesis* for the entire sample, meaning that a decline in cost efficiency precedes the non-performing loans increase, possibly because of poor loan portfolio management. Still, we must bear in mind that the prevalence of one hypothesis over another, on average for the entire sample, does not preclude the reversal of dominance in one or more individual banking institution. As a matter of fact, if the dataset is restricted to consistently efficient banks over time, the hypothesis found dominant is the skimping one. Last but not least, data also provide justification for the *moral hazard hypothesis*, signalling how decreases in banks' capital ratio generally precede increases in non-performing loans stock caused by moral hazard incentives.

The hypotheses formulated by Berger and DeYoung (1997) have been expanded and tested again by a number of scholars. Among the others, we recall Louzis et al. (2012) that tested the hypotheses of Berger and DeYoung (1997) on a panel of Greek commercial banks, and Podpera and Weil (2008) that tested them on a panel of Czech banks.

The paper by **Podpiera and Weill (2008)** extend the Granger-causality model developed in Berger and DeYoung (1997), by applying GMM dynamic estimator on a panel of 43 Czech banks over the period 1994 - 2005. The rationale of the analysis is once again the investigation of the causality between non-performing loans and cost efficiency finalized at a better understanding of the dynamics of bank failures. Podpiera and Weill (2008) accurately draw from the seminal paper of Berger and DeYoung (1997) in the definition of the hypotheses to test. As a matter of fact, the hypotheses tested by the paper under analysis are the well-known *bad luck, bad management* and *skimping hypothesis.* The authors decided not to speculate on the *moral hazard hypothesis* in order to avoid the consideration of the capital dimension in their model. A further difference with respect to Berger and DeYoung (1997) is the use of GMM dynamic panel data estimators, in the place of OLS estimators, in order not to suffer from omitted variable problems arising from the omission of capitalization. From a practical point of view, the variables addressed within this paper are the NPL ratio and the cost efficiency score. The former is defined as the ratio of non-performing loans to total loans[45] while the latter is defined as the relative cost efficiency score as compared to the best-practice-bank in each year,

[45] It has to be stressed that within the context of Podpiera and Weill (2008) a loan is considered non-performing when it is 361 days past due. It is then clear how this definition is very far away from the one employed within the scope of this work (please refer to chapter 1 for a thorough discussion about the definitory perimeter of the non-performing expoures).

and it captures management quality. The definition of the variable that describes the cost efficiency is a further difference with Berger and DeYoung (1997).

Empirical results provide clear support for the *bad management hypothesis* while the *bad luck hypothesis* is rejected as the total effect of non-performing loans on cost efficiency is not significant, thus implying that changes in NPLs do not Granger-cause changes in cost efficiency.

In general, literature consistently addressed the cost efficiency as one of the main determinants of non-performing loans. There is a deep dichotomy though among those scholars who measured cost efficiency via the estimation of a cost frontier as Berger and DeYoung (1997), and those who measured it as net income divided by total assets (ROA) as Gosh (2017) and Salas and Saurina (2002), among others.

The paper by **Gosh (2017)** investigates the impact of both macroeconomic and bank specific determinants on the non-performing loans of the 100 largest U.S. commercial banks between 1992 and 2016. Over the years, this paper has gained a prime relevance since it explores the evolution of non-performing loans of one of the biggest economies in the world at a disaggregated level, hence reporting the exposures of the loan portfolio at a sector-specific level of detail. In particular, NPLs are divided into four categories: *real estate*, *commercial and industrial (C&I)*, *individual* and *farm loans*. The empirical determinants of NPLs are drawn from the financial accelerator theory (Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997) that associates NPLs with a nation's macroeconomic environment. The model of Gosh (2017) also controls for bank specific determinants as capitalization, lending specialization, quality of credit, diversification, profitability and operational efficiency. We find then clear connections with the seminal work of Berger and DeYoung (1997) in dealing with *moral hazard* for capitalization and quality of credit, and *bad management - skimping* for profitability and operational efficiency.

Gosh (2017), similarly to Espinoza and Prasad (2010) employs a log-transformation of NPLs as dependent variable to exploit the benefits in terms of range of variation and symmetry. From an econometric point of view, the model of Gosh (2017) does not bring any innovation to the NPL literature: both static and dynamic estimation techniques have been used. The static framework uses a fixed effect estimation model that controls for the effect of time-invariant unobserved heterogeneity across banks, while in the dynamic framework, a two-step system-GMM estimation have been used.

The fineness of this paper's results consists in finding the disaggregated drivers of NPLs. In terms of results, an higher capitalization is associated with a significant increase of total and C&I NPLs, thus implicitly claiming that a higher capitalization lead banks to resort to lax credit checking and, in general, to more liberal lending policies. Data support the moral hazard hypothesis since a deterioration of banks credit quality significantly increases NPLs for all the types of loans considered. Similarly to Louzis et al. (2012), bank diversification is not found to significantly impact the level of NPLs. Bank profitability, measured as return on assets, is once again addressed to cause a reduction in total, real estate and C&I non-performing loans. In terms of macroeconomic variables, inflation is negatively associated to NPL ratio in total, real estate and individual exposures, suggesting a beneficial effect for borrowers of higher inflation as it makes debt repayments cheaper. In line with the results of Louzis et al. (2012), real GDP growth significantly reduces total and real estate NPLs, while unemployment rates increase NPLs. Building on the evidence of the dynamic specification of the model, a common feature of aggregate and sector specific NPLs can be captured: the significance and the positivity of lagged coefficients witnesses the persistence of the determinants analysed. Overall, the results presented show that total, real estate and C&I NPLs are most sensitive to banking and macroeconomic conditions while farm loans are least sensitive.

The conclusive section of the paper by Gosh (2017) employs panel VARs to explore the impact of disaggregated NPLs on key US macroeconomic fundamentals and to trace the duration of their impact.

In accordance with the papers presented so far, **Louzis et al. (2012)** combine both macroeconomic and bank specific factors, to investigate the determinants of NPLs over a panel dataset comprising nine Greek commercial banks, spanning from first quarter of 2003 to third quarter of 2009. The aim of the paper is to identify the most significant bank-specific determinants, after controlling for the macroeconomic environment. Similarly to Gosh (2017), loan exposures are presented with an high level of granularity, since the loan portfolios are broken-down into *mortgage*, *business loans* and *consumer loans*. Based on precedent literature, Louzis et al. (2012) employs GDP growth, unemployment rate and lending rates as primary macroeconomic determinants of NPLs and it estimates a baseline model using this set of macro-fundamentals as regressors. The rational of the paper is then to examine whether the addition of bank specific variables contributes to the explanatory power of the model.

The framework of hypotheses tested by Louzis et al. (2012) is significantly deep as it entails nine hypotheses; for sake of brevity, we give evidence of the most relevant ones. As Reinhart and Rogoff (2010), the *sovereign debt hypothesis* for which a rising sovereign debt leads to an

increase in NPLs is tested. In terms of bank specific factors, besides the traditional hypotheses *à la Berger and DeYoung*[46]*,* Louzis et al. (2012) consider, among others, three interesting original hypotheses. The first (*diversification hypothesis*) claims that the bank size and the weight of non-interest income on total income are negatively related to NPLs. The *too big to fail hypothesis* claims instead a positive effect of leverage on NPLs as large banks take excessive risks relying on the too big to fail presumption. The third (*bad management II hypothesis*) claims that performance, as measured by return on equity, is negatively associated with increases in future NPLs. Opposite sign of variation is instead supposed by the *pro-cyclical credit policy' hypothesis* that presumes a positive association between performance and future increases in NPLs, reflecting a liberal credit policy. As Salas and Saurina (2002) and Gosh (2017), the paper under analysis employs a dynamic approach in order to give evidence of time persistence in NPL phenomenon. The model specified is consistently estimated using the Generalized Method of Moments (GMM), an estimation procedure that has been frequently used in NPL literature.

The estimation of the baseline model evidences the statistical significance of the coefficient of the lagged NPL ratio in the case of business and consumer loans, and the statistical insignificance for mortgages. Contrary to Gosh (2017), the sign of the former association is negative, possibly signalling an extensive use of write-offs. Again from the baseline estimation is found that there are quantitative differences in the response of different NPL to macroeconomic variables. As a matter of fact, while both the real GDP growth rate and the unemployment rate have the strongest effects on business NPLs, lending rates have a significant effect on consumer NPLs. Among the others, mortgages are found to be the less sensitive to macro-fundamentals. Louzis et al. (2012) found strong evidence in favour of the *sovereign debt hypothesis* for all the types of NPLs considered. Empirical evidence considering also bank specific factors supports the *bad management hypothesis* as in Berger and DeYoung (1997) and Podipera and Weill (2008). On the other hand, both the *moral hazard* and the *diversification hypothesis* (at both its specifications) are clearly rejected by Greek data. Empirical results instead confirm the presence of a *too big to fail* effect on risk taking behaviours and confirms the *bad management II hypothesis.*

Following the body of literature that considers both macroeconomic and bank specific determinants, **Espinoza and Prasad (2010)** estimate the effect of their model on NPL ratio according to a dynamic panel estimated over the period 1995-2008 on around 80 banks in the

[46] Bad management hypothesis, skimping hypothesis, moral hazard hypothesis.

GCC region[47]. Similarly to Gosh (2017), this paper also estimates a macroeconomic panel VAR in order to assess the effects of banks performance on key macroeconomic fundamentals. As mentioned before, Espinoza and Prasad (2010) specified the dependent variable as a log-transformation of the NPL ratio itself.

Building on the specificities of the GCC countries, this paper envisages a particular set of macroeconomic regressors: non-oil real GDP growth, stock market returns, interest rates, world trade growth, the VIX index and a time-dummy for the Asian crisis. In parallel, the regressions also control for bank specific variables as the capital adequacy ratio (CAR), a set of different measures to capture efficiency (expenses/asset ratio, cost/income ratio, ROE), the banks' size as measured by the logarithm of equity and the lagged values of both net interest margin (NIM) and credit growth deflated by the CPI. With the purpose of exploring the largest range of opportunities, the authors decided to estimate several econometric specifications of the dynamic panel data gathered: OLS, Fixed Effects, 2-step Arellano-Bond, difference GMM and system GMM. Empirical results show that both macroeconomic and bank-specific variables do have a role in the build-up of NPLs in GCC countries. In particular, the most relevant and significant effects are found to be caused by non-oil GDP growth rate and interest rates in the macroeconomic category and by size of capital, credit growth and efficiency as measured by non-interest expenses/assets, in the bank-specific category.

The aim of **Salas and Saurina (2002)** is, by considering a model containing both macroeconomic and bank-specific determinants, to investigate the different behaviour of *ex-posts* credit risk (proxied by NPL ratio[48]) in two different institutional regimes: commercial and savings banks in Spain[49]. Indeed, even if the choice of determinants does not provide any particular insights, the choice to focus on an individual country, instead of on larger entities, may provide new points of view on the matter. Moreover, the paper compares the credit policies of two types of financial institutions which have very different ownership structures. The relevance of such a perspective has to be found in the fact that both types of banks operate under the same regulatory framework and under the same macroeconomic conditions; it then follows

[47] GCC region includes: United Arab Emirates, Saudi Arabia, Qatar, Oman, Kuwait and Bahrain.
[48] To be precise, Salas and Saurina (2002) refer to a general *problem loans over total loans* as dependent variable. In particular, they define problem loans as the "doubtful" plus "nonperforming" loans according to the 1/1982 Bank of Spain Rule (CBE). The "doubtful" category contains loans, overdue or not, with very low recovery probability. The "nonperforming" category contains instead loans and other balance sheet items that are 3 months overdue, and that are not accruing interest or principal payments (rational close to the most common 90 days past due).
[49] In Spain, commercial banks are for-profit organizations under shareholders control while savings banks, focusing primarily on retail clients, are close to a status of commercial nonprofit organization since their profits must be either retained or distributed in cultural and social community programs.

the interest in assessing whether and how the credit risk measured by the NPL ratio behaves in the two different banking paradigms.

The relation between banks problem loans and the business cycle is confirmed by empirical evidence; in this paper, Salas and Saurina (2002) measure the aggregated economic activity by the GDP growth rate given its high informative power also with respect to unemployment, real wages and real interest rates. In terms of bank specific determinants, the focus is here directed towards the rate of credit growth, the composition of the loan portfolio and the incentives to take riskier credit policies. Bearing in mind the purpose of the paper, it is then clear that if any difference in the risk taking behaviour between commercial and saving banks would be found, it would have to be assigned to the different form of ownership and governance. A significant credit growth rate is deemed to be one of the most significant determinants of problem loans as banks interested in enlarging their market share are likely to trade it off with a reduced borrowers' quality level. A thorough monitoring of borrowers is another key element of a good credit policy: recall Berger and DeYoung (1997) findings on the negative relation between cost efficiency and problem loans. Similarly to Louzis et al. (2012) and Gosh (2017), this paper recognises that different types of loans have different degrees of credit risk. Then the composition of the loan portfolio reflects the risk that the managers are taking, being loans to the real estate and construction sectors the riskiest ones. The last set of bank specific determinants finds in the incentives of bank managers another cause of problem loans. The well-known example is the case of the bank with solvency issues that gambles to survive by betting on a rapid credit expansion in sectors with high expected returns, but also high risks. As Espinoza and Prasad (2010) and Gosh (2017), the paper under analysis applies a logarithmic transformation to the ratio of problem loans in order to exploit the abovementioned benefits and to better suit the GMM procedure[50]. Beyond the model's specification, the estimation method employed is the Arellano-Bond estimator (linear GMM estimator) that fits dynamic panel data models. In terms of results, the null hypothesis that data referring to commercial and savings banks belong to the same empirical model is rejected, signalling that the two institutional models do respond to different drivers. Bank specific variables have higher explanatory power for savings banks than for commercial banks. Furthermore, problem loans are more sensitive to the business cycle in commercial banks than in savings banks and, among savings banks, growth policies, management incentives, managerial inefficiency, loan portfolio composition and market power have a highly significant effect on problem loans. Among commercial banks

[50] GMM procedure is indeed not deemed suitable when the dependent variable is a truncated one as the NPL ratio is.

instead, the statistically significant macroeconomic variables are only branch growth, capital ratio and size. In the end, ownership and governance affects problem loans through differences in the coefficient of the explanatory variables, which implies differences in the internal evaluation and management of loan decisions by the banks.

Among the macroeconomic literature on NPL determinants, a theme that gained particular relevance after the global financial crisis is the relationship between sovereign debt and banking distress. The seminal paper is in this case **Reinhart and Rogoff (2011)**. The two authors identified in the narrowness of the time periods usually considered, one of the most unfortunate tendencies of the economic research in general. For this reason, they analyse a panel data composed of 70 advanced and emerging economies and they span their analysis over two centuries, going back to the date of independence or well into the colonial period for some countries. During this time window, they take into consideration 290 banking crises and 209 sovereign default episodes. The hypothesis framework is extremely complex but it can be summarized as follows: first, external debt waves are a recurring antecedent to banking crises. Second, since banking crises precede or accompany sovereign debt crises, they may have a predictive role. Third, public debt increases ahead of an external sovereign debt crisis as governments often hide those debts that far exceed the disclosed levels of external debts. In terms of results, Reinhart and Rogoff (2011) claim that "banking crises most often either precede or coincide with sovereign debt crises" (p.1689). Similarly, Louzis et al. (2012) asserts that "the mechanisms at work include either the taking over of massive debt on the part of the government which undermines its solvency or the collapse of the currency which inflates foreign currency debt" (p. 1014). Nevertheless, according to Reinhart and Rogoff (2011), the opposite causal chain from sovereign debt crisis to banking crisis is not dismissed. This paper, besides its results and conclusions, had the role to prompt the inclusion by the academic community, of sovereign debt variables in the specification of their models as it is witnessed by the postulation of the *sovereign debt hypothesis* by Louzis et al. (2012).

Boudriga (2009) investigates the impact of bank industry factors on the aggregate NPL ratio analysing data for a panel of 59 countries over the period 2002-2006. The study also examines on the one hand the effect of the regulatory framework on the stock of problem loans, on the other hand the impact of legal and political environment on the compliance with supervisory regulations. The hypothesis framework indeed follow this double purpose. Among the bank specific determinants of NPLs, Boudriga (2009) expects a positive association to NPLs of loan loss provisions and state ownership, a negative effect of capital adequacy ratio, bank profitability (ROA) and foreign ownership, while the degree of industry concentration is

expected to have an ambiguous effect on NPLs. With respect to the effects of bank supervision on NPLs, this paper foresees a negative impact of the following variables: stringency of capital requirements, official supervisory power, private monitoring and supervisory authorities' independence. It may be noticed that the latter variables, excluding the degree of independence of supervisory authority, reflect the three pillars of Basel II. From a methodological point of view, Boudriga (2009) employs a two-fold specification of the model in order to investigate both the banking industry determinants of NPLs and the impact of supervisory environment. The baseline model regresses the banking industry variables on NPLs while the second specification investigates the impact of bank supervision factors by re-estimating the baseline model, this time including each of the four regulatory variables mentioned above. For estimation purposes, given the features of the panel data under analysis, the author used the PCSE method[51]. The estimated coefficients signal a negative relationship between NPLs and lagged loan loss provision rate, then countries with higher rates of problem loans exhibit lower level of provision rates and countries with low rates of NPLs are characterized by a better provisioning policy. This contradicts the idea of loan loss provisions as risk control tool and then positively related to problem loans. No evidence of association is found between NPLs and lagged ROA, probably because the relation between such variables holds at a bank firm level but not in aggregate. The estimated coefficients on state ownership are found to be positive and significant while foreign participation is found to have a positive effect on reducing the degree of bank problem loans. Finally, bank concentration is found to exert a negative effect on NPLs. Contrary to Salas and Saurina (2002), the coefficient for the lagged growth rate is not significant, signalling that economic conditions are not connected to problem loans. As mentioned above, the second part of the paper investigates the impact of the regulatory environment on problem loans. The entire set of regulatory variables introduced is not significant, suggesting that the regulatory channel is not suitable to reduce risk taking behaviour, hence problem loans. This result corroborates the growing literature that claims the ineffectiveness of supervisory regulation on banking outcomes. However, this result suffers from the fact that the measures used only relate to statutory powers and do not take into consideration their effective implementation. For this reason, Boudriga (2009) introduced three interactions using the level of corruption, the degree of political openness and the rule of law. Nevertheless, even using various specifications, the coefficients never entered significantly.

