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TRENDS IN THE RATIOS OF BANKS AFTER THE INTRODUCTION OF BASEL II & AFTER THE GLOBAL FINANCIAL CRISIS. IS THERE ANY EVIDENCE OF CONVERGENCE?

by

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Abstract

In this study, we have discussed in detail the importance and development of Basel, focusing on Basel II. Each change was in response to new investment products created over time, or events that revealed the weaknesses of the previous regulatory framework. Thus, on the occasion of the global financial crisis, the risks of the mismatch of maturity and the unstable combination of financing in the balance sheets of the banks appeared. As a result, what governs banks' liquidity has changed at a regulatory and supervisory level.

Using the four largest banks in terms of capitalization from the two core countries of the Eurozone, France and Germany, and two other countries from the periphery, Italy and Spain, we estimate a model using panel data to identify the key drivers of the capital adequacy ratio. We were not able to identify any variable affecting the capital adequacy ratio for the whole period. As the sample contains both the financial crisis of 2008 and the European debt crisis, we examine the relationship above in the aftermath of Mario Draghi's "whatever it takes" statement. Since the statement was in July 26, 2012 and our data are yearly, we estimate our model from 2013 to the end, to detect the influence of the unlimited quantitative easing provided in the system and we conclude that the ratios of total equity and net loans over total assets affect the capital adequacy ratio.

Finally, due to the support packages and the consolidation actions of the banks' balance sheets, we conclude that the β – convergence is achieved for the capital adequacy ratio of the group of banks selected.

Keywords: Basel, supervision, β – convergence, risk management, market risk, liquidity risk, operational risk, capital adequacy, non-performing loans, financial crisis

Περίληψη

Σε αυτή την μελέτη συζητήσαμε λεπτομερώς τη σημασία και την ανάπτυξη της Βασιλείας, εστιάζοντας στη Βασιλεία ΙΙ. Κάθε αλλαγή ήταν σε απάντηση σε νέα επενδυτικά προϊόντα που δημιουργήθηκαν με την πάροδο του χρόνου, ή γεγονότα που αποκάλυψαν τις αδυναμίες του προηγούμενου κανονιστικού πλαισίου. Έτσι, με την ευκαιρία της παγκόσμιας χρηματοπιστωτικής κρίσης, εμφανίστηκαν οι κίνδυνοι της αναντιστοιχίας της λήξης και του ασταθούς συνδυασμού χρηματοδότησης στους ισολογισμούς των τραπεζών. Ως αποτέλεσμα, αυτό που διέπει τη ρευστότητα των τραπεζών έχει αλλάξει σε ρυθμιστικό και εποπτικό επίπεδο.

Χρησιμοποιώντας τις τέσσερις μεγαλύτερες τράπεζες όσον αφορά την κεφαλαιοποίηση από τις δύο βασικές χώρες της Ευρωζώνης, τη Γαλλία και τη Γερμανία, και δύο άλλες χώρες από την περιφέρεια, την Ιταλία και την Ισπανία, εκτιμούμε ένα μοντέλο που χρησιμοποιεί δεδομένα πίνακα για τον προσδιορισμό των βασικών μοχλών της κεφαλαιακής επάρκειας. Δεν καταφέραμε να εντοπίσουμε καμία μεταβλητή που επηρεάζει τον δείκτη κεφαλαιακής επάρκειας για ολόκληρη την περίοδο. Καθώς το δείγμα περιέχει τόσο την οικονομική κρίση του 2008 όσο και την ευρωπαϊκή κρίση χρέους, εξετάζουμε την παραπάνω σχέση μετά τη δήλωση του Mario Draghi's "whatever it takes". Εκτιμώντας το μοντέλο μας από το 2013 έως το τέλος για να ανιχνεύσουμε την επίδραση της απεριόριστης ποσοτικής χαλάρωσης που δόθηκε στο σύστημα, βρίσκουμε ότι οι λόγοι των συνολικών ιδίων κεφαλαίων και καθαρών δανείων προς το σύνολο των περιουσιακών στοιχείων επηρεάζουν το δείκτη κεφαλαιακής επάρκειας.

Τέλος, λόγω των πακέτων στήριξης και των ενεργειών ενοποίησης των ισολογισμών των τραπεζών, καταλήγουμε στο συμπέρασμα ότι η β - σύγκλιση επιτυγχάνεται για τον λόγο κεφαλαιακής επάρκειας του επιλεγμένου ομίλου τραπεζών.

Λέξεις κλειδιά: Βασιλεία, εποπτεία, β – σύγκλιση, διαχείριση κινδύνου, κίνδυνος αγοράς, κίνδυνος ρευστότητας, λειτουργικός κίνδυνος, κεφαλαιακή επάρκεια, μη-εξυπηρετούμενα δάνεια, χρηματοπιστωτική κρίση

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1. A brief history of Basel Global standards

Basel I came into force in 1988, focused mainly on credit risk filling a gap in regulation as there were no standardized rules on capital adequacy for banks before then. During the next years a number of revisions took place to enhance the regulatory framework until the introduction of Basel II (see Table 1). In 1996, market risk rules were added. In December 1998, the Basel Committee on Banking Supervision (hereafter, BCBS), documented the need of a revision of Basel I, in order the credit risk to be reflected more effectively and the use of arbitrage by the banks to be controlled from an uncontrolled increase. The Committee's responsibility covers many things beyond capital adequacy, like risk management, liquidity risk, deposit insurance, corporate governance and stress testing, formulating supervisory standards and guidelines. The Committee recommends best practices and encourages convergence towards common approaches and standards without struggling full harmonization of member countries' supervisory techniques.

In 1999, the Committee decided to line a replacement of the capital adequacy framework that was supposed to enlarge and replace the one from 1988 to beat the most weaknesses of Basel I which were the following:

- The risk-management practices of banks were ignored
- Regulators determined very few risk weight for asset classes. Specifically, the cash rate assigned to cash was 0%, the same as claims on governments and central banks in local currency, claims on OECD countries, claims secured by OECD government securities or guaranteed by OECD governments. A rate of 20% was imposed on claims on multilateral development banks and on claims secured or secured by securities issued by those banks, claims or guarantees from banks established within the OECD (or outside the OECD with a residual maturity of up to 1 year), claims to non-domestic public sector entities of the OECD, excluding the central government, and claims for secured securities issued by these entities, as well as cash receipts during the gathering process. Also, a weighting rate of fifty on loans secured by a mortgage on property. Finally, a 100% weighting is required on receivables from the private sector, receivables from banks established outside the OECD with a residual maturity of more than one year, receivables from central governments outside the OECD (unless denominated and denominated in national currency), companies belonging to the general public sector, facilities, plant and equipment, and other fixed assets, property and other investments, capital assets issued by other banks (unless deducted from the capital), all other assets. Risks on credit and market were only covered
- Ignorance of the portfolio diversification risks
- Limited acceptance of collateral and guarantees
- Credit risk mitigation new instruments weren't included

In June 2004, after many refinements, the New Capital Framework named, Basel II, was released, consisted of three pillars: Minimum Capital Requirements, Supervisory Review Process, and Market Discipline (BCBS (2009)).

1.1 The need for transition to Basel II

According to the risk-based capital regulation, a bank should hold equity larger than a pre-specified percentage of risk-weighted assets (RWAs), which is found by multiplying the value of each class by a risk weight. Along with the principles of Basel I, the weights were imposed exogenously by the regulators, without carrying bank and country heterogeneity. Basel II has been ready since January 2007 and its rationale was to allow banks to use their own internal information to estimate risk weights more strictly associated with true risks (the "internal information" hypothesis), was born and took five years to progress and then additional four years to implement. Under Basel II, the calculation of the credit risk regulatory requirements was made using one of following methods which, in increasing order of sophistication, are the Standardized Approach, the Foundation Internal Ratings Based approach, and, the Advanced Internal Ratings-Based approach. The last is used by the majority of the international banks.

1.2 Description of Basel II Pillars

Pillar 1: Minimum capital requirements

Pillar 1 manages the continuous support of regulatory capital that is needed to protect against the three significant segments of risk that a bank faces - Credit Risk, Operational Risk, and Market Risk. According to Basel II, the calculation methodologies are the following:

- Standardized Approach, Foundation Internal Rating-Based (IRB) Approach, and Advanced IRB Approach are three different ways of credit risk calculation. Using the IRB approach, bank develop their own credit risk models to evaluate the capital requirements subject to risk profile of the borrower, which now are placed by seven versus the four categories, according to the Cook regulation. The seven categories are sovereign, corporate, banking, retail, project financing, securitization and stock. The risk indications according to the IRB approach are the probability of default by the counterparty after 12 months (PD), commitment maturity (M), exposure at time of default (EAD), and the evaluation of loss given default (LGD). If the bank adopts the advanced model, all remain the same but the diversification issue, which is the regulator's responsibility. Figure 4 shows the formation of the capital requirements according to the IRB model. The purpose of IRB models calculates unexpected losses of a portfolio, so that it retains a sufficient equity capital (K). K is formed either by or depending on whether the counterparty does not default (equation (1)) or goes into liquidation (equation (2)), respectively.

$$K = \left[LGD * \Phi\left(\frac{\Phi^{-1}(PD)+\sqrt{\rho(PD)}\Phi^{-1}(0.999)}{\sqrt{1-\rho(PD)}}\right) - LGD * PD\right] * \left(\frac{1+(M-2.5)b(PD)}{1-1.5*b(PD)}\right) \quad (1)$$

$$\rho(PD) = \rho_{min} * \frac{1-e^{-50PD}}{1-e^{-50}} + \rho_{max} * \frac{1-e^{-50PD}}{1-e^{-50}}$$

$$b(PD) = (0.11852 - 0.05478 * \ln(PD))^2$$

where Φ is the standard normal distribution, $\rho(PD)$ is the correlation function which depends on the probability of default, and $b(PD)$ is the adjustment of maturity which is a decreasing function of the probability of default.

$$K = max(0,\ LGD - EL)^2 \quad (2)$$

- Basic Indicator Approach (BIA), Standardized Approach (STA) and Internal Measurement Approach, an advanced form of which is the Advanced Measurement Approach (AMA) are used to calculate the operational risk
- Standardized and Internal approaches are used to evaluate the market risk. The preferred approach is Value at Risk (VaR).

As the Basel II, proposals are staged by the financial business, it moves from normalized necessities to more refined and explicit prerequisites that are custom for each risk by every individual bank. The advantage for banks that do build up their own risk estimation frameworks is that they are remunerated with conceivably lower risk capital requirements.

Pillar 2: Supervisory Review Process

The goal of Pillar 2 is twofold: first to ensure the capital adequacy of the banks to enhance their robustness to all type of risks and, second to encourage the development and the usage of better risk management techniques to monitor and manage risks. For that reason, Pillar 2 is also described as the supervisory review process. The Committee identified four key principles of supervisory review process, which are:

Principle 1: Banks should have a process for assessing their overall capital adequacy inn relation to their risk profile and a strategy for maintaining their capital levels.

Principle 2: Supervisors should review and evaluate banks' internal capital adequacy assessments and strategies, as well as their ability to monitor and ensure their compliance with regulatory capital ratios. Supervisors should take appropriate supervisory action if they are not satisfied with the result of this process.

Principle 3: Supervisors should expect banks to operate above the minimum regulatory capital ratios and should have the ability to require banks to hold capital in excess of the minimum.

Principle 4: Supervisors should seek to intervene at an early stage to prevent capital form falling below the minimum levels required to support the risk characteristics of a particular bank and should require rapid remedial action if capital is not maintained or restored.

Pillar 3: Market Discipline

Pillar 3 means to support market discipline by building up a set of disclosure requirements, which allow market participants to evaluate information key pieces on the

scope of utilization, capital, risk exposures, risk assessment processes, and thus the capital adequacy of the institution. Market Discipline is a regulation supplement, as the shared information eases assessment of the bank by investors, analysts, customers, other banks, and rating agencies driving to good corporate governance. Based on a common framework, the provided disclosures help the market to be effectively informed about a bank's exposure to risks, and offering simultaneously a consistent and understandable disclosure framework that enhances comparability. The disclosures are made at least twice a year, apart from qualitative disclosures which can be made annually, as they provide a summary of the general risk management objectives and policies. Additionally, the institutions are asked to have formal rules on what will be disclosed and controlled around them together with the validation and frequency of these disclosures. Overall, the disclosures apply to the top consolidated level of the banking group to which the Basel II framework applies. We summarize the key goals of Pillar 3 in Figure 3.

2. Basel II new elements and shortcomings

Basel II Accord expanded the risk weights range, gave degrees of freedom to realize diversification of the credit risk mitigation using derivative instruments (e.g., credit default swaps, total return swaps, credit linked notes), and ratings and internal models to determine the expected loss value, given the risk profile. For assessing the credit risk, the Basel II Accord proposes the standard approach (standardized approach), which is analogous to the one proposed by Basel I, but uses different shares and enables the using the financial instruments derived to limit the credit risk capital and to scale back the capital requirements, Internal Rating Based (IRB) approach, - allows a bank to use their own scoring system, including their own calculations on the probability of getting in insolvency, but the losses recorded when the counterparty enters into insolvency are provided by the supervisory institution. - The advanced methodology based internal ratings (advanced IRB approach) per which banks calculate their capital requirements supported their models, with the approval of the supervisory institution. Between the two agreements, there are differences in approach in terms of risk shares (Table 2 and Table 3).

