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Credit Risk Management: An Examination on the Basis of Exposures with Risk Weighting in Greek Banks

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Abstract

Bank's exposure values are classified by categories on the basis of the borrower or the kind of credit. On every credit a risk weight is applied depending on the risk of the exposure value. The exposure value multiplied by risk weight determines the weighted asset of the bank. This amount determines the regulatory capital a bank needs since the total capital ratio of a bank is defined as the ratio of regulatory capital over the weighted asset. The paper examines the evolution and structure of the exposure values considering the risk weighting of the systemic Greek banks during the crisis period. Due to mergers and acquisitions, these banks cover more than 98% of the Greek banking market by the end of 2016. The paper offers an analysis on a consolidated basis but also through a comparative analysis investigates similarities and differences existing within those banks and during the crisis period. Thus the paper can conclude on the policy followed by banks during the crisis period.

Keywords

Credit Risk, Greek Banks, Exposure Values, Weighted Asset

1. Introduction

Credit risk is the main risk that a bank is subject to; other risks are country risk, foreign exchange risk, interest rate risk, market risk, operational risk, settlement risk, liquidity risk (Wael, 2016). Credit risk is defined as the potential risk that a bank's borrower or counterparty will fail to meet obligations in accordance to agreed terms and conditions. A bank's exposure values are classified in categories on the basis of the borrower or the kind of credit. A risk weight is applied to every credit depending on the risk of the exposure value. The exposure value multiplied by risk weight determines the total risk exposure amount. This

amount determines the regulatory capital a bank needs since the total capital ratio of a bank is defined as the ratio of regulatory capital over the total risk exposure amount.

In 1988, the Basel Committee, at the Bank of International Settlements, developed the framework regarding the bank's capital adequacy (BIS, 2015). The ratio between the capital and the bank's weighted assets is the minimum capital adequacy ratio (CAR) that has to be equal to 8%. A lower ratio would demand an increase of the bank's capital. The European Union implemented additional rules regarding the market risk for the banks. The need of better knowledge of risks undertaken by banks reinforced the creation of a new regulatory framework known as Basel II. It is divided into 3 pillars that are as follows (European Union, 2013): Pillar I, which defines the minimum regulatory capital requirement based on principles and rules that specify and measure the credit, market and operational risks; Pillar II, which designs the process in order to estimate the total capital adequacy related to all risks the bank can take through the Internal Capital Adequacy Assessment Process (ICAAP); Pillar III, which determines the disclosure requirements that permit market participants to have a good knowledge of risks undertaken by banks and therefore, the capital adequacy for banks, which depends on the weighted assets of the bank.

The application of Basel II requirements is enforced in Greece due to the financial and economic crisis.

This paper examines the evolution and structure of the weighted assets, expressed by exposure values, of the systemic Greek banks during the crisis period. These banks are Alpha Bank, Euro bank, the National Bank of Greece and Piraeus Bank. Due to mergers and acquisitions, these banks covered more than 98% of the Greek banking market by the end of 2015 (Hellenic Bank Association, 2015). This paper offers a comparative analysis investigating similarities and differences existing within those banks during the crisis period. Thus, the paper can draw conclusions about the banks' credit policy during crisis. After the introduction, Section 2 presents the exposure classes related to borrower categories and weighted risk; Section 3 discusses the methodology and data, while Section 4 offers the results before setting out the final conclusions.

2. Previous Results

While numerous papers have expressed interest in credit allocation and bank's behavior during crisis, no paper has examined the structure of the assets and its evolution during the crisis period by referring to exposures by risk weighting; these exposures determine the bank's weighted assets and therefore the minimum capital adequacy ratio.

Credit allocation related to crisis has been the object of several studies. Banks seem to follow a more speculative policy during an expansion period as opposed to a safer policy during and after the crisis. This is the conclusion of Assoumou Ella and Gauvin, 2015, which distinguishes three categories of assets: speculative assets, safe assets (not including government bonds), and productive assets,

(mainly loans to non financial corporation). Risk aversion explains this evolution. Gilles et al., 2013, arrive at the same conclusion; they concluded that during expansion phases, monetary policy can induce failure in credit activity and increase in financial instability; on the contrary, during recessions, banks tend to credit rationing and quality of credits. Authors suggest the necessity of cooperation between central banks and micro prudential supervision. Carvalho et al., 2015, concluded that, in a crisis period, bank distress results in the cutting of loans towards firms, especially those in the weakest financial position. Gauvin, 2014, concluded that in a crisis period, the less capitalized and less liquid banks display more cyclical behavior. The author suggests that banks favor risky assets in the upward phase and safe assets in the downward phase at the expense of productive credit. The author proposes regulation to stimulate the increase of capital and limit cuts on lending by the implementation of macro-prudential policy, as well as the inclusion of the shadow banking system. On the specific issue of non-performing loans, (NPL), European Banking Authority, (EBA), offers a report on the non-performing exposures in the EU banking sector covering a sample of 166 EU banks for a limited time period September 2014 to March 2016; the study shows a high dispersion of NPL with higher ratio for banks from countries that were obliged to a more significant economic adjustment process, (EBA, 2016).

