Basel Accords, Presentation of Risks & Capital Adequacy of Greek Banks During the Crisis

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I hereby declare that the work submitted is mine and that where I have made use of another’s work, I have attributed the source(s) according to the Regulations set in the Student’s Handbook.

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Abstract

This dissertation was written as part of the MSc in Banking and Finance at the International Hellenic University.

The purpose of this dissertation is to record, study and compare the Greek banking institutions with regard to the most recent tools, methods and risk management measures that they apply for the latest comprehensive financial year (2017).

At a theoretical level, a reference is going to be made to the framework and evolution of Basel Accord I, II and III and at the implementation of the Basel Committee Pact for banking supervision regarding the Greek financial institutions. The aim of the study is to investigate the practices followed by the financial institutions operating in Greece, with particular emphasis on the four systemic banks: Eurobank, Alpha Bank, National Bank of Greece, Piraeus Bank and to ascertain whether these practices are in line with the provisions of the Basel Accord.

In order to fulfill the requirements of my dissertation I have asked the guidance and help of one of my professors, in the master program that I attend, Dr. Kyriaki Kosmidou, which I would like to thank for all the necessary guidelines, tips and knowledge that she had provided me in order to carry out the preparation and writing of my thesis.

Keywords: Basel Accord, Banking risk, Capital Adequacy, Credit risk, Market risk, Operational risk, Liquidity risk

Konstantinos Kleidaras

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Introduction

The banking industry plays a very important role in the economy, since the efficient provision of banking services is critical to the proper functioning and development of the economy. A banking institution due to the specificity of its activities, differs in the way it is organized and operating, and faces a multitude of risks that an average enterprise of any other sector does not face or faces to a much lesser extent. These risks arise both from the internal and external environment of the banking institution, and their mitigation is necessary for the proper functioning of the institution, and thus the entire economy.

In times of debt crisis, like the one we are experiencing today, the question that arises is whether the Greek banks are capitalized enough to withstand the effects of the crisis. The above condition refers to the existence of adequate capital from banks in order to cope with the economic crisis, without the intervention of the Hellenic Financial Stability Fund, by providing state funds to support them. The sensitivity of the banking institutions to a multitude of risks, coupled with a sensitivity to liquidity shocks that characterizes all banks, along with their strong interconnection, have led to the creation of a financial security grid that includes regulatory rules for micro and macro-prudential supervision in order to avoid any adverse effects on economic activity.

The banking supervision has a long history and aims to prevent or deal with financial crises in the most painless way. The financial crisis that broke out in America in the autumn of 2008 was transformed into an economic crisis that affected the entire planet. The reason behind this is that the collapse of the Lehman Brothers investment bank has triggered a strong turbulence in the international financial system which led to a lack of confidence in the system itself. It is an undeniable fact that in the last few years the markets are looking for tranquility and in order for this confidence to be restored there is a need for an enhancement of the supervision in the banking sector.

For the above reason, mechanisms have been put in place to monitor the degree of leverage of banks and minimum capital adequacy requirements have been
introduced in order to prevent large banks from taking risks and to protect themselves as well as the depositors. Within this framework, the Basel I, Basel II and Basel III regulatory frameworks have been issued by the Basel Committee, which aspires to strengthen micro-prudential regulatory intervention in the operation of banks by addressing macro-prudential systemic risks to the financial system.

The aim of this paper is to present and compare the most recent situation of the four Greek systemic banks (Alpha Bank, Piraeus Bank, Eurobank and National Bank of Greece) regarding their capital adequacy and the way they manage the main risks they face; the credit risk, market risk, operational risk as well as the liquidity risk. It will be examined whether and to what extent the capital adequacy and the management of the above risks meet the requirements set by the Basel Accords.

The methodology followed for the writing of this paper and the presentation of the most recent situation of the Greek banks, has resulted from a survey carried out through the latest comprehensive financial statements and reports of the banks (2017). The same methodology was used for the data that were taken into consideration for the calculation of the indices, presented in this paper, for the comparative analysis of the banks. Some data were taken also from Bankscope database.

Regarding the theoretical part of the thesis, various scientific manuals, articles, papers, books, presentations etc. have been used as an academic material, in order to make possible a more extensive reference to the history of Basel Committee as well as the analysis of each risk and index, presented in this paper.

The structure of this paper is consisted from four main parts. In Part A it is presented the history of the Basel Committee on banking supervision and the key elements of the three Basel Accords that have been introduced successively. In Part B a reference is made regarding the capital adequacy of the banks in accordance with the implementation of the Basel Accords and the main risks that affect it. In Part C a research analysis has been made with data derived from the annual reports of the four systemic banks in order to be presented the most recent image of the Greek banks regarding their capital adequacy, the way they handle the main risks that
affect it and to what extent the measures they take towards these risks are in line with the requirements of the Basel Committee. Finally, in Part D, is presented a comparative analysis of the major risks the banks face for the period 2016-2017 with the use of ratios for every risk separately. Following Part D is the conclusion of the analysis presented in this paper.

**Literature review**

The implementation of the Basel Accords in the banking system, the way they affect the capital adequacy of the banks and the way banks manage their main risks, have been a subject to many scientific papers worldwide. Their line of research expands to many aspects related to Basel Accords such as the determination of the appropriate amount of capital buffers, the nature of capital adequacy constraints, the relationship between bank capital, lending and macroeconomic activity, the role of non-performing loans and capital adequacy in banking structure, the connection between stress tests and VaR measure regarding market risk, the liquidity and transparency in banking risk management, the examination of the capital stability rules introduced by the Basel Committee, and many more.

In this chapter they are going to be presented indicatively some studies related to the two main topics of this thesis, the capital adequacy of the banks as it is instructed by the Basel Accords and the ways the banks manage their main risks according to the Basel provisions.

Some scientific papers that examine the effects of Basel Accords to the capital adequacy of the banks are the following:

Ralph Chami and Thomas Cosimano (2003) in their scientific paper entitled “The nature of capital Adequacy Constraints Under the Basel Accord”, demonstrate that the only constraint that matters regarding the analysis of the bank’s behavior is the minimum total capital ratio which is no less than 8%. According to their study the overemphasis on equity capital by regulators and market participants is likely to increase the cost of lending for banks, and as a consequence the bank profitability, credit extension, and the overall economic activity will be affected.
The case of banks’ capital adequacy but this time through a simulation-based stress testing analysis is presented to the study of Samu Peura and Esa Jokivuolle (2003). The authors in their paper entitled “Simulation-based stress testing of banks’ regulatory capital adequacy” present a simulation-based approach to stress testing of capital adequacy where rating transitions are conditioned on business-cycle phase and business-cycle dynamics are taken into account. The aim of their study is to create an extension to the standard “credit portfolio analysis” by simulating actual bank capital and minimum capital requirements at the same time. Their research uses data from actual bank capital ratios and enables a ceteris paribus extrapolation of bank capital under the capital provisions of Basel II.

Lea Zicchino (2005) in her paper “A model of bank capital, lending and the macroeconomy: Basel I versus Basel II” presents an analysis of the relationship between bank capital, lending and macroeconomic activity under the capital adequacy constraints introduced by the Basel II Accord. The author uses the model of Chami and Cosimano (2001), “Bank Balance-Sheet Channel of Monetary Policy” but it uses the capital constraints of Basel II. The results of her model suggest that bank capital is likely to be less variable under the capital provisions of Basel II rather than that of Basel I which according to the author is characterized by invariant asset risk weights. Finally, in her study concludes that bank lending is likely to be more responsive to macroeconomic shocks.

The implementations of Basel III and its capital adequacy buffers is the case examined by Peter Miu, Bozi Ozdemir and Michael Giesinger (2010) in their research study entitled “Can Basel III work? - Examining the new Capital Stability Rules by the Basel Committee – A Theoretical and Empirical Study of Capital Buffers”. In their paper the authors study and present the fundamental changes that Basel III introduced regarding the more restrictive definition of Tier 1 Capital, the use of leverage ratios, the restrictions on discretionary distributions of earnings, and a “bottom-of-the-cycle” calibration for the Pillar I regulatory capital requirements. Apart from the theoretical point of view in which they address the issues presented to this paper, the authors conduct also a quantitative impact study.
The way banks manage their main risks under the Basel provisions is the topic of many scientific papers some of which are presented below:

Simone Varotto (2011) in his paper “Liquidity risk, credit risk, market risk and bank capital” takes a sample of twelve U.S. bond indices and investigate the impact of the bank capital regulation for trading portfolios that was introduced by Basel III Accord. More specifically the author estimated the new capital requirements regarding liquidity risk and credit risk through the “Incremental Risk Charge” as well as the risk of extreme market movements, which was measured through stress tests based on the 2007-2009 financial crisis. As a conclusion the research points out that capital requirements should increase substantially more than it was suggested by the regulators. The author also suggests that the lower impact on capital reported by the banks may be due to the assumed risk reduction stemming from their hedging strategies.

The necessity of Basel III and its consequences to market risk is the topic analyzed in the working paper written by Settor Amedicu (2011) entitled “Was Basel III necessary and will it bring prudent risk management in banking?”. In his paper the author tries to present some deficiencies of the implementation of Basel III since the provision according to his opinion did not fully address many of the factors that were responsible for the global financial crisis and the fundamental problems identified with Basel I and Basel II. According to the author the risk weighting system suffers from the assumption of portfolio invariance and has not been refined. In the paper it is presented how the over reliance on external rating agencies regarding the capital framework has not been properly addressed by Basel III and it is pointed out that the issue of reliance on market disclosure to aid the market in the assessment of quality of capital across the financial institutions has not be resolved either.

The risk management in the banking sector under the Basel III Provision is a topic analyzed also by Baitshepi Tebogo (2012) in his scientific paper entitled “Basel III and Risk Management in Banking”. The paper presents an examination of the necessity of Basel III and its ability in bringing about prudent risk management among banks and other financial institutions. The paper gives an overview of the Basel III framework and its efforts towards improving risk management initiatives. The author examines also the role of Basel III accord in controlling liquidity risk exposures and analyses the strengths and shortcomings of the system. Finally, he gives a recommendation about the way Basel III creates a prudent risk management for the banking industry.