Although Basel II had various advantages, the financial crisis of 2007 highlighted shortcomings. First, it has been wrongly assumed that if a bank was compliant to the principles of Basel II, then the bank meant that Bank would be adequate to withstand a crisis, as the authorities and market participants pursued Basel II as an almost-complete banking regulation system. In this way, the banks assumed that they were robust in assessing systemic risk. Second, the reliance on rating agencies, which failed to estimate the risk of structured products driving to large losses during the financial crisis of 2007, and third, the procyclicality (BCBS (2010)). According to this, a negative spiral effect is resulted between asset market-to-market valuations and Basel II capital demands. This suggests that as a downturn develops the probability of borrower default and loss at default both increase, which means that regulatory capital requirements increase. This might be handled through Pillar 2 capital planning buffers but the risks had been underestimated by banks and supervisors alike. As Kashyap and Stein (2004) mention, "In a downturn, when a bank's capital base is likely being eroded by loan losses, its existing (non-defaulted) borrowers will be downgraded by the relevant credit-risk models, forcing the bank to hold more capital against its current loan portfolio. To the extent that it is difficult or costly for the bank to raise fresh external capital in bad times, it will be forced to cut back on its lending activity, thereby contributing to a worsening of the initial downturn."

We summarize the goals of the three pillars under Basel II; the minimum regulatory capital requirements for credit, market and operational risk are handled by Pillar 1 of Basel II. In its turn, the supervisory review process it is evaluated by the supervisors whether the capital hold by the banks is more than that of the Pillar 1 minimum, is handled by Pillar 2. Finally, Pillar 3 handles the transparency of the banking system, encouraging market discipline by requiring disclosure requirements by banks to the market.

Opinions on the causes of the financial crisis are well and widely recognized. The Report of the de Larosiere Group on the future of European regulation and supervision (Report, the high-level group on financial supervision in the EU, chaired by Jacques de Larosiere, 25 February 2009), identified the primary causes of the financial crisis and suggested reforms within the European region and globally. Earlier the crisis, there was an age of excess liquidity. Consequently, the liquidity risk held become nearly undetectable. After the dry-up of the wholesale funding, banks realized the insufficiency of their liquidity reserves to meet their obligations. Also, banks had insufficient good quality of capital. The reason is that the investors seek for returns because due to the low inflation and returns, leveraged and complex financial products were introduced. On top of the lack of transparency and the difficulty of counterparty risk to be identified, several unanticipated risks were generated, which were transmitted to the interconnected financial system, and the things were worse than they seemed as the Basel II capital principles for credit risk were procyclical. Procyclicality is an important feature of risk-based capital requirements but it is maybe the least digested. This examines the nature of procyclicality in Pillar 1 capital requirements and modelling (which affects both Standardized and Advanced banks), and the proposed "dampeners" of provisioning and capital buffers. To understand the risks and the emerged requirements over the cycle, stress testing is a key tool capital. In the late of 2010, the Federal Reserve asked by the larger US banks to undertake stresses before it would agree on the dividend distributions and bonuses. The European Banking Authority and before this, the Committee for European Banking Supervisors, have run the European stress tests in 2010 and 2011 proving that they are very challenging exercises for banks and supervisors. G20 financial regulatory reform agenda after the crisis was very rich. The international authorities developed a variety of regulatory reforms to avoid, or at least eliminate, the features that could lead to a new crisis. In April 2009, the Financial Stability Board (FSB) was established and together with the G20 coordinated the reforms, which were designed by the relevant Standard Setting Bodies and authorized FSB working groups. The reforms applied to banks included new regulations by BCBS, the FSB reforms on Systemically Important Financial Institutions (SIFIs) and the new Bank Resolution Regimes. Therefore, in the light of effects of the financial crisis, five main objectives are met through Basel:

I. advance the standard quality, quantity, consistency and transparency of the capital base to make sure that banks are in an exceedingly better position to soak up losses;
II. reinforce risk coverage of the capital framework by firming the capital requirements for counterparty credit risk exposures;
III. set a leverage ratio as a complementary measure to the Basel II risk-based capital;
IV. introduce measures to market a build-up of capital buffers in good times which will be drawn upon in periods of stress. Linked to the current, the Committee is boosting the accounting groups to adopt an expected loss provisioning model to acknowledge losses sooner; and
V. set a worldwide minimum liquidity standard for internationally active banks that features a 30-day liquidity coverage ratio requirement, underpinned by a longer-term structural liquidity ratio.

The Basel II was not the final guide introduced by the regulators. The insufficiencies encouraged the Committee to implement yet another set of guidelines for banking regulation. The BCBS's efforts resulted in the Basel III (BCBS (2011a)) guidelines, which came to correct the shortcomings of Basel II, meet the new needs of the market and to improve financial stability. Before this, a transitional regulatory guide was inferred by Basel II.5. Basel III (BCBS (2013a), BCBS (2013b), BCBS (2013d), BCBS (2013e), BCBS (2013f), BCBS (2014)) also goes further and recommends changes to Pillar 2 (banks' internal assessment of capital requirements and supervisory review of risk management and capital assessment) and Pillar 3 (market discipline). The Committee delivers supplementary guidance on important areas as part of Pillar 2, like that of risk concentrations, which were expected to be implemented immediately. On Pillar 3, the Commission reiterates the obligation of banks to ensure that their disclosures to market participants are evolving in such a way as to keep pace with changes in their risk profile. The committee also makes detailed recommendations on the disclosure of securitized transactions. Given the major changes proposed in Basel III, a long transition period was agreed. The phasing out of capital instruments, such as hybrids and Tier 2 instruments that will no longer qualify will be completed by 1 January 2022. After 1 January 2013, new issues of capital instruments that do not qualify as common Tier 1 equity will be required to include a conversion feature, making them contingent capital. For the leverage ratio, the Liquidity Coverage Ratio and the Net Stable Funding Ratio, observation periods will be used to monitor carefully how the new measures will work before they are phased in. The capital requirements also have increased through Basel II.5 for the trading book and securitizations and through Basel III for counterparty credit risk. Given the rapidity with which agreement was reached on Basel III, it is probable that we will see some alterations as the consequences and application challenges become better understood through the switch period.

In addition, in Europe, European Systemic Risks Board (ESRB) was created along with a European Banking Authority (EBA) to deliver new macroeconomic policies to avert the generation of new bubbles. Table 4 and Table 5 show the evolution of the list containing the Global Systemically Important Financial Institutions (G-SIFIs), showing the initial and the latest list (BCBS (2012b), BCBS (2013b)). As it is shown the list not only changed through years, but it was much enriched.

3. A review of measures of bank risk

Given Basel II, the banks had the flexibility to ascertain their risk weights by their in-house models, contingent upon a necessary approval and the specialists' general guideline, gaining better tuning of the financial structure characteristics, to level the international playing field, and "further strengthen the soundness and stability of the international banking system" (BCBS (2006)). Blum (2008) raised some concerns due to the voluntary nature of the system, advocating a supplement of the Basel II system with a leverage constraint to avoid the negative consequences of strategic reporting of risk. Following the start of its implementation in 2007, Basel II has indeed allowed considerable international heterogeneity in terms of RWAs (see for example, BCBS (2013), EBA (2013), Avramova and Le Leslé (2012)). Some research explored the "regulatory arbitrage" hypothesis, that is whether banks have misused Basel II to engage in regulatory arbitrage. Behn et al. (2014) find that large banks assigned relatively low risk weights to loans originated under internal models but were aware of the true risks when pricing them, and Begley et al. (2017) show that banks under-reported risks in their trading book when they had low equity capital.

The adoption of risk-based capital standards by a large number of countries in accordance with the risk-based capital adequacy regulation obliged banks to hold capital to deal with the risk of their portfolio. A very important question that the capital requirements of Basel Accords do not answer is the adequacy of the capital requirements even a crisis happens (see for example, Jacques and Nigro (1997)). It was inevitable that both researchers, bankers and regulators seek for a relationship between capital adequacy regulation and bank risk in the presence of a crisis, resulting two main strands in the literature. One supports the positive relationship between regulatory capital and bank risk-taking behavior (Ashraf et al. (2016); Danisman and Demirel (2019); Jacques and Nigro (1997); Shrieves and Dahl (1992)), and the other supports the opposite (see for example, Zhang et al. 2008). The financial crisis of 2007 exposed the inefficiency of the capital requirements to prevent by their own the bank failures, as some banks bailed out by governments held adequate capital just before the crisis (Demirgüç-Kunt et al. (2013)).

There are different ways to measure bank risk, such as the ratio of risk-weighted assets to total assets (Andrien and Peirce (2016); Shrieves and Dahl (1992)), non-performing loans (ESRB (2019)), and z-score (Danisman and Demirel (2019); Zheng et al. (2017)). The risk-weighted assets ratio is extensively used to signify bank risk, because this ratio associates with the risk profile of banks. Additional, several definitions for capital ratios were introduced (see for example, Demirgüç-Kunt et al. (2013) and Anginer and Demirgüç-Kunt (2014)). Initially, the capital ratios are calculated according to the Basel guidelines using risk-weighted assets. Secondly, the ratios are calculated by using total assets instead. Thus, the capital ratios are formed as: Tier1 over the risk-weighted assets, sum of Tier 1 and Tier 2 over the risk-weighted assets, common equity over the risk-weighted assets, and other capital over the risk-weighted assets. Tier 1 capital denotes the sum of shareholders' funds and perpetual, noncumulative preferred shares. Total capital serves as the numerator in the capital adequacy ratio and encompasses a part of Tier 2 capital in addition to Tier 1 capital. Tier 2 comprises subordinated debt and some hybrid

capital. Under Basel II guidelines, the total capital ratio must be maintained above the level 8% (Andrien and Peirce (2016)). Abedifar et al. (2013) employ growth rate of total assets as a proxy for bank growth and development strategies. As they expand and develop, banks are expected to attract more skilled employees and be less exposed to information asymmetry. Furthermore, it is likely that they are able to improve their credit risk management, decreasing consequently their risk and at the same time, their efficiency and profitability are increased, because of better screening and monitoring of investments.

The non-interest income is examined by the literature. Demirgüç- Kunt and Huizinga (2010) find that it is associated with more volatile returns, while Abedifar et al. (2013) find that it is negatively associated with bank interest margins, reaching to similar results with those of Stiroh (2004, 2006), who finds that a shift on noninterest income does not increase bank profits. On the other hand, Laeven and Levine (2007) introduce the income diversity which equal to 1 minus the ratio of the difference between the net interest income and the other operating income over the operating income. The higher the value, the more a bank's activities are diversified.

The literature shows that larger banks can benefit from economies of scale and portfolio diversification, which should improve their efficiency and decrease their risk exposure (see for example, Chortareas et al. (2012); Abedifar et al. (2013)). To control for diversification, it is used a measure of income diversity, which captures the degree to which banks diversify between lending and non-lending activities. There are different opinions concerning the effect of income diversity on bank risk and returns. Abedifar et al. (2013) claim that by expanding their activities, banks can accumulate different information on clients' businesses, which can be used successfully manage lending decisions and screen clients' risk profile. Finally, the cost to income ratio in the risk model is used to control for risk and efficiency and loan loss reserves to total assets in the efficiency and profitability models.

3.1 Capital Adequacy Ratio (CAR)

Capital Adequacy Ratio, CAR, is a measure where the capital of the bank is related to different categories of risk exposures. To calculate CAR, Tier 1, Tier 2 capital, total risk weighted assets are used. Tier 1 includes equity capital, retained earnings and non-cumulative preference shares, which is the main reserve to deal against losses and it measures the bank's ability to manage risk (Van Greuning and Brajovic Bratanovic, 2009). The equity capital and the retained earnings are defined as the equity capital and the retained earnings define Core Capital (BCBS (1988)), which is also very important, as it is one of the key features that are reported in the financial statement, according to the rules of Basel Committee. Further, it is the same across countries even if the accounting systems might be different. Tier 2 is based on capital obligations that will bring a future income but have a mandatory fee, or that finally would be redeemed and it includes the general provisions/loss reserves, debt/equity capital instruments and the subordinated term debt. In addition, Tier 2 cannot exceed 100 percent of the Tier 1 capital (Van Greuning and Brajovic Bratanovic (2009)). Tier 1 and 2 capital define the Regulatory Capital. On the other hand, the risk-weighted assets are comprised by the

credit risk, market risk and operational risk, which are weighted into different probabilities of default either by a Standardized Approach or by an in-house risk model (Van Greuning and Brajovic Bratanovic (2009)). The calculation considered by the Basel Committee (BCBS (1988)) to improve bank's capital adequacy. To summarize, the capital adequacy ratio is calculated as

$$CAR = \frac{Tier\ 1 + Tier2}{Total\ risk - weighted\ assets} * 100.$$

CAR measures the amount of capital required for risk-weighted credit exposure, which is legalized in Basel capital regulation. Banks with higher CAR are considered to have a lower risk and more probable to meet any financial obligations during the recession periods. A major issue in the banking industry after the subprime mortgage problem was capital-based regulation. To preserve the minimum capital adequacy ratio, a bank can begin collecting outstanding debts or become reluctant to approve a new loan (Hyun and Rhee, 2011).

3.2 Return on Assets (ROA)

Return on assets (ROA) is a profitability measure, as it relates the bank's performance to its potential. It is found as the ratio of the total after tax income divided by the total assets, that is,

$$ROA = \frac{Net\ income}{Total\ assets} * 100.$$

The ROA indicates how well a bank is managed because it shows how much profit it makes on average per unit of asset (Mishkin and Eakins (2012)), allowing a comparison among banks of different sizes because of the way it is calculated (Mishkin and Eakins (2012)). Moreover, it relates the risk management and bank performance.