[51] Panel Corrected Standard Errors (PCSE) method used to improve inferences by taking into account the complexity of the error process (Beck and Katz (1995, 1996)).

Besides Boudriga (2009), **Osei-Assibey and Asenso (2015)** and a number of other studies, attempt to test and verify the impact of bank capitalization, as measured by the capital adequacy ratio (CAR) on NPLs. To current date, there is no general consensus among scholars on the sign and the magnitude of the relationship between CAR and NPLs. The intuition behind this relation is that CAR may serve as a tool to control excessive risk taking behaviour, thus preventing NPL build-ups. Building on the moral hazard hypothesis, both Berger and DeYoung (1997) and Salas and Saurina (2002) approve the idea that banks with low CAR carry higher risk, ultimately causing higher NPLs.

Osei-Assibey and Asenso (2015) aim at investigating the influence of the central bank's regulatory capital on commercial banks specific outcomes: credit supply, interest rate spread and, most importantly for our purposes, non-performing loans. The empirical reference is a panel data of commercial banks from Ghana covering the period 2002-2012. This study models three separate equations using the system generalised method of moments[52] (GMM), one for each bank specific outcome on which the impact of regulatory capital requirements is assessed. In particular, the dependent variables considered are: net interest margin to capture the interest rate spread, credit growth rate as a proxy for credit supply and finally the NPL ratio. For sake of coherence, we will discuss only the model referring to the bad-loans problem. Osei-Assibey and Asenso (2015) envisage a positive relationship between the net minimum capital requirement[53]and the NPL ratio. The intuition behind such a prediction is that a low excess of capital, as compared to the level required, would prevent banks from making excessive risky loans. On the other hand, excessive capital holdings could tempt the bank to make riskier loans with the purpose to guarantee adequate returns for capital providers. As in the majority of precedent literature, the model also controls for other bank-specific characteristics, industry and macroeconomic indicators. In terms of results, we remark the positive relation between net minimum capital requirement and NPLs, thus confirming the prevision under which banks create more (bad) loans when they have excess capital over the required target. Among the control variables, we signal the negative effect of GDP growth rate on NPLs, thus corroborating the majority of literature that recognizes that higher income levels enable borrowers to better meet their loan commitments.

[52] The estimation approach choosen (GMM) ensures unbiased and consistent estimates of regression parameters in presence of endogeneity and dynamic panel bias.

[53] It should be noted that in this study the capital requirements are expressed as net minimum capital requirement. Meaning that such variable is defined as the ratio of the difference between the minimum capital required and a bank's stated capital position to its assets.

Within the body of literature that identify the bank capitalization as the most relevant determinant of NPLs, the most-known study is with no doubt **Kwan and Eisenbeis (1997)**. This paper investigates the relationship between banks' leverage and the incentives for managers to take inefficient behaviours. There are empirical evidences that agency costs and information asymmetries may exert a significant effect on risk, leverage and efficiency, thus explaining why some institutions react to increased cost of capital by taking-on more risk. Closely related to this paper is the study by Berger and DeYoung (1997). As mentioned at the beginning of the chapter, such study examines the relationship between bad loans, asset risk and cost efficiency using the Granger causality test. The main difference with the paper under analysis -Kwan and Eisenbeis (1997)- is indeed the structural relationship assumed to hold between risk-taking and efficiency. Results from Kwan and Eisenbeis (1997) provide evidence on the link between bank capitalization, risk and operating efficiency based on a simultaneous equation framework. A positive effect on the level of capital attributable to regulatory pressure on underperforming institutions is determined (p.117). On the other hand, the authors claim that properly capitalized banks are found to operate more efficiently than less capitalized organizations, also, the relationship between inefficiency and credit growth is found to be U-shaped, indicating that operating efficiency improves at a decreasing rate as loan growth rate rises (p.117).

The last branch of literature we are discussing is the one referring to corporate governance as determinant of non-performing loans. The range of variables that can be brought together under the corporate governance hat is huge. For this reason, we will not discuss papers related to the role of corruption and political imperfections as Barth et al. (2004) and Hu et al. (2004), rather we will focus on how the internal structure of government of credit institutions may have a role in reducing the NPL build-ups. The seminal paper will be then Tarchouna et al. (2017). This paper gains even further relevance since it will provide the grounds for the development of the empirical analysis of our study (Chapter 4).

Tarchouna et al. (2017) aim at estimating the effect of corporate governance on non-performing loans. In the aftermath of the global financial crises, the weak corporate governance principles and the excessive risk taking behaviours that have led to it, shed light on the importance of an active role of variables such as board features, CEO pay and ownership in the control of dimensions like NPLs. Nevertheless, the simultaneous introduction of a consistent number of corporate governance variables in the model if on the one hand increases its explanatory power, on the other it may cause problems in terms of over-parameterization. Over the past years, this issue has been solved by scholars considering a unique corporate governance

index that includes many different dimensions of banks' corporate governance (Grove et al. (2011), Love and Rachinsky (2015), Zagorchev and Gao (2015)). The research question developed by Tarchouna et al. (2017) can be then summarized as follows: how to evaluate the effect of many governance variables on banks NPLs simultaneously? The authors developed their study following two steps: first, following prior literature[54], build up a corporate governance index exploiting the Principal Component Analysis (PCA); second, similarly to Salas and Saurina (2002) and Louzis et al. (2012), use the GMM method to investigate the determinants of NPLs. The model includes both macroeconomic and bank-specific variables in excess of the abovementioned corporate governance index. The model finds empirical confirmation in a sample of 184 US commercial banks over the period 2000-2013.

The dependent variable identified in Tarchouna et al. (2017) is the ratio of non-performing loans to total loans, where non-performing loans are defined as the sum of non-accrual loans[55] and 90-days past due loans. The independent variables include, on aggregate, the corporate governance index, bank-specific variables and macroeconomic variables. Given the relevance this paper fulfils in the context of our dissertation, we provide the reader with the complete set of hypothesis formulated by Tarchouna et al. (2017):

- The *corporate governance index (CGI)* is expected to have either a positive or negative relation with NPLs. The following variables are considered in the composition of the index: *board size, CEO duality, board independence, majority ownership and directors' ownership.*
- The *bank size*, as measured by the logarithm of bank total assets, is expected to have either a positive or negative relation with NPLs. Corroborating the positive sign view, we recall the too big to fail assumption by Louzis et al. (2012). On the other hand, the paper by Salas and Saurina (2002) supports the evidence of a negative relation between banks' size and NPLs level.
- The *proportion of loan loss provisions* on bank total loans is expected to have a positive relationship with NPLs. Nevertheless, we recall how Boudriga et al. (2009) report a negative relation between these variables since the provisioning rate can signal banks attitude towards risk.

[54] Callanhan et al. (2003); Larcker et al. (2007); Dey (2008); Florackis & Ozkan (2009a), (b); Ammann et al. (2011); Veprauskaite & Adams (2013).
[55] Non-accrual loans are defined as loans not earning the predermined rate either because the complete assemblage of principal is uncertain or since the payment of interests has not been completed (Stiroh and Metli (2003)).

- A negative relation is expected between *diversification opportunities* and NPLs. Following Louzis et al. (2012), diversification opportunities are captured by the ratio of non-interest income to total income. Corroborating the view of this hypothesis, we recall the empirical results of Salas and Saurina (2002).
- *Interest rate* is expected to have a positive association to NPLs. Please note how this study refers to interest rate as the real interest rate calculated as the difference between long-term interest rate and inflation rate.
- *Unemployment* is expected to have a positive association to NPLs. This hypothesis follows the empirical results of Louzis et al. (2012) that claims how higher unemployment rate deteriorates the ability of borrowers to reimburse their credits.
- A positive relationship is expected between the global financial crisis (captured by a time dummy variable) and the NPLs.

Finally, the financial market risk as captured by the annual downside volatility is employed within the model as control variable.

Principal Component Analysis reduces the five aforementioned corporate governance measures into a single index to be used as regressor in the dynamic panel data estimation. Still, it is of major interest to consider the contributions, in terms of sign, of each variable to the GCI as a whole. *Board size* has a negative contribution to the index throughout the entire sample except for the global financial crisis period (2006-2008) when the weight associated to board size has been positive, signalling how large boards may be beneficial during stress periods. *Directors independence* contributes negatively to the index, reflecting the passive role played by independent directors within the corporate governance environment. *Majority ownership* and *directors' ownership* positively contributes to the CGI, signalling the relevance of the ownership structure in the corporate governance system.

Empirical results show that the coefficient of the CGI is negative and statistically significant at a 1% level for small banks while it is significant but positive for medium, large and for the full sample of US commercial banks. Building on their corporate governance mechanisms, small banks are able to perform a better selection of borrowers thus avoiding too risky prospects that may jeopardize the stability and the performance of the bank. Small banks then focus on creating value via investments having more controllable risk, this would in turn keep the NPL ratio under control. This evidence corroborates the finding of Ellul and Yerramilli (2013) that, based on the construction of a Risk Management Index (RMI), claim that those banks having higher RMI before the global financial crisis, have lower NPLs ratio and better operating

performance during the stress-period. On the other hand, NPL ratio of medium and large banks in the sample is found to be positively related to the index capturing the quality of corporate governance. The authors identify two reasons that may explain this finding: first, having an higher degree of liquidity, medium and large banks are more prone to accept riskier investment projects as compared to small institutions. Second, the multinational scope of medium and large banks is generally associated to the transferral of the parent's risk level to the subsidiaries. Then, a strengthen of corporate governance systems would lose power in a multinational context, not allowing a more sound loan-granting policy.

Besides the CGI, the remaining hypotheses whose expected sign was unidirectional are confirmed by models' estimation: proportion of loan loss provision (+), income diversification opportunities (-), real interest rate (+), unemployment (+), time dummy related to global financial crisis (+). All the coefficients are found to be significant at least at a 10% level. With respect to bank size, empirical results of this study corroborate the too big to fail assumption by Louzis et al. (2012) that assign a positive relation between assets 'amount and NPL ratio.

CHAPTER 4 – EMPIRICAL ANALYSIS

The last chapter of this study will be devoted to present to the reader the empirical analysis carried out in order to disentangle the determinants of NPLs' evolution in the European banking system. To perform the analysis a set of econometric and statistical tool will be employed; the paper will also provide the reader with some hints for each of them so to allow a sufficient understanding to everyone.

We also stress the importance of including in our research a descriptive phase aimed at a complete understanding of the dataset used as input for the analysis. In our case, such stage take-on even a deeper relevance given the complexity and the width of the dataset, in particular considering the number of variables appraised.

As it will become clear in the following pages, the goal of our research is to build a consistent baseline model able to capture and describe the relations between the ratio on non-performing loans held by each bank and a set of both macroeconomic and banking-specific determinants. The literature investigating this matter is huge, with an increase of production in the aftermath of the global financial crisis[56]. Building on this idea, we decided to follow a less-explored path investigating the empirical effects of a set of corporate governance variables on the magnitude of the non-performing loans held by each bank within the European framework. As in Tarchouna et al. (2017), the focus on the role of corporate governance on the ability to manage exposures is precisely the main contribution of our work to the academic community. Differently from Tarchouna et al. (2017), the geographical scope of our work is the European banking system and not the American one.

This chapter will be organized as follows: the first section will introduce the dataset employed, explaining the rationale underneath its composition and offering a descriptive analysis highlighting the core variables considered. The second section of the chapter will propose the specification of the econometric models and hypotheses tested by their means. In particular, this section will be furnished with useful references to past literature findings. The third section will provide the reader with an essential understanding of the econometric tools employed in

[56] Please refer to chapter 3 for further information about past literature on the subject.

the analysis from a theoretical point of view. The results of the empirical analysis will be presented in section four, section five concludes.

4.1.1. Introduction to the dataset

Since its early stages, this research project has been conceived with the strong ambition to highlight common patterns at a European level rather than at a country-specific level. It is opinion of the author that the increasing convergence of the regulatory and supervisory framework happening within the Euro-Area in the last decade will open significant research possibilities to investigate banking-related issues on a European level, in the wake of the significant number of papers already performing analysis with such a scope in relation to the US market.

The first step we took with the purpose of composing the dataset has been to decide a rule to follow in order to select the banks upon which to perform our empirical analysis. Following a common scheme in literature, we decided to pick the top 50 banks in Europe according to their total assets amount[57]. The ranking refers to 2019 and has been published by Business Insider on their website[58]. On the abovementioned 50 banks, we performed a further selection, restricting the sample on the base of both data availability and on the banks' status of being listed to regulated exchanges, thus coming up with the final sample of 20 banks that has been actually the subject of our research. Data availability has been a relevant and decisive issue throughout the process, thus it will be further discussed in the following paragraphs.

Table 1 - Top 50 European banks by total assets (2019). Source: Business Insider

Ranking	Bank	Identifier	Tot. Assets € (bn)	Country
1	**HSBC Holdings plc**	HSBC	2100,13	GBR
2	**BNP Paribas SA**	BNP	1963,43	FRA
4	**Deutsche Bank AG**	DBK	1470,38	DEU
5	**Banco Santander SA**	SAN	1446,15	ESP
6	**Barclays plc**	BARC	1275,62	GBR
11	**UniCredit SpA**	UCG	936,79	ITA
12	**Royal Bank of Scotland Group plc**	RBS	930,78	GBR
13	**Intesa Sanpaolo SpA**	ISP	800,01	ITA
15	**UBS Group AG**	UBS	782,45	CHE
16	**Credit Suisse Group AG**	CSGN	680,46	CHE
17	**Banco Bilbao Vizcaya Argentaria SA**	BBVA	671,02	ESP
19	**Nordea Bank AB**	NDA	581,61	SWE

[57] Please refer to the Annex for the full list of banks considered.
[58] https://www.businessinsider.com/largest-banks-europe-list?IR=T

20	**Standard Chartered plc**	STAN	552,56	GBR
28	**KBC Group NV**	KBC	292,34	BEL
29	**Svenska Handelsbanken AB**	SHB A	281,51	SWE
32	**Skandinaviska Enskilda Banken AB**	SEB A	260,41	SWE
35	**Swedbank AB**	SWED	225,11	SWE
36	**Banco de Sabadell SA**	SAB	221,35	ESP
38	**Erste Group Bank AG**	EBS	220,66	AUT
40	**Raiffeisen Gruppe Switzerland**	RBI AG	194,60	CHE

Before entering into the details of the descriptive analysis of the dataset, I would like to spend a couple of words regarding the data collection process. The latter is indeed a crucial moment of every empirical analysis since solid econometric models can be built only through solid and accurate datasets. As it will become clear soon, our empirical analysis relies on variables coming from three macro-areas: macroeconomic, banking-specific and corporate governance. For each of them, different data sources have been questioned. Concerning the macroeconomic area, both the AMECO and the WorldBank (WB) datasets have been used. Time series about bank-specific variables have been extracted instead from Thomson Reuters Eikon, while corporate governance variables have been hand collected analysing banks' annual reports, from here the importance of including in our sample only listed companies. The main issue that caused the reduction of the sample from 50 to 20 banks has been with no doubt the availability of data concerning bank-specific variables in general and about non-performing loans ratio in particular. As a matter of fact, Eikon dataset includes only partially complete time series of such ratio. For this reason, one of the most challenging tasks performed has been to identify the most complete time series available on Eikon and then 'fill the blanks' by manually building the ratios using the annual reports as inputs while simultaneously complying with the Eikon definition of the ratio for consistency reasons. Similarly, the construction of the time series regarding the corporate governance dimension has been time consuming since each variable appraised has been hand collected from the corporate governance section of the annual report of the 20 banks of the sample. The choice regarding which dimensions of the corporate governance structure to take into consideration has been inspired by Tarchouna et al. (2017) and further enriched as original research.

The following table provides a summary of the variables collected, their formal definition and their source.

Table 2 – Summary of the variables collected and analysed. Source: own elaboration

Variable	Definition	Source
Real interest rate	Real short-term interest rates, deflator GDP (ISRV)	AMECO
Unemployment rate	Unemployment, total (% of total labor force)	WB
NPL ratio	Nonperforming loans as a percentage of total loans and other real estate owned. It is calculated as non-performing loans at the end of the fiscal year divided by total gross loans for the same period and is expressed as percentage.	Eikon
Total assets	Total assets	Eikon
Loan loss provision	Ratio of provision for loan losses for the fiscal year as a proportion of total loans for the same period, expressed as percentage.	Eikon
Tier 1 ratio	Ratio of Tier 1 Capital[59] *(eoy)* to total risk-weighted assets for the same period, expressed as percentage.	Eikon
Non-interest income/Op. income	Non-interest income divided by the sum of income before tax and total interest expense for the same period. This ratio represents the portion of operating income that comes from non-lending sources.	Eikon
Efficiency ratio	Ratio of non-interest expense for the fiscal year to total revenue less interest expense for the same period, expressed as percentage. It measures the cost to the bank of each unit of revenue.	Eikon

[59] Tier 1 Capital, also known as Core Capital, is defined as the sum of common stockholder's equity, certain qualifying issues of preferred stock and minority interest, less goodwill, intangible assets, investments in certain subsidiaries and other adjustments. Regulatory requirements generally mandate this ratio to exceed 4%.

Loans growth rate		Percent change in the annual period: net loans as compared to the same period one year ago. It is calculated as net loans for the fiscal year minus net loans for the same period one year ago divided by the annual net loans one year ago, multiplied by 100.	Eikon
Pretax ROE		It represents the return on equity before taxes. It is calculated as income before tax for the fiscal year divided by the total equity and is expressed as percentage	Eikon
CGI	Board size	Size either of the Board of Directors or of the Supervisory board, depending on the type of governance adopted by the bank	AR[60]
	Board size adjusted	Board size relativized to the bank's dimension as measured by the natural logarithm of total assets.	AR
	Directors and Executives ownership	Percentage of total share capital held by directors and executives in the form of Ordinary shares.	AR
	Independence rate	Number of independent directors divided by the Board Size	AR
	Executives rate	Number of Executives belonging to the Board of Directors divided by the Board Size	AR
	Gender diversity rate	Number of women belonging to the Board of Directors divided by the Board Size	AR

The information collected has been then organized within a panel structure in order to give evidence of both the cross-sectional and time series nature of the data. The time window considered covers a horizon of 10 years, from 2008 to 2017. The choice of this particular time

[60] "Annual Report".

window allowed us to dodge the complications arising from the change of accounting standard from IAS 39 to IFRS 9[61]. In conclusion, our panel dataset considers 20 European banking institutions over a period of 10 years resulting in 200 observations for each variable[62].