Finally, Björn Imbierowicz and Christian Rauch (2013) in their scientific paper entitled “The Relationship between Liquidity Risk and Credit Risk in Banks” investigate the relationship between the two major sources of bank default risk; liquidity risk and credit risk. Their research is based on a sample of virtually all U.S. commercial banks during the period 1998 to 2010 and they analyze the relationship between these two risk sources on the bank institutional-level and how this relationship influences banks’ probabilities of default (PD). The results of their research show that both these risk categories do not have an economically meaningful reciprocal contemporaneous or time-lagged relationship. However, they do influence banks’ probability of default. This effect is twofold: whereas both risks separately increase the PD, the influence of their interaction depends on the overall level of bank risk and can either aggravate or mitigate default risk. According to the authors these results provide new insights into the understanding of bank risk, as developed by the body of literature on bank stability risk in general and credit and liquidity risk in particular. They also serve as an underpinning for recent regulatory efforts aimed at strengthening banks (joint) risk management of liquidity and credit risks, such as the Basel III and Dodd-Frank frameworks.
PART A

Introduction to Basel Accords

1. The Basel Committee on Banking Supervision

International financial markets and cross-border money flows developed in the 1970s, highlighted the lack of effective supervision of banks at international level. National supervisors have regulated the core domestic banks and the domestic activities of international banks, while the international activities of these banks have not always been supervised.

The collapse in 1974 of the Herstatt Bank in Germany and the Franklin National Bank in the United States pushed the Group of 10 Central Bank Governors (G-10), to the establishment of the Basel Committee on Banking Supervision. In particular, the Basel Committee was set up as the initiative of the Group of Ten Governors with the aim of developing a united control system and supervisory practices in the banking sector.

The Commission's initial name was the Committee on Banking Regulation and Supervisory Practices. Its first meeting was held in September 1975. Its members come from Belgium, Canada, France, Italy, Japan, Luxembourg, the Netherlands, Spain (since 2001), Sweden, Switzerland, the United Kingdom and the United States. These countries are represented by the Central Banks or by another authority charged with prudential supervision of the country's banking system.

The Basel Committee is not a supranational supervisory authority but a forum without legal authority, which operates within the Bank of International Settlements (B.I.S.). Its conclusions have not legal force but aim at forming general supervisory guidelines and best practices. The Basel Committee meets regularly 4 times a year and includes about 30 technical working groups, publishing many consultative texts. Since it does not have legal force, is not itself a regulatory or supervisory authority. It basically relies on the assumption that the participating authorities take the necessary steps to implement its decisions on a case-by-case basis. The Basel Committee of Banking Supervision submits its findings to Governors of the Group of
10 every time and seeks the approval and commitment of all the organizations that participate in it (Aggelopoulos, 2013).

The main objective of the Basel Committee is to improve the quality and effectiveness of banking supervision at a global level. In order to achieve this goal, its members exchange information on national supervision issues, improve the effectiveness of the international banking system's rules and supervision techniques, and thus define the minimum supervisory rules that identify the best practices for banks and supervisors.

At the same time, the Basel Committee on Banking Supervision encourages cooperation with non-G10 countries in order to spread its rules and principles globally. One of the main tools used to achieve this is the Rescue Principles team, which aims to promote technical cooperation between the Basel Committee on Banking Supervision and the Banking Supervision Authorities of Emerging Economies, as well as and with the International Monetary Fund and the World Bank. Furthermore, the Basel Committee on Banking Supervision seeks to increase contacts with supervisors from other countries through the International Banking Supervisors' Conference, which meets every two years. (European Central Bank, Monthly Report, "International Cooperation on Supervision", May 2002)

2. The Introduction of the First Accord of the Basel Committee (Basel I)

In recent years, the Bank's Capital Adequacy has been particularly important for the Commission. The Commission has found since the early 1980s that, along with the development of financial risks, especially in the times of credit risk, the capital adequacy of many major international banks has started to deteriorate. The Commission has therefore decided to take initiatives, with the support of the governments of the G10 countries, to stop the deterioration in banks' capital adequacy, at least in the countries of the group, and to achieve greater convergence in its measurement. Credit risk was the risk that then grew. Therefore, the credit risk had to be measured after the risk weights had been determined, depending on the
risk posed to each placement or financing, both for the bank's on and off-balance sheet items.

The members of the Commission felt it was necessary to adopt an International Covenant (Treaty) to strengthen the stability of the banking system internationally and taking into account the fact that international bank funds were significantly reduced due to intense competition and internationalization of the markets. A consultative document was produced and made public in December 1987 with relevant proposals. The interested parties made a series of observations and finally formed a risk-measurement system, known as the Basel Capital Accord or Basel I, which, after being approved by the authorities of the Group of Ten was given for application to the banks in July 1988. The final implementation time for the scheme was set at 31/12/1992.

The document of 1988 on the Capital Adequacy gradually was adopted not only by the member countries of the Group of Ten, but also from many other countries, especially countries with banks having international operations. In September 1993, it was announced that all banks of the Group of Ten countries with international activities have covered the minimum capital required by the Capital Adequacy Accord. A credit risk measurement method, which forms the basis of the Basel Accord I system, is introduced and it was considered essential that banks should always meet a minimum capital requirement of 8%. This factor became known as the Solvency Ratio and aims to protect credit institutions from the credit risk assumed (Aggelopoulos 2013).

The Supervisory Equity of the Bank to the risk weighted assets (on and off-balance sheet) formed this rate. That is, the first measurement of the Solvency Ratio was related exclusively to credit risk. The share capital of credit institutions for capital adequacy purposes were set by the Commission, significantly different from accounting share capital. For this reason, they became known as supervisory regulatory capital. The capitals include, in addition to share capital and reserves (Tier 1 capital), some forms of foreign capital, such as subordinated debt (Tier 2 capital).
3. The Introduction of the Second Accord of the Basel Committee (Basel II)

In view of the rapidly changing financial conditions and the fact that the 1988 capital adequacy rule took into account the features of the banking system of the 1980s, in June 1999, the Commission has formulated and issued a new proposal. It was therefore considered that the Capital Adequacy Treaty of 1988 was inadequate for the needs of the international financial sector of the 21st century. This new proposal, which it formulated and issued, refers to a renewed capital adequacy framework, known as Basel II, and its purpose is to replace the existing one. Following a positive response to the original proposal, a new analytical package was released in 2001.

The main objective of the Committee's work was to develop a framework that would further strengthen the integrity and stability of the international banking system by maintaining with consistency that the capital would be sufficient and would not be an important source of competitive imbalance among internationally active banks. The Commission believes that the revised framework will promote the adoption of stronger risk management practices in the banking sector and considers this to be one of its most important assets. *(Basel Committee on Banking Supervision, June 2004)*

The new Capital Adequacy Framework proposed by the Commission includes the following three pillars:

1. Minimum Capital Requirements (Alternative Calculation Methods)
2. Supervisory Evaluation Process
3. Effective public information and discipline through the market.

The first and second pillars seek to develop and extend the standardized capital adequacy regulations set out in the 1988 Treaty.

The ability to develop internal credit risk assessment systems and their use was among the important new proposals for post-accreditation by supervisory authorities instead of the standard rules in force so far. The main aim of the Commission is the parallel implementation and application of the three pillars, so that the capital adequacy framework to become more effective.
The purpose of the new Capital Adequacy Accord was to improve the way capital requirements met the risks and financial innovations of recent years, such as the securitization of receivables. The promotion of the new Accord was based on extensive cooperation with banks and businesses in the financial field. The views of the interested parties were submitted to the Committee at the end of May 2001. The Commission subsequently adopted the next text of the new Treaty. The Commission has delineated the start of the new Treaty, at least for the G10 countries, by the end of 2006. For countries beyond that, the start-up time could have exceeded the one above.

The Basel II rules are formulated to apply to all countries that may wish. Although our country is not part of the Group of Ten, the rules have been implemented almost simultaneously with all EU member states.

In detail, the three pillars of the Basel II Accord are described in the following table:

*Table 1: The most important features of the three pillars of the Basel II supervisory framework*

<table>
<thead>
<tr>
<th>Pillar I</th>
<th>Pillar II</th>
<th>Pillar III</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minimum Capital Requirements</strong></td>
<td><strong>Supervisory Control</strong></td>
<td><strong>Discipline of the Market</strong></td>
</tr>
<tr>
<td>1. Market Risk</td>
<td>- Credit institutions should have robust procedures for assessing their capital adequacy and an effective strategy to maintain the required level of regulatory capital.</td>
<td>- Market discipline strengthens efforts to promote the security and creditworthiness of credit institutions.</td>
</tr>
<tr>
<td>Minimum changes relative to Basel I.</td>
<td>- Incentives to credit institutions to adopt</td>
<td>- The increased requirements for main and additional information make market discipline more effective.</td>
</tr>
<tr>
<td>2. Credit Risk</td>
<td>- Major changes in relation to Basel I.</td>
<td></td>
</tr>
<tr>
<td>- Three different approaches to estimating minimum capital requirements.</td>
<td>- Supervisory authorities should oversee and evaluate the credit</td>
<td></td>
</tr>
<tr>
<td>- Incentives to credit institutions to adopt</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
sophisticated credit risk management methods, based mainly on internal rating methods.
- Requirements for the use of sophisticated information collection and control systems.

3. Operational Risk
- New element of the supervisory framework.
- Three different approaches to estimating minimum capital requirements.

- Institutions' internal systems and the strategies followed to preserve their capital adequacy.
- It is at the discretion of the supervisory authorities to impose additional capital charges.
- Supervisory authorities should intervene at an early stage to prevent and address the capital anemia of credit institutions.

Source: Economic Chamber of Greece

4. The Introduction of the Third Accord of the Basel Committee (Basel III)
On 16 December 2010, after many months of negotiations in Switzerland, the Basel Committee on Banking Supervision has issued two reports compiling the new international regulatory framework known as Basel III. This is perhaps the most important initiative of the Commission following the recent international financial crisis, through which the banking industry will become less vulnerable to possible financial crises. It is therefore intended to strengthen micro-prudential regulatory intervention in the operation of banks in order to address the systemic risk that may arise in the financial system.
Its purpose is to build stronger measures of protection within the financial system. The Basel III proposals, cover capital, liquidity and provisions and are expected to raise defenses and to reduce the pro-cyclical leverage in the system.