3.3 Non-Performing Loan Ratio (NPL)

Non-performing loans ratio (NPL) measures the default risk and it is often used to investigate how big the credit risk exposure of the bank is.

$$NPL = \frac{Non - performing\ Loans}{Gross\ loans} * 100.$$

NPL ratio consists of all loans overdue on principal and interest payments. Banks with higher equity to total assets ratio and a higher net income margin are expected to have a higher NPL, whereas an increase in net loans to total assets ratio is expected to reduce the non-performing loan. NPL ratio is likely positively correlated with the probability of default of the bank (Barrios and Blanco, 2003). Ozili (2019) found that the NPL is negatively related with the CAR ratio, implying that banking sectors with greater regulatory capital experience fewer NPLs.

3.4 Equity Ratio (EQTA)

Equity ratio (EQTA) is the ratio of the equity over the total assets which measures the leverage used by the bank and the solvent positions.

$$EQTA = \frac{Equity}{Total\ assets} * 100.$$

Low values of the ratio imply high leverage, and consequently higher risks (Ben Naceur and Kandil (2009)). In banking, the financial ratios related to equity are very important, as high equity implies excess liquidity for the bank which could be used for dividends to the shareholders. Since the equity and reserves do not generate any further proceeds, so the existence of excess liquidity in the reserves is still a question (Eakins and Mishkin (2012)).

3.5 Net Loans over Total Assets Ratio (NLTA)

Net loans over total assets ratio (NLTA) is a liquidity ratio measuring the part of total assets fixed in loans.

$$NLTA = \frac{Net\ loans}{Total\ assets} * 100.$$

The greater is the greater is the part of total assets that consists of loans, indicating less liquidity. The risk is higher when there is large amount of loans relative to total assets, because it takes longer to liquidate them compared to other asset classes, increasing the risk of illiquidity.

3.6 Liquid Assets to Total Deposits Ratio (LATD)

Liquid assets to total deposits ratio (LATD) expresses the liquidity risk, as it is the ratio of the liquid assets over total debt and borrowing.

$$LATD = \frac{Liquid\ assets}{Total\ debt\ and\ borrowing} * 100.$$

The ratio shows bank's capacity to pay its debt without taking a new loan or raise equity capital. A low liquidity can force the bank to make necessary and expensive loans and therefore raise the risk.

4. Data analysis

We explore the evolution of capital adequacy ratio based on other important ratios of the banks, namely the return on assets, the non-performing loans, the total equity over the total assets, the net-loans over the total assets, and the liquid assets over the total bank deposits. We use Global Industry Classification Standards (GICS) to search for banks. The GICS is an industry taxonomy firstly introduced in 1999 by MSCI and Standard & Poor's to provide a common way to identify the sector that a security belongs. Using Bloomberg LP and the function EQS to do equity screening, we select banks as sector, and as county of domicile the two core countries of the Eurozone, that are France and Germany, and from periphery, the banks of Italy and Spain. The particular selection of these countries is because we want to have in our dataset the two core economies of the Eurozone and two countries, which were hit by the financial crisis of 2007. Recall, that the banking system in the periphery suffered huge losses due to the austerity measures, the explosion of unemployment, the default of many households and small-medium enterprises. Some of the countries of the periphery still struggle to deal with the non-performing loans. Additionally, another major problem faced the bank was the Greek PSI (Private Sector Involvement) in 2012. As the press mentioned in that days

"the group of banks negotiating the voluntary exchange of Greek bonds to accept a 53.5% haircut – announced more firm commitments to the exchange from holders now accounting for 39.3% of the €216 billion of bonds eligible. Among those adding their names to the 12 steering committee members who announced their commitment on Tuesday are Ageas, Banque Postale, BBVA, Crédit Agricole, Crédit Foncier, DekaBank, Dexia, Emporiki Bank of Greece, Generali, Groupama, HSBC, KBC, Marfin Popular Bank, MetLife, Piraeus Bank, Royal Bank of Scotland, Société Générale and UniCredit."

Table 6 - Table 9 show all the banks in each country sorted by market capitalization (in euros). We reduce our pool by selecting only the top four banks by market capitalization. Therefore, we end with the following banks:

BNP PARIBAS, CREDIT AGRICOLE SA, SOCIETE GENERALE SA, CR DE CREDIT AGRICOLE IDF, COMMERZBANK AG, HSBC TRINKAUS & BURKHARDT AG, DEUTSCHE PFANDBRIEFBANK AG, AAREAL BANK AG, BANCO SANTANDER SA, BANCO BILBAO VIZCAYA ARGENTA, CAIXABANK SA, BANKIA SA, INTESA SANPAOLO, UNICREDIT SPA, FINECOBANK SPA, MEDIOBANCA SPA.

It is obvious that many of the banks of our dataset were heavily hit by the haircut of the Greek government bonds.

The data cover the period from 2000 to 2019 in annual frequency; therefore, we have 320 observations in total.

Table *10* - Table *25* show the descriptive statistics of the ratio we described analytically in the previous section. We analyze the evolution of the ratios along with the Figure 5 – Figure 12. The first column of Table *10* - Table *25* show the descriptive

statistics of the capital adequacy ratio. The numbers along with the graphical representation of the ratio in Figure 5 show that there was a drop starting from 2007 and ending in 2009. Then almost all the banks acted in such a way to make robust their positions enhancing their capital adequacy ratio. One of the banks, FINECOBANK, an Italian bank, is that which had the lower capital adequacy ratio (7.65%) and then achieved the highest value (33.67%) among all the other banks of our dataset. Additionally, in the aftermath of the financial crisis of 2007, the main driver behind the increased capital adequacy ratio was the equity (see also, column four in Table *10* - Table *25* and Figure 8. This is very true as for example only Deutsche bank raised €10.2 billion in 2008. Additionally, the increase of the capital adequacy ratio could indicate write-off of toxic assets or the acquisition of impaired assets by bad banks (Heynderickx et al. (2016)).

The second column of the Table *10* - Table *25* and the Figure 6 show that the return on assets for seven banks of our dataset turned on 2009 and some of them stayed negative until 2016. This is a feature also reported for the average of the Single Supervisory Mechanism (SSM) banks (Can Bertay and Huizinga (2017)) indicating also that for the banks that turned positive thereafter, their return on assets remained in low levels, emphasizing our finding that the lower return on asset was -6.51% (Table 26).

We like to point that the very low return on assets was not a characteristic only for the banks of the periphery countries. For example, both BNP PARIBAS, which is a French bank, and BANCO SANTANDER, which is an Italian bank, their return on assets was very lower 0.2%. Obviously, at levels in this area, banks are not able to earn a satisfactory return for their shareholders, implying that banks are forced to limit some activities and downsize to raise their profitability.

Table *10* - Table *25* (column three) and Figure 7 reveal the same pattern for the banks of our dataset for the non-perming loans (NPLs), a sharp increase and then a gradual decrease. The increased NPLs in the post crisis period is the main reason for which the robustness and the stability of the European banking system was put in question. For some countries of the periphery remained a serious challenge, as these countries were hardest hit by the financial crisis. Losses because of the NPLs, drive to the reduction of banks' profits. Inevitably, banks needed an urgent recapitalization and further reduction of the liquidity injected to the economy through loans, constraining the economic activity. The goal of the banks to sharply reduce the NPLs had another root. The high rate of non-performing loans was a risk and a threat for the stability of the banking system, increasing the probability of another systemic risk event, which may cause a bank run reducing the intermediation power of the banks.

Table *10* - Table *25* (column five) and Figure 9 reveal evolution of the total assets. For five banks of our dataset, there is a sharp decrease of the total assets, occurred between 2008-2012, whereas for the rest either there is a mild decline or a stabilization at the levels of 2012. The pattern exhibited is very close to that of the total bank deposits (Table *10* - Table *25* (column eight) and Figure 12) showing that the investor's trust to the banking system was heavily injured.

Table *10* - Table *25* (column six) and Figure 10 reveal evolution of the net loans. For six banks of our dataset, there is a sharp decrease starting from and ending in 2016.

All these banks remained in much lower levels before the decrease started. This is a pattern also documented by Altavilla et al (2019) showing that although banks can acquire information on a firm's default risk and therefore decide the level of the leverage that the firm can handle, they prefer to shift to bond issuance.

Finally, Table *10* - Table *25* (column seven) and Figure 11 show the numbers for the liquid assets, which exhibit a large increase after 2012.

5. Model specification & estimation technique

Following Andrien and Peirce (2016), where the capital adequacy ratio is used to measure the bank's efficiency, we use the ratios analyze before to model it and identify the key drivers. Instead of using single equations for each of the banks, we model them using a panel data model.

Since the data are obtained from Bloomberg, we give the exact calculations and the notation of the variables used:

$\boldsymbol{TA_{it}}$, total assets. According to Bloomberg, it's the sum of the "cash and bank balances, Fed funds sold & resale agreements, Investments for Trade and Sale, Net loans, Investments held to maturity, Net fixed assets, Other assets, Customers' Acceptances and Liabilities."

It is equal to:

Cash & near cash items +

Short-term investments & securities inventory +

Net receivables +

Total Long-Term Investments +

Net fixed assets +

Other assets.

$\boldsymbol{CAR_{it}}$, the capital adequacy ratio, calculated as:

(Trailing 12M Net Income / Average Total Assets) * 100

where: Trailing 12M Net Income (TRAIL_12M_NET_INC)

Average Total Assets is the average of the beginning balance and ending balance (BS_TOT_ASSET)

$\boldsymbol{ROA_{it}}$, the return on assets. According to Bloomberg, ROA is an "indicator of how profitable a company is relative to its total assets, in percentage. Return on assets gives an idea as to how efficient management is at using its assets to generate earnings." For banks, it is calculated as

(Trailing 12M Net Income / Average Total Assets) * 100

where:

Trailing 12M Net Income is RR813, TRAIL_12M_NET_INC

Average Total Assets is the average of the beginning balance and ending balance of BS035, BS_TOT_ASSET

$\boldsymbol{NPL_{it}}$, which is the ratio of non-performing loans to total assets. According to Bloomberg, "the nominator is a sum of borrowed money upon which the debtor has

not made the scheduled payments for a period of usually at least 90 days for commercial banking loans and 180 days for consumer loans. Nonpayment means there have been zero interest or principal payments made on the loan within a specified period — generally, 90 to 180 days depending on industry and loan type. Any definition of a nonperforming loan will depend on the loan's terms and agreement as there is no definitive definition of a nonperforming loan - NPL."

$\boldsymbol{TE2TA_{it}}$, the ratio of total equity to total assets. According to Bloomberg, total equity is the "firm's total assets minus its total liabilities. Figure is reported in millions; the Scaling Format Override (DY339, SCALING_FORMAT) can be used to change the display units for the field." For banks, the total assets are calculated as the sum of

Common Equity + Minority Interest + Preferred Equity

where:

Common Equity is RR010, TOT_COMMON_EQY

Minority Interest is BS062, MINORITY_NONCONTROLLING_INTEREST

Preferred Equity is BS061, BS_PFD_EQTY_&_HYBRID_CPTL

$\boldsymbol{NL2TA_{it}}$, the ratio of net loans to total assets. The net loans are calculated by Bloomberg as "Net loans after reserve for loan losses" for banks, and as "Net Loans & Mortgages after Reserve for Loan Losses including short-term loans" for financials.

$\boldsymbol{LA2TD_{it}}$, the ratio of liquid assets to total deposits. Liquid assets are the assets "that easily can be converted into cash such as money market fund shares, treasury bills, and bank deposits." The total deposits are calculated as the cash received form customers. Amount due to banks are shown in borrowings

where $i = 1, \ldots,16$, and $t = 2010, \ldots,2020$.

Therefore, the model is formed as:

$$\boldsymbol{Y_{it} = \beta_0 + \beta_1 ROA_{it} + \beta_2 NPL_{it} + \beta_3 TE2TA_{it} + \beta_4 NL2TA_{it} + \beta_5 LA2TD_{it} + v_{it},}$$

where $i = 1, \ldots,16$, and $t = 2010, \ldots,2020$

5.1 Background

A panel data (or longitudinal data) contains observations on multiple individuals or entities, where each entity is observed at several points in time. Panels can be used to look at issues that cannot be addressed using pure cross-section or time series data. Panel data refers to the pooling of observations on a cross-section of households, firms or countries over several periods. Panel data is increasingly becoming available, mainly through large surveys, repeated over time. In 1968, it appeared one of the first applications of the panel data methodology, that is the Panel Study of Income Dynamics at the University of Michigan. The study was about the investigation of the causes of the poverty, and for this

reason they were collected annual data on over 5000 variables on about 4800 families in the USA.

Some other examples are:

- Data on hospitals across several districts from 2010 to 2020.
- Data on traffic fatality rates for European countries for T years (1,…, T).
- GDP, population, unemployment for the European countries over the years 2000-2020.

The notation used for the panel contains a double subscript to distinguish the entities and the periods (years). Therefore, if we denote with

i, the entity, and with n, the number of entities,

so

$i = 1,\ldots, n$, t = time period (year), T = number of time periods so $t = 1,\ldots, T$

and we assume that there is only one regressor X, the data are denoted as

$$(X_{it}, Y_{it}),\ i = 1,\ldots, n,\ t = 1,\ldots, T.$$

Accordingly the panel data with k regressors:

$$(X_{1,it}, X_{2,it}, \ldots, X_{k,it}, Y_{it}),\ i = 1,\ldots, n,\ t = 1,\ldots, T.$$

The econometric setup may be as the one described in the following equation

$$Y_{it} = \alpha + \beta X_{it} + u_{it},$$

where

Y_{it} is the dependent variable,

α is the intercept term,

β is a $k \times 1$ vector of parameters to be estimated on the explanatory variables,

and

$X_{it} = (X_{1,it}, X_{2,it}, \ldots, X_{k,it})$ is a $1 \times k$ vector of observations on the explanatory variables, $i = 1,\ldots, n,\ t = 1,\ldots, T$.