Banks' liquidity and funding had been on the basis of other conclusions. Plosser, 2015, focusing on liquidity and funding sources of banks, concluded that business cycle affects capital allocation; in deteriorated conditions, loan allocation decrease while, on the contrary, liquid assets increase. Furthermore, banks with fewer funding sources and higher capital ratios are more sensitive to reducing loan allocations compared to other banks. Altunbas et al., 2011, interested in bank business models, conclude that bank size, undercapitalization and the degree of credit expansion during the pre-crisis period exacerbated the distress of banks during the financial crisis. Banks with a large deposit base suffered less than the others, depending on market funding. That is more evident for the risky banks. Authors also concluded that there was a need for more prudential regulatory initiatives via Basel III, raising the core capital levels of banking institutions, especially to those undercapitalized.

Sovereign debt has been the object of numerous studies due to the crisis period. Altavilla et al., 2016, using data for 226 banks euro-area the period 2007-2015 concluded that in vulnerable countries the public owned banks and the less capitalized banks increased their domestic sovereign holdings more than other banks; their exposures amplified the transmission of risk on lending. Nielsen, 2016, mentioned the recent objective to the reduction of domestic sovereign exposure of banks. He noticed that this objective undermines other issues more important according to him as the banking governance and trust. Kirschenmann et al., 2016, interested on the portfolio of sovereign exposures of banks, they notice the risk banks undertake, even in safer countries, because of their exposures to non-domestic sovereign debt; they also notice the funding costs because of

implicit bailout assumptions.

On an institutional level two studies interested on the implementation of the regulatory framework. Reynolds, 2013, offers an interesting comparison on the divergences and similarities existing on the rules implementing the Basell III regulation in the United Sates and the European Union. Issues examined in particular are related to capital requirements and the asset risk weightings. Authors conclude that rules particular on liquidity and leverage will influence the relative competitiveness of US and EU financial institutions. Mansilla-Fernández, 2016, focusing on the institutional issue examined the integration of Basel framework and capital requirement to the national legislation in the case of USA, UK, Sweden and Japan.

Governance played an important role during crisis and credit allocation. Beltratti and Stulz, 2009, interested in the relation of governance, regulation and balance sheet characteristics before the crisis, concluded that banks from countries with more restrictions on bank activities, with stronger capital supervision and more liquid assets, performed better during crisis. Aebi et al., 2012, also interested in governance during crisis, conclude that, during financial crisis, banks perform significantly better when the reporting of the chief risk office goes directly to board of directors and does not pass through the CEO, because of conflicting interests that may exist between them. Creel et al., 2015, conclude that monitoring bank credits, as for example capital adequacy ratios, would alleviate the risk of bank instability. They suggest that any supervision of bank credits in the EU periphery, within the bank union, should be complemented by macroeconomic policies for low and stable inflation and interest rates.

Akins et al., 2016, focusing on market competition, found that banks with greater competition earn lower interest margins; they have lower profitability, cash holdings and Tier 1 capital than the others; they also make investments with lower risk. These banks are less likely to be targeted for regulatory enforcement and are less likely to fail.

3. Exposure for a Bank

Exposures can be examined under two parameters: the structure of credit allocations and the risk weighting, applied to every exposure that depends on the rating assigned. Procedures for the regulation are set out in the mandatory statutory framework of Law 3016/2002, Law 4261/2014, (Hellenic Republic, 2014), Bank of Greece Governor's Directive No 2577/9.3.2006, Capital Market Commission Resolution No 5/204/14.11.2000 (see: Piraeus Bank, 2015) and European Parliament and the Council regulation on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012 (European Parliament and Council, 2013). Four main risk weight categories are considered: 100% if the asset item is full, 50% if it is a medium risk, 20% if it is a medium/low risk, 0% if it is a low risk item (European Parliament and Council, 2013). Within them some other categories exist that are 35%, 75% and 150% and more.

Each exposure is assigned to one of the following exposure classes. Every class has some main credit risk adjustment but not limited to them. Every adjustment depends on the specific asset item. Below, the main risk adjustments by exposure class are presented.

3.1. Exposures to Central Governments and Central Banks

Exposures to European Central Bank (ECB) and exposures to member states' central government and central banks denominated in the domestic currency of that central government and central bank are assigned with a risk weight of 0%. Exposures to other central bank and central government have a risk weight of 100%, (European Parliament and European Council, 2013). Other risk weights are assigned also to this class exposure according to quality of asset item. In total, six quality steps are assigned; they have the follows risk weights 0%, 20%, 50%, 100% and 15%, (European Parliament and European Council, 2013, article 114).