Its basic provisions concern:

- The introduction of a leverage ratio, as well as monitoring mechanisms for all internationally active banks.
- Strengthening the capital requirements for exposure to credit risk arising from derivatives, repos and stock exchange activities.
- Increasing the quality, consistency and transparency of capital requirements. Under the new rules, the Tier I capital will contain a more stringent definition of common stock and some of the existing Tier I funds will be considered inappropriate.
- The introduction of a global minimum common level of liquidity for banks with international activity, which will contain requirements for a 30-day capital coverage, which in turn will be based on more long-term liquidity.
- The introduction of measures that will encourage the building of security capital pillars in good times, on which the system can rely in times of tension. Additionally, the promotion of more provisions based on expected losses, which present the actual losses more transparent and appear less pre-cyclical than the current forecasting model. (Gortso, 2011)

The provisions of Basel III can be classified into two main categories:

a. The first category includes the provisions through which amendments are made to the existing regulatory framework governing the capital adequacy of international banks (i.e. Basel II) and also additions to it.

b. The second category includes provisions introducing "innovative elements", which are further distinguished below:
   - those through which new micro-prudential rules are introduced, mainly regulatory intervention in the operation of banks and
   - those introducing macro-prudential regulatory intervention rules.
All provisions of the new regulatory framework were gradually implemented from 1 January 2013 to 1 January 2019 (*full date of completion*).
PART B

1. Capital Adequacy

In recent years and after the last financial crisis in 2008, the main objective of the supervisory authorities in Europe has been to strengthen the capital adequacy of banks. By doing so, the European Parliament and the Council of Europe issued Directive 2013/36/EU and Regulation (EU) No 575/2013 (known as CRD IV and CRR respectively), which incorporate the key amendments that have been proposed by the Basel Committee for Banking Supervision (known as Basel III). Directive 2013/36/EU has been transported into Greek Law by virtue of Greek Law 4261/2014 and regulation (EU) No 575/2013 has been directly applicable to all EU Member States since 1 January 2014, but some changes under CRD IV will be implemented gradually, mainly between 2014 and 2019. (Eurobank EFG, Consolidated Pillar III Report, 2017)

To achieve this goal the banks should maintain a certain capital adequacy ratio (Total Capital Adequacy Ratio), the value of which should be equal to or greater than 8%. This ratio reflects the relation between the bank’s net worth to its risk weighted assets and off-balance-sheet exposures, and is calculated as follows:

$$CAR = \frac{\text{Total Capital}}{\text{Credit risk RWA} + \text{Market risk RWA} + \text{Operational risk RWA}} \geq 8\%$$

- The numerator includes both the Tier I capital (ordinary shares, retained earnings) and the additional Tier II capital (preference shares, revaluation reserve, subordinated debt) of a bank.
- The denominator is the sum of the weighted assets for credit risk, operational risk and market risk of the bank.
According to the *Capital Requirement Directive IV* provisions (Basel III framework), a bank is considered to have a capital adequacy if it complies with the following prerequisites:

- Minimum Common Equity Tier 1 (CET1) ratio: 4.5%
- Minimum Tier 1 ratio: 6%
- Minimum Total Capital ratio: 8%

Furthermore, banks are required to gradually create a capital conservation buffer of 2.5% until 1 January 2019 (0.625% on 1 January 2016, 1.25% on 1 January 2017 and 1.875% on 1 January 2018) beyond the existing minimum capital. Conservation buffer is a capital buffer of 2.5% of total risk exposures that needs to be met with an additional amount of CET1 capital. (*Eurobank EFG, Consolidated Pillar III Report, 2017*)

As a result, the minimum ratios which must be met, including the capital conservation buffer and which shall apply from 1 January 2019 are:

- a. Minimum CET1 capital ratio 7%
- b. Minimum Tier I capital ratio: 8.5%
- c. Total capital adequacy ratio 10.5%.

2. Credit Risk

*Definition*

Credit risk is the risk of a counterparty to be unable to fully meet its contractual borrowing obligations (repayment of interest and principal) at the time the debt is due.

Credit risk can be estimated taking into account the following parameters:

- The *Probability of Default (PD)* expressed as a percentage of the probability that the borrowers of the bank are unable to meet their financial obligations.
- The *Loss Given Default (LGD) or Recovery Risk*, which refer to the percentage of the total exposure that represents the financial loss of the bank in the event of
failure to repay the borrower’s loans after the completion of the collateral liquidation procedures.

- **Exposure at Default (EAD)**, which expresses the total amount exposed to credit risk at a specific time.

The possibility of *credit risk* is particularly high for financial institutions, as their main business and revenue realization derive from lending. However, there are some ways to control this risk and minimize it. More specifically, credit risk management can be achieved through:

- Development of credit rating systems for the financial institutions’ counterparties.
- Establishment of risk limits, both by the financial institution itself and by the supervisory authority.
- Constant monitoring of risk taking and corrective actions where and when they are required.
- Training and utilization of staff to control the loans provided to customers.
- Development of a diversified portfolio.

*Grading as a Credit Rating Criterion*

The assessment of capital adequacy of the financial institutions includes the weighing of individual risks and their valuation for all on- and off-balance sheet assets. For this reason, it is necessary to be set a *Risk Weighting (RW) ratio*. It is perceived that the more satisfactory the credit rating is, the lower the risk weight becomes, and hence the smaller is the required regulatory capital.

In order for the weighting ratio to be estimated, the use of credit ratings as a credit rating criterion has been adopted. Thus, there are two alternatives:

- The *Standardized Approach*, which assesses the banks’ risk, based on published ratings by specialized rating agencies (i.e Moody's, Standard & Poors, Fitch). According to this approach, a bank's portfolio is categorized on the basis of the risk coefficient assigned to each group, according to an external evaluation. It is
noted that the risk weighting (RW) ratio is predetermined by the Basel II framework.

- The development of Internal Ratings Based Systems (IRBs) by the bank itself. In this case, the bank itself groups and weighs its risks through a fully modeling system. It is noted that in order for a bank to be allowed to apply this approach, it is essential to be subject to prior supervisory accreditation.

Furthermore, in order for this approach to be implemented, it is necessary:

- To develop a complete internal rating system,
- to specify the risk parameters and
- to certify the results of the approach.

3. Market Risk

Definition

Market risk means the risk of losses to the financial institution due to adverse changes in the value of the bank's trading portfolio and its liquidity. This risk is due to fluctuations of market factors. The more placements a bank holds in financial products for trade, such as stocks, bonds, derivatives, etc., the more exposed is to the risk that an external factor will change their value. According to Basel II market risk for the bank, derives from the type of receivables (financial products) that are included in its trading portfolio. This risk is subdivided into the following categories:

a) Interest Rate Risk

This specific risk arises from the mismatch of interest rates both in the aspect of duration and volume of securities, loans and liabilities, but also of the off-balance sheet items of the bank. This is the risk of decline in interest-bearing instruments resulting from changes in interest rates. It is measured with sensitivity. In a rise of interest rates (case of positive sensitivity) or a fall (case of negative sensitivity), the net asset value can be significantly reduced. An unexpected change in interest rates can seriously affect both the value of the stock and the profitability of the bank. More specifically, if a bank's liabilities are more sensitive compared to its
requirements when interest rates change, then a fall in interest rates will increase profits and an increase will reduce them. Essentially, this risk relates to the possibility of a credit institution's net assets or equity being reduced.

The bank functions as an intermediary between the surplus (depositors) and the deficit units (borrower) of the economy. Therefore, the capital requirements between these units, in terms of the time horizon of freezing funds, lead the banks to create liabilities (deposits) and receivables (loans), whose maturity is not the same. Thus, the bank is at risk due to the continuous changes in interest rates.

b) Equity Risk

If a bank's share prices change, it is possible for a bank's net position to change as well. This may be the case if stock prices are declining (purchase), or rising (selling), and the risk caused by these changes is the equity risk. More specifically, the interest rate risk arises from the unfavorable change in interest rates, which may affect an interest rate position such as a deposit, loan, bond, etc.

c) Foreign Exchange Risk

Investments made on foreign capital markets may be accompanied by the risk of loss of capital returns from a fall in the exchange rate or a devaluation of the currency. Foreign exchange risk is defined as an estimate of the change in the net position of the bank due to changes in exchange rates. Risks of this nature can arise either from foreign currency transactions or from accounting entries when any of the balance sheet items of a company are in foreign currency and must be valued in local currency at regular intervals.

d) Commodities Risk

This risk arises from the placement of the bank in tradable commodities (agricultural products, oil, etc.) and gemstones. This type of risk consists in the possibility of damage to a bank due to changes in market prices in these commodities, and in the case they obtain open positions in them.
e) **Option Risk**

This risk arises from the placement of the Bank's trading portfolio in options. Basel II points out that there is a difficulty in recording the risk of the warrants on which the capital charge is calculated. The reservation of funds for reasons related to the market risk can be done either in Tier I and II or in Tier III. Tier III are subordinated short-term loans with an initial maturity of at least two years, without the possibility of early repayment (without the approval of the central bank) and a binding condition for interest and capital to be paid at maturity, in case the payment reduces the bank's capital requirements under the permitted limits. The Tier III funds held for market risk purposes should not exceed 250% of capital Tier I.

**Value-at-Risk (VaR)**

The Value-at-Risk approach is a method of managing market risk, which is in accordance with the Basel II requirements, and it is widely accepted by the financial institutions and the regulatory authorities (FASB, SEC). Its techniques are mostly used by the banking sector in order to assess the risk of buying financial instruments and calculate the riskiness of their asset portfolios.