The easiest way to deal with an estimation problem would be to estimate a pooled regression. This would involve the estimation of a single equation on all the data together, stacking the data for y into a single column containing all the cross-sectional and time-series observations. Accordingly, all of the data for each explanatory variables would be also stacked up into single columns in the x matrix, and then this would by a classical model to be estimated using OLS.

Though this is a simple way to continue with low demands in term of parameter estimation, it has some severe limitations. Most notable limitation is that pooling the data in this way it is implicitly assumed a constant relationship that is the average values of the variables and the relationships between them are constant over time and across all of the cross-sectional units in the sample (Brooks (2014)). It could be estimated separately using time-series regressions each of the entities, but this is not an optimal way to proceed, as in this way, any common structure present in the series of interest is not taken into

account. Otherwise, cross-sectional regressions for each of the time periods could be estimated separately, but again this may not be a good way in the presence of some common variation in the series over time.

5.2 What panel techniques are available?

A way to make use of the structure of the data is to use the seemingly unrelated regression (SUR) approach proposed. This approach is widely used in finance to model closely related variables. It took its name by the fact that although the dependent variables look initially unrelated across the equations, a closer and more careful look shows that indeed are related in a way. An example is the funds flows to portfolios operated by two different banks. The flows might be related as they might be thought as substitutes. For example, if a fund performs poorly, the investor may switch to the other fund. Additionally, they are related as the total flow is affected by common factors. SUR methodology allows contemporaneous relationship between the error terms in the two equations, so the idea behind is modifying the model so that the error terms become uncorrelated. In the case of no correlation between the error terms, then the methodology would be the same with estimating separate each equation using OLS. There are limitations with the applicability of the methodology, as it can be used only when the sample size, T, per cross-sectional unit i is at least as large as the total number of the units, N. Another limitation SUR is the large number of parameters to be estimated. For all above, the panel data approach is mostly used.

The most broadly known panel estimation approaches known and employed in financial research: fixed effects models and random effects models. The basic specification of the fixed-effects panel data model assumes that the intercept differs cross-sectionally but not over time, while all of the slope estimates are fixed both cross-sectionally and over time, resulting a parsimonious model compared to the SUR specification. The next step is to tell whether the panel data model is a balanced or an unbalanced panel data model.

5.3 Balanced and unbalanced panel models

Panel models are distinguished in two categories, the balanced and unbalanced panel models. In the case of the balanced panel, there are no missing observations, contrary to the unbalanced panel.

Panel data has several advantages. Panels usually offer a very large number of cross-sectional observations and so offer large datasets that a researcher can work with. On the other hand, there are some shortcomings related with panel data models, such as the need the careful design to have representative coverage of the population. Otherwise, there is selectivity problem, as some groups are excluded from the population and consequently not examined.

5.4 Panel data fixed-effects model

To understand how fixed-effects panel data work, we start from equation

$$Y_{it} = \alpha + \beta X_{it} + u_{it}.$$

And we decompose the error term u_{it}, into an individual specific effect, μ_i, and the 'remainder disturbance', v_{it}, capturing the unexplained part of Y_{it} , which varies over time and entities

$$u_{it} = \mu_i + v_{it}.$$

Based on this, we rewrite the equation $Y_{it} = \alpha + \beta X_{it} + u_{it}$ by substituting the disturbance term $u_{it} = \mu_i + v_{it}$, to obtain

$$Y_{it} = \alpha + \beta X_{it} + \mu_i + v_{it}.$$

The way to think the decomposition is that μ_1 encapsulates the independent variables used to explain Y_{it} cross-sectionally, but does not change over time. An example might be the case where we use in a model the sector that a firm operates in, the CEO's gender, or firm's country of domicile etc. The estimation of the model can be done using dummy variables, which is known as the least squares dummy variable (LSDV) approach

$$Y_{it} = \beta X_{it} + \mu_1 D_{1i} + \mu_2 D_{2i} + \ldots + \mu_N D_{Ni} + v_{it}$$

where the dummy variable D_{1i} takes the value 1 for all observations on the first entity in the sample and zero otherwise, D_{2i} takes the value 1 for all observations on the second entity and zero otherwise, and so on. The number of parameters to be estimated are *N* + *k*, which would be a demanding problem, when *N* is large.

A different way to do the demeaning is be to run a cross-sectional regression on the time-averaged values of the variables, which is known as the *between estimator*. Another way is to apply the first difference operator, so that the change of Y_{it} is modeled instead of its level. Since we use the differenced model, any variables that are constant over time, like μ_i, will cancel out, as before. In cases of two time periods, differencing and the within transformation will yield same estimates in situations. If there are more than two, the choice between the two approaches depends on the assumptions about the error term.

We estimate the last equation using OLS on the pooled sample of demeaned data, but the degrees of freedom must be clarified. The estimation uses k-degrees of freedom from the NT observation, but a further N degree of freedom are used to construct the demeaned variables, hence the number of the degrees of freedom are NT-N-k. The regression on the time-demeaned variables and the LSDV regression will give identical parameters and standard errors, but without needed to estimate so many parameters. The shortcoming of this approach is that the influences of all of the variables that affect cannot be determined.

5.5 The time-fixed effects model

An alternative to an entity fixed model is to have a time-fixed effects model, that we will use it later. We assume that the average value of Y_{it} changes over time but not cross-sectionally, therefore, the intercepts are time-varying but fixed across the entities at each given point in time. The time-fixed effects panel data model is written as

$$Y_{it} = \mathrm{a} + \beta X_{it} + \lambda_t + v_{it}$$

where λ_t is a time-varying capturing all of the variables affecting Y_{it} that vary over time but are constant cross-sectionally, allowing to be time-varying in the same manner as with the entity-fixed effects model, concluding again to a dummy variable model to be estimated,

$$Y_{it} = \beta X_{it} + \mu_1 D_{1i} + \mu_2 D_{2i} + \ldots + \mu_T D_{Ti} + v_{it}$$

where the dummy variable D_{1i} takes the value 1 for all observations on the first entity in the sample and zero otherwise, D_{2i} takes the value 1 for all observations on the second entity and zero otherwise, and so on. The only difference is that now, the dummy variables capture time variation rather than cross-sectional variation.

To avoid the demanding estimation, we transform the data to simplify the procedure, which is made by subtracting the time-mean of each entity away from the values of the variables. The model is written as

$$Y_{it} - \overline{Y_t} = \beta(X_{it} - \overline{X_t}) + v_{it} - \overline{v_t}$$

where $\overline{Y_t} = \frac{\sum_{i=1}^{N} Y_{it}}{N}$ is the mean of the observations on Y across the entities at each point of time. Using a new notation for the demeaned model, we obtain

$$\ddot{Y_{it}} = \beta \ddot{X_{it}} + \ddot{v_{it}}$$

where $\ddot{Y_{it}} = Y_{it} - \overline{Y_t}$, $\ddot{X_{it}} = X_{it} - \overline{X_t}$ and $\ddot{v_{it}} = v_{it} - \overline{v_t}$. Recall that the intercept is not required since by construction, the dependent variable has zero mean.

5.6 Estimation results

We estimate the model using the fixed-effects panel data methodology and we obtain the following specification.

$$\widehat{CAR_{it}} = 13.42^{***} + 0.72ROA_{it} - 17.73NPL_{it} + 138.90TE2TA_{it} - 13.38NL2TA_{it} + 1.48LA2TD_{it}$$

Only the constant variable is statistically significant at the one percent level, and the joint test of the significance of the model rejects the null that all the coefficients are zero (F-statistic=3.3114). Additionally the R^2 equals to 27.76%, which indicates that the constant explains approximately 27.76 percent of the value of CAR.

As the sample contains both the financial crisis of 2008 and the European debt crisis, we examine the relationship above in the aftermath of Mario Draghi's "whatever it takes" statement. Since the statement was in July 26, 2012 and our data are yearly, we estimate our model from 2013 to the end, to detect the influence of the unlimited quantitative easing provided in the system.

Indeed, the estimated coefficients are changed as we see below:

$$\widehat{\mathrm{CAR}}_{\mathrm{it}} = 13.53^{***} - 0.67\mathrm{ROA}_{\mathrm{it}} - 12.17\mathrm{NPL}_{\mathrm{it}} + 316.09^{***}\mathrm{TE2TA}_{\mathrm{it}} - 34.58^{***}\mathrm{NL2TA}_{\mathrm{it}} - 1.74\mathrm{LA2TD}_{\mathrm{it}}$$

Now, we have two more variables statistically significant, the ratios of total equity and net loans over total assets. The model rejects the null that all the coefficients are zero (F-statistic=5.104). The signs of the coefficients are the expected one. Additionally the R^2 equals to 41.48%, which indicates that the independent variables together explain approximately 41.48 percent of the value of CAR.

5.7 Beta convergence

Adopting the method developed by Barro and Sala-i-Martin (1992), beta convergence is estimated from a fixed effects panel estimator of the following equation

$$y_{it} = \mathrm{a} + \beta \ln(CAR_{it-1}) + v_{it}$$

where $y_t = \ln(\frac{CAR_t}{CAR_{t-1}})$ and v_{it}, the error term.

Beta convergence is achieved if $\beta -$ coefficient is negative. The coefficient β represents the speed of adjustment. Estimating the equation above for the selected banks, we obtain

$$\hat{y}_{it} = 0.1965 - 0.1683^{***}\ln(CAR_{it-1})$$

and we verify that the convergence is achieved.

6. Conclusions-Discussion

In this study, we have discussed in detail the importance and development of Basel, focusing on Basel II. Each change was in response to new investment products created over time, or events that revealed the weaknesses of the previous regulatory framework. Thus, on the occasion of the global financial crisis, the risks of the mismatch of maturity and the unstable combination of financing in the balance sheets of the banks appeared. As a result, what governs banks' liquidity has changed at a regulatory and supervisory level.

One of the variables, which is of main concern, both the banks and the supervisory authorities, is the capital adequacy ratio. This variable becomes the main variable that we study in relation to other important ratios, such as that of non-performing loans that are still under discussion now, after 12 years since the financial crisis and 8 years since the debt crisis in the Eurozone.

Using the four largest banks in terms of capitalization from the two core countries of the Eurozone, France, and Germany, and two other countries from the periphery, Italy, and Spain, we estimate a model using panel data to identify the key drivers of capital adequacy ratio. We were not able to identify any variable affecting the capital adequacy ratio for the whole period. As the sample contains both the financial crisis of 2008 and the European debt crisis, we examine the relationship above in the aftermath of Mario Draghi's "whatever it takes" statement. Since the statement was in July 26, 2012 and our data are yearly, we estimate our model from 2013 to the end, to detect the influence of the unlimited quantitative easing provided in the system and we conclude that the ratios of total equity and net loans over total assets affect the capital adequacy ratio.

Finally, due to the support packages and the consolidation actions of the banks' balance sheets, we conclude that the β – convergence is achieved for the capital adequacy ratio of the group of banks selected.

Table 1: Short history of Basel Committee regulatory developments for banking supervision

1. End of 1992 - Introduction of Basel I

2. Jan 1996 – Introduction of Market risk component in Capital Adequacy Ratio (CAR) calculation

3. Oct 1998 – Defining the components of capital under Basel I

4. Jun 2004 – Release of Basel II which improved the credit risk measurement and set a capital requirement for the operational risk. Was due to be implemented from year-end 2006.

5. Jul 2009 – Basel 2.5 enhanced the measurements of risks related to securitization and trading book exposures and was due to be implemented no later than end 2011.

6. Dec 2010 – Release of Basel III which sets higher levels of capital requirements and introduced a new global liquidity framework. Committee members agreed to implement Basel III from 1 January 2013, subject to transitional and phase-in arrangements.

Table 2: Basel I risk metrics. Source: BCBS (1988)

Counterparts	Sovereigns	Banks	Mortgages	Corporates
Risk-weights	0%	20 %	50 %	100 %

Table 3: Basel I and Basel II risk weights. Source: Georgescu, 2006.

EXPOSURE	Credit risk associated to the local exposures	
	Basel I	Basel II
Central governments, central banks and international financial institutions similar (for exposures denominated and funded in local currency)	0	0
Central governments, central banks and international financial institutions similar (for exposures other than the ones denominated and funded in local currency)	0%	50%
Credit institutions - short-term exposures financed and expressed in local currency	20%	20%
Credit institutions - long-term exposures	20%	50%
SSIF - short term exposures financed and expressed in local currency	100%	20%
SSIF- long term exposures	100%	50%
Exposures towards institutions in the group	20%-100%	20%-100%
Regional and local administrations	20%	100%
Entities of the public sector	100%	100%
Retail exposures (includes exposures to population)	100%	75%
Exposures to corporates	100%	100%
Loans secured by commercial properties	100%	100%
Loans secured by real estate	50%	35%
Exposure with high risk (investment in shares in unlisted entities)	100%	150%

Capital ratios and targets			New capital definition Higher minimum ratios New leverage ratio Buffers Systemic add-on
RWA requirements	Pillar 3 Disclosure Pillar 2 ICAAP Pillar 1 Operational risk, Credit risk	New Pillar 1: Credit risk = { Incremental risk Trading book Securitization revision	Counterparty risk
Liquidity standards			Liquidity coverage ratio Net stable funding ratio
	Basel II (2007-2008)	Basel II.5 (2012)	Basel III (2013-2022)

Table 4: Global systemically important banks 2011 list. Assessment methodology and the additional loss absorbency requirement, using data as of end-2009.