4.1.2. Descriptive analysis of the dataset

Before entering into the details of the econometric models specification and estimation, this paragraph provides a useful description of the dynamics of the *NPLratio* across our dataset.

To better understand the magnitude of the phenomenon associated to our target variable, we built a set of categorical variables to help us in our comparative analysis: *NPLratio* dynamics has been then addressed sorting by *bank*, by *region* and by *dimension*. In particular: *region* is a variable that assign to each bank a label in relation of their geographical area (*south, continental and north*). *Dimension* is instead used to sort banks by their size, as measured by total assets, in: *small (less than €500bn), medium (between €500bn and €1500bn) and big (more than €1500bn).*

The first set of graphs considers the average (full-sample) *NPLratio* across each bank considered in the sample (Figure 4.1) as well as in each size class (Figure 4.2) and in each macro-region (Figure 4.3). The results are not surprising, confirming a strong variability between southern and northern credit institutions, with banks belonging to the south-area being weighted down by a significant amount of non-performing loans (8,68% versus 2,60%). Differences in size on the other hand may not be so relevant to the purposes of non-performing loans management. As a matter of fact, we were not able to highlight a significant difference between the average NPL ratio values sorted by dimension: banks belonging to the medium-size class display an average NPL ratio of 5,2% across the sample, while banks belonging to both small and big credit institutions are characterized by an average NPL ratio of 4,4%. In general, the average NPL ratio spans from a minimum of 0,45% *(Swenska Handelsbanken)* to a maximum of 12,75% *(Unicredit)*.

[61] IFRS 9 is the new accounting standard in place since 1st January 2018. It contains provisions on the accounting treatment of financial instruments, introducing disruptive changes in the classification and measurement of financial instruments, impairment of financial assets and hedge accounting.

[62] The final dataset has been reduced to 186 observations as it has not been possible to fill the missing values for all the variables as we did for the *NPLratio*.

Figure 4.1 – Average NPL ratios across the banks considered in the sample. Source: own elaboration on Thompson Reuters Eikon data.

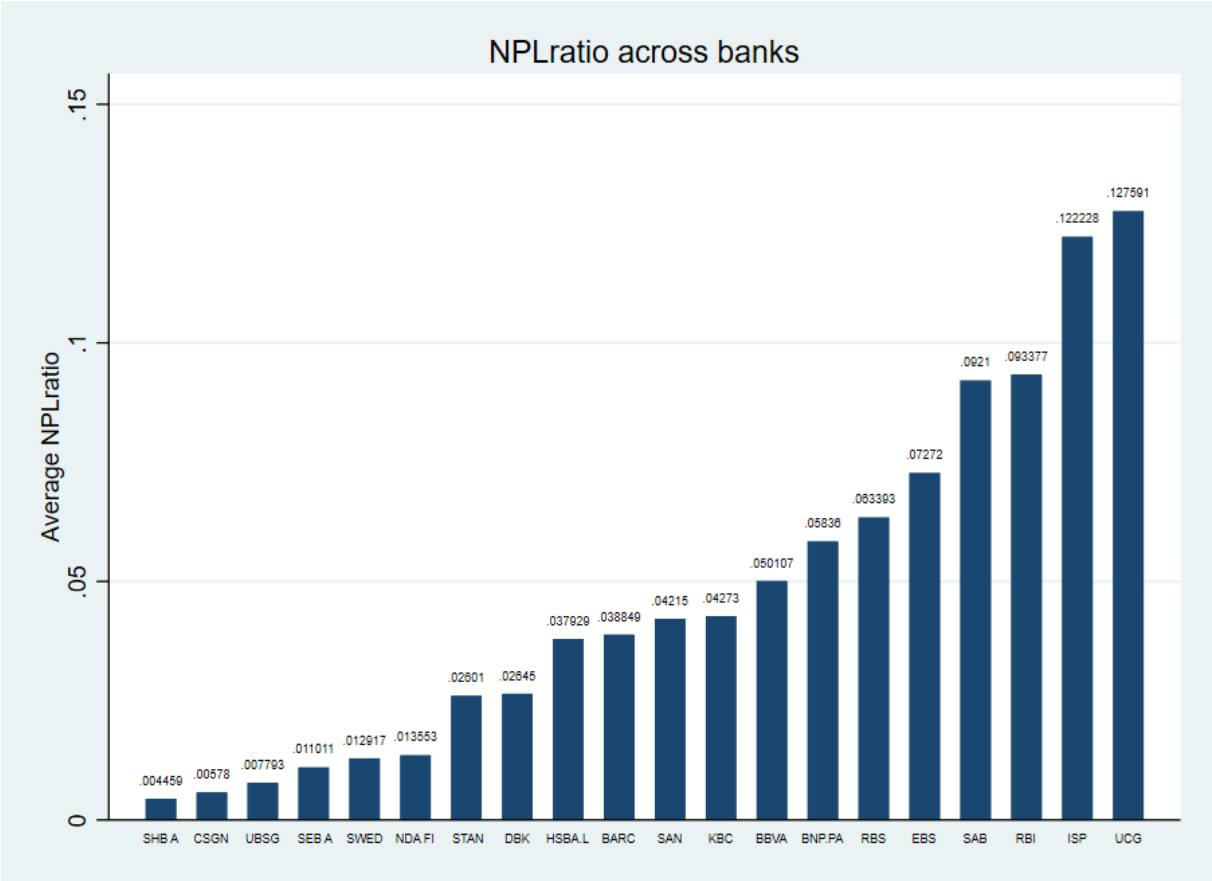


Figure 4.2 – Average NPL ratios across the different banks' size categories considered. Source: own elaboration on Thompson Reuters Eikon data.

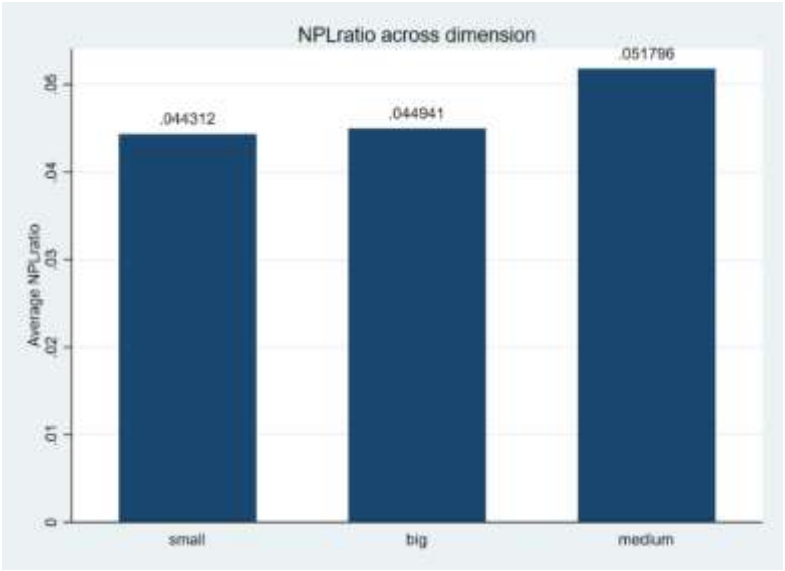
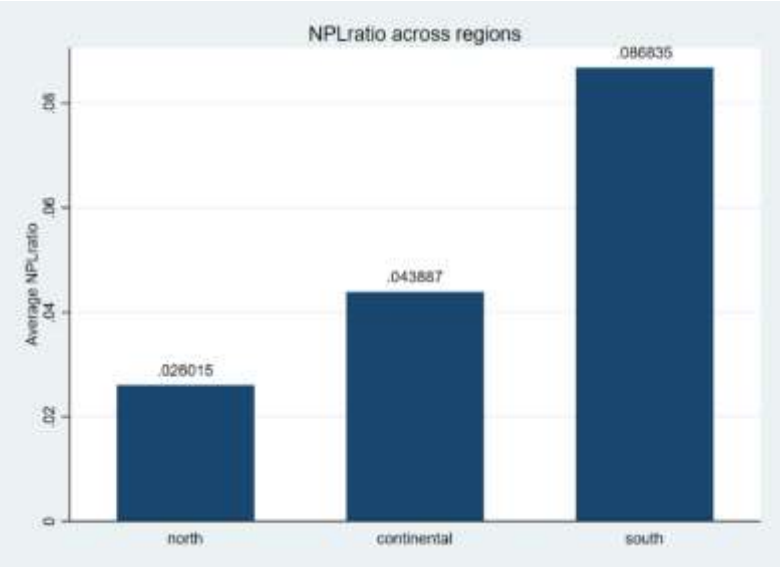
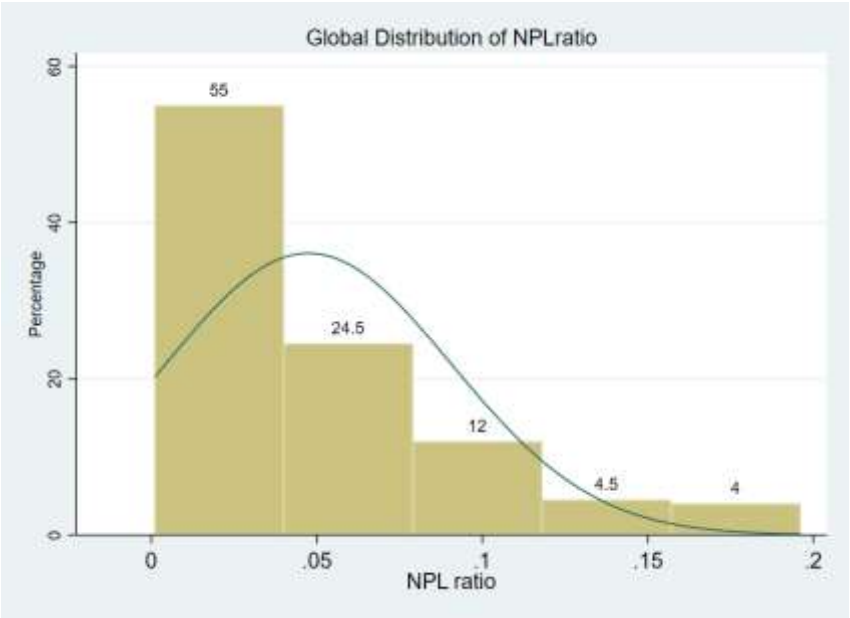


Figure 4.3 - Average NPL ratios across the different geographical regions considered. Source: own elaboration on Thompson Reuters Eikon data.



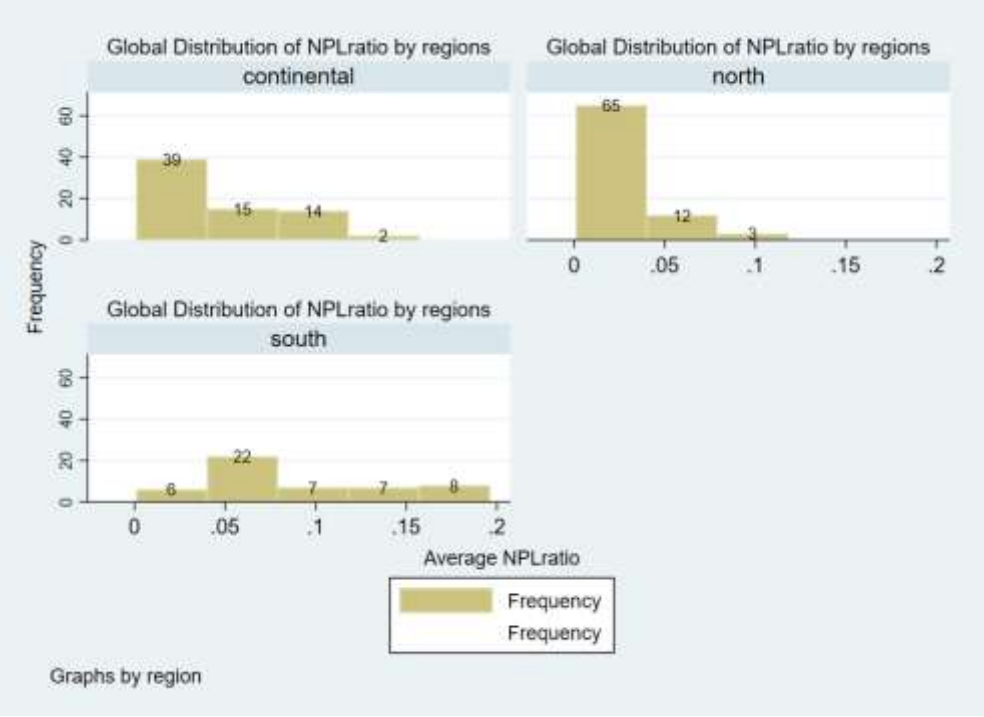
Further analysis can be performed in relation to the distribution of the target variable across the sample chosen. The following graph (Figure 4.4) shows precisely the distribution of the observations, where each bars' height signals the percentage of observations recorded in the generic range of values. In particular, we highlight how NPL ratios between 0% and 5% constitutes approximately 60% of the total observations (200) and how values below 10% characterizes approximately 85,5% of the total observations.

Figure 4.4 – Global distribution of NPL ratio, % of tot. observations. Source: own elaboration on Thompson Reuters Eikon data.



The analysis regarding the distribution of the target variable can be expanded considering once again the different regions: the following graphs (Figure 4.5) give evidence of the distribution of the variable *NPLratio* across the three regions considered for our descriptive analysis. Please note how, differently from the previous graph, the frequencies over the 200 observations are reported (instead of percentages). Nevertheless, this graph is crucial since it corroborates the evidence of geographical differences in the magnitude of the phenomenon, with the *NPLratio* distribution being significantly different between southern and northern credit institutions and with the continental area that appears to be somewhere in the middle.

Figure 4.5 - Global distribution of NPL ratio by geographical region, frequencies. Source: own elaboration on Thompson Reuters Eikon data.



4.2. Into the empirical analysis

The conclusion of the descriptive analysis of the target variable allows us to restore the dual feature of the project by considering both the cross-sectional and the time series nature of the phenomenon. In this paragraph, we will clarify the structure of the project, explaining its rationale and its inspiration. Subsequently, we will specify the models and state the hypotheses tested by their means.

4.2.1. The research project

The analysis that follows will be structured into two moments: the creation of a Corporate Governance Index (CGI) via the Principal Component Analysis (PCA) and the estimation of the econometric models.

The need of the creation of a Corporate Governance Index to add as regressor in our model is borrowed from Tarchouna et al. (2017) and it answers to the willingness of including a set of different corporate governance variables in the model without causing statistical problems. In fact, these problems would have been linked to the existing interrelation, as substitutability or complementarity relations, between the different corporate governance mechanisms (Weir et al. 2002; Peasnell et al. 2003; Florackis 2005; Lasfer 2006). Moreover, the introduction of many variables can lead to an over-parameterization of the model that can, consequently, influence its reliability and make the conclusions biased. To overcome all these statistical problems, Tarchouna et al. (2017), as well as prior studies, suggested the necessity of using a single corporate governance measure able to evaluate the whole corporate governance system since the variables taken in isolation would offer only a limited picture of the bank's overall corporate governance. Building on this evidence, we decided to build our own version of the Corporate Governance Index taking advantage of the PCA method[63] while enriching the specification of Tarchouna et al. (2017) by considering a broader set of variables[64]. As mentioned above, the outcome of this procedure will be a time series, covering 10 years, of a bank-specific governance index that will be included in the model's specification as independent variable.

The second step of the research project consists of the estimation of the models and of the interpretation of their results. The estimation process is entirely coded and performed using Stata16 as computational device. The rationale behind the specification of the models is the following: the first model, answering to a consistency request, strictly follows the specification employed by Tarchouna et al. (2017). The second model considers four further bank-specific variables, as compared to the baseline model. The additional variables are introduced with the purpose of capturing a higher part of the individual effect for each bank. Under such occurrence, it would be more likely the possibility of a consistent use of the Random Effect estimator (RE) that, combining both between and within variation, would result in more interesting estimates of the coefficients from an economic point of view. Models 3 and 4 respectively retrace the first two models with the only difference that the macroeconomic variables have been replaced by

[63] Please refer to paragraph 4.3.2 for further details.
[64] Please refer to paragraph 4.2.2. for further details.

year dummies. The introduction of year dummies provides an alternative way of accounting for the time effect and it also captures potential aggregate macro shocks.

4.2.2. Specification of the corporate governance variables considered

We will now briefly account for the formal definitions and assumptions employed in the construction of the seven variables considered within the scope of the corporate governance index (CGI). The reader may refer to the Appendix for a complete disclosure of the corporate governance data hand-collected from each banks' Annual Reports.

One-tier system *(ots):* it is specified as a dummy variable that takes value 1 if the corporate governance system is monistic, 0 otherwise. It has to be reported that, in the definition of this variable, a quite demanding simplification has been applied. As a matter of fact, especially within the Italian context, a third corporate governance structure could be considered. This third way is usually referred to as *"modello tradizionale"* and it is mainly characterized by a clear separation between administrative and control activities. The former is performed by the Board of Directors, appointed by the Shareholders' meeting while the latter is performed by a completely separated entity, called Board of Statutory Auditors, also appointed by the Shareholders' meeting. Within our sample, the only occurrence of *"modello tradizionale"* is associated to Unicredit. Then, with the aim of simplifying the set of variables considered, we decided not to create a further dummy variable to capture the presence of this governance model, but rather to make it flow into the *non-monistic* category *(ots=0)*. This decision can be justified by the need of accounting for the fact that, contrary to the monistic governance model, both in the dualistic and in the *"modello tradizionale"* environment, the entity designated to perform the control tasks does not belong to the Board of Directors.

Size of the Board of Directors *(bsize)*: it is a variable that captures the numerousness of the Board of Directors *(or of the Supervisory Board if ots=0)*.

Size of the Board of Directors, adjusted *(bsize_adj)*: it is a variable that considers the numerousness of the Board of Directors *(or of the Supervisory Board)* relativized to the dimension of the bank, as measured by the natural logarithm of the total assets. This variable has been introduced with the purpose of accounting for the heterogeneity in dimension that characterizes the banks of the sample.