The VAR approach provides a statistical risk measure, which is used in order to estimate the market risk of a portfolio for which historical price data are not available. More specifically, it is a statistical estimate that calculates, within a certain confidence interval (e.g., 95%), the amount of money in a particular currency that a portfolio or institution can afford to lose within a certain time horizon, due to the potential changes in the market prices of the underlying securities. The probable period of analysis may be only one day for most trading positions or even one month or more for investment portfolios. The importance of this method is derived from the fact that it is the first collective effort of market participants and regulators to develop a risk assessment methodology, whether it is a specific debt instrument, an investment portfolio or an organization's balance sheet. In the report of the G-30 (1993), VAR was defined as the best measure of the market risk of OTC derivatives, defining a two-week horizon and a confidence level of 99%. In addition, the Bank for
International Settlements (BIS) set the p at 99% and the t in 10 days in order to measure the adequacy of each bank's capital.

Despite the importance of value at risk as a measure of market risk assessment, it should be noted that it is only a statistical estimation, which is usually based on a distribution of historical data. It is, therefore, a prediction, which by its very nature cannot be determined within a 100% confidence level. The methodologies used to calculate this specific provision are the historical price modelling, the Variance-Covariance or Delta Normal approach, the Monte Carlo Simulation and the stress analysis. This analysis was suggested by the Group of Thirty as an additional tool of VAR-based methodologies. Instead of using historical market prices or randomly selected prices, a series of price scenarios are used in order to examine the performance of a portfolio. (D. Kainouriou, 2002, “Value-at-risk (VAR) market risk assessment methodology and VAR derivative instruments, Hellenic Bank Association)

4. Operational Risk

Financial institutions face risks that are not easily quantifiable and do not belong always in a certain category of risk. It is believed that one of the major risks they face is the operational risk, since it has been proven that most cases of large losses are due to a type of operational risk that has not been properly managed. Examples of operational risk is the inadequate job segregation, fraud, tax mistakes, legal issues, the incorrect computation of liabilities to the supervisors, inadequate systems, and others.

The Basel Committee defines operational risk as the risk of potential damage due to incomplete or unsuccessful in-house internal control procedures, human actions (error or fraud), inadequate management and IT systems, and external events.

There are three methods to approach operational risk.

a. The Basic Indicator Approach,

b. the Standardized Approach and

c. the Advanced Measurement Approaches.
These methods are under the Basel II approval and can be used to calculate the capital charge for the bank to address operational risk. Basel II allows a bank - subject to certain minimum criteria - to use the Basic Indicator Approach for some activities and the other two approaches for more sophisticated activities.

1. **The Basic Indicator Approach**

Capital requirements for operational risk amount to 15% of the credit institution's Relative Income Index. This index is defined as the average of the gross operating income of the credit institution at the end of each of the last three financial years. If in any financial year the gross operating income is negative or zero, this amount is not taken into account in the average calculation. It is usually used by small banks, while larger ones usually use more complex methods of measuring that risk.

2. **The Standardized Approach**

The bank subdivides its activities into 8 sub-categories. The capital requirement is derived from the relative income index of each category by the corresponding rate (18%, 18%, 12%, 15%, 18%, 15%, 12%, 12%). The Relative Income Index of each category is defined as the average of its Gross Operating Expenses at the end of each of the last 3 financial years.

3. **The Advanced Measurement Approaches**

Basel II, recognizing the sophisticated internal processes of certain banks, allows under certain circumstances the internal assessment of the operational risk from them. This right is granted to commercial banks when the inspectors of the central bank in each country decide that the banks are in a position to apply it. It is usually used when we want to calculate the capital adequacy of internationally active banks.
PART C
Analysis of The Capital Adequacy & The Weighted Risks for The Greek Banks

1. Capital Adequacy

In this chapter it is going to be presented an analysis of each of the four Greek systemic banks in regard to their capital adequacy with information provided by their consolidated financial annual reports and Pillar 3 reports of their most recent comprehensive financial year, 2017.

1.a. Analysis of the Capital Adequacy Ratio of EFG Eurobank Ergasias S.A.

Eurobank EFG focuses on strengthening its capital position by further increasing its pre-provision income, actively managing its non-performing exposures (NPEs) that are supported by a fully functioning internal bad bank, as well as making additional initiatives related to restructuring, transformation or optimization of activities in Greece and abroad that will create or release further capital and reduce the exposure of risk-weighted assets (RWA). As a result, at 31 December 2017, the CET1 capital of the Group amounted to € 6.9 billion, accounting for 17.9% of the RWAs, compared to 17.6% in December 2016, while the Total Capital Adequacy ratio stood at 18%, compared to 17.9% in December 2016. Additionally, on the same date, the Group’s CET1 index, based on the full implementation of the Basel III rules in 2024 (Fully loaded CET1), pro-forma on the completion of the sale of its subsidiaries in Romania classified as held for sale would be 15.3%, while the total pro-forma capital ratio with the completion of the above sale and the acquisition of the preferred shares / the issue of the subordinated bonds by the Bank as capital instruments of category 2 would be 17.9%. (Eurobank EFG, Consolidated Annual Financial Report, 2017)
Table 2: EFG’s Capital Adequacy Ratios

<table>
<thead>
<tr>
<th></th>
<th>Minimum Capital Requirements 2017</th>
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<tr>
<td>Common Equity Tier 1</td>
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<td>Tier 1 Capital</td>
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<td>Total Capital Adequacy Ratio</td>
<td>8% (+1.25% buffer)</td>
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Source: EFG’s Annual Report 2017

Analysing Table 2 and the banks’ minimum capital requirements, it can easily be observed that Eurobank meets all the minimum capital requirements for the year period 2016-2017.

1. b. Analysis of the Capital Adequacy Ratio of Piraeus Bank Group

The total equity of Piraeus Bank Group, on December 31, 2017 amounted to € 9.5 billion compared to € 9.8 billion on December 31, 2016, mainly as a consequence of the payment of interest € 165.5 million of contingent convertible bonds amounting to € 2.040 million in the last quarter of 2017 (€ 117.5 million after taxes). The Group’s capital adequacy ratio, under the Basel III framework, stood at 15.1% at the end of December, including ongoing divestments, as well as the Tier I capital. Moreover, the common equity Tier I ratio (CET 1) of the Group, stood at a satisfactory level at 15.1% on December 31, 2017, compared to 16.9% at 31 December 2016, as it is depicted in Table 3.

With the completion of the Supervisory Review and Evaluation Process (SREP) for 2017, the European Central Bank (ECB) has notified the Piraeus Group its overall capital requirement, which applies from 1 January 2018. According to the above decision, Piraeus Bank has to maintain, on a consolidated basis, a total capital adequacy ratio of 13.625%, which includes:

a. The minimum total capital requirements of Pillar I of Basel Accord (8%) according to the provisions of Article 92 (1) of Regulation (EU) No. 575/2013.

b. The additional capital requirements under Pillar II of Basel Accord (3.75%) under Article 16 (2) of Regulation (EU) No. 1024/2013.
c. The transitional capital conservation buffer of Regulation (EU) No. 575/2013, which for 2018 is set at 1.875%.

It is worth mentioning that on February 27, 2018, the Moody's rating agency upgraded the long-term credit rating of Piraeus Bank's deposits and debt to Caa2 from Caa3 with stable prospects.

The main objectives of the Group regarding the management of its capital adequacy are:

- Compliance with the capital requirements against undertaken risks, in accordance with the supervisory framework.
- Maintaining the ability of the Group to continue its activities seamlessly in order to provide returns and benefits to its shareholders and ensure the trust of its customers.
- Maintaining a robust and stable capital base to support the Group's business plans.
- The maintenance and enhancement of existing infrastructures, policies, procedures and methodologies to adequately meet the supervisory requirements in Greece and abroad. (*Piraeus Bank Business Report, 2017*)

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*Source: Piraeus’s Annual Report 2017*

1.c. Analysis of the Capital Adequacy Ratio of Alpha Bank Group

The Group's policy is to maintain a strong capital base in order to ensure the Bank's growth as well the trust of the depositors, shareholders, markets and trading parties. Share capital increases carried out by the General Assembly or the Board of Directors, in accordance with the statutes or the applicable provisions.
As long as the Financial Stability Fund (FSF) participates in the Bank's share capital, the Bank is not allowed to buy its own shares without the approval of the FSF, in accordance with the Relationship Framework Agreement signed between them.

The capital adequacy of the Bank is supervised by the ECB Single Supervisory Mechanism (SSM), to which data are submitted on a quarterly basis. The minimum ratios (CET I, Tier I, capital adequacy) that the Group must obtain are determined by Bank of Greece Governor's Acts and they are depicted on Table 4. (Alpha Bank, Consolidated Annual Report, 2017)

Some of the most important strategic events of the Bank, during the year 2017, that affected the Bank's capital adequacy are summarized as follows: (Alpha Bank, Business Project Briefing, 2017)

- In January, an agreement with the Serbian MK Group was signed for the sale of 100% of the shares that the bank held in Alpha Bank Srbija A.D., after a bidding process which started in 2016. The transaction was completed in April 2017, following the adoption of the relevant supervisory approvals and contributed to the achievement of the objectives of the Bank's Reconstruction Plan.

- In February, the Bank increased its share capital as a result of exercising the conversion rights for the entire convertible bond loan amounting to €150 million issued on 1/2/2013 under the agreement with Crédit Agricole S.A. for the acquisition of Emporiki Bank. The conversion resulted in the issue of 6,818,181 new ordinary shares, which correspond to 0,44% of the total number of the Bank's shares.

- In November, the consortium APE Commercial Property SA, in which the Bank participated with 72.2%, proceeded to the sale of its total stake (37%) held in the company "ELPET. Balkan SA ".

Table 4: Alpha Bank’s Capital Adequacy Ratios

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<td>17.1%</td>
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</tbody>
</table>

Source: Alpha Bank’s Annual Report 2017

As it is depicted on the table above, Alpha Bank meets all the minimum capital requirements for the year period 2016-2017.


The Group of National Bank of Greece S.A. ensures the maximization of the returns of the shareholders of its companies through the maximization of the loan-to-equity ratio, since it continuously monitors its capital base. Its aim is to maintain capital adequacy at a higher level than the minimum regulatory level but also to reduce the weighted average cost of capital, using modern fundraising methods.