Bank of America
Bank of China
Bank of New York Mellon
Banque Populaire CdE
Barclays
BNP Paribas
Citigroup
Commerzbank
Credit Suisse
Deutsche Bank
Dexia
Goldman Sachs
Group Crédit Agricole
HSBC
ING Bank
JP Morgan Chase
Lloyds Banking Group
Mitsubishi UFJ FG
Mizuho FG
Morgan Stanley
Nordea
Royal Bank of Scotland
Santander
Société Générale
State Street
Sumitomo Mitsui FG
UBS
Unicredit Group
Wells Fargo

Table 5: G-SIBs as of November 2019 allocated to buckets corresponding to required levels of additional capital buffers.

Bucket	**G-SIBs in alphabetical order within each bucket**
5 **(3.5%)**	(Empty)
4 **(2.5%)**	JP Morgan Chase
3 **(2.0%)**	Citigroup HSBC
2 **(1.5%)**	Bank of America Bank of China Barclays BNP Paribas Deutsche Bank Goldman Sachs Industrial and Commercial Bank of China Mitsubishi UFJ FG Wells Fargo
1 **(1.0%)**	Agricultural Bank of China Bank of New York Mellon China Construction Bank Credit Suisse Groupe BPCE Groupe Crédit Agricole ING Bank Mizuho FG Morgan Stanley Royal Bank of Canada Santander Société Générale Standard Chartered State Street Sumitomo Mitsui FG Toronto Dominion UBS UniCredit

Table 6: Market capitalization of banks in France (as of December 2019)

Name	Market Cap
BNP PARIBAS	68,324,855,808
CREDIT AGRICOLE SA	37,310,529,536
SOCIETE GENERALE SA	18,190,198,784
CR DE CREDIT AGRICOLE IDF	2,649,002,496
CA NORD DE FRANCE-CCI	1,543,196,928
CRCAM DU LANGUEDOC	1,491,591,168
CA ATLANTIQUE VENDEE-CCI	1,035,074,944
CA SUD RHONE ALPES-CCI	878,914,880
CA ALPES PROVENCE-CCI	867,540,160
CA NORMANDIE SEINE-CCI	861,000,704
CA LOIRE-HAUTE-LOIRE-CCI	782,015,872
CA TOURAINE POITOU-CCI	750,621,184
CA ILLE ET VILAINE-CCI	659,645,632
CREDIT AGRICOLE TOULOUSE 31	585,811,264
CREDIT AGRICOLE DU MORBIHAN	550,087,424

Table 7: Market capitalization of banks in Germany (as of December 2019)

Name	Market Cap
COMMERZBANK AG	8,502,536,704
HSBC TRINKAUS & BURKHARDT AG	2,983,004,672
DEUTSCHE PFANDBRIEFBANK AG	1,492,219,008
AAREAL BANK AG	1,481,199,616
UMWELTBANK AG	554,416,256
PROCREDIT HOLDING AG & CO KG	504,675,840
MERKUR PRIVATBANK KGAA	103,481,432

Table 8: Market capitalization of banks in Italy (as of December 2019)

Name	Market Cap
INTESA SANPAOLO	45,880,750,080
UNICREDIT SPA	21,851,234,304
INECOBANK SPA	10,175,602,688
MEDIOBANCA SPA	8,076,793,344
BANCO BPM SPA	3,536,701,184
BPER BANCA	2,857,361,664
CREDITO EMILIANO SPA	1,805,832,576
BANCA MONTE DEI PASCHI SIENA	1,359,649,664
BANCA POPOLARE DI SONDRIO	1,255,280,768
CREDITO VALTELLINESE SPA	987,310,080
ILLIMITY BANK SPA	765,661,248
BANCO DESIO E DELLA BRIANZA	428,089,792
BANCA SISTEMA SPA	167,728,272

Table 9: Market capitalization of banks in Spain (as of December 2019)

Name	Market Cap
BANCO SANTANDER SA	59,223,044,096
BANCO BILBAO VIZCAYA ARGENTA	34,450,739,200
CAIXABANK SA	16,691,552,256
BANKIA SA	5,857,194,496
BANKINTER SA	5,384,843,264
BANCO DE SABADELL SA	2,700,726,272
UNICAJA BANCO SA	1,348,829,184
LIBERBANK SA	892,532,096

Table 10: Descriptive statistics for the ratios of interest of BNP PARIBAS

	Capital adequacy ratio	ROA	NPLs	Total equity	Total assets	Net loans	Liquid assets	Total bank deposits
Mean	12.695	0.388275	27,190	71,516	1,626,297	534,899	265,778	757,674
Median	12.75	0.38605	24,650	82,985	1,928,489	658,402	285,000	760,991
Maximum	15.5	0.5926	43,696	111,845	2,164,713	817,173	309,000	1,306,606
Minimum	10	0.0081	12,200	24,425	693,315	221,973	160,000	523,124
Std. Dev.	1.942	0.140	12,809	29,458	523,870	217,008	46,835	208,774
Skewness	-0.038	-0.911	0.195	-0.292	-0.832	-0.393	-1.364	1.218
Kurtosis	-1.649	1.186	-1.928	-1.523	-1.037	-1.656	1.539	1.541
Observations	20	20	20	20	20	20	9	16

Table 11: Descriptive statistics for the ratios of interest of CREDIT AGRICOLE SA

	Capital adequacy ratio	ROA	NPLs	Total equity	Total assets	Net loans	Liquid assets	Total bank deposits
Mean	13.21578947	0.194985	13,915	45,621	1,306,281	274,853	238,556	468,825
Median	11.8	0.21905	13,515	47,610	1,526,763	312,513	247,000	463,273
Maximum	20.3	0.5268	24,759	70,843	1,767,643	391,110	298,000	645,899
Minimum	8.5	-0.3825	3,970	15,684	495,067	69,204	110,000	282,287
Std. Dev.	4.362	0.191	4,601	15,782	424,793	92,015	49,225	90,162
Skewness	0.428	-1.224	0.228	-0.404	-0.984	-1.085	-2.111	-0.174
Kurtosis	-1.511	3.201	0.840	-0.651	-0.600	0.189	5.773	0.084
Observations	19	20	20	20	20	20	9	20

Table 12: Descriptive statistics for the ratios of interest of SOCIETE GENERALE SA

	Capital adequacy ratio	ROA	NPLs	Total equity	Total assets	Net loans	Liquid assets	Total bank deposits
Mean	13.2175	0.315485	17,922	43,685	1,018,591	323,984	150,333	349,886
Median	12.305	0.2804	19,350	48,907	1,131,038	356,125	168,000	347,965
Maximum	18.3	0.6257	24,900	68,570	1,382,241	430,703	190,000	409,852
Minimum	8.87	0.063	10,100	16,570	455,881	175,272	84,000	279,203
Std. Dev.	2.576	0.177	5,823	17,806	316,928	81,652	37,506	44,482
Skewness	0.716	0.459	-0.218	-0.180	-0.722	-0.552	-1.214	-0.086
Kurtosis	-0.505	-0.922	-1.818	-1.558	-1.044	-1.232	-0.054	-1.713
Observations	20	20	18	20	20	20	9	16

Table 13: Descriptive statistics for the ratios of interest of CR DE CREDIT AGRICOLE IDF

	Capital adequacy ratio	ROA	NPLs	Total equity	Total assets	Net loans	Liquid assets	Total bank deposits
Mean	13.2271875	0.892815	339	3,653	32,206	25,776		20,522
Median	12.2	0.87075	376	3,557	32,312	27,127		20,391
Maximum	20.3	1.229	503	6,545	57,756	44,076		28,272
Minimum	8	0.5394	139	1,145	15,706	13,139		11,787
Std. Dev.	4.458	0.217	101	1,539	10,906	7,835		6,057
Skewness	0.316	0.037	-0.417	0.044	0.572	0.430		-0.124
Kurtosis	-1.437	-1.218	-0.430	-0.798	0.209	0.331		-1.770
Observations	16	20	15	20	20	20		11

Table 14: Descriptive statistics for the ratios of interest of COMMERZBANK AG

	Capital adequacy ratio	ROA	NPLs	Total equity	Total assets	Net loans	Liquid assets	Total bank deposits
Mean	14.42	0.04979	12,520	21,603	543,706	225,096	87,811	281,922
Median	14.7	0.07245	12,239	25,527	517,007	218,927	92,100	277,092
Maximum	19.2	0.3255	21,804	30,667	844,103	329,832	104,700	387,633
Minimum	9.9	-0.6176	3,735	10,070	381,585	133,263	68,800	195,249
Std. Dev.	2.706	0.244	6,212	7,544	116,994	53,534	12,562	58,949
Skewness	-0.053	-1.762	0.079	-0.321	0.964	-0.118	-0.355	0.344
Kurtosis	-1.070	3.335	-1.379	-1.730	0.605	-0.473	-1.030	-1.150
Observations	20	20	14	20	20	20	9	17

Table 15: Descriptive statistics for the ratios of interest of HSBC TRINKAUS & BURKHARDT AG

	Capital adequacy ratio	ROA	NPLs	Total equity	Total assets	Net loans	Liquid assets	Total bank deposits
Mean	13.445	0.64326		1,586	18,782	4,991		12,952
Median	13.2	0.69205		1,548	19,929	3,876		12,929
Maximum	17.2	1.0307		3,040	26,593	10,867		17,651
Minimum	10.7	0.2388		660	10,294	2,323		9,062
Std. Dev.	1.706	0.181		803	4,914	2,818		2,213
Skewness	0.502	-0.306		0.476	-0.536	1.048		0.320
Kurtosis	-0.280	0.374		-1.309	-0.892	-0.307		0.894
Observations	20	20		20	20	20		11

Table 16: Descriptive statistics for the ratios of interest of DEUTSCHE PFANDBRIEFBANK AG

	Capital adequacy ratio	ROA	NPLs	Total equity	Total assets	Net loans	Liquid assets	Total bank deposits
Mean	23.875	0.158	369	2,718	92,034	54,647		11,762
Median	23.55	0.1478	348	2,975	75,335	45,171		10,709
Maximum	26.6	0.3247	510	3,512	215,217	132,279		23,985
Minimum	20.4	-0.092	248	1,129	56,822	36,094		7,730
Std. Dev.	1.984	0.144	108	818	46,962	25,012		4,798
Skewness	-0.110	-0.198	0.686	-1.214	1.969	2.463		2.411
Kurtosis	-0.406	-1.640		0.001	3.033	6.384		6.361
Observations	8	14	3	14	14	14		8

Table 17: Descriptive statistics for the ratios of interest of AAREAL BANK AG

	Capital adequacy ratio	ROA	NPLs	Total equity	Total assets	Net loans	Liquid assets	Total bank deposits
Mean	18.672	0.294	1,085	2,055	41,629	25,198		23,840
Median	17.25	0.26915	1,085	2,077	41,137	24,530		21,170
Maximum	30	0.739	1,365	3,129	51,948	34,038		36,050
Minimum	9.5	-0.3363	827	1,074	31,970	16,041		12,324
Std. Dev.	6.927	0.272	191	715	4,498	3,608		8,748
Skewness	0.323	-0.350	0.231	0.093	0.488	0.178		0.342
Kurtosis	-1.548	0.379	-1.409	-1.627	0.927	2.497		-1.637
Observations	18	18	9	19	19	19		9

Table 18: Descriptive statistics for the ratios of interest of INTESA SANPAOLO

	Capital adequacy ratio	ROA	NPLs	Total equity	Total assets	Net loans	Liquid assets	Total bank deposits
Mean	13.2175	0.39451	36,914	40,641	559,595	296,782	139,333	242,357
Median	12.5	0.4444	36,996	48,956	630,489	331,869	124,000	215,461
Maximum	17.9	1.2612	63,114	56,956	816,102	395,189	190,000	325,188
Minimum	9	-1.262	8,248	13,601	260,215	154,105	105,000	182,975
Std. Dev.	3.136	0.554	18,799	16,799	188,195	85,966	30,685	50,371
Skewness	0.259	-1.437	-0.191	-0.825	-0.556	-0.803	0.502	0.552
Kurtosis	-1.541	3.380	-1.291	-1.269	-1.192	-1.209	-1.657	-1.499
Observations	20	20	16	20	20	20	9	16

Table 19: Descriptive statistics for the ratios of interest of UNICREDIT SPA

	Capital adequacy ratio	ROA	NPLs	Total equity	Total assets	Net loans	Liquid assets	Total bank deposits
Mean	12.607	0.22932	43,731	44,952	721,617	393,675	148,800	432,576
Median	11.955	0.43455	42,400	53,161	840,504	434,619	148,800	417,120
Maximum	18.1	0.8683	80,005	67,703	1,045,612	602,763	148,800	627,949
Minimum	8.67	-1.5935	6,764	11,179	202,656	113,824	148,800	156,826
Std. Dev.	2.420	0.699	24,783	19,775	293,301	166,619		113,818
Skewness	0.872	-1.709	-0.086	-0.800	-1.080	-0.806		-0.292
Kurtosis	0.374	2.071	-1.358	-0.956	-0.590	-0.781		0.843
Observations	20	20	19	20	20	20	8	16