Directors' ownership rate *(Dir_Own):* it is a variable that measures the number of ordinary shares held by Directors and Executives as compared to the total ordinary share-capital of the bank.

Rate of independent directors *(Indep_r):* it is a variable that returns the share of Directors appointed with the status of 'independent' *(from the bank)*.

Rate of Executives *(Ex_r):* it is a variable that counts the number of Executives seated in the Board of Directors and compares it with the numerousness of the BoD itself.

Gender diversity ratio *(Gen_Div)*: it is a variable that counts the number of women belonging to the Board of Directors and compares it with the numerousness of the BoD itself.

Last but not least, we specify that, for consistency purposes, all the information collected concerning the different corporate governance dimensions refers to the situation as of the date of approval of the Annual Report.

4.2.3. Specification of the model and hypothesis tested

In this paragraph, the formal specification of the models estimated will be presented. In particular, the hypotheses underlying the first model are heavily inspired by Tarchouna et al. (2017), while the second model's specification answers to the need of finding a way to consistently capture an higher part of the bank individual effect. For this reason, a set of four additional banking-specific variables has been introduced. Models 3 and 4 do not entail the specification of additional hypotheses but they rather consider an alternative way to account for the time effect and the potential aggregate macro shocks. The macroeconomic variables used as explanatory variables in the first two models have been here replaced by year dummies. In terms of hypotheses tested, models 3 and 4 retrace model 1 and 2, respectively.

4.2.3.1. Model 1

The first model studied is specified as follows:

$$NPLratio_{i,t} = \alpha + \beta_1 ME_t + \beta_2 BS_{i,t} + \beta_3 CGI_{i,t} + f_i + u_{i,t}$$

Where the subscripts $i = 1, \dots, N$ denotes the cross sections; $t = 1, \dots, T$ denotes the number of periods of the panel data; $NPLratio$ denotes the ratio of NPL over total gross loans; α is the constant term; ME_t is the $kx1$ vector of macroeconomic explanatory variables, $BS_{i,t}$ is the $kx1$ vector of bank-specific explanatory variables, β is a $kx1$ vector of coefficients; f_i is the unobserved bank individual effects and $u_{i,t}$ is the error term.

The dependent variable of the model is the ratio of non-performing loans to total gross loans. For consistency reasons, we adopted the definition of the ratio available on Eikon dataset (please refer to Table 2 for further information).

In accordance with prior literature, the explanatory variables include, besides the corporate governance index, banking-specific determinants as well as macroeconomic determinants. In the following, the set of hypotheses tested is presented.

- Unemployment. The unemployment rate captures the ability of individuals and companies to comply with their debt commitments. Louzis et al. (2012) report a positive impact of the unemployment rate on NPLs, justified with the intuition that an increase of unemployment deteriorates the ability of the borrowers to reimburse their credits.
  H1: We expect a positive relation between unemployment rate and NPL ratio.
- Real Interest Rate. Literature widely agrees on the idea that rising interest rates are passed though to the lending rate of banks, hence changing the debt-servicing abilities of borrowers.
  H2: We expect a positive relation between real interest rate and NPL ratios.
- Bank size. The bank size is measured by the natural logarithm of bank's total assets. According to the "too big to fail" assumption proposed by Louzis et al. (2012) among others, the size of any credit institution affects NPL ratios positively. On the other hand, relying on the idea of the diversification by bank size, Salas and Saurina (2002) and Hu et al. (2004) find that the size of the bank affects its NPL ratio negatively.
  H3: We expect that the relation between bank size and NPL ratio can be either positive or negative.
- Loan Loss Provision. The bank provisions for loan losses are measured by the percentage of loan loss provisions over banks' total loans. A strand of literature evidences that the provisions for loan losses are positively related to NPL ratio as the retrospective behaviour of provisioning which supposes that the default in loans repayment causes the creation of provisions. Nevertheless, Boudriga et al. (2009) find a negative relation between loan loss provisions and NPL ratios building on the idea that the provisioning rate can signal the banks attitude towards risk.
  H4: We expect a positive relationship between loan loss provision and NPL ratio.
- Diversification opportunities. The diversification opportunities are here captured and measured by the ratio of non-interest income to operating income. Both Louzis et. al (2012) and Tarchouna et al. (2017) consider the ratio of non-interest income to total income in order to give evidence of the diversification opportunities of the bank. This apparent inconsistency is resolved by recalling that the ratio hereby considered reflects the portion of operating income (in place of total income) that comes from non-lending sources, thus returning us a percentage that signals the relative weight of operations

other than lending in the individual bank, thus diversification. According to Salas and Saurina (2002) and Hu et al. (2004), the diversification opportunities are negatively related to the NPL ratios.

H5: We expect a negative relation between diversification opportunities and NPL ratios.

- Corporate Governance Index. We consider seven relevant corporate governance variables in the construction of the CGI. The set of variables chosen enriches the set employed in Tarchouna et al. (2017) and it is composed of the following: one-tier system, board size, board size adjusted, directors and executive officers' ownership, rate of independent directors, rate of executive officers' seated in the board of directors, gender diversity rate.

  H6: We expect that the relation between the corporate governance index and NPLs can be either positive or negative.

4.2.3.2. Model 2

The second model studied is specified as follows:

$$NPLratio_{i,t} = \alpha + \beta_1 ME_t + \beta_2 BS_{i,t} + \beta_3 CGI_{i,t} + f_i + u_{i,t}$$

Where the subscripts $i = 1, \dots, N$ denotes the cross sections; $t = 1, \dots, T$ denotes the number of periods of the panel data; $NPLratio$ denotes the ratio of NPL over total gross loans; α is the constant term; ME_t is the $kx1$ vector of macroeconomic explanatory variables, $BS_{i,t}$ is the $kx1$ vector of bank-specific explanatory variables, β is a $kx1$ vector of coefficients; f_i is the unobserved bank individual effects and $u_{i,t}$ is the error term.

As is it immediately clear, the econometric specification of the two models is the same; nevertheless, the second model is enriched with a broader set of banking variables. The hypotheses underlying the introduction of these additional variables are presented below. Please note that the entire set of hypotheses tested by model 1 is kept, thus the hypotheses that will follow have to be considered as additional, and the ones already specified will not be reported again not to incur in redundant information.

- Tier 1 Ratio. It is computed as the percentage of Tier 1 Capital to the Total Risk-Weighted Assets for the same period. Numerous studies attempt to verify the impact of bank capitalization on NPL ratio. The dimension usually considered to study such behaviour is the CAR (capital adequacy ratio), in our research project we consider instead the Tier 1 Ratio due to data availability issues. The only difference between the two measures is that the CAR considers also the Tier 2 amount of capital, thus resulting

in a less conservative measures as compared to the one considered in our study. Based on the moral hazard argument, various authors, such as Berger and DeYoung (1997), Salas and Saurina (2002) or Us (2017) support the idea that banks with low CAR carry greater risk, ultimately causing higher NPL. Boudriga et al. (2009), addressing the regulatory situation in Europe, point out how banks with capital that is less than the regulatory minimum are forced to adjust their balance sheet to comply with the regulatory requirements either by raising more capital or reducing risk-weighted assets (Boudriga et al. 2009, p. 288 f.). The study of Barth et al. (2004) suggest that stricter CAR (higher) might encourage banks to enter into riskier lending activities to increase profitability, thus resulting in higher NPL ratios eventually.

H7: We expect that the relation between banks' capitalization, measured by the Tier 1 ratio, and NPL ratio can be either positive or negative.

- Cost Efficiency. In our study, the cost efficiency is measured through the ratio of non-interest expense to total revenue less interest expense. Such a ratio measures the cost to the bank of each unit of revenue. Cost efficiency has been one of the most studied and revised NPLs' determinants with a huge strand of literature addressing the direction of causality between the increase of NPLs and the cost efficiency of the bank. The timing and directional issues regarding cost efficiency go beyond the scope of this project, thus the set of relevant hypotheses to report reduces to two. Beyond the order of causality, both under the *bad management* and the *bad luck hypothesis* (Berger and DeYoung, 1997) cost efficiency is negatively related to NPL ratio. On the other hand, under the *skimping hypothesis,* high efficiency is positively correlated with increasing number of NPLs, reflecting the idea that banks that poorly allocate resources to underwriting and monitoring loan quality are more cost-efficient in the short-term, but suffer of higher NPL ratios in the long-term (Berger and DeYoung, 1997, Louzis et. al, 2012).

  H8: We expect that the relation between banks' cost efficiency measured and NPL ratio can be either positive or negative.

- Lending policy. Banks' lending policies are captured by the loan growth rate. Kwan and Eisenbeis (1997) highlight how rapid credit growth is linked with a risky lending policy and thus with higher NPL ratios, on average. Salas and Saurina (2002) address this issue from a European perspective, recognizing rapid credit expansion as one of the most significant determinants of NPLs.

  H9: We expect a positive relation between loans growth rate and NPL ratio.

- Return on Equity[65]. Both Klein (2013) and Makri et al. (2014) use return on equity as banking-specific explanatory variable and find a significant influence on the NPL rate for Eurozone countries.
  H10: We expect that the relation between banks' return on equity and NPL ratio can be either positive or negative.

4.2.3.3. Models 3 and 4

Models 3 and 4 do not entail the specification of additional hypotheses. The macroeconomic variables used as explanatory variables in the first two models have been here substituted by the use of year dummies, thus leading to a different specification of the models. In any case, the hypotheses tested by models 3 and 4 retrace those of the models 1 and 2, respectively.

$$NPLratio_{i,t} = \alpha + \beta_1 year_t + \beta_2 BS_{i,t} + \beta_3 CGI_{i,t} + f_i + u_{i,t}$$

The introduction of year dummies in the place of the macroeconomic variables is justified by the willingness of finding an alternative way to consider both the time effect and possible aggregate macro shocks.

The estimation results of the models specified as presented in this paragraph are provided at paragraph 4.4.2.

4.3. Econometric introduction on panel data and PCA

4.3.1. Panel data

Panel data (or *longitudinal data*) are time-series of cross-sections where the same individuals are followed over time. According to Baltagi (2013), panel data can be defined as the pooling of observations on a cross-section of households, firms, countries, etc. over several time-periods. A generic example:

$$y_{it} = x'_{it}\beta + u_{it} + f_i \qquad (3)$$

where $i = 1, \dots, N$ denotes individual i and $t = 1, \dots, T$ denotes period t, x_{it} is a $1xk$ vector of regressors and f_i is an individual unobserved effect[66] which does not vary over time.

[65] Pretax.

[66] In a post-estimates phase, it is also possible to recover the individual specific effects:

$$\hat{f}_i = \bar{y}_i - \bar{x}'_i\hat{\beta}$$

Panel data provide information on individual behaviour, both across individuals and over time, meaning they have both a cross-sectional and time-series nature. Analytically, panel datasets include N individuals observed at T regular time-periods. They are said to be balanced when all individuals are observed in all time-periods ($T_i = T\ \forall i$) and unbalanced when individuals are not observed in all time periods ($T_i \neq T$). In terms of dimensions, they are usually classified either as *short panel* if there are many individuals and few time periods or as *long panel* if there are many time periods and few individuals. Among the variables that can compose a longitudinal dataset we recall: *varying regressors* (x_{it}), *time-invariant regressors* ($x_{it} = x_i\ \forall t$), *individual-invariant regressors* ($x_{it} = x_t\ \forall i$).

The dual nature of panel data is also reflected in the concept of variance: as a matter of fact, in the context of panel data analysis the *overall variation* can be decomposed in two drivers that highlight the cross-sectional and time-series nature of the dataset, respectively. In particular, we refer to *between variation* to describe the variability between individuals (cross-sectional), while we refer to *within variation* to describe the variation existing within individuals (over time). It follows that *time-invariant regressors* have zero *within variation*, *individual-invariant regressors* have zero *between variation* and we may want to analyse which component is predominant in our dataset in order to make assumptions concerning the right model and estimator.

Recalling (3), the objective of a panel data analysis is to consistently estimate β. The paramount issue is now to determine under what assumptions on the error term u_{it} (*exogeneity assumptions*) and on the unobserved effect f_i, β can be consistently estimated. The fulfilment of one or more of the following assumptions justifies or rejects the employment of the estimators available. The following table summarizes the set of assumptions in turn required by the estimators. In particular we have two families of assumptions:

Exogeneity assumptions	
Weak exogeneity	$E(u_{it}\|x_{it}, f_i) = 0 \ \Rightarrow\ E(x'_{it}u_{it}) = 0\ and\ E(u_{it}f_i) = 0$ (A)
Strict exogeneity	$E(u_{it}\|x_{i1}, \dots, x_{iT}, f_i) = 0 \Rightarrow E(x'_{is}u_{it}) = 0, for\ s,t = 1, \dots, T\ and\ E(u_{it}f_i) = 0$ (B)

Said otherwise, the intuition about the individual-specific effects is that they can be intended as representing the leftover variation in the dependent variable that cannot be explained by the regressors.

Assumptions on f_i[67]		
No correlation	$E(f_i \mid x_{i1}, \dots, x_{iT}) = E(f_i) = 0$	(C)
No restrictions	No restrictions on the correlation between f_i and x_{it} for $t = 1, \dots, T$	(D)

The estimator we choose to consistently estimate the vector of coefficients β depends on the exogeneity assumption and on the assumption on the relationship between f_i and x_{it}. The following table proves to be useful in directing the choice of the estimator to be employed towards a consistent estimate of β.

Pooled OLS estimator	
Weak exogeneity	Assumption A
No correlation between f_i and x_{it} for $t = 1, \dots, T$	Assumption C
Random Effects estimator (RE)	
Strict exogeneity	Assumption B
No correlation between f_i and x_{it} for $t = 1, \dots, T$	Assumption C
Fixed Effects estimator (FE) and First difference estimator	
Strict exogeneity	Assumption B
No restrictions on the correlation between f_i and x_{it} for $t = 1, \dots, T$	Assumption D

Pooled OLS estimator. It employs both the between and within variation to estimate the parameters. From a practical point of view, the pooled OLS estimator is obtained by stacking the data over i and t into a single regression with NT observations and estimating it by OLS. With no doubt the pooled OLS estimator is the simplest method of estimation, on the other hand though, it comes with a set of assumptions that rarely holds. The model we implicitly estimate is:

$$y_{it} = x_{it}\beta + v_{it} \quad where \quad v_{it} = f_i + u_{it} \qquad (4)$$

For the coefficients estimated to be consistent we need $E(x'_{it}v_{it}) = 0$ [68] and $E(x'_{it}f_i) = 0$. The latter is a very restrictive assumption, and it is also the reason why this estimator is not used much in literature, even if it is usually at least reported. The set of assumptions required by the

[67] Each exogeneity assumption implies that the unobserved (fixed) effect f_i is uncorrelated with u_{it} but it does not tell anything about the relationship between f_i and x_{it} for $t = 1, \dots, T$.
[68] $E(x'_{it}v_{it}) = 0 \Rightarrow E(x'_{it}u_{it}) = 0$

Pooled OLS estimator says nothing about the relationship between x_{is} and v_{it} for $s \neq t$. Last but not least, because of the unobserved heterogeneity captured by f_i, the error term is usually serially correlated and thus the use of a cluster-robust variance matrix estimator is required.

Random Effects estimator (RE). In general terms, inference using Pooling OLS estimator will result, most of the times, biased due to the presence of serial correlation of the error terms. Estimation through random effects method requires strict exogeneity of the dependent variables with respect to the error term (Assumption B) and zero correlation between f_i and x_{it} ($E(f_i|x_{i1}, \ldots., x_{iT}) = 0$, Assumption C). Said otherwise, the RE model assumes the individual-specific effects f_i to be distributed independently of the regressors. The RE estimator exploits the serial correlation characterizing the composite error term $v_{it} = f_i + u_{it}$ within a Generalized Least Squared (GLS) framework. It follows that the Random Effects model is written, similarly to the Pooled OLS one, as:

$$y_{it} = x_{it}\beta + v_{it} \quad where \quad v_{it} = f_i + u_{it} \qquad (5)$$

One of the paramount concepts to understand in the process of the RE estimation is the specification of the variance-covariance matrix ($\boldsymbol{V}$) associated to the composite error term. Each diagonal element can be defined as $E(v_{it}^2) = E(f_i^2) + 2E(f_i u_{it}) + E(u_{it}^2) = \sigma_f^2 + \sigma_u^2 \; \forall t$ as the strict exogeneity assumption implies $2E(f_i u_{it}) = 0$. On the other hand, off-diagonal elements can be defined as: $E(v_{it}v_{is}) = E[(f_i + u_{it})(f_i + u_{it})] = \sigma_f^2 \; for \; t \neq s$. It strictly follows than that the GLS estimator exploits the serial correlation in the error terms as:

$$\rho_v = corr(v_{it}v_{is}) = \frac{\sigma_f^2}{\sigma_f^2 + \sigma_u^2} \qquad (6)$$

Where rho is the interclass correlation of the error. Rho is the fraction of the variance in the error due to the individual-specific effects. It approaches 1 if the individual effects dominate the idiosyncratic error.

Up to this point, the GLS estimator cannot be implemented since the variance-covariance matrix is unknown. The latter depends on two unknown parameters (σ_f^2, σ_u^2) that we need to estimate. Such a task can be performed by estimating (5) with OLS and using the estimated residuals ($\hat{v}_{it}$) to obtain a consistent estimate of σ_f^2 and σ_u^2. Omitting the analytical specification of the estimator, we can claim that the estimated coefficients ($\hat{\beta}_{RE}$) are consistent and asymptotically normal. Under particular circumstances (the composite error variance has the random effect structure), $\hat{\beta}_{RE}$ is also asymptotically efficient.

Between estimator. it only uses the between variation. It is an OLS estimation of the time-averaged dependent variable on the time-averaged regressors for each individual. The biggest drawback of the between estimator is then clear: it disregards the entire temporal dimension of the panel dataset given that data are collapsed through the averaging process into a single observation per individual.