Regarding its capital adequacy, the Bank strengthened its Common Equity Tier I capital (CET1) by about 750 basis points in 2016, through the successful completion of the disinvestments by Finansbank, ASTIR PALAS and NBGI Private Equity. As a result, the Bank received approval from the European Commission to repay funds of € 2 billion in the form of CoCos at the end of the year. The successful completion of the remaining disinvestments, whether they are already agreed or in progress, is expected to strengthen further the Bank’s capital adequacy ratios.

On 31 December 2017 the Common Equity Tier I ratio of the Group stood at 17%, as it is depicted in Table 5, exceeding the Supervisory Review and Evaluation Process (SREP) index of 12,25% and 12,875% for 2017 and 2018 respectively. The application of IFRS 9 will burden the Bank’s regulatory capital by a total of approximately 350 basis points, an effect which stands at around 120 basis points for the three-year time horizon in the context of the ECB's stress test, due to the implementation of the transitional period. The remaining disinvestments are expected to strengthen the
capital and liquidity of the Bank significantly, focusing on the sale of Ethniki Insurance Company. *(National Bank of Greece Consolidated Annual Report 2017)*

### Table 5: NBG Group Capital Adequacy Ratios

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Source: NBG’s Annual Report 2017

2. Operational Risk

In this chapter it is going to be presented an analysis of each of the four Greek systemic banks in regard to the operational risk they face with information provided by their consolidated financial annual reports and Pillar 3 reports of their most recent comprehensive financial year, 2017.

2.a. Operational Risk Analysis of EFG Eurobank Ergasias S.A.

The Group has recognized that the operational risk is embedded in each business activity. It therefore authorizes the Board of Directors to monitor this risk through the Risk Committee and the Audit Committee. The Operational Risk Management Committee evaluates the operational risks arising from the Group’s operations, ensures that each entity has appropriate policies and procedures in place to control these risks and takes immediate corrective actions if a high risk is identified.

The Group applies an operational risk framework based on the following elements:

- Principles
- Governance & Organization
- Infrastructure
- Processes

According to the capital requirements of the Regulation (EU) No. 575/2013, the Group uses the standardized approach to calculate the Pillar 1 capital charge for operational risk. As it is required by Basel II for the use of the standardized method, the Group’s business activities have been divided into eight business segments, while
the annual gross operating income for 2015, 2016 and 2017 has been calculated for each business segment separately. The required beta ratios of each business segment are applied to gross operating income to determine the regulatory capital requirement per business sector and these figures are added together to determine the total regulatory capital requirements for Pillar 1 operational risk.

The Group applies some operational risk procedures that focus on risk identification, control, management, evaluation, reporting and performance improvement. These specific processes to be completed are supported by some tools, the most important of which are the following:

- **Risk & Control Self-Assessment (RCSA)** is a technique with the primary objective of identifying, evaluating and eventually limiting operational risk. Risks are evaluated on the basis of the methodology followed and then processed to classify operational risks, disclose the high risk in the business segments, create the operational risk profile, and calculate the capital adequacy. The RCSA is carried out every year, but if major changes occur then it happens more often.

- **Operational risk indicators.** They are based on historical data related to specific and measurable activities and show openings to operational risk. Operational risk indicators are quantitative and expressed as a percentage or ratio.

- **Analysis of operational risk scenarios.** It is the structure within which the scenarios are defined, documented and selected for analysis and for measurement. *(Eurobank Consolidated Financial Report 2017)*

2. b. **Operational Risk Analysis of Piraeus Bank Group**

Piraeus Bank Group recognizes its exposure to Operational Risk, which stems from its day-to-day operation and the implementation of its business and strategic goals. Group Management aims to continuously improve operational risk management by implementing and constantly developing an integrated, unified and adequate operational risk management framework that is in line with best practices and supervisory requirements. The operational risk management framework, documented through methodologies and procedures, covers the identification,
evaluation, measurement, reduction and monitoring of operational risk in all the
Group's business activities and support functions, while aiming at a proactive and
remedial reduction of the risk. In addition, it ensures the diffusion of a uniform and
understandable perception of the management of this form of risk by all parties
involved.

The operational risk management framework for which the Operational Risk
Management Unit is responsible is an integral part of the Group's overall risk
management framework, approved by the Risk Management Committee, is
periodically reviewed and adjusted in accordance with the overall level of exposure
and the Group's risk taking.

This framework is applied to Piraeus Bank and the Group's Subsidiaries, both
domestically and externally. It is adjusted based on the size and scope of the Bank's
and Subsidiaries activities, as well as any local supervisory requirements. Supervision
and coordination of the implementation of the overall framework as well as the
relevant methodologies are undertaken at the central level by the Operational Risk
Management Unit. The basic principles for managing operational risk are:

- The commitment and responsibility for addressing this risk is set at unit level as
close as possible to its source.
- The operational risk management framework includes:
  - the organizational structure and responsibilities for operational risk
    management,
  - Assignment of operational risk (formalities, limits & indices),
  - Procedures for the self-assessment of operational risks, key risk
    indicators, action plans, the collection of operational risk events and
damages, the calculation of capital requirements and Value at Risk (VaR),
    operational risk reduction techniques and finally the framework of
    internal and external reporting.
- The Group has a well-documented and adequate Internal Audit System, which is
  a set of control mechanisms and processes that continuously cover each Group's
  activity, contributing to its effective and safe operation.
The Internal Audit System incorporates the Business Continuity Plan, seeking to minimize the negative consequences that may be caused by extraordinary crisis situations to the Group's activity. (Piraeus Consolidated Financial Report 2017)

2.c. Operational Risk Analysis of Alpha Bank Group

The Group follows the standardized approach to the calculation of operational risk capital and meets all the qualitative requirements of this approach. Specifically, in order to effectively manage operational risk, the Group has adopted and implemented an Operational Risk Framework that includes the following issues:

- Collection and management of operational risk events, including the management of lawsuits against the Group.
- Recognition and evaluation of operational risks through operational risk assessment and other relevant techniques.
- Definition and monitoring of operational risk indicators.
- Create reports.
- Introduction of techniques for reducing operational risk, which concern both the implementation of action plans that improve the existing internal control system, as well as the insurance against specific risks.
- Calculation of capital requirements for operational risk.

This Framework is continually controlled, and specific projects are being carried out to upgrade it. It is supported by an appropriate organizational structure with clear roles and responsibilities for operational risk management under the basic prerequisite that all Bank Units and Group Companies have the primary responsibility for managing their operational risks.

In 2017, the development of an internal statistical model for capital adequacy calculation, which is based on the basic principles of the Advanced Measurement Approach (AMA), is completed and utilized in the Pillar II reports. In addition, the Group’s Operational Risk Management Policy was updated, and projects have been launched to strengthen the evaluation procedures of the Information and Communication Technology Risk and Model Risk.
At the same time, the process of developing Operational Risk Indicators continued and operational practices for monitor the operational risk events were improved. In the normal practice of the Group, the Operational Risk Self-Assessment Method (RCSA) was applied during the year according to the general design. It should be noted that this method provides for the recognition and assessment of potential operational risks and the adoption of corrective action plans. At the same time, a specific approach to risk assessment related to outsourcing, which will be further strengthened in 2018, has been applied. (Alpha Bank Consolidated Financial Report 2017)

2.d. Operational Risk Analysis of National Bank of Greece Group

The Group, recognizing the importance of operational risk, has established and maintains since 2006 a high-quality framework for its management, which covers the full range of its activities. The implementation of the Group's operational risk management framework has been computerized since 2009 through the OpVar system of the Algorithmics company (now IBM). This system covers the whole operational risk management framework, in particular the process of collecting infectious events, the annual implementation of the process of self-assessment of risks and the related environmental control, the establishment and monitoring of Key Risk Indicators, the Scenario Analysis project, and the implementation of Action Plans.

For the purpose of calculating regulatory capital against operational risk, the Bank follows the Standardized Approach, both on an individual basis and on a consolidated basis.

Operational risk management has been integrated into day-to-day operations and creates added value based on the following pillars:

- Recognition, prioritization and management of potential risks, through the process of Self-Assessment of Hazards and Environmental Control.
- Process of collecting operational risk damages and keeping a complete and consistent database of loss-making events.
- Longitudinal analysis of operational risks and identification of warning signs through the definition and monitoring of Key Risk Indicators.

- Analysis of the Group’s potential exposure to extreme events with severe impacts / low frequency through the Structured Scenario Analysis.

- Start risk mitigation actions by drawing up and monitoring action plans.

All of the above improve the control environment and strengthen the corporate culture of NBG in terms of operational risk, positively affecting its reputation.

*(National Bank of Greece S.A Pillar III Disclosures on a consolidated Basis 2017)*

3. Market Risk

In this chapter it is going to be presented an analysis of each of the four Greek systemic banks in regard to the market risk they face with information provided by their consolidated financial annual reports and Pillar 3 reports of their most recent comprehensive financial year, 2017.

3.a. Market Risk Analysis of EFG Eurobank Ergasias S.A.

The Group is exposed to market risk, which is the risk of possible loss due to adverse changes in market variables. Changes in interest rates, exchange rates, credit spreads, stock prices and other relevant factors, such as the implied volatility of the previous ones, may affect the Group’s income or the fair value of its financial instruments.

The Group applies the Value-at-Risk method (VaR) to calculate and monitor market risk in Greece and Cyprus. For the rest, however, Europe uses sensitivity analysis for the same purpose. It is noted that the use of the sensitivity analysis is in accordance with one of the Basel Committee's proposals.

The VaR methodology measures the financial risk and calculates the probable negative change in the market value of a portfolio over a specific confidence interval and for a predetermined duration. Eurobank’s internal model is based on the Monte Carlo simulation method. The confidence interval used is 99% and the duration one day. It is also designed to be used under normal market conditions. Additionally, any changes made to the factors affecting the risk follow a normal distribution.
Therefore, one of the principles of the Basel Committee is being followed, since it uses one of the proposed approaches to market risk, the Monte Carlo approach.