Table 20: Descriptive statistics for the ratios of interest of FINECOBANK SPA

	Capital adequacy ratio	ROA	NPLs	Total equity	Total assets	Net loans	Liquid assets	Total bank deposits
Mean	17.81153846	0.74523077	25	569	17,650	1,915		15,231
Median	18.91	0.7055	21	432	17,480	827		14,854
Maximum	33.67	1.0932	117	1,382	28,023	6,836		25,696
Minimum	7.65	0.3026	3	313	9,094	398		7,737
Std. Dev.	7.682	0.281	28	290	4,967	2,070		4,847
Skewness	0.602	-0.095	2.960	1.795	0.380	1.563		0.557
Kurtosis	-0.317	-1.699	9.892	3.280	0.023	1.395		0.067
Observations	13	13	13	14	14	14		14

Table 21: Descriptive statistics for the ratios of interest of MEDIOBANCA SPA

	Capital adequacy ratio	ROA	NPLs	Total equity	Total assets	Net loans	Liquid assets	Total bank deposits
Mean	16.13058824	0.9389	1,801	6,913	58,586	30,805		12,707
Median	16.18	0.96785	1,720	6,849	70,132	33,655		15,301
Maximum	19.91	2.0355	2,385	9,899	78,679	46,087		23,516
Minimum	11.82	-0.2325	1,017	3,594	26,195	15,723		3,618
Std. Dev.	2.285	0.629	440	1,834	18,736	9,611		6,331
Skewness	-0.007	-0.039	-0.218	-0.045	-0.642	-0.352		-0.235
Kurtosis	-0.804	-0.706	-1.327	-0.923	-1.383	-1.278		-0.940
Observations	17	20	11	20	20	20		15

Table 22: Descriptive statistics for the ratios of interest of BANCO SANTANDER SA

	Capital adequacy ratio	ROA	NPLs	Total equity	Total assets	Net loans	Liquid assets	Total bank deposits
Mean	13.388	0.63279	23,526	68,809	999,467	577,272		667,672
Median	13.095	0.68075	30,279	76,756	1,113,146	675,703		762,330
Maximum	15.05	1.0374	42,420	110,659	1,522,695	896,515		877,219
Minimum	10.86	0.1821	3,223	29,159	324,208	162,973		321,369
Std. Dev.	1.110	0.216	14,866	28,456	393,152	246,103		193,536
Skewness	-0.131	-0.077	-0.346	-0.073	-0.618	-0.648		-0.957
Kurtosis	-0.384	-0.608	-1.756	-1.483	-0.948	-1.015		-0.733
Observations	20	20	18	20	20	20		16

Table 23: Descriptive statistics for the ratios of interest of BANCO BILBAO VIZCAYA ARGENTA

	Capital adequacy ratio	ROA	NPLs	Total equity	Total assets	Net loans	Liquid assets	Total bank deposits
Mean	13.571	0.71657	13,616	36,179	521,119	290,828		323,621
Median	13.01	0.77845	15,658	34,119	547,694	327,554		334,576
Maximum	15.9	1.341	25,996	55,428	749,855	409,129		469,632
Minimum	11.9	0.275	2,202	13,805	279,542	137,467		182,973
Std. Dev.	1.352	0.282	8,251	13,963	156,050	92,252		79,971
Skewness	0.436	0.432	-0.125	0.108	-0.272	-0.615		-0.075
Kurtosis	-1.457	-0.476	-1.462	-1.572	-1.343	-1.146		-0.281
Observations	20	20	18	20	20	20		18

Table 24: Descriptive statistics for the ratios of interest of CAIXABANK SA

	Capital adequacy ratio	ROA	NPLs	Total equity	Total assets	Net loans	Liquid assets	Total bank deposits
Mean	14.35	0.2991	14,850	23,516	342,406	201,932		179,297
Median	15.65	0.3025	14,530	24,155	346,091	198,126		181,665
Maximum	16.2	0.5158	25,365	25,232	391,414	222,154		228,378
Minimum	8.9	0.0743	7,236	19,597	270,425	181,940		126,051
Std. Dev.	2.347	0.153	5,554	1,860	40,112	13,815		30,722
Skewness	-1.479	-0.162	0.417	-1.220	-0.798	0.078		-0.227
Kurtosis	1.417	-1.522	-0.713	0.451	-0.085	-1.609		-0.601
Observations	10	9	10	10	10	10		10

Table 25: Descriptive statistics for the ratios of interest of BANKIA SA

	Capital adequacy ratio	ROA	NPLs	Total equity	Total assets	Net loans	Liquid assets	Total bank deposits
Mean	13.477	-0.5922	13,402	10,941	238,732	133,511		121,446
Median	14.52	0.2618	12,995	12,767	223,790	118,702		117,901
Maximum	18.09	0.472	19,800	13,613	302,846	205,531		173,934
Minimum	7.7	-6.5133	6,465	(6,056)	190,167	104,677		102,568
Std. Dev.	3.743	2.135	4,184	5,699	38,832	33,064		20,596
Skewness	-0.336	-2.800	-0.030	-3.096	0.555	1.618		1.690
Kurtosis	-1.719	8.004	-0.681	9.685	-1.404	1.302		3.486
Observations	10	9	9	10	10	10		10

Table 26: Descriptive statistics of financial ratios for the pool of banks used in this study from 2000-2019.

	CAR	ROA	NPL	TE2TA	NL2TA	LA2TD
Mean	14.41	0.42	17461.23	0.06	0.44	0.16
Median	13.4	0.43	13806.00	0.06	0.49	0.16
Maximum	33.67	2.04	80005.19	0.15	0.86	0.23
Minimum	7.65	-6.51	2.98	-0.02	0.00	0.06
Std. Dev.	4.28	0.61	17548.11	0.03	0.20	0.04
Skewness	1.39	-5.52	1.38	0.50	-0.40	-0.47
Kurtosis	5.79	62.80	4.69	3.35	2.64	3.22
Jarque-Bera	175.40	41,447.97	92.85	12.88	8.59	2.09
Probability	0	0	0	0.00	0.01	0.35
Observations	271	269	212	271	271	53

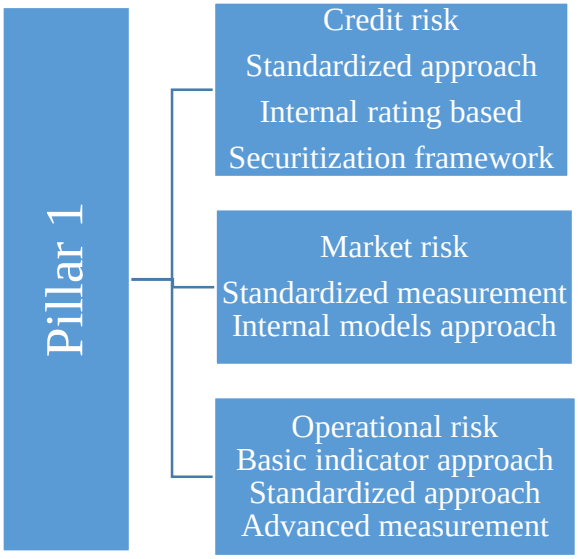

Figure 1: Structure of Basel II, Pillar 1

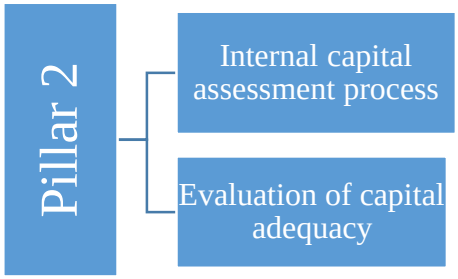

Figure 2: Structure of Basel II, Pillar 2

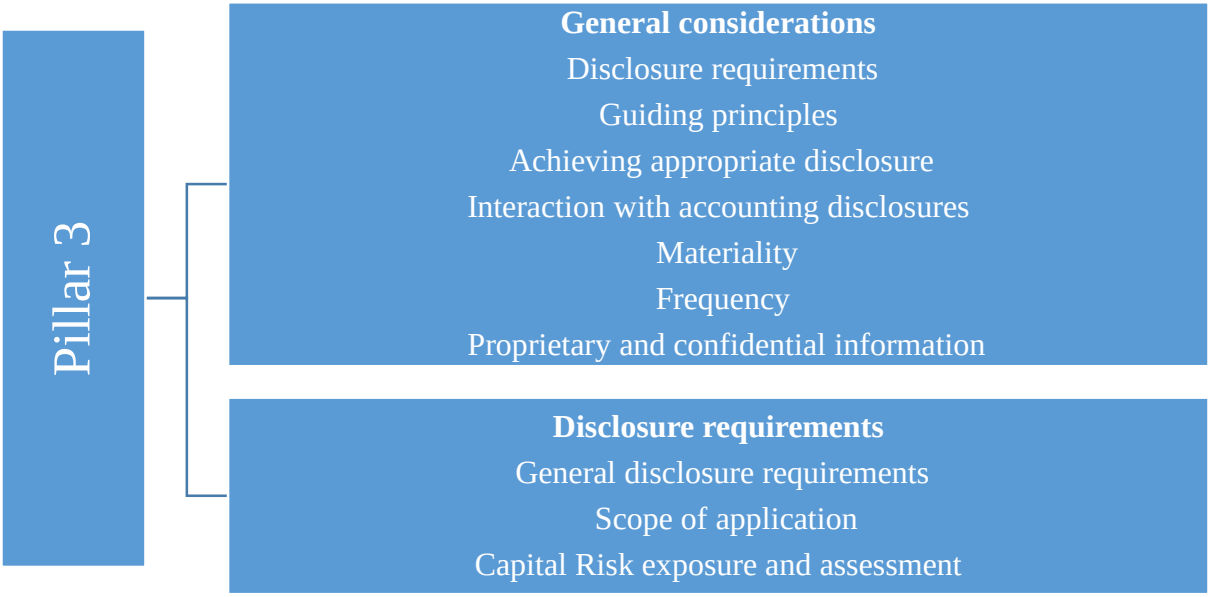

Figure 3: Structure of Basel II, Pillar 3

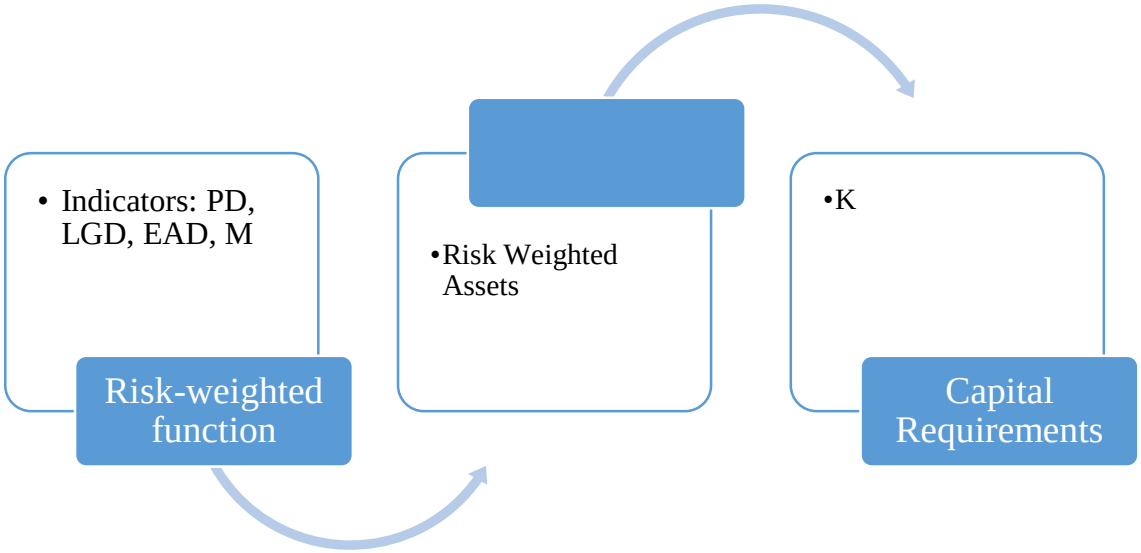

Figure 4: Structure of Internal Rating-Based (IRB) model

Figure 5: Evolutions of capital adequacy ratio. Starting from the top left and moving to the right, the banks shown are CREDIT AGRICOLE SA (FR), AAREAL BANK AG (DE), BANCO BILBAO VIZCAYA ARGENTA (SP), BANKIA SA (SP), BNP PARIBAS (FR), CAIXABANK SA (SP), CR DE CREDIT AGRICOLE IDF (FR), COMMERZBANK AG (DE), FINECOBANK SPA (IT), SOCIETE GENERALE SA (FR), INTESA SANPAOLO (IT), MEDIOBANCA SPA (IT), DEUTSCHE PFANDBRIEFBANK AG (DE), BANCO SANTANDER SA (SP), HSBC TRINKAUS & BURKHARDT AG (DE), UNICREDIT SPA (IT)