Fixed Effects estimator (FE). It employs the within variation. FE estimation of β builds on the idea of eliminating the unobserved effect f_i. Such a necessity is justified by the idea that the individual-specific effects f_i contain non-observable errors that may correlate with the explanatory variables x_{it}, thus returning biased estimates. The fixed effects estimator is based on the use of time-demeaned variables, namely the individual-specific deviations of variables from their time-averaged values. The FE estimator $\hat{\beta}_{FE}$ is then obtained as an OLS estimation of the time-demeaned dependent variable on the time-demeaned regressors ("the transformed equation"):

$$y_{it} - \bar{y}_i = (x_{it} - \bar{x}_i)\beta + (u_{it} - \overline{u_i}) \quad or \quad \tilde{y}_{it} = \tilde{x}_{it}\beta + \tilde{u}_{it} \qquad (7)$$

Please notice how the number of observations on which the estimation is performed is once again NT and how the individual-specific effects f_i cancels out.

In terms of assumptions required, the Fixed Effects estimator requires on the one hand strict exogeneity of x_{it} with respect to u_{it} (Assumption B), but on the other hand it allows for correlation between x_{it} and the unobserved effect f_i, for $t = 1, \dots, T$ (Assumption D). The strict exogeneity assumption on the transformed model (in deviation from the mean) is required in order to ensure the consistency of the OLS estimation instrumental to obtain $\hat{\beta}_{FE}$. Under the aforementioned set of assumptions, $\hat{\beta}_{FE}$ is consistent and asymptotically normal. The FE estimator is then consistent under weaker conditions than the RE estimator. However, this comes at a cost: some of the parameters of the model may be no longer identifiable. As a matter of fact, the FE estimator uses the time variation within each cross section, thus the effect of regressors that do not vary over time (time-invariant variables) cannot be identified. This constitutes the biggest limitation in the use of the FE estimator. The FE estimator is the most efficient estimator under the assumption of strict exogeneity and when the assumptions of no serial correlation and homoskedasticity of u_i hold ($E(u_i u_i' | x_i, f_i) = \sigma_u^2 I_T$).

When both FE and RE estimators are consistent, the RE estimator is more efficient than the FE estimator. This can be easily explained by recalling that the RE estimator combines between-

groups variability with within-group variability, while the FE estimator only uses within-group variability.

First-differences estimator it uses the one-period changes on an individual basis, namely it employs the first-differenced variables that can be defined as the individual-specific one-period changes for each individual. This is an OLS estimation of the one-period changes of the dependent variable on the one-period changes in the regressors.

$$y_{it} - y_{i,t-1} = (x_{it} - x_{i,t-1})\beta + (u_{it} - u_{i,t-1}) \quad or \quad \Delta y_{it} = \Delta x_{it}\beta + \Delta u_{it} \qquad (8)$$

Where $t = 2, \dots, T \; and \; i = 1, \dots, n$. The number of obervations is thus $N(T-1)$ since we lose the first observation for each individual because of differencing. Once again, the individual-specific effects f_i cancels out and the greatest drawback of this estimator is that time-invariant variables are dropped from the model and their coefficients cannot be identified.

In the following, we will provide a brief introduction regarding the statistical tests commonly used in literature in order to choose between the different estimators presented above.

Breusch-Pagan Lagrange Multiplier test (LM). This is a test for the random effects model based on the OLS residual. It tests whether σ_u^2 or, equivalently, $corr(u_{it}, u_{is})$ is significantly different from zero. In particular, the LM test's null is that the variance of the random effect is zero: $Var(u_i) = 0$. Effectively, this would mean that there is no significant variability across individuals. Under this scenario, there is no panel effect, the intercepts are the same on an individual basis and the estimation of a pooled regression would be meaningful. If the LM test is significant, we can reject the abovementioned null hypothesis and the use of either the random effects estimator (RE) or of the fixed effects estimator (FE) is justified in order not to ignore the panel effect evidenced by the LM test. Nevertheless, we need to provide statistical support to the choice between fixed and random effects; in this sense, the Hausman test will do the job.

Hausman test. The Hausman test (1978) represents the most powerful tool available to scholars in order to spot the true model, and consequently the consistent estimator, according to the dataset in use. As we have already mentioned, in general terms, the random effects estimator would be more efficient, still we need to have the supportive action of the Hausman test in order to justify its employment. On the contrary, if the test does not support its use, we shall use the fixed effects model.

The Hausman test is based on the null hypothesis (H_0) that the individual-specific effects f_i are not correlated with any explanatory variable in the model.

$$H_0: cov(f_i, x_{it}) = 0 \; then \; RE \; model \; consistent$$

$$H_1: cov(f_i, x_{it}) \neq 0 \; then \; FE \; model \; consistent$$

From the hypothesis specification presented and from the dissertation held within this paragraph, it follows that under the null hypothesis, both the Fixed Effects and the Random Effects models are consistent. Nevertheless, if the null hypothesis is accepted, the Random Effect will result as the true model. On the contrary, if the null hypothesis is rejected, we shall conclude that the individual-specific effects f_i are significantly correlated with at least one of the explanatory variable of the model. The latter implies that the Random Effect model cannot be considered as the true one and the use of the Fixed Effects model should be preferred in order to avoid the inconsistencies that the use of the random effect estimator on the (true) fixed effects model would generate on our estimates.

In other words, Hausman (1978) suggests to compare $\hat{\beta}_{RE}$, the estimation obtained from the Random Effect model, and the $\hat{\beta}_{FE}$, the estimated coefficients obtained from the Fixed Effect model. Said otherwise, Hausman test tests, for time-varying regressors, whether there is a significant difference between the fixed and random effects estimators.

$$H = \left(\hat{\beta}_{RE} - \hat{\beta}_{FE}\right)' \left[\left(V(\hat{\beta}_{RE}) - V(\hat{\beta}_{FE})\right)^{-1}\right] \left(\hat{\beta}_{RE} - \hat{\beta}_{FE}\right) \qquad (9)$$

$\hat{\beta}_{RE}$ will be consistent and the best linear unbiased estimator only under the null hypothesis. It would be inconsistent when H_0 is rejected. The Hausman test statistic is a chi-squared distributed with degrees of freedom equal to the number of parameters for the time-varying regressors. The test statistic is based on the difference between the estimated coefficients in the two models considered. When such a difference is significant, the null hypothesis is rejected and the Fixed Effects model shall be considered.

4.3.2. Principal Component Analysis (PCA)

Principal component analysis (PCA) is a data reduction method used to re-express multivariate data with fewer dimensions. The goal of such methodology is to re-orient the data so that a multitude of original variables can be summarized with relatively few components that capture the maximum possible information (variation) from the original variables.

The ultimate purpose of PCA is to find components $z = [z_1, z_2, \dots, z_p]$, which are a linear combination $u = [u_1, u_2, \dots, u_p]'$, of the original variables $x = [x_1, x_2, \dots, x_p]$, that achieve maximum variance. The first component z_1 is given by the linear combination of the original variables x and accounts for maximum possible variance. The second component captures most

information not captured by the first component and is also uncorrelated with the first component. PCA maximizes the variance of the elements of $z = xu$, such that $u'u = 1$.

The solution is obtained by performing an eigenvalue decomposition of the correlation matrix, by finding the principal axes of the shape formed by the scatterplot of the data. The eigenvectors represent the direction of one of these principal axes. Solving the equation $(R - \lambda I)u = 0$, where R is the sample correlation matrix of the original variables x, λ is the eigenvalue, u is the eigenvector and I is the identity matrix. The eigenvalues λ are the variances of the associated components z. The diagonal covariance matrix of the components is denoted as $D = diag(\lambda)$.

The proportion of the variance in each original variable x_i, accounted for by the first c factors, is given by the sum of the squared factor loadings; that is: $\sum_{k=1}^{c} f_{ik}^2$. When $c = p$ it means that all components are retained, thus all variation in the data is explained: $\sum_{k=1}^{c} f_{ik}^2 = 1$.

Factor loadings are the correlations between the original variables x and the components z, from an analytical point of view, it is denoted as: $F = cor(x, z) = uD^{\frac{1}{2}}$.

Next, the topic of component retention is crucial. Since principal component analysis is a data reduction method, there is the need to retain an appropriate number of factors based on the trade-off between simplicity (retaining as few possible factors) and completeness (explaining the most of the variation in the data).

To conclude we now follow Tarchouna et al. (2017) to draft a list of the main reasons that justify the employment of PCA as data reduction method in the context of our research project.

- it helps to aggregate the existing information of the individual bank corporate governance characteristics into a unique index;
- it controls for multicollinearity that may be caused by the introduction of multiple corporate governance variables in the same regression;
- it produces the weights for each corporate governance variable automatically. This makes the CGI able to explain as much of the variance in the set of the corporate governance variables selected.

According to Maddala (2001), the use of the PCA requires the use of two statistical tests to validate the methodology, namely the *Bartlett's sphericity test* and the *Kaiser-Meyer-Olkin (KMO) test*. The former, by comparing the correlation matrix with the identity matrix, has a null hypothesis claiming that the correlation matrix is not factorable. For this reason, the p-

value of the Bartlett's test should not be higher than 5%. The KMO measure, commonly used for sampling adequacy, ranges between 0 and 1 with 0,5 as lower threshold for acceptance.

4.4. Results

4.4.1. PCA

As mentioned above, this project employs the PCA to build a corporate governance index (CGI) that evaluates the overall functionalities and characteristics of the governance systems of European banks. Within the scope of this study, the PCA summarizes seven variables, describing general features of corporate governance, into a single measure called CGI. In performing PCA, following Tarchouna et al. (2017), Florackis and Ozkan (2009) and Ellul and Yerramilli (2013), we take only the first component since it captures the largest percentage of variation in the original dataset. This component linearly combines the seven variables chosen to represent and describe the corporate governance system of each bank: *one-tier system (ots), size of the Board of Directors (bsize), size of the Board of Directors corrected by the dimension of the bank (bsize_adj), Directors and Executives ownership (Dir_Own), rate of independent Directors (Indep_r), rate of Executives within the Board of Directors (Ex_r), gender diversity rate (Gen_Div).*

Contrary to Tarchouna et al. (2017), we decided not to propose the same analysis performed on subsamples defined by size of the bank, given the scarce number of banks included in our original sample: 20 versus 184.

The PCA method assigns weights for each corporate governance attribute rather than using arbitrary or equal weights. Such weights are then employed within the creation process of the governance index. Table 3 displays the weights of each individual corporate governance variable used to build the CGI for the full sample of European banks over the 2008-2017 period.

Table 3 – PCA, loadings results. Own elaboration on hand-collected data from banks' Annual Reports over the 2008-2017 period. For consistency with the original paper, the loadings have not been subject to any rotation.

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
ots	0,1288	-0,2246	-0,3555	-0,3485	-0,4094	-0,4811	-0,5118	-0,5053	-0,4838	-0,4975
bsize	0,5101	0,6059	0,5935	0,6020	0,6236	0,6003	0,5021	0,4906	0,5130	0,5089
bsize_adj	0,5068	0,6064	0,5870	0,5973	0,6286	0,6111	0,5104	0,5005	0,5283	0,5166
Dir_Own	0,2470	-0,1767	0,1377	0,0257	-0,0463	-0,0831	-0,3029	-0,2939	-0,3228	-0,2763
Indep_r	-0,4882	-0,3971	-0,3199	-0,3791	-0,0167	-0,0426	0,2514	0,2983	0,2203	0,2696
Ex_r	0,3351	0,1476	0,0011	0,0003	-0,0601	-0,1138	-0,2617	-0,2686	-0,2410	-0,2775
Gen_Div	-0,2339	-0,0630	-0,2357	-0,1220	-0,2061	-0,1144	-0,0449	-0,0771	-0,1135	-0,0247
Kaiser-Meyer-Olkin	0,446	0,533	0,566	0,570	0,571	0,524	0,570	0,571	0,473	0,532
Bartlett's test p-value	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

The weights produced as output of the PCA are the loadings that express the direction and magnitude of the correlation between the single variable in a specific year and the principal component in the same year. The sign of the weights then signals either positive or negative correlation with the principal component. It is at this point important to underline that we are not yet addressing the issue of the determinants of NPLs. The sign and the magnitude of the weights presented in Table 3 are linked to the construction of the corporate governance index and not in any way to the dynamics of NPL ratios.

Based on the results of Table 3, we can claim that the rate of independent directors has a negative contribution to the corporate governance index up to 2013 and a positive one from then onwards. This result is partially in line with the finding of Tarchouna et al. (2017) on US commercial banks evidencing a consistent negative sign for the rate of independence of the directors. This empirical result is thought to reflect the passive role played by independent directors in the corporate governance and may shed light on the alternative control assisted by insider directors who can facilitate the transmission of information between board and management. As a matter of fact, the weight associated to the rate of Executives seated in the Board is positive up to 2011 and negative from then onwards, perhaps signalling a complementarity of the two measures. In terms of size of the Board, it has to be noted how, both for *bsize* and *bsize_adj,* the weights are positive and consistent throughout the entire time-window considered. This is partially in contrast with the findings of Tarchouna et al. (2017) that evidence positive weights only during distressed periods. The numerousness of the boards appears then to play a different role in affecting the effectiveness of the corporate governance depending on the geographical area considered (Europe vs USA).

Interestingly, the weights associated to the gender diversity rate are consistently negative for the entire time-period, signalling a negative correlation between the percentage of women belonging to the boards and the principal component. Such result is definitely odd but it may be explained in the same way as for the independent Directors rate. The negative weights associated to the gender diversity rate may signal the passive role of female Directors within the Board. Furthermore, the female presence in the Boards started to became significant only around 2012-2013[69], meaning that for more than a half of the time-window considered the awareness towards the gender diversity in board was extremely low.

Table 3 also reports the two diagnostic measures commonly used in order to assess the significance of the PCA method as compared to the informative contribution of the original

[69] Please refer to the Appendix for the quantitative detail of female presence in Boards.

dataset. The null hypothesis of the Bartlett's test of sphericity, suggesting that the correlation matrix equals to the identity matrix, is rejected for all the years considered. This evidence confirms the existence of a linear relationship between variables. On the other hand, the critical threshold value of 0,5 of the KMO measure is reached eight times out of ten. Hence, the results of these two tests generally support the validity of the use of PCA in our study.

As last reminder, we recall that the results of the application of the PCA (the first component in our case-study) are then organized in the context of the panel data structure, thus resulting in a 10-years time series on an individual bank base. Such outcome will be then introduced as independent variable in the models' specification, and its contribution will be assessed though the commonly used econometric tools.

4.4.2. Panel data estimation

This paragraph will be structured as follows: first, we will report the standardized table describing the different components of variability (overall, between, within) for every variable included in the models estimated; second, we will present the estimation results for each model specified considering four different panel data estimators: *pooled OLS estimator*, *fixed effects estimator (within estimator)* and *random effects estimator*. In particular, two variations of the random effect estimator (RE) have been employed: generalized least squares (GLS) and maximum likelihood estimation (MLE). Recalling that neither AIC (Akaike Information Criterion) nor BIC (Bayesian Information Criterion) can be computed for the Random Effects GLS estimation, the estimation via Random Effects MLE allowed us to assign an index of goodness of fit to the Random Effect model, hence making a comparative analysis among the different models possible. Building on the evidences of a set of statistical tests, we will finally choose the most consistent estimator for each model and provide a thorough discussion regarding the sign, the magnitude and the significance of each coefficient in relation to the hypotheses previously formulated.

4.4.2.1. Descriptive analysis of the explanatory variables

The following table constitutes a decisive moment of panel data analysis as it is able to give evidence of the weight of the different components that drive the overall variability of each variable employed in the research.

Table 4 – Descriptive analysis. Source: own elaborations.

Variable		Mean	Std. Dev.	Min	Max	Observations
NPL ratio	Overall	.0441678	.0403349	.001	.1961	N = 186
	Between		.036441	.0044595	.1197185	n = 20
	Within		.0221746	-.0246322	.1481678	T-bar = 9.3

unemployment rate	Overall	.1017245	.0125453	.0748463	.1192839	N = 186
	Between		.0014716	.0987942	.1061629	n = 20
	Within		.0124775	.0744328	.1197733	T-bar = 9.3
real interest rate	Overall	-.0025065	.0114469	-.0136896	.0258473	N = 186
	Between		.0015329	-.0071463	.0010055	n = 20
	Within		.0113667	-.0164917	.0261115	bar = 9.3
ln(assets)	Overall	20.17055	.925739	18.14986	21.64474	N = 186
	Between		.9175618	18.57531	21.42165	n = 20
	Within		.1628221	19.56208	20.66828	T-bar = 9.3
loan loss provision	Overall	.0074548	.0067503	-.0037	.0335	N = 186
	Between		.0049324	.0004	.01696	n = 20
	Within		.0046535	-.0054327	.0253548	T-bar = 9.3
Non-interest income/Op. income	Overall	1.168387	1.257424	-.06	13.01	N = 186
	Between		.8435692	.298	4.265	n = 20
	Within		.9866762	-2.026613	9.913387	T-bar = 9.3
Tier1 ratio	Overall	.1328167	.0413909	.068	.287	N = 186
	between		.0254071	.1042714	.2053875	n = 20
	Within		.0336996	.0372167	.2462167	T-bar = 9.3
efficiency ratio	Overall	.7543065	.5232353	.461	7.196	N = 186
	between		.2438397	.4872	1.59	n = 20
	Within		.4664323	-.0676935	6.360306	T-bar = 9.3
loans growth rate	Overall	.0402903	.2321911	-.269	2.807	N = 186
	between		.0580181	-.0177143	.24775	n = 20
	Within		.2258295	-.4764597	2.59954	T-bar = 9.3
pre-tax ROE	Overall	.0876183	.1274413	-.814	.769	N = 186
	between		.0667923	-.08075	.171375	n = 20
	Within		.1104618	-.6923817	.7250183	T-bar = 9.3
CGI	Overall	-.0226517	1.598384	-3.43535	3.855551	N = 186
	Between		1.30993	-2.161802	2.544437	n = 20
	Within		.9798573	-3.791932	3.035398	T-bar = 9.3

As first consideration, we shall underline how the sample has been reduced to 186 observation as the issue of missing values over banking-specific variables has been accounted for. Such a reduction allowed the estimation of the different models specified on a common sample of data.