The bank applies also other methods, like the stress testing in order to predict negative outcomes from extreme scenarios that may occur. As the VaR approach does not cover extreme market conditions, the Group applies these stress tests to simulate the impact of many risk factors and to analyze historical correlations. The bank applies two different types of these tests.

- The Historical Stress Tests based on selected historical events in the financial markets.
- The Subjective Stress Tests in which portfolios are exposed to scenarios for risk factors that are considered to be particularly significant (devaluation of foreign currencies, credit spread increase, decreased stock prices and adverse movements in implied volatility variables).

Therefore, one of the principles of the Basel Committee is being followed, as it uses one of the proposed approaches to market risk, the Stress Testing method.

Finally, the Bank performs ex-post back testing to verify the validity of the assumptions and parameters used to calculate the VaR. This method is applied on a continuous basis but does not prevent losses outside these limits in case of extreme market changes. *(Eurobank Consolidated Financial Report 2017)*

3.b. Market Risk Analysis of Piraeus Bank Group

The Risk Management Committee of the Bank has adopted a single market risk management policy that applies to the Group and describes the key definitions of market risk management and defines the roles and responsibilities of the units and executives involved.

The Piraeus Bank Group applies modern and widely accepted techniques for measuring market risk. In particular, uses sensitivity indicators, such as the PV 100 measurement (adverse effect on the net present value of all balance sheet items against parallel shift of interest rate curves by 100 basis points in all currencies), and the Value at Risk measure, which incorporates all the risk factors.
For each activity involving market risk, appropriate risk limits have been established, which are checked on a systematic basis. Market risk management is not limited to trading activities but covers all items of the Consolidated Statement of Financial Position.

The Value-at-Risk is the estimate of the maximum potential loss in the net present value of a portfolio, which may occur over a specified period of time and for a certain confidence level. The Group of Piraeus Bank applies the following three methods for calculating VaR:

a. The parametric Value-at-Risk method with a one-day horizon and a confidence level of 99% with historical observations of two years and an equal weighting between observations,

b. the parametric Value-at-Risk method with a one-day horizon and a confidence level of 99% and market data that take into account more recent observations (variables and correlation coefficients calculated using exponential methodology, \( \lambda = 0.94 \)) and

c. the parametric Value at Risk method using Stress Value at Risk correlation coefficients that assess the potential impact on current positions. The calculation of variances and correlation matrix is performed on a daily basis by the company RiskMetrics.

The Value at Risk methodology cannot cover an estimate of economic losses that may result from extreme market conditions, and so the measurements are accompanied by a number of stress simulation scenarios. These scenarios are based on the main risk factors that may affect the value of balance sheet items.

The Group applies a back-testing program for the Bank's trading portfolio for value-at-risk ratings. On a daily basis, the Value-at-Risk price is compared with the corresponding change in portfolio value due to a change in market prices.

The value at risk on 29/12/2017 was € 0.5 million for the Group's total trading portfolio. This estimate is broken down into € 0.2 million value at risk for interest rate risk and € 0.5 million for exchange rate risk. By structuring the trading portfolio
on 31/12/2017, there is a decrease of € 0.2 million in the total value at risk due to the degree of diversification of the portfolio.

The value at risk at 31/12/2016 was € 0.8 million for the Group's total trading portfolio. This estimate is broken down into € 0.4 million value at risk for interest rate risk and € 0.8 million for foreign exchange risk. By structuring the trading portfolio on 31/12/2016, a € 0.4 million decrease in total value at risk is achieved due to the degree of diversification of the portfolio.

In 2017, the value at risk of the Group's trading portfolio decreased mainly due to the decrease in the position of Greek Government Bonds. (Piraeus Bank, Annual Financial Report 2017)

3.c. Market Risk Analysis of Alpha Bank Group

Market risk for Alpha Bank Group derives from changes in product prices, interest rates, foreign exchange, equity, indices and commodity markets. The Group's Risk Management Committee is responsible for supporting and supervising the Market Risk Management framework and, on the other hand, the Asset Liabilities Committee (ALCO) of the Group is responsible for approving the guidelines, strategy and organizational structure regarding the management of Market Risk.

The market risk of the trading portfolio is measured by calculating Value at Risk. The Value at Risk methodology used for the calculation of regulatory capital for market risk is the method of historical simulation. The Bank uses a period of up to ten days, depending on the time required to liquidate the portfolio. To calculate the VaR of one trading book day, a two-year observation period and a confidence interval of 99% is used.

To measure the market risk of the Trading Portfolio, in addition to the Value-at-Risk calculation, its behavior is tested on hypothetical changes in market parameters (extreme scenarios) as well as on extreme changes that have been occurred in the past (stress tests). On top of that, the simultaneous change of many parameters, such as a change in the interest rate curve, changes in stock prices, changes in volatility and changes in exchange rates, are also being considered. In addition, on a
daily basis, ex-post testing and validation of the accuracy and back-testing of the Value-at-Risk calculation model is performed. (*Alpha Bank Group, Annual Financial Report, 2017*)


The Bank uses market risk models and specific procedures to assess and quantify the market risk of its portfolio based on best practices and widely accepted risk measurement. In particular, the Bank calculates the market risk for its trading and available-for-sale portfolio using the Value at Risk (VaR) method through the RiskWatch system of Algorithmics company (today IBM). Specifically, due to the mainly linear nature of its portfolio, the Bank applies the Variance-Covariance method, with a one-day horizon and a 99% confidence interval. The VaR is calculated daily for the Bank's commercial and available-for-sale portfolio, together with the VaR of the Bank's individual risks (interest rate, equity, foreign exchange). VaR estimates are used internally as a risk management tool and also for regulatory purposes.

For internal use, the Bank calculates daily the VaR for its commercial and available-for-sale portfolio, using the 75 most recent exponential weighted daily observations to construct the Variance-Covariance standards. For regulatory purposes, the calculations only concern the trading portfolio and the Variance-Covariance models are based on 252 balanced daily observations. The risk factors associated with financial products in the Bank's portfolio are interest rates, equity indices, exchange rates vis-à-vis the euro and commodity prices.

In addition, the Bank and the Group's Market and Operational Risk Management Division (GMORMD) calculates the VaR of extreme conditions for the Bank's trading portfolio, which is defined as the VaR where the data input into the model is calibrated according to historical data from a continuous twelve-month period of significant extreme financial conditions relevant to the Bank's portfolio. Specifically, the Variance-Covariance models dating from January 3, 2008 have been calculated on a daily basis and the Variance-Covariance model corresponding to the maximum VaR of the Bank's trading portfolio throughout the period is selected. Similarly, the
calculates on a daily basis the VaR derived from extreme conditions, over a one-day horizon and a confidence interval of 99%. Finally, GMORMD calculates the VaR of the Bank’s portfolios following the Historical Simulation Approach for benchmarking purposes.

The Bank has also set a framework for the limits of VaR to control and manage its risks more effectively. The limits are based on the Bank’s Risk Disposal, as defined in the Risk Take-Over Framework, the expected profitability of Treasury and Money Market, and the Bank’s own capital (capital expenditure budget) as part of the Group’s strategy. The VaR limits refer not only to specific types of market risk, such as interest rate, foreign exchange and equity, but also to the total market risk of the Bank’s commercial and available-for-sale portfolios, taking into account the corresponding diversification among the portfolios.

The operation of the market risk management unit as a whole, including the framework for the calculation of the VaR, has been thoroughly audited and approved by the Bank of Greece and by external consultants. The Internal Audit Department also regularly evaluates the effectiveness of the internal controls. In addition, the adequacy of the market risk management framework as well as the suitability of the VaR model used to calculate the Bank’s capital requirements were reassessed by the Single Supervisory Mechanism (SSM) in the last quarter of 2017.

The Group's other subsidiaries face minimal market risk and, given the current disinvestment program, the Bank is the only company of the Group that faces a substantial risk of this type. (National Bank of Greece, Consolidated Financial Report 2017)

4. Credit Risk

In this chapter it is going to be presented an analysis of each of the four Greek systemic banks in regard to the credit risk they face with information provided by their consolidated financial annual reports and Pillar 3 reports of their most recent comprehensive financial year, 2017.
4.a. Credit Risk Analysis for EFG Eurobank Ergasias S.A.

The Eurobank Group applied the Basel II framework for the first time in accordance with the Standardized Approach in January 2007 and included the relevant risk indicators in the published financial statements. Until that time, the Group applied the rules of Basel I accord.

In June 2008, the Group received approval from the Central Bank of Greece to use the Internal Ratings Based Approach (IRB) to calculate the capital requirements related to credit risk. Therefore, with effect from 1 January 2008, the Group applies:

- The Foundation Internal Rating Based Approach for the calculation of risk-weighted assets for the Bank’s business loans in Greece.
- The Advanced Internal Rating Based Approach for the majority of the Bank's retail lending portfolio, e.g. mortgages, SME loans, credit cards and revolving credits in consumer lending.
- Since September 2009, the Foundation Internal Rating Based Approach has been applied to the entire business portfolio of Eurobank Leasing SA in Greece.
- Since March 2010, the Advanced Internal Rating Based Approach has been applied to the portfolio of personal loans and car loans.

The implementation of the Internal Ratings Based Approach (IRB) covers the 76.9% of the Group’s loan portfolio, excluding parts it that are not significant in terms of size and risk profile, as well as other permanent exclusions. The Bank is in the process of reviewing the plan for the gradual implementation of the IRB, taking into account the recently issued draft guidelines and the Group’s business plan. The revised phasing-in plan of the IRB is subject to the approval of the European Central Bank. Permanent exclusion from IRB is applied to the weighted assets up to 10% for which the Standardized Approach is used. In addition to the above exemption, permanent exemption has been granted for the following categories of exposures, as described under the Capital Requirements Directive:

- exposures to or guaranteed by central governments and central banks,
- exposures to or guaranteed by credit and financial institutions and
• exposures to administrative bodies and non-profit organizations.

For these exposures, the Standardized Approach is used. (Eurobank, Consolidated Pillar Ill Report, 2017)

4.b. Credit Risk Analysis for Piraeus Bank Group

Credit risk is the most important source of risk for Piraeus Group and, for this reason, its effective monitoring and management is the primary concern of the administration. The Group's overall exposure to credit risk is mainly attributable to corporate and private lending, Group's investment activities, OTC trading, derivatives trading, and transactions settlement.