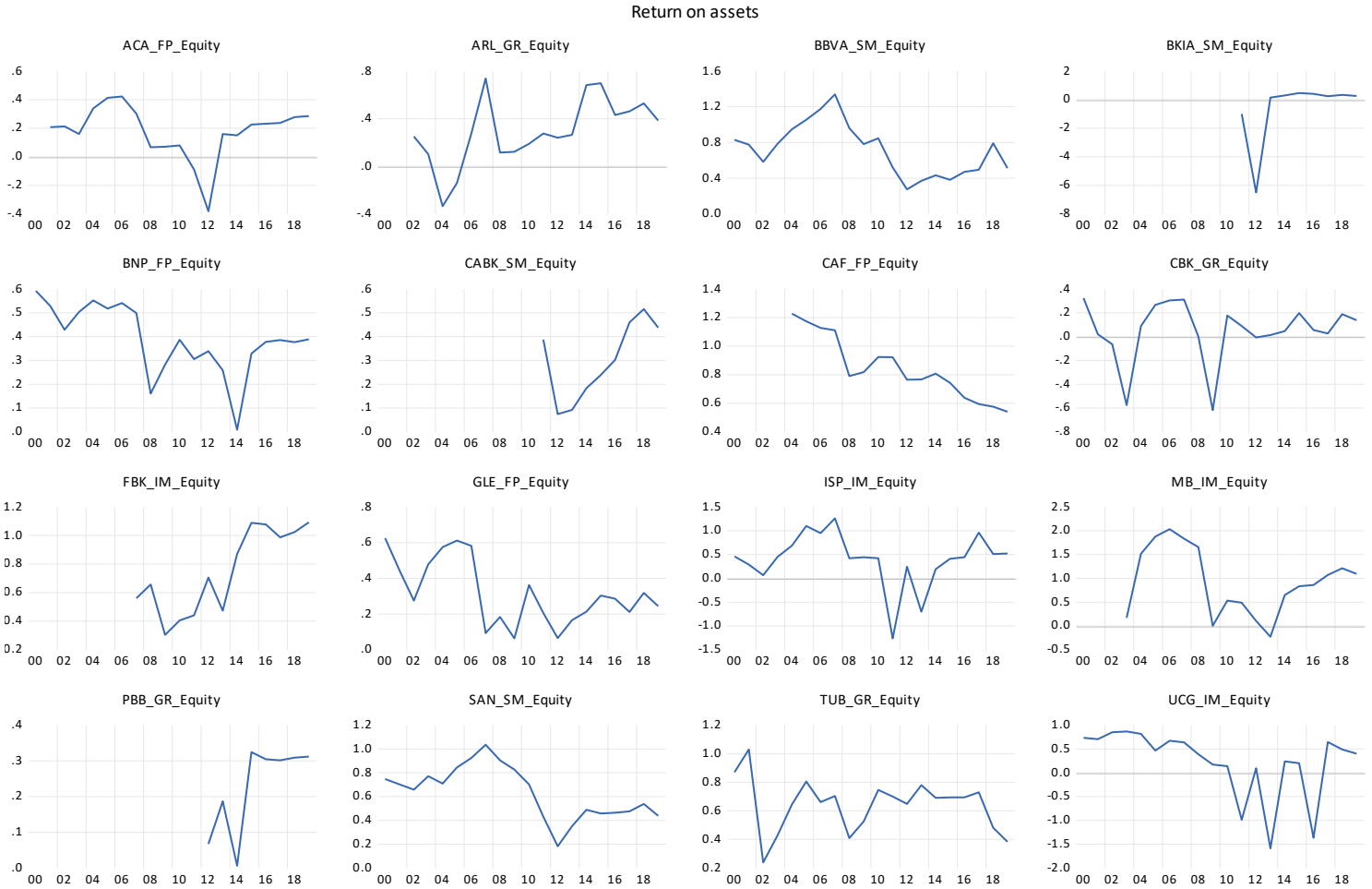

Figure 6: Evolutions of return on assets. Starting from the top left and moving to the right, the banks shown are CREDIT AGRICOLE SA (FR), AAREAL BANK AG (DE), BANCO BILBAO VIZCAYA ARGENTA (SP), BANKIA SA (SP), BNP PARIBAS (FR), CAIXABANK SA (SP), CR DE CREDIT AGRICOLE IDF (FR), COMMERZBANK AG (DE), FINECOBANK SPA (IT), SOCIETE GENERALE SA (FR), INTESA SANPAOLO (IT), MEDIOBANCA SPA (IT), DEUTSCHE PFANDBRIEFBANK AG (DE), BANCO SANTANDER SA (SP), HSBC TRINKAUS & BURKHARDT AG (DE), UNICREDIT SPA (IT)

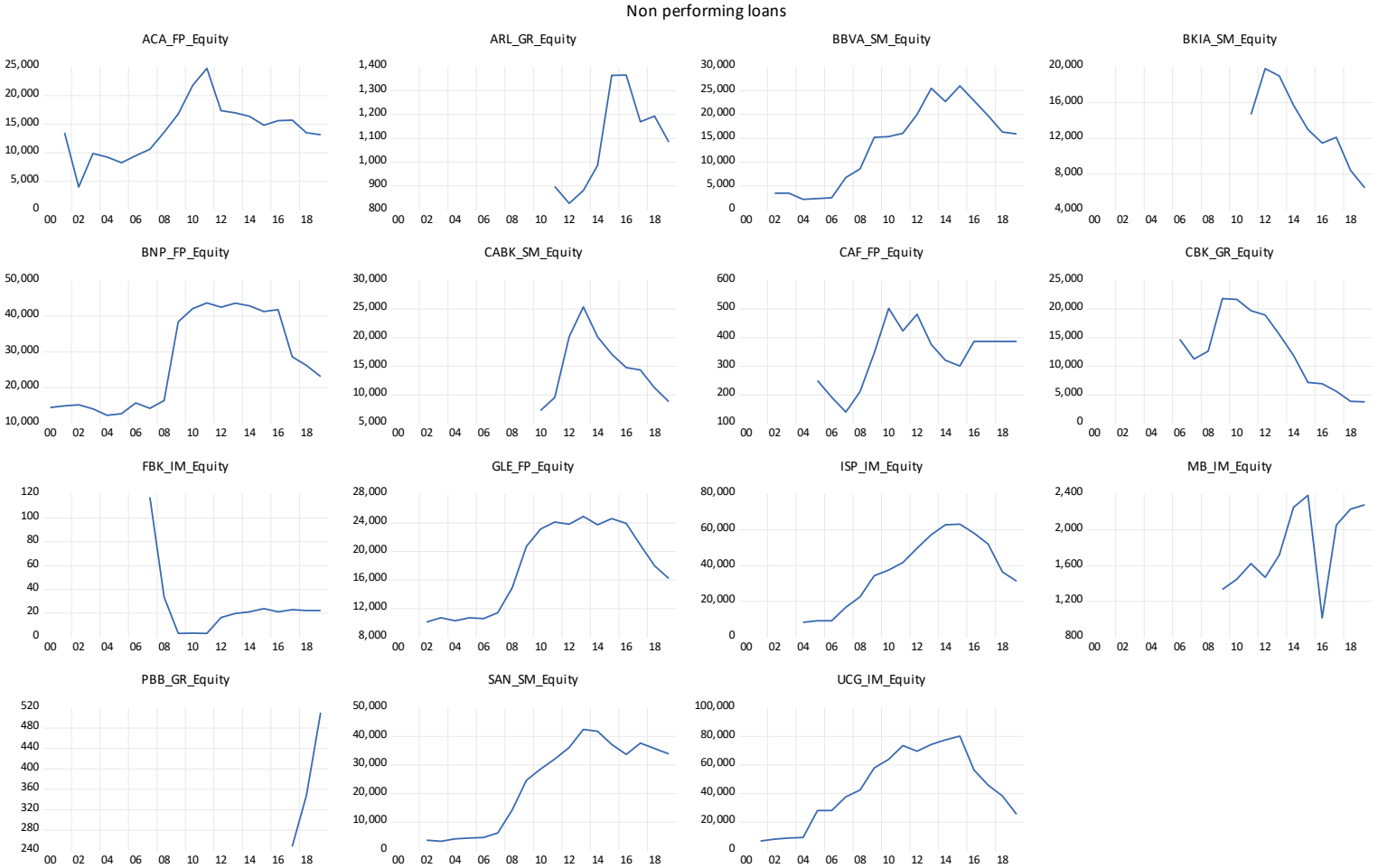

Figure 7: Evolutions of non-performing loans. Starting from the top left and moving to the right, the banks shown are CREDIT AGRICOLE SA (FR), AAREAL BANK AG (DE), BANCO BILBAO VIZCAYA ARGENTA (SP), BANKIA SA (SP), BNP PARIBAS (FR), CAIXABANK SA (SP), CR DE CREDIT AGRICOLE IDF (FR), COMMERZBANK AG (DE), FINECOBANK SPA (IT), SOCIETE GENERALE SA (FR), INTESA SANPAOLO (IT), MEDIOBANCA SPA (IT), DEUTSCHE PFANDBRIEFBANK AG (DE), BANCO SANTANDER SA (SP), HSBC TRINKAUS & BURKHARDT AG (DE), UNICREDIT SPA (IT)

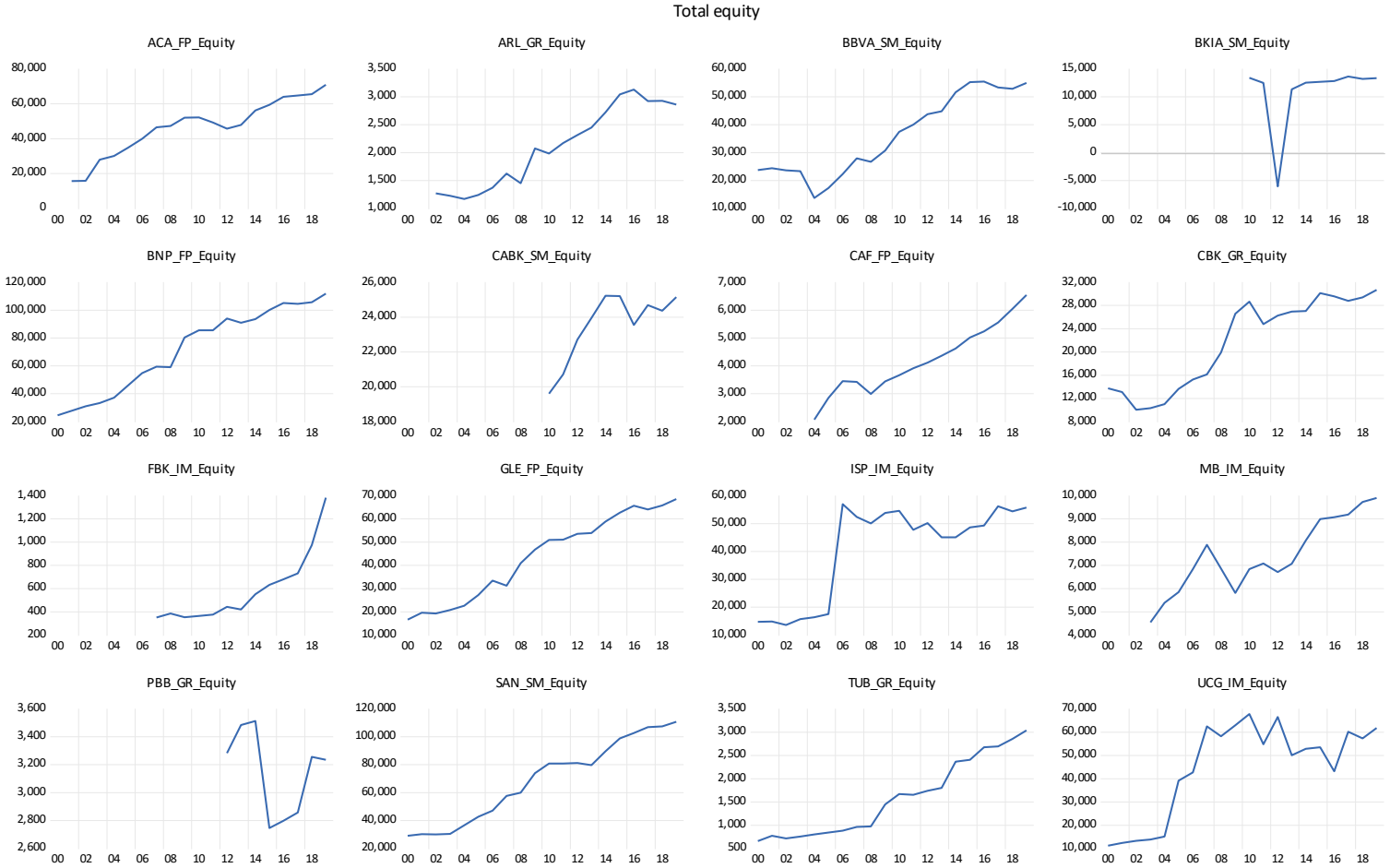

Figure 8: Evolutions of total equity. Starting from the top left and moving to the right, the banks shown are CREDIT AGRICOLE SA (FR), AAREAL BANK AG (DE), BANCO BILBAO VIZCAYA ARGENTA (SP), BANKIA SA (SP), BNP PARIBAS (FR), CAIXABANK SA (SP), CR DE CREDIT AGRICOLE IDF (FR), COMMERZBANK AG (DE), FINECOBANK SPA (IT), SOCIETE GENERALE SA (FR), INTESA SANPAOLO (IT), MEDIOBANCA SPA (IT), DEUTSCHE PFANDBRIEFBANK AG (DE), BANCO SANTANDER SA (SP), HSBC TRINKAUS & BURKHARDT AG (DE), UNICREDIT SPA (IT)