In terms of drivers of variability, we evidence a general equilibrium, with the exception of a small number of explanatory variables characterized by the prevalence of one component. In particular, the variability of both *loans growth rate* and *pre-tax ROE,* is mostly driven by the within component signalling perhaps the presence of a sort of *industry-best-practice* among banks on a year-by-year basis that would indeed explain the prevalence of the variability over time on top of that among individuals. Considering the *Corporate Governance Index*, we highlight a slightly higher importance of the variability among individuals (between variation) as compared to the within variation. This is completely rational as corporate governance models may differ substantially among the individual banks but are likely not to change much over time: corporate governance structures are *sticky* over time. Same reasoning could be made

regarding the bank size as measured by the natural logarithm of the total assets: the overall variability is almost completely driven by the between variability as the differences in assets over time (time series perspective) are negligible compared to the magnitude of the total assets amount.

Lastly, we report that the between component of the macroeconomic determinants should be zero as we used time-series referring to the Euro-area, hence from a purely theoretical point of view, both the unemployment rate and the real interest rate are non-varying determinants on the individual banks basis. Still, the table above reports a between component slightly positive as a consequence of the distortions caused by the sample reduction process aimed at obtaining a common sample for our estimates.

4.4.2.2. Model 1 – Results

The following table presents the estimation results of Model 1 considering different panel data estimators.

Table 5 – M1, Estimation results. Source: own elaboration.

	(PooledOLS)	(Fixed Effects)	(Random Effects GLS)	(Random Effects MLE)
	NPLratio	**NPLratio**	**NPLratio**	**NPLratio**
unemployment rate	0.395	0.626***	0.586***	0.610***
	(0.263)	(0.163)	(0.174)	(0.161)
real interest rate	-0.512***	-0.387**	-0.459**	-0.431**
	(0.156)	(0.190)	(0.201)	(0.187)
ln(assets)	-0.00747	0.0164*	0.000678	0.00484
	(0.00450)	(0.00872)	(0.00479)	(0.00610)
loan loss provision	3.125***	1.549***	1.938***	1.744***
	(0.526)	(0.325)	(0.330)	(0.319)
non-interest income/Op. income	0.00470*	-0.000712	-0.000153	-0.000538
	(0.00248)	(0.00150)	(0.00156)	(0.00147)
CGI	0.00595*	0.000889	0.00252*	0.00171
	(0.00306)	(0.00145)	(0.00144)	(0.00141)
_cons	0.125	-0.362**	-0.0424	-0.127
	(0.0806)	(0.176)	(0.0978)	(0.124)
N	186	186	186	186
R^2	0.445	0.361		
AIC	-763.1	-959.4	.	-867.0
BIC	-740.6	-936.9	.	-838.0

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

The first step in the analysis of the estimation results is to take into consideration a set of statistical tests commonly used in literature in order to guide the choice of the researcher towards the best regression estimates, given the dataset available. The *Breusch-Pagan Lagrange Multiplier test (LM)* assesses the presence of a panel-effect within the dataset in use. If the LM test is significant, the use of the random effects model in place of the OLS model is justified, precisely in order to give empirical substance to the panel-effect evidenced by the LM test itself. In our particular case the LM test resulted significant, hence the null hypothesis is rejected and the presence of the panel-effect justifies and requires the employment of estimators different from the Pooled OLS one.

$H_0: Var(u) = 0$

$$chibar2(01) = 114.40$$

$$Prob > chibar2 = 0.0000$$

Nevertheless, we still need to provide statistical support to the choice between fixed and random effects; in this sense, the *Hausman test* will do the job.

$H_0: difference\ in\ coefficients\ not\ systematic$

$$chi2(6) = \left(\hat{\beta}_{RE} - \hat{\beta}_{FE}\right)' \left[\left(V(\hat{\beta}_{RE}) - V(\hat{\beta}_{FE})\right)^{-1}\right] \left(\hat{\beta}_{RE} - \hat{\beta}_{FE}\right)$$

$$= 47.2$$

$$Prob > chi2 = 0.0000$$

The p-value of 0,0000 leads us to reject the null hypothesis and to adopt the Fixed Effects model as the true model for our research. We recall that the use of the Random Effect estimator would result in inconsistent estimates if the true model is the Fixed Effects one, thus in this case we shall prefer consistency over efficiency and use the Fixed Effects estimator. The statistically relevant results of the estimation are then those reported in the second column of the Table above.

The *unemployment rate* is found to have a positive and strongly significant (1%) effect on the NPL ratio, precisely as evidenced by Louzis et al. (2012). Contrary to the statement of *hypothesis nr.2*, the real interest rate is found to be negatively correlated to the dependent variable of the study. As one may expect, this evidence strongly deviates from the literature. The rationale is that the period considered by the present research (2008-2017) is characterized

by a particular and unique management of the interest rates. As confirmed by Table 4, the full-sample average of the real interest rate for the Euro-Area has been negative for the time-period considered. We can argue then that this is the reason that generated estimation results not comparable with those evidenced by former literature. In accordance with the "too big to fail" assumption formulated by Louzis et al. (2012), the *size of the bank*, measured as the natural logarithm of the total assets amount, is found to have a positive and significant at a 10% level relation with the stock of NPLs. With regard to the *loan loss provisions*, we can now confirm the hypothesis stated on the pre-estimation stage of a positive and strongly significant relationship between loan loss provisions and NPL ratio. Such a dynamic has been justified in literature by the idea of the retrospective behaviour of provisioning that supposes that the default in loans repayment causes the creation of provisions. In accordance with Salas and Saurina (2002) and Hu et al. (2004), our results evidence a negative effect, yet not significant, of the diversification opportunities on NPL ratios. Results on diversification effect are further weakened by the magnitude of the coefficient estimated. Consistently with the full-sample, medium banks and large banks results of Tarchouna et al. (2017), the *corporate governance index* is found to positively affect the NPL ratio, even though in the context of this first model (FE) we have not managed to reject the null hypothesis claiming the CGI coefficient being equal to zero.

4.4.2.3. Model 2 – Results

With respect to model 1, a set of additional four banking-specific variables is introduced. The employment of FE estimator in the context of Model 1 implicitly caused to the elimination of the unobserved individual effects f_i. The broader specification of Model 2 is then not arbitrary but rather it is aimed at capturing a higher part of the bank individual effect so to avoid their elimination for estimation purposes. In this way we are implicitely *steering* the Hausman Test towards the acceptance of the Random Effect model as true model. The latter would be the desirable conclusion as it would justify the employment of the RE estimator in place of the FE estimator. As we know, the FE estimator considers only within variation while the RE estimator considers both within and between variation so its estimates may provide us with different results.

Table 6 – M2, estimation results. Source: own elaboration.

	(PooledOLS)	(Fixed Effects)	(Random Effects GLS)	(Random Effects MLE)
	NPLratio	**NPLratio**	**NPLratio**	**NPLratio**
unemployment rate	0.185	0.628***	0.542***	0.598***
	(0.225)	(0.178)	(0.187)	(0.172)

real interest rate	-1.098***	-0.364	-0.606**	-0.491*
	(0.298)	(0.262)	(0.272)	(0.254)
ln(assets)	-0.00823**	0.0171*	-0.000281	0.00403
	(0.00382)	(0.00967)	(0.00486)	(0.00631)
loan loss provision	2.583***	1.515***	1.891***	1.705***
	(0.542)	(0.342)	(0.346)	(0.331)
non-interest income/Op. income	0.00372	-0.000259	-0.000122	-0.000397
	(0.00244)	(0.00161)	(0.00166)	(0.00154)
Tier1 ratio	-0.237**	-0.00157	-0.0512	-0.0218
	(0.0897)	(0.0597)	(0.0617)	(0.0579)
efficiency ratio	-0.00420	0.00380	0.00357	0.00406
	(0.00631)	(0.00472)	(0.00500)	(0.00458)
loans growth rate	-0.00846	-0.00809	-0.00441	-0.00504
	(0.0121)	(0.00737)	(0.00754)	(0.00695)
pre-tax ROE	-0.0473	0.0000798	-0.00710	-0.00355
	(0.0386)	(0.0202)	(0.0214)	(0.0197)
CGI	0.00467	0.000897	0.00241*	0.00165
	(0.00300)	(0.00146)	(0.00146)	(0.00140)
_cons	0.204***	-0.379*	-0.0138	-0.109
	(0.0666)	(0.193)	(0.0999)	(0.128)
N	186	186	186	186
R^2	0.487	0.373		
AIC	-769.6	-954.9	.	-862.1
BIC	-734.1	-919.5	.	-820.2

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Retracing the analysis performed regarding model 1, we compute once again the *Breusch-Pagan Lagrange Multiplier test (LM)* in order to verify the presence of a panel-effect within the dataset in use. The LM test resulted significant, thus the null hypothesis is rejected and the presence of the panel-effect justifies and requires the employment of estimators different from the Pooled OLS one. Consequently, the coefficients reported in the first column of Table 6 shall not be deemed consistent for the purposes of our research.

$$Test:\ Var(u) = 0$$

$$chibar2(01) = 82.30$$

$$Prob > chibar2 = 0.0000$$

Having established the presence of a panel-effect, it is now crucial to implement the *Hausman test* in order determine the true model between the fixed and random effect one, and consequently choosing the most efficient and consistent estimator among those available. The results of the *Hausman test* are the following:

$$Ho:\ difference\ in\ coefficients\ not\ systematic$$

$$chi2(10) = \left(\hat{\beta}_{RE} - \hat{\beta}_{FE}\right)' \left[\left(V(\hat{\beta}_{RE}) - V(\hat{\beta}_{FE})\right)^{-1}\right] \left(\hat{\beta}_{RE} - \hat{\beta}_{FE}\right)$$

$$= \quad 34.40$$

$$Prob > chi2 = \quad 0.0002$$

The significance of the test leads us to reject the use of the Random Effects model as the true model for our research. Building on this evidence, we employ once again the Fixed Effects estimator as it is consistent and most efficient within the scope of Model 2 specification. The statistically relevant results of the estimation are then those reported in the second column of Table 6.

The addition of the banking-specific variables does not change the results obtained within the estimation of Model 1. In particular, Model 2 estimates corroborate the results in terms of sign, significance and magnitude of all the coefficients estimated by Model 1, with the exception of the loss of significance of the coefficient associated to the real interest rate. In terms of capitalization, in accordance with Berger and DeYoung (1997), Salas and Saurina (2002) and Us (2017), the *Tier1 ratio* is proved to beneficially affect the NPL ratio by lowering its amount. The statistically significance of the coefficient is instead not ensured, so as for the coefficients capturing the effect of the other banking specific variables. In our research project, we used the *efficiency ratio* as defined by Eikon dataset in order to study the cost efficiency of the bank. Results lack of significance but the negative coefficient would have led us to reject the *skimping hypothesis* (Berger and DeYoung, 1997; Lousiz et al., 2012). Results regarding the *loan growth rate* are not satisfying as we would expect it to have a positive effect on NPL ratio, while empirical evidence suggests insignificance of the coefficient, thus not providing any support to the findings of both Kwan and Eisenbeis (1997) and Salas and Saurina (2002). Not-significant and extremely small in absolute value is the coefficient associated to the *pretax-ROE.* This variable is then deemed not to have an influence on the NPLs accumulation in the context of our study; the latter result contradicts the empirical evidence of both Klein (2013) and Makri et al. (2014). Accordingly with Model 1, we find a positive yet small coefficient associated to the

CGI explanatory variable. Once again though, in the context of the Fixed Effects, we are not able to reject the null hypothesis claiming the CGI coefficient being equal to zero.

4.4.2.4. Model 3 – Results

Model 3 specification retraces that of Model 1 and it answers to the willingness of finding an alternative way of capturing both the time effect and the potential aggregate macro shocks. The set of macroeconomic variables employed as regressors in Model 1 is then replaced by the introduction of year dummies, while keeping the banking-specific and the CGI explanatory variables fixed.

Table 7 – M3, estimation results. Source: own elaboration.

	(PooledOLS)	(Fixed Effects)	(Random Effects GLS)	(Random Effects MLE)
	NPLratio	**NPLratio**	**NPLratio**	**NPLratio**
2008	0	0	0	0
	(.)	(.)	(.)	(.)
2009	0.00117	0.00994	0.00574	0.00815
	(0.00427)	(0.00646)	(0.00727)	(0.00618)
2010	0.0209***	0.0223***	0.0220***	0.0223***
	(0.00600)	(0.00611)	(0.00702)	(0.00590)
2011	0.0218***	0.0247***	0.0246***	0.0251***
	(0.00640)	(0.00625)	(0.00712)	(0.00600)
2012	0.0288***	0.0344***	0.0335***	0.0346***
	(0.0100)	(0.00630)	(0.00716)	(0.00604)
2013	0.0251**	0.0363***	0.0340***	0.0360***
	(0.0120)	(0.00659)	(0.00753)	(0.00634)
2014	0.0411***	0.0429***	0.0433***	0.0435***
	(0.0116)	(0.00624)	(0.00711)	(0.00599)
2015	0.0274***	0.0351***	0.0344***	0.0355***
	(0.00789)	(0.00683)	(0.00772)	(0.00654)
2016	0.0326***	0.0343***	0.0359***	0.0356***
	(0.00768)	(0.00675)	(0.00756)	(0.00643)
2017	0.0256***	0.0244***	0.0263***	0.0254***
	(0.00597)	(0.00651)	(0.00738)	(0.00625)
ln(assets)	-0.00782*	0.00897	-0.00345	0.000806
	(0.00447)	(0.00926)	(0.00397)	(0.00581)
loan loss provision	3.356***	1.894***	2.555***	2.126***
	(0.537)	(0.358)	(0.360)	(0.337)

non-interest income/Op. income	0.00467*	-0.00105	0.000303	-0.000811
	(0.00227)	(0.00158)	(0.00170)	(0.00150)
CGI	0.00578*	0.00105	0.00350**	0.00186
	(0.00300)	(0.00145)	(0.00145)	(0.00137)
_cons	0.149	-0.176	0.0706	-0.0111
	(0.0878)	(0.186)	(0.0800)	(0.117)
N	186	186	186	186
R^2	0.475	0.391		
AIC	-759.2	-954.4	.	-864.1
BIC	-714.0	-909.3	.	-812.5

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Breusch-Pagan Lagrange Multiplier test (LM):

$$Test:\ Var(u) = 0$$

$$chibar2(01) = 119.60$$

$$Prob > chibar2 = 0.0000$$

Having established the presence of a panel-effect, the implementation of the Hausman test allows us to determine the true model among the Fixed and Random Effects ones, and consequently to choose the most efficient and consistent estimator among those available. The results of the *Hausman test* are the following:

$$Ho:\ difference\ in\ coefficients\ not\ systematic$$

$$chi2(13) = \left(\hat{\beta}_{RE} - \hat{\beta}_{FE}\right)' \left[\left(V(\hat{\beta}_{RE}) - V(\hat{\beta}_{FE})\right)^{-1}\right] \left(\hat{\beta}_{RE} - \hat{\beta}_{FE}\right)$$

$$= 65.89$$

$$Prob > chi2 = 0.0000$$

The significance of the test makes us reject the use of the Random Effects model as the true model for our research. Consequently, we employ once again the Fixed Effects estimator since it is consistent and most efficient within the scope of Model 3 specification. The statistically relevant results of the estimation are then those reported in the second column of Table 7.

Year dummies control for time variation of the dependent variable across the panel. Estimation results signal the presence of a positive, yet not linear, time effect given by the presence of positive but not constant coefficients associated to each year dummy[70]. In this scenario, the

[70] The "2008 - effect" is dropped by construction.

coefficients signal the effect, on the dependent variable (*NPL ratio*), of being in one year as compared to the base year (2008 in our case). Furthermore, the positive signs of the coefficients corroborate the evidence of a general build-up of the NPL ratio, as compared to the "2008-level", in the years following both the global financial crisis and the sovereign debt crisis in Europe.

Model 3 verifies the result of Model 1 in terms of loan loss provision, hence confirming the idea that the retrospective behaviour of provisioning supposes that the default in loans repayment causes the creation of provisions. Model 3 also confirms the sign associated by previous models to the effects of both corporate governance and diversification opportunities. With regards of the bank size, if on the one hand the positive correlation with NPL ratio is confirmed, the 10% significance of the coefficient evidenced by the first model is now lost.

4.4.2.5. Model 4 – Results

Model 4 specification retraces that of Model 2. This being said, the set of macroeconomic variables employed as regressors in Model 2 are replaced by the introduction of year dummies, while the banking specific and the CGI explanatory variables are kept fixed. As in Model 3, the year dummies are introduced to control for time variations of *NPLratio* across the panel.

Table 8 – M4, estimation results. Source: own elaboration.