The Group applies a unified policy and practice in relation to the valuation methods and the procedures for approving, renewing and monitoring credit. The credit limits are reviewed and / or renewed at least annually, and the relevant approval levels are determined on the basis of the amount and the category of the total credit risk assumed by the Group for each obligor or group of debtors (one obligor principle).

A credible measurement of credit risk is top priority for the Group's risk management framework. Continuous development of infrastructures, systems and methodologies for quantification and credit risk assessment is a prerequisite for timely and effective support of management and business units in decision-making, policy-setting and compliance requirements.

In order to monitor and measure the credit risk associated with the Group's loans and receivables in a counterparty level:

a. the client's creditworthiness is systematically evaluated, and the probability of default is assessed and
b. the likely recovery rate, which may be received by the Group if the borrower fails to meet its obligations, is estimated based on existing collateral and guarantees.

The Group assesses the counterparty's creditworthiness and assesses the possibility of default on its contractual obligations using credit rating models tailored to the
categories and specific characteristics of counterparties. These models combine financial and statistical analysis with the judgment of the executives and are evaluated wherever possible by comparing them with externally available information. *(Piraeus Business Report 2017)*

4.c. Credit Risk Analysis for Alpha Bank Group

The primary objective of the Group's credit risk management strategy in order to maximize risk-adjusted returns is the continuous, timely and systematic monitoring of the loan portfolio and the maintenance of credit exposures within the context of eligible global risk taking. At the same time, its day-to-day operations are ensured within a clearly defined credit framework, supported by rigorous credit criteria.

The Group's credit risk management framework is based on a series of credit policy processes and credit risk measurement, monitoring and control systems that are subject to a continuous review process in order to ensure full harmonization with the new institutional and supervisory framework and best international practices and their adaptation to the requirements of the economic circumstances and the nature and extent of the business environment of the Group.

Alpha Bank Group has adopted a well-defined credit risk management strategy that, in response to its business objectives, reflects the risk tolerance levels as well as the expected level of profitability relative to their risk exposure. The credit risk management framework is formulated according to the following objectives:

- The independence of the management of credit risk from risk taking operations and from the managers to whom these activities fall.
- Providing full and timely support to operational units in the decision-making process.
- The continuous and systematic monitoring of the loan portfolio, in accordance with the Group's policy and procedures that ensure the proper approval of loans.
- Monitoring and strengthening the credit risk profile according to the defined maximum risk tolerance levels, including the credit portfolio quality assessment
(expected loss) and credit risk concentration (limits per borrower by economic sector and by geographical area).

- Maintaining a framework of controls to ensure that credit risk is based on sound credit risk management principles and clearly defined and rigorous credit standards.

- The accurate identification, assessment and measurement of the credit risk assumed at a Bank and Group level, and in particular at a loan and loan portfolio level.

- The approval by clearly defined hierarchical structures of any new credit granting and any substantial change to an existing credit (for example, over time, the structure of collateral against credit or limitations on credit clauses).

- The assignment of approval powers for granting credit to the relevant credit councils, composed of executives of business units and credit monitoring units with sufficient knowledge and experience in the field of risk management, fully capable of implementing internal policies and procedures of the bank.

- Implementing a decision-making process to define and approve funding conditions within a clearly defined authorization framework.

- The measurement and evaluation of the total risks arising from all types of loans of the Bank and the Group companies to individual enterprises or groups of affiliated enterprises, as well as the lending to their entities in accordance with the regulatory requirements.

The above objectives are achieved within a continuously evolving framework of credit risk assessment methodologies and systems, using a series of decision-making procedures for granting credit, examining and analyzing risk concentrations, early warning of risks beyond the tolerance levels, and the management of problematic lending. *(Alpha Bank Annual Financial Report, 2017)*

4.d. Credit Risk Analysis for National Bank of Greece Group

Credit risk management and control plays a fundamental role in the overall strategy of the Group in order to effectively monitor the actual and potential risks of the
organization and to harmonize its operations with the legal and regulatory requirements.

The credit risk management function of the Group is divided into three different levels of defense:

The first line of defense concerns the operational function, i.e. the credit risk assumed by the business units. They are accountable for the risk they undertake and are therefore responsible for implementing corrective actions to address procedural and audit deficiencies. Their ultimate goal is to minimize the risk to a given level of expected return by establishing and implementing internal rules in their day-to-day activities.

The second line of defense is provided by the Credit Units and the Group Risk Control and Architecture Division (GRCAD). The credit units act independently from the business units. They receive credit recommendations from the business units, which they submit to an impartial risk assessment by applying the principle of dual control and ultimately, they assume the risk and have the right to cancel the approval process. The role of GRCAD is to identify, monitor, control and quantify the risks at portfolio or company level. It also helps other risk-taking units and introduces the adoption of appropriate pricing and risk measurement tools. In this sense, it assists the risk-taking units to define the exposure risk target and submit reports with sufficient information on the risk across the Group. The Group Regulatory Compliance helps to ensure compliance with the current legislation and regulations.

Finally, the third line of defense is the subject of Internal Audit - Review of the Bank and the Group, which provides the Board of Directors with independent assurance, based on the highest level of independence and objectivity within the organization. The duties and responsibilities of all the aforementioned lines of defense are clearly defined and distinguishable in the Group's Risk Strategy. (National Bank of Greece S.A., Pillar III Disclosures on a Consolidated Basis, 2017)
PART D
A Comparative Analysis of The Major Risks the Banks Face

In this chapter a comparison of the major risk indicators, introduced by the Basel accords is presented, related to the four systemic banks (Alpha Bank, Piraeus, Eurobank and National Bank of Greece), in order to have an image for their performance in the latest completed financial year (2017). More specifically they are going to be presented the main ratios that depict the performance of the banks related to credit risk, market risk, operational risk and liquidity risk. The latter was introduced by the third Basel Accord and it is going to be presented thoroughly in this chapter.

1. Market Risk

As we have seen before in this paper all four systemic banks in order to calculate their market risk for both their trading and available-for-sale portfolios, they use the Value at Risk methodology which incorporates all the risk factors associated with this type of risk (interest rate risk, equity risk, foreign exchange risk and commodities risk). The methodology they follow is in accordance with the Basel provisions and in some aspects is the same for all banks (stress testing methodology and back testing). Of course, there are also differentiations between the methods they follow, as it was presented in the previous chapters, since National Bank of Greece uses the variance-covariance methodology for the calculation of its VaR, Alpha Bank uses a historical simulation approach, Eurobank uses the Monte Carlo simulation method and Piraeus Bank which uses the parametric value-at-risk method with historical observations of two years as well as with more recent observations.

The table below presents a synopsis of the average (daily value) of each bank’s VAR using a 1 day holding period and 99% confidence level. It should be mentioned that all four banks are mostly exposed to the interest rate risk according to the information provided from their annual reports.
Table 6: VAR (99%, 1 day)

<table>
<thead>
<tr>
<th>Market Risk</th>
<th>Eurobank</th>
<th>NBG</th>
<th>Alpha Bank</th>
<th>Piraeus Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Avg. VaR 2017</td>
<td>18</td>
<td>7,29</td>
<td>1,45</td>
<td>0,5</td>
</tr>
<tr>
<td>Total Avg. VaR 2016</td>
<td>18</td>
<td>9,63</td>
<td>1,76</td>
<td>0,8</td>
</tr>
</tbody>
</table>

Source: Data derived from each bank’s Annual Reports of 2017

As we can observe from the table above all banks except Eurobank had a decrease in their VaR related to the previous year and this is due mainly to the decrease in the amount of Greek government bonds the banks held. The implementation of the bond exchange program that took place in 2017 had as a result for the Greek banks to exchange for cash the EFSF floating-rate notes that they held, and this process affected the banks’ portfolios composition and consequently the exposure to key risk factors, namely the euro swap rates and the Greek government bond yields. All this situation has led to fluctuations of the interest rates and the total VaR estimates during the last year for all four banks. (*National Bank of Greece, Form 20-F, 2017*)

2. Credit risk

The Credit risk that banks face can be monitored by the calculation of some ratios related to their capital adequacy, as it was presented previous in this paper. These ratios are the Common Equity Tier 1 (*CET 1*), the Tier 1 and the Capital Adequacy ratio. These ratios are important tools for the measurement of credit risk since the stress tests that have been conducted by the European Banking Authority in 2016 used the CET1 ratio in order to understand how much capital banks would have left in the adverse event of a financial crisis. By the implementation of Basel III, the minimum regulatory limits that have been set for these ratios including the new introduced capital conservation buffers for the period under scrutiny (2016-2017) are presented in the following table.
Table 7: Calibration of the capital framework

<table>
<thead>
<tr>
<th>Regulatory Limits</th>
<th>2017</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>CET 1</td>
<td>5,75%</td>
<td>5,125%</td>
</tr>
<tr>
<td>TIER 1</td>
<td>7,25%</td>
<td>6,625%</td>
</tr>
<tr>
<td>CAR</td>
<td>9,25%</td>
<td>8,625%</td>
</tr>
</tbody>
</table>


As we have already seen in the previous chapters of this paper all four Greek systemic banks manage to meet the above limits as it is presented in the table below.

Table 8: Capital Adequacy Ratio

<table>
<thead>
<tr>
<th>Capital Adequacy Ratio</th>
<th>EUROBANK</th>
<th>NBG</th>
<th>ALPHA BANK</th>
<th>PIRAEUS BANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Equity Tier 1</td>
<td>17.90%</td>
<td>17.60%</td>
<td>17%</td>
<td>16.30%</td>
</tr>
<tr>
<td>Tier 1</td>
<td>17.90%</td>
<td>17.60%</td>
<td>17%</td>
<td>16.30%</td>
</tr>
<tr>
<td>Total CAR</td>
<td>18%</td>
<td>17.90%</td>
<td>17%</td>
<td>16.30%</td>
</tr>
</tbody>
</table>

Source: Data derived from Annual Reports of each bank 2017

What is apparent from the above table is that in 2017 EFG, NBG and Alpha Bank managed to increase their Capital Adequacy Ratios, while Piraeus Bank’s was declined. This movement of the Capital Adequacy Ratio can be explained by the information presented on the table below, which depicts all banks’ Non-Performing Loans (NPLs) as a percentage of their Total Loans to be reduced for all banks except Piraeus.