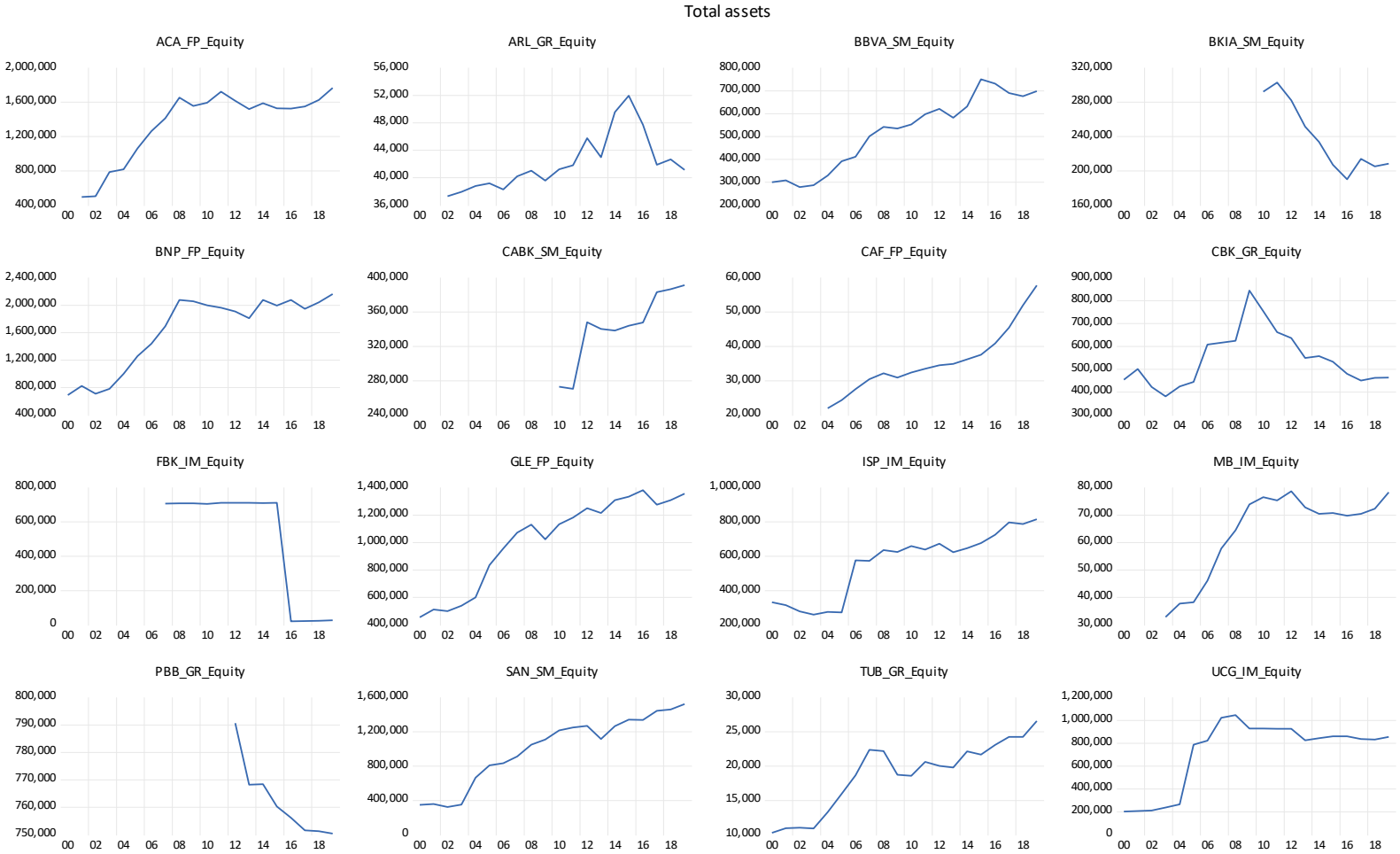

Figure 9: Evolutions of total assets. Starting from the top left and moving to the right, the banks shown are CREDIT AGRICOLE SA (FR), AAREAL BANK AG (DE), BANCO BILBAO VIZCAYA ARGENTA (SP), BANKIA SA (SP), BNP PARIBAS (FR), CAIXABANK SA (SP), CR DE CREDIT AGRICOLE IDF (FR), COMMERZBANK AG (DE), FINECOBANK SPA (IT), SOCIETE GENERALE SA (FR), INTESA SANPAOLO (IT), MEDIOBANCA SPA (IT), DEUTSCHE PFANDBRIEFBANK AG (DE), BANCO SANTANDER SA (SP), HSBC TRINKAUS & BURKHARDT AG (DE), UNICREDIT SPA (IT)

Figure 10: Evolutions of net loans. Starting from the top left and moving to the right, the banks shown are CREDIT AGRICOLE SA (FR), AAREAL BANK AG (DE), BANCO BILBAO VIZCAYA ARGENTA (SP), BANKIA SA (SP), BNP PARIBAS (FR), CAIXABANK SA (SP), CR DE CREDIT AGRICOLE IDF (FR), COMMERZBANK AG (DE), FINECOBANK SPA (IT), SOCIETE GENERALE SA (FR), INTESA SANPAOLO (IT), MEDIOBANCA SPA (IT), DEUTSCHE PFANDBRIEFBANK AG (DE), BANCO SANTANDER SA (SP), HSBC TRINKAUS & BURKHARDT AG (DE), UNICREDIT SPA (IT)

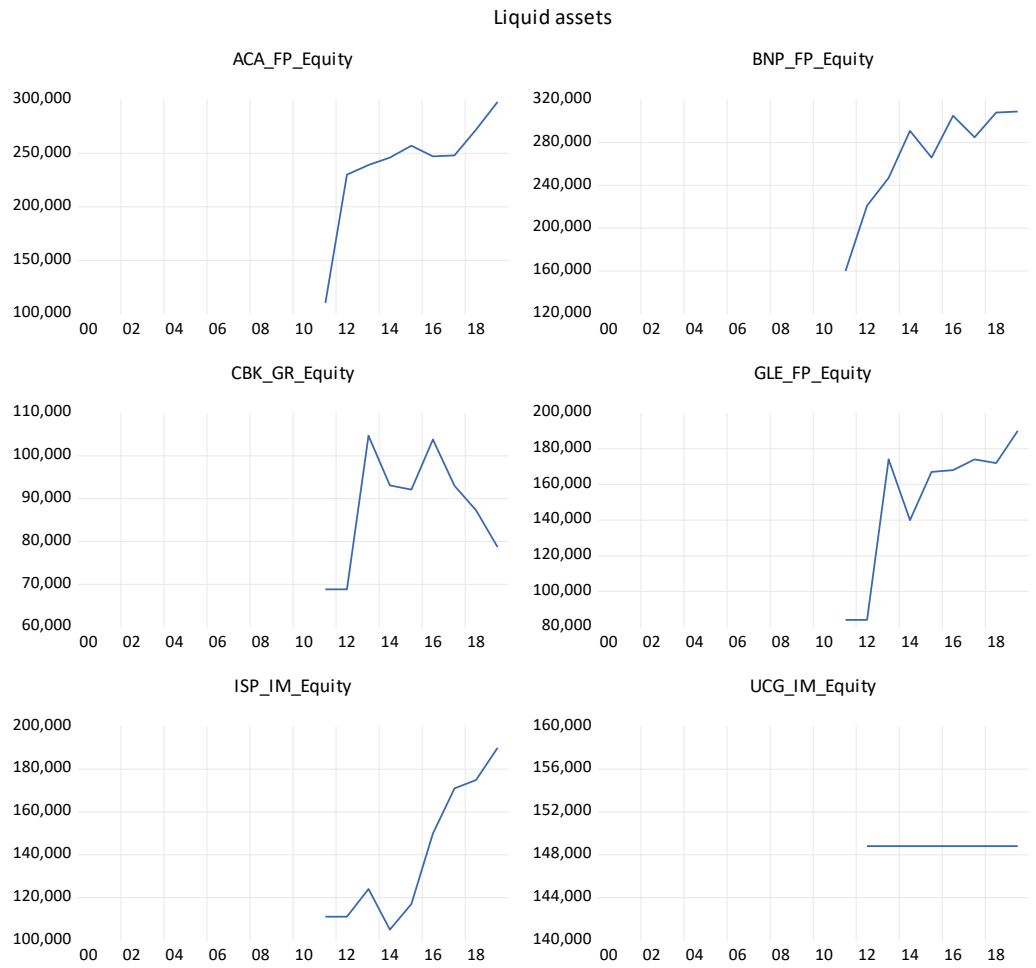

Figure 11: Evolutions of liquid assets. Starting from the top left and moving to the right, the banks shown are CREDIT AGRICOLE SA (FR), AAREAL BANK AG (DE), BANCO BILBAO VIZCAYA ARGENTA (SP), BANKIA SA (SP), BNP PARIBAS (FR), CAIXABANK SA (SP), CR DE CREDIT AGRICOLE IDF (FR), COMMERZBANK AG (DE), FINECOBANK SPA (IT), SOCIETE GENERALE SA (FR), INTESA SANPAOLO (IT), MEDIOBANCA SPA (IT), DEUTSCHE PFANDBRIEFBANK AG (DE), BANCO SANTANDER SA (SP), HSBC TRINKAUS & BURKHARDT AG (DE), UNICREDIT SPA (IT)

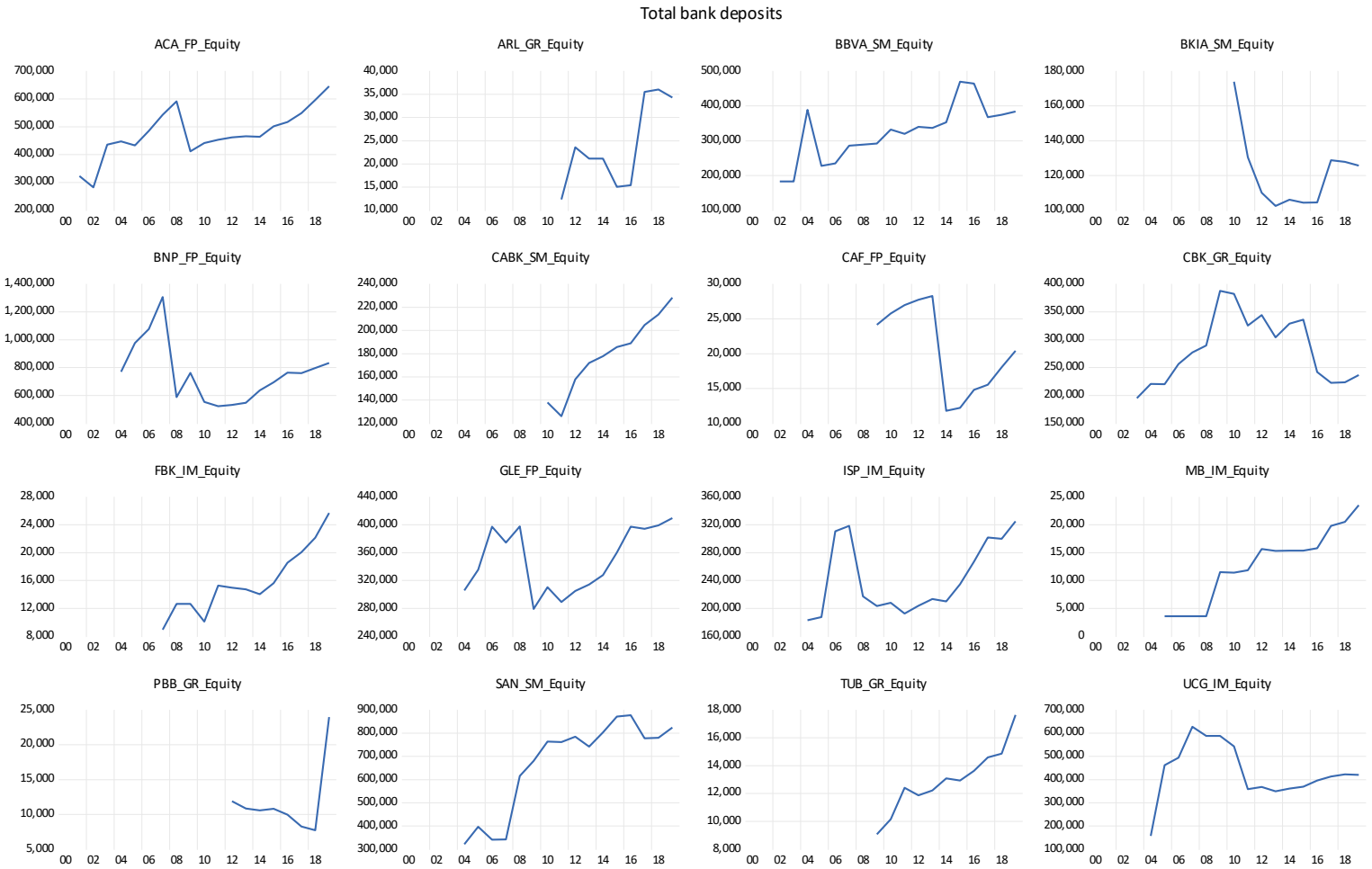

Figure 12: Evolutions of total bank deposits. Starting from the top left and moving to the right, the banks shown are CREDIT AGRICOLE SA (FR), AAREAL BANK AG (DE), BANCO BILBAO VIZCAYA ARGENTA (SP), BANKIA SA (SP), BNP PARIBAS (FR), CAIXABANK SA (SP), CR DE CREDIT AGRICOLE IDF (FR), COMMERZBANK AG (DE), FINECOBANK SPA (IT), SOCIETE GENERALE SA (FR), INTESA SANPAOLO (IT), MEDIOBANCA SPA (IT), DEUTSCHE PFANDBRIEFBANK AG (DE), BANCO SANTANDER SA (SP), HSBC TRINKAUS & BURKHARDT AG (DE), UNICREDIT SPA (IT)

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