3.2. Regional Governments and Local Authorities

These exposures that are denominated and funded in the domestic currency of that regional and local authority have a risk weight of 20%. In all other case different risk weights are applied, (European Parliament and European Council, 2013, article 115).

3.3. Public Sector Entities

To the exposures with an original maturity of maximum three months, the risk weight is 20%. For exposure to public sector entities, incorporated in countries where the central government is unrated, the risk weight is 100%. In total six credit quality steps are described; they have, respectively, the risk weights of 0%, 20%, 50%, 100% and 15%, (European Parliament and European Council, 2013, article 116).

3.4. Institutions

Exposures to institutions are assigned with a minimum risk weight of 20%. Institutions are classified also to rated institutions and unrated institutions. Different quality steps are applied receiving risk weight of 20%, 50%, 100%, 150%, (European Parliament and European Council, 2013, articles 119, 120 and 121).

3.5. Multilateral Development Banks

Fourteen multilateral banks are considered as no risk and exposures to them are assigned with 0% risk weight, (European Parliament and European Council, 2013, article 117). Exposures to other multilateral banks are treated in the same manner as exposures to institutions.

3.6. International Organizations

Exposures to European Union, International Monetary Fund, Bank for International Settlements, European Financial Stability Facility, European Stability Me-

chanism and international financial institutions established by two or more EU member states to finance its members in difficulty are assigned to 0% risk.

3.7. Corporate Customers

Two classes are distinguished. In the first case, exposures are assessed by a nominated External Credit Assessment Institution (ECAI); in this case several steps of credit quality exist having respectively the risk weights of 20%, 50%, 100% and 150%, (European Parliament and European Council, 2013, article 122). In the second case exposures are not assessed by a nominated ECAI and as a consequence the 100% risk weight is assigned.

3.8. Retail Customers

Exposures are assigned a risk weight of 75% (European Parliament and European Council, 2013, article 123).

3.9. Loans Secured by Mortgages on Immovable Property

Two main distinctions exist, those for residential property and those secured by commercial immovable property. In the case of residential property a 35% risk weight is assigned under condition that the exposure does not exceed the 80% of the market value of the property or the 80% of the mortgage lending value of this property. In the case of commercial immovable property a 50% risk weight is assigned under condition that the exposure does not exceed the 50% of the market value of the property or the 60% of the mortgage lending value of this property, (European Parliament and European Council, 2013, articles 124, 125, 126).

3.10. Exposures in Default

If specific credit risk adjustments are less than 20% of the unsecured part of the exposure value, a 150% risk weight is applied; if these adjustments are at least 20% a 100% risk weight is applied, (European Parliament and European Council, 2013, articles 127).

3.11. Items Associated with Particularly High Risk

Several risk weight are applied depending the risk considered; a 150% risk weight is applied in the most of cases, (European Parliament and European Council, 2013, articles 128).

3.12. Covered Bonds

Exposures on this class are distinguished between these having the credit assessment of a nominated ECAI and those who don't have it. In both cases several credit equity steps are considered with risk weight of 10%, 20%, 50% and 100% (European Parliament and European Council, 2013, articles 129).

3.13. Equity Exposures

Equity exposures are considered non-dept exposures conveying a subordinated,

residual claim on the assets or income of the issuer, or debt exposures and other securities having the same economic substance. Equity exposures are assigned mainly with 100% risk weight and in some cases a 250% risk (European Parliament and European Council, 2013, articles 133).

3.14. Other Items

Several risk weight are applied in accordance to asset item. Tangible assets are assigned with 100% risk weight, cash items in the process of collections are assigned with 20% risk weight while cash in hand and equivalent and gold bullion held in own vaults are assigned with 0% risk weight, (European Parliament and European Council, 2013, articles 134).

4. Methodology and Data

Elements of every class exposure are assigned by a risk weight. As a consequence new classes of exposures result; these classes are no more designed according to the object of exposures or client; they are designed according to the risk weight. We call them Risk Weighted Exposures (RWE). These RWE are the follows regardless the exposure class they belong: RWE 0%, RWE 20%, RWE 35%, RWE 50%, RWE 75%, RWE 100%, RWE 150% and plus. Thus we have for every RWE an amount. If we add the amounts included to every RWE we obtain the total exposures of the bank. It is the same total considering the class exposures described in the previous paragraph.

In our investigation we are interested in the importance of every RWE to the total of bank's exposures. For example, which is the ratio of 0% RWC to the total of exposures of the bank, in a given year? Thus we can have a picture of the risk undertaken for every bank and its comportment during the examined period.