Table 9: Credit Risk Ratios

<table>
<thead>
<tr>
<th></th>
<th>EUROBANK</th>
<th>NATIONAL BANK OF GREECE</th>
<th>ALPHA BANK</th>
<th>PIRAEUS BANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPL/Total Loans</td>
<td>42,56%</td>
<td>45,18%</td>
<td>45,89%</td>
<td>46,93%</td>
</tr>
<tr>
<td>Impairment Allowance/Total Loans</td>
<td>19,09%</td>
<td>20,34%</td>
<td>26,99%</td>
<td>27,51%</td>
</tr>
<tr>
<td>Loan-to-Value ratio</td>
<td>98,25%</td>
<td>99,90%</td>
<td>106,1%</td>
<td>102,2%</td>
</tr>
</tbody>
</table>

Source: Data derived from Annual Reports of each bank 2017 & calculations of the author
The table above depicts the main ratios concerning credit risk. The reduction in the first two ratios (*NPL & Impairment Allowance to Total Loans*) for all banks except Piraeus is in line with the banks’ strategies for reducing the amount of non-performing loans from their assets. Furthermore, the Loan-to-Value ratio (*LTV*) is also associated with credit risk since financial institutions use it in order to approve a mortgage. This ratio reflects the gross loan exposure at the balance sheet date over the market value of the property held as collateral. Typically, assessments with high LTV ratios are generally seen as higher risk for the financial institutions.

Finally, in table 10 is presented the amount of Greek Government Bonds the banks held in 2017 and 2016 respectively since this value reflects the Country risk measurement which is also associated with Credit risk. This risk relates to the losses arising from economic difficulties or political unrest in a country, including the risk of losses following nationalization, expropriation and debt restructuring. Regarding the Greek case, this risk is extremely high due to the low credit rating of the bonds, which implements a high-risk source for the banks’ portfolios. What is apparent from the table below, is that EFG and Alpha bank face the highest exposure as they hold 2.530m. € and 3.543m. € of Greek government bonds, respectively.

*Table 10: Acquisition of Greek Government Bonds*

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</tr>
</thead>
<tbody>
<tr>
<td>EUROBANK</td>
<td>2.530</td>
<td>2.025</td>
<td>1.106</td>
<td>1.451</td>
<td>3.543</td>
<td>3.968</td>
<td>1.476</td>
<td>8.428</td>
</tr>
<tr>
<td>NATIONAL BANK OF GREECE</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>ALPHA BANK</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIRAEUS BANK</td>
<td></td>
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</tr>
</tbody>
</table>

*Source: Data derived from Annual Reports of each bank 2017*

3. Operational risk

This type of risk cannot be reliably measured and does not affect the expected free cash flows of the banks as the other types of risk do, but it is considered as a major risk that should be mitigated through discipline of execution with proper governance at all levels of the organization starting from the CEO, the Board and the Operational Risk Committee. Basel II & III requirements focus on comprehensive and dynamic
capital, risk and liquidity management requirements that cannot be met if operations risk is not well managed.

As it was presented in this paper before, all four banks (Eurobank, Piraeus, Alpha Bank and National Bank of Greece) are in line with the Capital Requirements Regulation (EU) No. 575/2013 and they apply the *standardized approach*, introduced by the Basel II, through the allocation of their gross operating income to the eight regulated categories of their business activities. It should also be mentioned that Alpha Bank, in 2017, has developed an internal statistical model for the calculation of capital adequacy based on the *Advanced Measurement Approach (AMA)*.

4. Liquidity Risk

Regarding liquidity risk, banks need to be protected against any sudden and large in volume withdrawals, known as bank runs and they need to maintain high liquidity reserves in order to be able to meet their financial obligations when they become due.

With the introduction of Basel III an emphasis was given to the high-quality liquid assets of the banks and their funding stability in order to mitigate the risk of bank runs. For this reason, two types of ratios were introduced in order to monitor the liquidity levels of the banks; the *Liquidity Coverage Ratio (LCR)* and the *Net Stable Funding Ratio (NSFR)*.

The *LCR* refers to the highly liquid assets (with maturity less than one month) held by financial institutions in order to meet their short-term financial obligations and to survive in emergency stress scenarios. The NSFR refers to the more medium and long-term funding activities of the banks (*assets with maturity of 3 months*), while it ensures that these investment activities are funded by stable liabilities. These two ratios are used as a generic stress test that aims to anticipate market-wide shocks.

According to the Bank for International Settlements these two ratios were introduced on January 2015 with the minimum requirement for the first ratio to be set at 60% and with the aim to be gradually increased to 100% until the first day of January 2019 and for the second to be set at 100%. At the time this paper is being
written, the minimum requirement for the first ratio was set at 80% for 2017 and 70% for 2016. It should also be noted that the Liquidity Coverage ratio is not an appropriate liquidity risk indicator for credit institutions that use the “Emergency Liquidity Assistance” (ELA) program for funding. In the following table it is presented the status of the four Greek systemic banks regarding their liquidity levels.

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>LCR</td>
<td>19.90%</td>
<td>17.02%</td>
<td>76.20%</td>
<td>54.04%</td>
<td>65.36%</td>
<td>47.92%</td>
<td>13.06%</td>
<td>8.22%</td>
</tr>
<tr>
<td>NSFR</td>
<td>20.96%</td>
<td>18.13%</td>
<td>83.67%</td>
<td>68.03%</td>
<td>60.60%</td>
<td>49.48%</td>
<td>15.26%</td>
<td>11.93%</td>
</tr>
</tbody>
</table>

Source: Data derived from Annual Reports of each bank, 2017 & from calculations of the author

As it can be observed from the table above the banks struggle to meet the requirements been set by the Basel III Accord regarding their liquidity, with only National Bank of Greece being quite close to the requirements as its NSFR ratio exceeds by 4% the limit, but for covering its short-term potential obligations, it falls behind the limit by 4%. Piraeus seems to face the greatest liquidity risk as its ratios are the lowest comparing to the other three banks.

Another important observation that derives from the above table is that all four banks have increased their liquidity reserves since the previous year (2016). This can be explained by the increase of the deposits since during the year and especially after the completion of the second evaluation of the Greek program in the summer of 2017 there was an improvement in the economic environment and the confidence in the Greek economy was restored. Furthermore, the banks sold the EFSF and ESM bonds that they had in their possession and deleverage assets from their portfolios, raised liquidity by issuing a new series of bonds and finally there was an increase in the repos transactions for all banks in covered bonds and treasury bills of the Greek government.
Conclusion

Banks face a series of major challenges for their further development, which are not depleted in dealing only with their non-performing loans (NPLs). These challenges are a key factor for the banks and in order to be dealt with successfully a political and financial stable environment is required.

Following the recapitalization of 2015, Greek banks have already won the "bet" of capital adequacy, which goes improving. According to what was presented in this thesis during the period 2016-2017, the Greek banks' capital adequacy ratio was strengthened as a result of their return to profitability and the reduction in their risk-weighted assets.

However, starting with capital adequacy, banks face major issues ahead, with priority being given to the consolidation of bank portfolios through a more effective response to the problem of non-performing loans.

In this respect, the banks achieved the targets set for September 2016 for the reduction of non-performing exposures on their balance sheets (€ 106 billion against the target of € 106.9 billion). The ultimate goal, however, of reducing the non-performing exposures to € 66.7 billion in December 2019, is coming forward in a fast pace under the close control of the SSM, with a peak in the period 2018-2019.

Solving the problem of NPLs is a prerequisite for the second challenge faced by banks: finding ways to restart the investment process and return to growth.

Beyond these two key challenges, Greek banks are also faced with a number of issues. These are in particular:

1. To continue the process of reducing their dependency on State funds regarding their capital and the Eurosystem regarding their liquidity until their full repayment.
2. The consistent implementation and application of the restructuring plan.
3. The increase in the rate of return of deposits, focusing on cash reserves in Greece that are outside the system, and on foreign deposits with negative returns.
4. The regulation of the issue of deferred tax assets, which are considered by the supervisory authorities and, in some cases, by the markets, as lower quality funds, as their recoverability is a function of the profitability of the banks.

5. The implementation of the International Accounting Standard IFRS 9, in 2018 that will replace the incurred loss model with the expected loss model, leading banks having higher provisions with any negative impact this entails for their capital adequacy.

6. The introduction of the "Minimum Requirement for Own Funds and Eligible Obligations", known as the MREL, which seeks to ensure that banks have adequate liabilities with the possibility of absorbing losses in case of resolution, in order to be able to face bank crises in the future, maintain banking stability and minimize the burden on taxpayers.

The new MREL requirement entails the need for banks to issue new eligible liabilities, mainly senior bonds, at a cost which banks should incorporate into their business model.

7. New technologies that will radically change the banking system, both in terms of providing services to bank customers and in relation with the introduction of new business models that will complement or, if necessary, substitute the traditional banking model.

8. The restoration of confidence in the Greek economy on the part of citizens, markets and the country’s partners.

9. The positive credit expansion, which, although is a necessary condition for sustainable economic growth, will follow and will not precede the economic recovery.

10. In the field of corporate governance, the changes in the shareholder structure of Greek banks, following the recent recapitalizations, with foreign institutional investors holding significant shareholdings, as well as the recent legal and supervisory changes, led to significant changes in the Boards of Directors and this is another challenge for the Greek banking system.
11. Finally, the further expansion of the shareholding base to private investors, in foreign portfolios but also in Greek, whose participation has declined significantly in recent years due to recapitalizations.

In the volatile economic environment of our time, in which our country makes small steps of recovery, it would be interesting to be investigated in future research whether and to what extent banks maintain the same levels of capital adequacy and in which way they manage the main risks they face.
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