	(PooledOLS)	(Fixed Effects)	(Random Effects GLS)	(Random Effects MLE)
	NPLratio	**NPLratio**	**NPLratio**	**NPLratio**
2008	0	0	0	0
	(.)	(.)	(.)	(.)
2009	0.00861	0.0105	0.00882	0.0100
	(0.00680)	(0.00714)	(0.00911)	(0.00681)
2010	0.0309***	0.0231***	0.0281***	0.0247***
	(0.00836)	(0.00690)	(0.00872)	(0.00653)
2011	0.0276***	0.0250***	0.0280***	0.0270***
	(0.00825)	(0.00713)	(0.00881)	(0.00666)
2012	0.0362**	0.0350***	0.0374***	0.0370***
	(0.0140)	(0.00736)	(0.00906)	(0.00686)
2013	0.0364**	0.0374***	0.0393***	0.0393***
	(0.0171)	(0.00792)	(0.00979)	(0.00745)
2014	0.0531***	0.0442***	0.0515***	0.0471***
	(0.0149)	(0.00777)	(0.00947)	(0.00727)
2015	0.0440***	0.0364***	0.0440***	0.0398***
	(0.0140)	(0.00897)	(0.0107)	(0.00837)

2016	0.0507***	0.0363***	0.0485***	0.0408***
	(0.0135)	(0.00916)	(0.0107)	(0.00852)
2017	0.0445***	0.0271***	0.0404***	0.0311***
	(0.0123)	(0.00891)	(0.0105)	(0.00837)
ln(assets)	-0.00851**	0.0110	-0.00587*	0.000791
	(0.00372)	(0.0101)	(0.00320)	(0.00594)
loan loss provision	2.788***	1.911***	2.693***	2.147***
	(0.546)	(0.382)	(0.382)	(0.353)
non-interest income/Op. income	0.00381*	-0.000538	0.00159	-0.000551
	(0.00205)	(0.00169)	(0.00192)	(0.00156)
Tier1 ratio	-0.259***	-0.0410	-0.183***	-0.0680
	(0.0890)	(0.0633)	(0.0705)	(0.0596)
efficiency ratio	-0.00523	0.00404	-0.000240	0.00399
	(0.00610)	(0.00479)	(0.00589)	(0.00453)
loans growth rate	-0.0122	-0.00766	-0.00826	-0.00569
	(0.0116)	(0.00751)	(0.00902)	(0.00688)
pre-tax ROE	-0.0485	0.00654	-0.0195	0.00360
	(0.0372)	(0.0212)	(0.0257)	(0.0201)
CGI	0.00434	0.000940	0.00389***	0.00167
	(0.00283)	(0.00146)	(0.00149)	(0.00136)
_cons	0.201**	-0.217	0.136**	-0.00835
	(0.0739)	(0.203)	(0.0650)	(0.119)
N	186	186	186	186
R^2	0.522	0.403		
AIC	-768.6	-950.0	.	-859.8
BIC	-710.6	-892.0	.	-795.3

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Breusch-Pagan Lagrange Multiplier test (LM):

$$Test\colon\ Var(u) = 0$$

$$chibar2(01) = 84.81$$

$$Prob > chibar2 = 0.0000$$

The result of the Breusch-Pagan LM test establishes the presence of a panel-effect, hence proving inconsistency of PooledOLS estimator. Now it is crucial to implement the *Hausman test* in order determine the true model between the Fixed and Random Effects one, and

consequently choosing the most efficient and consistent estimator among those available. The results of the *Hausman test* are the following:

$$Ho:\ difference\ in\ coefficients\ not\ systematic$$

$$chi2(17) = \left(\hat{\beta}_{RE} - \hat{\beta}_{FE}\right)' \left[\left(V(\hat{\beta}_{RE}) - V(\hat{\beta}_{FE})\right)^{-1}\right] \left(\hat{\beta}_{RE} - \hat{\beta}_{FE}\right)$$

$$= \quad 9.73$$

$$Prob > chi2 = \quad 0.9145$$

The non-significance of the test leads us adopt the Random Effects model as the true model for our research. Building on this evidence, we employ the Random Effect estimator as it is consistent and most efficient for the scope of Model 4 specification. The statistically relevant results of the estimation are then those reported in the third and fourth column of Table 8 above. The interpretation of the coefficients associated to the year dummies is precisely the same presented with regards to Model 3, hence it will not be proposed again in order to avoid redundancy. Nevertheless, the time effect appears to be reinforced in magnitude by the introduction of further explanatory variables able to capture unobserved individual specific heterogeneity.

Model 4 confirms the sign and the significance of the estimates obtained by model 2 concerning *loan loss provision* and *loans growth rate*. *Bank size* is now found to beneficially affect the level of NPL ratio by lowering its amount. This effect, even though small in magnitude, is confirmed in literature by the papers of Salas and Saurina (2002) and Hu et al. (2004) that identified the banks' size as a form of diversification, namely *diversification by asset size.*

The relevance of including this fourth model within the scope of our research project is justified by the paramount results obtained with respect to both the *Tier1 ratio* and the *Corporate Governance Index*. Tier 1 ratio is found to significantly (1%) and negatively affect the NPL ratio. Such a result corroborates those of Berger and DeYoung (1997), Salas and Saurina (2002) and Us (2017) that proved how the *Tier1 ratio* beneficially affect the NPL ratio by lowering its amount. On the other way around, building on the moral hazard argument, this evidence may be rationalized by claiming that banks with low levels of capital carry greater risk, ultimately causing higher levels of NPLs.

In terms of Corporate Governance Index, Model 4 evidences a positive and strongly significant effect (1%) on the dependent variable. On the other hand, the effect estimated is small in absolute value. Our result is in line with that of Tarchouna et al. (2017) referred to *full-sample* as well as to both *medium* and *large* sub-samples of banks. As a matter of fact, Tarchouna et al.

(2017) evidence a coefficient of (0,006620*)*, (0,031307) and of (0,021957) for the *full-sample*, *large* and *medium* banks, respectively. The banks of the sample considered appear then to be poorly-governed given that their corporate governance index is positively related to NPLs. In order to explain the positive coefficient of CGI, two explanations could be advanced. First, given the fact that our sample is made mostly of large credit institutions, their intrinsic high level of liquidity leads them to accept the investment even in risky projects (Tarchouna et al. (2017)). The excessive risk-taking occurs when they accept projects without sufficiently making the trade-off between the returns, the risk of projects and the possibility of losses (Zagorchev & Gao (2015)). In such a scenario, the corporate governance seems unable to prevent the management from taking bad lending decisions. Second, we recall the *domino effect* studied by Upper and Worms (2004) linking credit risk and interbank lending. Reminding that the banks belonging to our sample are generally multinational institutions, we argue that the level of risk in a multinational bank can be transferred between subsidiaries and the parent bank. Putting together the ideas and in accordance with the *domino effect*, we can claim that the failure of a subsidiary can lead to the failure of many banks in different countries without being directly influenced by the original shock. In such a scenario, even though credit institutions try to strengthen their corporate governance system, this latter loses its power in multinationals and loses the ability to ameliorate loan quality.

4.5. Conclusions and limitations

In this research, we provide an empirical study of the relation between bank corporate governance and non-performing loans using a sample of 20 European banks over the 2008-2017 period.

Based on seven variables related to governance structure, we use the principal component analysis (PCA) in order to build a corporate governance index (CGI) for the full sample of banks considered. The main advantage of using the PCA resides in the fact that this method produces a single measure of corporate governance which evaluates the overall bank corporate governance system without the need of any subjective judgment concerning the production of weights related to the different individual corporate governance variables.

The central finding of this study is that the corporate governance fails to protect European banks from the excessive risk-taking that damages their performance and loan quality thereafter. This finding can be explained by arguing that the high level of liquidity that characterizes large multinational credit institutions pushes their Directors to increase their investment and ignore the undue risks and potential losses. Additionally, the corporate governance can be thought to be powerless in controlling loan quality because the multinational feature of the banks studied

implies the *domino effect* linking credit risk, interbank lending and risk transmission between parent and subsidiaries.

Our study contributes to the literature dealing with the association between corporate governance and bank risk-taking. This strand of literature encompasses many studies: Beltratti and Stulz (2012), Erkens *et al.* (2012), Ellul and Yerramilli (2013) and Minton *et al.* (2014) among others and argues that boards push their banks to maximize the shareholders' wealth by taking excessive risks.

The heterogeneity that characterizes the dataset employed can be seen as a weakness at first sight. On the other hand, one of the purposes of the present work was to evidence common patterns at a European level, thus broadening the scope of the analysis and overcoming the traditional setting of country-specific analyses. The consideration of a broad and heterogeneous dataset was thus inevitable and, on the contrary, it may lay the foundation for future studies and analyses performed when the European landscape will be even more uniform.

Our study can be extended firstly by considering other corporate governance variables in the construction of the CGI, that is to consider different dimensions in studying the relationship between banks' CGI and loan quality, and secondly, by increasing the dimension of the panel. As a matter of fact, the size of the panel hereby considered is excessively limited: if the length of the time-window considered is similar to the one employed by Tarchouna et al. (2017)[71], the cross-sectional dimension of our study deviates considerably from the reference. A sample of 184 commercial banks as in the reference paper was indeed out of our reach from a computational and data-collection point of view. A broadening of the sample shall with no doubt lead to more significant results, and it would also allow for a partitioning of the sample according to the size of each credit institution. The latter analysis has not been feasible in the context of the present work given the scarce number of banks considered. In terms of further limitations, our research suffers mainly from the loss of the dynamic perspective. The paper by Tarchouna et al. (2017) performs indeed a dynamic GMM panel data estimation while we decided to capture only the static side of the panel data thus dropping the lagged dependent variable. This decision is justified by the lack of a long dataset as well as by the search for simplicity.

Another weakness of our research resides in the fact that the model that evidences a strong significance of the corporate governance index is also the model with the worst goodness of fit to the data. Running a comparative analysis employing the *Akaike Information Criterion* (AIC)

[71] Tarchouna et al. (2017) consider a time-window of 13 years.

and the *Bayesian Information Criterion* (BIC) among the models estimated, we obtain the following results.

Table 9 – Goodness of fit, comparative analysis. Source: own elaboration.

	M1-FE	M2-FE	M3-FE	M4-RE(MLE)
AIC	-959,4	-954,9	-954,4	-859,8
BIC	-936,9	-919,5	-909,3	-795,3

We recall that the model with the lowest values of either AIC or BIC is the one with the highest goodness of fit. In our particular case, Model 4 is characterized by the highest values both of AIC and BIC, thus resulting the model with the worst goodness of fit. Nevertheless, we shall underline in conclusion that the Random Effects model was able to capture, for all the models specified, a significance of at least 10% for the coefficient of interest (CGI). This evidence, together with the consistency of the sign (+) and with the results of Model 4, reassures us regarding the goodness of the analysis performed and of the consistency of its results.

APPENDIX

Top 50 European banks by total assets – *Business Insider.*

	Bank	Tot. Assets € (bn)	Country
1	HSBC Holdings plc	2100,13	GBR
2	BNP Paribas SA	1963,43	FRA
3	Crédit Agricole Group	1763,17	FRA
4	Deutsche Bank AG	1470,38	DEU
5	Banco Santander SA	1446,15	ESP
6	Barclays plc	1275,62	GBR
7	Société Générale SA	1275,13	FRA
8	Groupe BPCE	1259,42	FRA
9	LLoyds Banking Group plc	914,14	GBR
10	ING Groep NV	846,22	NLD
11	UniCredit SpA	936,79	ITA
12	Royal Bank of Scotland Group plc	930,78	GBR
13	Intesa Sanpaolo SpA	800,01	ITA
14	Crédit Mutuel Group	793,52	FRA
15	UBS Group AG	782,45	CHE
16	Credit Suisse Group AG	680,46	CHE
17	Banco Bilbao Vizcaya Argentaria SA	671,02	ESP
18	Rabobank	602,99	NLD
19	Nordea Bank AB	581,61	SWE
20	Standard Chartered plc	552,56	GBR
21	DZ Bank AG	505,60	DEU
22	Danske Bank A/S	475,39	DNK
23	Commerzbank AG	452,49	DEU
24	Cassa depositi e prestiti SpA	419,53	ITA
25	PAO Sberbank of Russia	392,55	RUS
26	ABN AMRO Group NV	390,08	NLD
27	CaixaBank SA	383,19	ESP
28	KBC Group NV	292,34	BEL
29	Svenska Handelsbanken AB	281,51	SWE
30	DNB ASA	274,52	NOR
31	Nationwide Building Society	262,05	GBR
32	Skandinaviska Enskilda Banken AB	260,41	SWE
33	Landesbank Baden-Württemberg	238,00	DEU
34	La Banque Postale SA	231,48	FRA
35	Swedbank AB	225,11	SWE
36	Banco de Sabadell SA	221,35	ESP
37	BFA Sociedad Tenedora de Acciones SAU	221,12	ESP
38	Erste Group Bank AG	220,66	AUT
39	Bayerische Landesbank	214,52	DEU
40	Raiffeisen Gruppe Switzerland	194,60	CHE
41	Nykredit A/S	191,62	DNK
42	JSCVTB Bank	188,36	RUS
43	Dexia SA	178,85	BEL
44	Belfius Banque SA	167,96	BEL
45	Norddeutsche Landesbank Girozentrale	165,22	DEU
46	Banco BPM SpA	161,21	ITA
47	Landesbank Hessen-Thüringen Girozentrale	158,35	DEU
48	Zürcher Kantonalbank	140,04	CHE
49	Banca Monte dei Paschi di Siena SpA	139,15	ITA
50	OP Financial Group	137,24	FIN

Coloured cells signal the banks that have been included in the sample of the empirical analysis of chapter 4.

Detail of the corporate governance variables observed – *Annual Reports.*

2008	bank	ots	bsize	Dir_Own	Indep_r	Ex_r	Gen_Div	bsize_adj
HSBC	HSBA	1	21	0,0408%	66,6667%	28,5714%	14,2857%	98,5195%
BNP Paribas	BNP	1	15	0,0475%	100,0000%	0,0000%	20,0000%	69,9187%
Deutsche Bank	DBK	0	18	0,0893%	0,0000%	0,0000%	44,4444%	83,6710%
Banco Santander	SAN	1	19	3,6912%	47,3684%	31,5789%	10,5263%	91,4706%
Barclays	BARC	1	16	0,0603%	68,7500%	31,2500%	12,5000%	74,4606%
Unicredit	UCG	0	23	0,0000%	69,5652%	4,3478%	0,0000%	110,7480%
Royal Bank of Scotland	RBS	1	9	0,0071%	55,5556%	33,3333%	0,0000%	41,5805%
Intesa SanPaolo	ISP	0	19	0,0000%	84,2105%	0,0000%	5,2632%	93,7303%
UBS	UBS	1	12	0,2009%	91,6667%	0,0000%	16,6667%	57,0773%
Credit Suisse	CSGN	1	13	0,1778%	100,0000%	0,0000%	7,6923%	63,4737%
Banco Bilbao Vizcaya Argentaria	BBVA	1	14	0,0610%	78,5714%	21,4286%	7,1429%	69,6103%
Nordea	NDA	1	15	0,0220%	80,0000%	0,0000%	26,6667%	75,0868%
Standard Chartered	STAN	1	13	0,0280%	69,2308%	30,7692%	15,3846%	66,4754%
KBC Groep NV	KBC	1	25	0,0000%	12,0000%	12,0000%	4,0000%	126,9775%
Svenska Handelsbanken AB	SHB A	1	12	0,4302%	75,0000%	8,3333%	33,3333%	62,8192%
Skandinaviska Enskilda Banken AB	SEB A	1	14	0,0872%	64,2857%	7,1429%	28,5714%	72,7142%
Swedbank AB	SWED	1	10	0,0160%	70,0000%	0,0000%	60,0000%	52,8341%
Banco de Sabadell SA	SAB	1	12	0,0092%	58,3333%	16,6667%	8,3333%	65,9259%
Erste Group Bank AG	EBS	0	13	0,0942%	92,3077%	0,0000%	30,7692%	67,9880%
Raiffeisen Bank International AG	RBI AG	0	6	0,0394%	100,0000%	0,0000%	0,0000%	32,8536%
2009	**bank**	**ots**	**bsize**	**Dir_Own**	**Indep_r**	**Ex_r**	**Gen_Div**	**bsize_adj**
HSBC	HSBA	1	21	0,0359%	71,4286%	28,5714%	14,2857%	98,9398%
BNP Paribas	BNP	1	14	0,0407%	57,1429%	0,0000%	28,5714%	65,2837%
Deutsche Bank	DBK	0	20	0,0942%	0,0000%	0,0000%	35,0000%	94,6559%
Banco Santander	SAN	1	19	0,0000%	52,6316%	31,5789%	10,5263%	91,2229%
Barclays	BARC	1	13	0,0793%	69,2308%	23,0769%	0,0000%	61,4211%

Unicredit	UCG	0	23	0,0000%	78,2609%	4,3478%	8,6957%	111,3836%
Royal Bank of Scotland	RBS	1	12	0,0077%	66,6667%	25,0000%	8,3333%	56,1466%
Intesa SanPaolo	ISP	0	19	0,0000%	84,2105%	0,0000%	5,2632%	93,8132%
UBS	UBS	1	12	0,1132%	91,6667%	0,0000%	16,6667%	58,1884%
Credit Suisse	CSGN	1	14	0,2220%	92,8571%	0,0000%	7,1429%	68,7605%
Banco Bilbao Vizcaya Argentaria	BBVA	1	13	0,0710%	76,9231%	15,3846%	7,6923%	64,6834%
Nordea	NDA	1	14	1,7757%	57,1429%	0,0000%	21,4286%	69,8425%
Standard Chartered	STAN	1	16	0,0251%	56,2500%	37,5000%	12,5000%	81,9007%
KBC Groep NV	KBC	1	22	0,0000%	13,6364%	13,6364%	4,5455%	112,2623%
Svenska Handelsbanken AB	SHB A	1	12	0,4311%	75,0000%	8,3333%	25,0000%	62,6675%
Skandinaviska Enskilda Banken AB	SEB A	1	14	0,0969%	64,2857%	7,1429%	21,4286%	72,7938%
Swedbank AB	SWED	1	10	0,0289%	70,0000%	0,0000%	60,0000%	52,6849%
Banco de Sabadell SA	SAB	1	13	0,0100%	53,8462%	15,3846%	15,3846%	71,3024%
Erste Group Bank AG	EBS	0	19	0,0910%	63,1579%	0,0000%	31,5789%	99,3653%
Raiffeisen Bank International AG	RBI AG	0	7	0,1066%	100,0000%	0,0000%	0,0000%	38,5678%
2010	**bank**	**ots**	**bsize**	**Dir_Own**	**Indep_r**	**Ex_r**	**Gen_Div**	**bsize_adj**
HSBC	HSBA	1	17	0,2412%	70,5882%	29,4118%	23,5294%	79,6988%
BNP Paribas	BNP	1	15	0,0407%	61,1111%	13,3333%	33,3333%	70,0428%
Deutsche Bank	DBK	0	22	0,1201%	0,0000%	4,5455%	27,2727%	102,9573%
Banco Santander	SAN	1	20	3,0394%	50,0000%	30,0000%	10,0000%	95,6020%
Barclays	BARC	1	13	0,0907%	76,9231%	15,3846%	15,3846%	61,1032%
Unicredit	UCG	0	23	0,0000%	73,9130%	4,3478%	8,6957%	111,3794%
Royal Bank of Scotland	RBS	1	11	0,0063%	72,7273%	18,1818%	18,1818%	51,7624%
Intesa SanPaolo	ISP	0	19	0,0000%	94,7368%	0,0000%	10,5263%	93,5690%
UBS	UBS	1	11	0,1683%	90,9091%	0,0000%	18,1818%	52,9487%
Credit Suisse	CSGN	1	15	0,3298%	86,6667%	0,0000%	6,6667%	73,0545%
Banco Bilbao Vizcaya Argentaria	BBVA	1	12	0,0710%	75,0000%	16,6667%	8,3333%	59,6113%
Nordea	NDA	1	14	0,0413%	64,2857%	0,0000%	21,4286%	69,3757%
Standard Chartered	STAN	1	16	0,0303%	68,7500%	31,2500%	12,5000%	80,9235%

KBC Groep NV	KBC	1	23	0,0000%	13,0435%	8,6957%	4,3478%	117,4284%
Svenska Handelsbanken AB	SHB A	1	12	0,4248%	75,0000%	8,3333%	25,0000%	62,1895%
Skandinaviska Enskilda Banken AB	SEB A	1	15	0,0995%	66,6667%	6,6667%	40,0000%	77,6881%
Swedbank AB	SWED	1	12	0,0278%	75,0000%	0,0000%	50,0000%	62,9308%
Banco de Sabadell SA	SAB	1	15	0,0097%	60,0000%	13,3333%	13,3333%	81,5606%
Erste Group Bank AG	EBS	0	18	0,0809%	100,0000%	0,0000%	27,7778%	94,0327%
Raiffeisen Bank International AG	RBI AG	0	15	0,0755%	100,0000%	0,0000%	6,6667%	80,2481%
2011	**bank**	**ots**	**bsize**	**Dir_Own**	**Indep_r**	**Ex_r**	**Gen_Div**	**bsize_adj**
HSBC	HSBA	1	17	0,0223%	76,4706%	23,5294%	23,5294%	79,4266%
BNP Paribas	BNP	1	16	0,0508%	88,8889%	6,2500%	31,2500%	74,7702%
Deutsche Bank	DBK	0	22	0,1872%	0,0000%	0,0000%	36,3636%	102,3481%
Banco Santander	SAN	1	18	2,2239%	50,0000%	27,7778%	11,1111%	85,9303%
Barclays	BARC	1	12	0,3552%	75,0000%	8,3333%	16,0000%	56,2017%
Unicredit	UCG	0	20	0,0000%	70,0000%	5,0000%	10,0000%	96,9327%
Royal Bank of Scotland	RBS	1	13	0,0128%	76,9231%	15,3846%	23,0769%	60,9880%
Intesa SanPaolo	ISP	0	19	0,1438%	94,7368%	0,0000%	5,2632%	93,7061%
UBS	UBS	1	12	0,1868%	91,6667%	0,0000%	8,3333%	57,4765%
Credit Suisse	CSGN	1	14	0,3107%	85,7143%	0,0000%	7,1429%	68,0353%
Banco Bilbao Vizcaya Argentaria	BBVA	1	13	0,0690%	76,9231%	15,3846%	7,6923%	64,4093%
Nordea	NDA	1	12	0,0423%	58,3333%	0,0000%	25,0000%	58,9154%
Standard Chartered	STAN	1	17	0,0339%	58,8235%	35,2941%	11,7647%	85,2470%
KBC Groep NV	KBC	1	25	0,0000%	12,0000%	8,0000%	4,0000%	128,4070%
Svenska Handelsbanken AB	SHB A	1	12	0,4457%	75,0000%	8,3333%	25,0000%	61,7560%
Skandinaviska Enskilda Banken AB	SEB A	1	15	0,1142%	66,6667%	6,6667%	33,3333%	77,3443%
Swedbank AB	SWED	1	12	0,0212%	75,0000%	0,0000%	41,6667%	62,6488%
Banco de Sabadell SA	SAB	1	15	0,0090%	60,0000%	13,3333%	13,3333%	81,4109%
Erste Group Bank AG	EBS	0	19	0,0813%	94,7368%	0,0000%	26,3158%	99,1512%
Raiffeisen Bank International AG	RBI AG	0	15	0,1008%	100,0000%	0,0000%	6,6667%	79,7625%

2012	bank	ots	bsize	Dir_Own	Indep_r	Ex_r	Gen_Div	bsize_adj
HSBC	HSBA	1	16	0,0188%	81,2500%	18,7500%	25,0000%	74,6388%
BNP Paribas	BNP	1	16	0,0482%	62,5000%	6,2500%	31,2500%	74,8752%
Deutsche Bank	DBK	0	20	0,1096%	80,0000%	0,0000%	40,0000%	93,3595%
Banco Santander	SAN	1	16	1,9216%	50,0000%	31,2500%	18,7500%	76,3286%
Barclays	BARC	1	12	0,1573%	76,9231%	16,6667%	8,3333%	56,2606%
Unicredit	UCG	0	13	0,0000%	92,3077%	7,6923%	30,7692%	62,9623%
Royal Bank of Scotland	RBS	1	12	0,0159%	75,0000%	16,6667%	25,0000%	56,5946%
Intesa SanPaolo	ISP	0	19	0,1397%	89,4737%	0,0000%	5,2632%	93,4666%
UBS	UBS	1	12	0,2434%	91,6667%	0,0000%	25,0000%	57,7886%
Credit Suisse	CSGN	1	15	0,2251%	93,3333%	0,0000%	13,3333%	73,3294%
Banco Bilbao Vizcaya Argentaria	BBVA	1	14	0,0720%	78,5714%	14,2857%	14,2857%	69,1462%
Nordea	NDA	1	13	0,0179%	69,2308%	0,0000%	23,0769%	63,9762%
Standard Chartered	STAN	1	21	0,0423%	66,6667%	28,5714%	14,2857%	105,0737%
KBC Groep NV	KBC	1	20	0,1936%	15,0000%	10,0000%	10,0000%	103,2828%
Svenska Handelsbanken AB	SHB A	1	12	0,4296%	75,0000%	8,3333%	25,0000%	61,7180%
Skandinaviska Enskilda Banken AB	SEB A	1	15	0,1223%	66,6667%	6,6667%	40,0000%	77,0337%
Swedbank AB	SWED	1	12	0,0214%	75,0000%	0,0000%	41,6667%	62,5391%
Banco de Sabadell SA	SAB	1	15	0,0053%	53,3333%	20,0000%	13,3333%	79,3638%
Erste Group Bank AG	EBS	0	18	0,0784%	100,0000%	0,0000%	27,7778%	93,8445%
Raiffeisen Bank International AG	RBI AG	0	18	0,1254%	100,0000%	0,0000%	11,1111%	96,1075%
2013	**bank**	**ots**	**bsize**	**Dir_Own**	**Indep_r**	**Ex_r**	**Gen_Div**	**bsize_adj**
HSBC	HSBA	1	17	0,0176%	76,4706%	23,5294%	29,4118%	79,4847%
BNP Paribas	BNP	1	16	0,0449%	62,5000%	6,2500%	25,0000%	75,0579%

Deutsche Bank	DBK	0	20	0,1183%	80,0000%	0,0000%	35,0000%	94,3380%
Banco Santander	SAN	1	16	1,6665%	56,2500%	31,2500%	18,7500%	76,8020%
Barclays	BARC	1	15	0,1039%	73,3333%	13,3333%	20,0000%	70,7390%
Unicredit	UCG	0	19	0,0000%	63,1579%	5,2632%	21,0526%	92,5384%
Royal Bank of Scotland	RBS	1	11	0,0325%	72,7273%	18,1818%	27,2727%	52,5390%
Intesa SanPaolo	ISP	0	19	0,1516%	84,2105%	0,0000%	26,3158%	93,8181%
UBS	UBS	1	12	0,2338%	91,6667%	0,0000%	25,0000%	58,4458%
Credit Suisse	CSGN	1	13	0,2255%	92,3077%	0,0000%	15,3846%	63,7801%
Banco Bilbao Vizcaya Argentaria	BBVA	1	13	0,0800%	76,9231%	23,0769%	15,3846%	64,4101%
Nordea	NDA	1	13	0,0179%	69,2308%	0,0000%	30,7692%	64,1598%
Standard Chartered	STAN	1	18	0,0429%	66,6667%	27,7778%	11,1111%	89,9495%
KBC Groep NV	KBC	1	20	0,1934%	5,0000%	15,0000%	15,0000%	103,6771%
Svenska Handelsbanken AB	SHB A	1	11	0,4759%	45,4545%	9,0909%	27,2727%	56,5456%
Skandinaviska Enskilda Banken AB	SEB A	1	16	0,1093%	68,7500%	6,2500%	43,7500%	82,2480%
Swedbank AB	SWED	1	12	0,0257%	75,0000%	0,0000%	41,6667%	62,6820%
Banco de Sabadell SA	SAB	1	14	0,0014%	64,2857%	21,4286%	14,2857%	74,0253%
Erste Group Bank AG	EBS	0	15	0,0645%	100,0000%	0,0000%	26,6667%	78,4761%
Raiffeisen Bank International AG	RBI AG	0	16	0,1697%	100,0000%	0,0000%	6,2500%	85,6166%
2014	**bank**	**ots**	**bsize**	**Dir_Own**	**Indep_r**	**Ex_r**	**Gen_Div**	**bsize_adj**
HSBC	HSBA	1	17	0,0198%	76,4706%	23,5294%	35,2941%	79,0644%
BNP Paribas	BNP	1	16	0,0465%	62,5000%	6,2500%	31,2500%	74,5762%
Deutsche Bank	DBK	0	20	0,1158%	80,0000%	0,0000%	35,0000%	94,0778%
Banco Santander	SAN	1	14	1,4151%	64,2857%	35,7143%	28,5714%	66,7959%
Barclays	BARC	1	14	0,0934%	80,0000%	14,2857%	21,4286%	65,7840%
Unicredit	UCG	0	19	0,0000%	63,1579%	5,2632%	21,0526%	92,4398%
Royal Bank of Scotland	RBS	1	10	0,0221%	70,0000%	20,0000%	30,0000%	47,5611%
Intesa SanPaolo	ISP	0	19	0,0178%	84,2105%	0,0000%	26,3158%	93,6496%
UBS	UBS	1	11	0,2359%	90,9091%	0,0000%	27,2727%	53,3996%
Credit Suisse	CSGN	1	13	0,1866%	92,3077%	0,0000%	15,3846%	63,5479%

Banco Bilbao Vizcaya Argentaria	BBVA	1	14	0,0800%	50,0000%	21,4286%	21,4286%	68,9832%
Nordea	NDA	1	12	0,0214%	66,6667%	0,0000%	41,6667%	59,0499%
Standard Chartered	STAN	1	17	0,0558%	64,7059%	29,4118%	11,7647%	84,1061%
KBC Groep NV	KBC	1	18	0,2070%	22,2222%	16,6667%	22,2222%	93,1799%
Svenska Handelsbanken AB	SHB A	1	10	2,4145%	50,0000%	10,0000%	20,0000%	51,2429%
Skandinaviska Enskilda Banken AB	SEB A	1	15	0,0962%	66,6667%	6,6667%	46,6667%	77,1185%
Swedbank AB	SWED	1	11	0,0257%	72,7273%	0,0000%	45,4545%	57,1982%
Banco de Sabadell SA	SAB	1	14	0,0010%	57,1429%	21,4286%	7,1429%	74,0295%
Erste Group Bank AG	EBS	0	17	0,0616%	100,0000%	0,0000%	29,4118%	89,0281%
Raiffeisen Bank International AG	RBI AG	0	17	0,1132%	100,0000%	0,0000%	11,7647%	91,3221%
2015	**bank**	**ots**	**bsize**	**Dir_Own**	**Indep_r**	**Ex_r**	**Gen_Div**	**bsize_adj**
HSBC	HSBA	1	18	0,0224%	77,7778%	22,2222%	33,3333%	83,6422%
BNP Paribas	BNP	1	14	0,0280%	57,1429%	7,1429%	35,7143%	65,3793%
Deutsche Bank	DBK	0	22	0,0394%	72,7273%	0,0000%	31,8182%	103,7182%
Banco Santander	SAN	1	15	1,2465%	53,3333%	26,6667%	33,3333%	71,3738%
Barclays	BARC	1	14	0,1116%	71,4286%	14,2857%	28,5714%	66,2191%
Unicredit	UCG	0	17	0,0000%	58,8235%	5,8824%	35,2941%	82,6328%
Royal Bank of Scotland	RBS	1	11	0,0120%	72,7273%	18,1818%	27,2727%	52,8223%
Intesa SanPaolo	ISP	0	19	0,0097%	89,4737%	0,0000%	26,3158%	93,4467%
UBS	UBS	1	10	0,2617%	90,0000%	0,0000%	30,0000%	48,5907%
Credit Suisse	CSGN	1	12	0,0788%	91,6667%	0,0000%	25,0000%	58,7041%
Banco Bilbao Vizcaya Argentaria	BBVA	1	15	0,0600%	53,3333%	20,0000%	20,0000%	73,4021%
Nordea	NDA	1	13	0,0237%	69,2308%	0,0000%	38,4615%	64,0784%
Standard Chartered	STAN	1	14	0,0607%	78,5714%	14,2857%	21,4286%	69,3233%
KBC Groep NV	KBC	1	16	4,4983%	18,7500%	18,7500%	25,0000%	82,7029%
Svenska Handelsbanken AB	SHB A	1	9	12,7415%	55,5556%	11,1111%	33,3333%	46,3151%
Skandinaviska Enskilda Banken AB	SEB A	1	15	0,0999%	66,6667%	6,6667%	46,6667%	77,2332%
Swedbank AB	SWED	1	11	0,0215%	72,7273%	0,0000%	45,4545%	57,0778%
Banco de Sabadell SA	SAB	1	15	0,0008%	60,0000%	20,0000%	13,3333%	78,3042%

Erste Group Bank AG	EBS	0	20	0,0588%	100,0000%	0,0000%	30,0000%	104,6433%
Raiffeisen Bank International AG	RBI AG	0	16	0,0987%	100,0000%	0,0000%	18,7500%	86,2281%
2016	**bank**	**ots**	**bsize**	**Dir_Own**	**Indep_r**	**Ex_r**	**Gen_Div**	**bsize_adj**
HSBC	HSBA	1	18	0,0260%	77,7778%	22,2222%	33,3333%	83,5723%
BNP Paribas	BNP	1	14	0,0154%	64,2857%	7,1429%	41,6000%	65,2554%
Deutsche Bank	DBK	0	20	0,0280%	80,0000%	0,0000%	35,0000%	94,3960%
Banco Santander	SAN	1	15	1,1990%	53,3333%	26,6667%	40,0000%	71,3766%
Barclays	BARC	1	13	0,0618%	76,9231%	15,3846%	30,7692%	61,6805%
Unicredit	UCG	0	17	0,0000%	64,7059%	5,8824%	35,2941%	82,6370%
Royal Bank of Scotland	RBS	1	12	0,0219%	75,0000%	16,6667%	25,0000%	58,0879%
Intesa SanPaolo	ISP	1	19	0,0062%	73,6842%	5,2632%	36,8421%	93,1289%
UBS	UBS	1	11	0,2546%	90,9091%	0,0000%	27,2727%	53,4275%
Credit Suisse	CSGN	1	13	0,1214%	92,3077%	0,0000%	23,0769%	63,5480%
Banco Bilbao Vizcaya Argentaria	BBVA	1	15	0,0600%	53,3333%	20,0000%	20,0000%	73,4894%
Nordea	NDA	1	13	0,0197%	69,2308%	0,0000%	38,4615%	64,2349%
Standard Chartered	STAN	1	13	0,0558%	76,9231%	15,3846%	23,0769%	64,2377%
KBC Groep NV	KBC	1	16	0,1999%	18,7500%	12,5000%	31,2500%	82,3341%
Svenska Handelsbanken AB	SHB A	1	10	2,6547%	70,0000%	10,0000%	50,0000%	51,4663%
Skandinaviska Enskilda Banken AB	SEB A	1	17	0,1010%	70,5882%	5,8824%	52,9412%	87,5047%
Swedbank AB	SWED	1	10	0,0112%	70,0000%	0,0000%	50,0000%	51,9979%
Banco de Sabadell SA	SAB	1	14	0,0005%	50,0000%	21,4286%	14,2857%	73,0137%
Erste Group Bank AG	EBS	0	18	0,0595%	100,0000%	0,0000%	33,3333%	93,9745%
Raiffeisen Bank International AG	RBI AG	0	16	0,0731%	100,0000%	0,0000%	18,7500%	86,3335%
2017	**bank**	**ots**	**bsize**	**Dir_Own**	**Indep_r**	**Ex_r**	**Gen_Div**	**bsize_adj**
HSBC	HSBA	1	17	0,0293%	82,3529%	17,6471%	29,4118%	79,1941%
BNP Paribas	BNP	1	14	0,0155%	64,2857%	7,1429%	41,6000%	65,4481%
Deutsche Bank	DBK	0	20	0,0218%	80,0000%	0,0000%	35,0000%	94,7340%
Banco Santander	SAN	1	14	1,1290%	72,7273%	21,4286%	35,7143%	66,3794%
Barclays	BARC	1	14	0,0782%	78,5714%	14,2857%	21,4286%	66,7704%

Unicredit	UCG	0	17	0,0000%	70,5882%	5,8824%	35,2941%	82,7449%
Royal Bank of Scotland	RBS	1	14	0,0280%	78,5714%	14,2857%	35,7143%	68,1645%
Intesa SanPaolo	ISP	1	19	0,0080%	73,6842%	5,2632%	36,8421%	92,7002%
UBS	UBS	1	11	0,3013%	90,9091%	0,0000%	36,3636%	53,7145%
Credit Suisse	CSGN	1	12	0,1024%	100,0000%	0,0000%	16,6667%	58,9984%
Banco Bilbao Vizcaya Argentaria	BBVA	1	13	0,0600%	46,1538%	23,0769%	23,0769%	63,8749%
Nordea	NDA	1	14	0,0187%	71,4286%	0,0000%	42,8571%	69,3711%
Standard Chartered	STAN	1	14	0,0358%	71,4286%	14,2857%	28,5714%	69,5443%
KBC Groep NV	KBC	1	16	0,2609%	18,7500%	18,7500%	31,2500%	82,0789%
Svenska Handelsbanken AB	SHB A	1	11	2,9076%	63,6364%	9,0909%	45,4545%	56,5416%
Skandinaviska Enskilda Banken AB	SEB A	1	15	0,0769%	66,6667%	6,6667%	46,6667%	77,4164%
Swedbank AB	SWED	1	11	0,0163%	72,7273%	0,0000%	45,4545%	57,1989%
Banco de Sabadell SA	SAB	1	15	0,0002%	66,6667%	20,0000%	13,3333%	78,0630%
Erste Group Bank AG	EBS	0	19	0,0595%	100,0000%	0,0000%	36,8421%	98,8958%
Raiffeisen Bank International AG	RBI AG	0	18	0,0282%	100,0000%	0,0000%	27,7778%	96,1442%

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