If we multiply every RWE (ex. 0%, 20%..), with its ratio on total exposures of the bank and we add every separate result, we obtain the ratio of the weighted asset to the real asset of the bank (WA/RA). For example: if we consider that the ratio of 0% of RWE to total exposures is 40%, this of 20% is 8%, this of 35% is 10%, this of 50% is 5%, this of 75% is 11%, this of 100% is 29% and this of 150% is 2% we obtain the follow ratio of Weighted Asset to Real Asset: [(0% * 42%) + 20% * 8%) + (35% * 10%) + (50% * 5%) + (75% * 11%) + (100% * 29%) + (150% * 2%)] = 48.3%. The weighted asset is then 48,3% of the real asset. This ratio determines the amount of weighted asset, the denominator of the capital adequacy ratio. For a real asset of 100 million Euros (Meuros), 48.3 Meuros will be considered to be the Risk Weighted Asset, the denominator of the capital adequacy ratio. Considering a capital ratio of 8%, the needed capital will be of 3.86 Meuros; this is the result of 48.3 Meuros multiplied by 8%. If the ratio WA/RA is 55% for the same real asset, (100 Meuos), the amount of the weighted asset will be of 55 Meuros and the needed minimum capital will be of 4.4 Meuros.

On a next step, we are interested in the evolution of the risk weighted exposures to the total exposures of the bank during the examined period; whether exposures with less risk take a bigger ratio to the total exposures against expo-

sures with more risk or the contrary. This may be the result of the bank's policy or the consequence financial and economic crisis or both.

The investigation was considered on two levels: on a consolidated basis and every bank separately. On the consolidated level, we considered the average, not the total, because we did not have data for all banks for all the years. In particular, data for the National Bank of Greece are available only for years 2011, 2012 and 2013.

The time period examined is from 2010 to 2015. This period is the core period of the Greek crisis after the memorandum of understanding that Greece signed with its lenders.

The data result from the author's calculations and are provided by annual reports on capital adequacy and risk management regulatory disclosures according to Pillar III of the following banks: Alpha Bank, Eurobank, the National Bank of Greece and Piraeus Bank

5. Results

On a consolidated basis, we observe that exposures with 0% weighting risk constitute 35% of the total exposures, on average, during the examined period; they are followed by those with 100%, 75% and 35% risk weighting, (having respectively, 29%, 12% and 9% of the total exposures), **Table 1**. We can say that Greek banks concentrated their loans on financing the Greek public debt and deficit, buying Greek government bonds and treasury bills. We observe the growth of the importance of the 100% risk weighting; their part to total exposures pass from 25% in 2011 to 38% in 2015; these exposures are mainly corporate loans, including exposures in default.

Contrary to the above categories, loans of 75% weighting risk, mainly retail loans, present a considerable decrease, from 17% on 2012 to 7% in 2015, **Table 1**, as a result of the restriction of such loans during the last years of the examined period.

Table 1. Ratio of exposures by risk weighting to the total exposures: average of consolidated exposures (%).

Risk Weighting class	2010	2011	2012	2013	2014	2015	Average 2010/15
0%	36%	35%	37%	35%	35%	32%	35%
20%	6%	5%	3%	6%	7%	4%	5%
35%	19%	6%	8%	9%	10%	11%	9%
50%	6%	7%	7%	7%	5%	5%	6%
75%	10%	18%	17%	13%	8%	7%	12%
100%	30%	25%	25%	27%	30%	38%	29%
150%	3%	3%	4%	3%	5%	4%	4%
Total	100%	100%	100%	100%	100%	100%	100%

Source: Author's calculations, Alpha Bank: 2011, 2012, 2013, 2014, 2015, 2016; Eurobank: 2011, 2012, 2013, 2014, 2015, 2016; the National Bank of Greece: 2011, 2012, 2013, 2014, 2015, 2016; Piraeus Bank: 2011, 2012, 2013, 2014, 2015, 2016.

If we consider the ratio of the risk weighted assets (WA) to the real assets (RA), we observe that the consolidated WA is about half the RA (51%) on average during the examined period, **Table 2**; during this period, it grew, increasing from 48.9% in 2010 to 55.5% in 2015. The average does not characterize every bank separately. Two banks, Alpha Bank and Piraeus Bank presented the higher ratio throughout the examined period, with the average of the period being 62.3% and 61.9% respectively. A different evolution is observed between the two banks characterized by a decrease in the ratio, during the last two years in the case of Piraeus Bank, contrary to an increase in the case of Alpha Bank, during the last three years. Eurobank presented the lowest ratio WA/RA, 28.1% on average during the examined period while for the National Bank of Greece, the WA/RA ratio was 49.5% on average for the period of 2011-2013, **Table 2**.

As a consequence, for 100 M Euros real asset, Eurobank's weighted asset is only 28 M Euros; for the capital adequacy ratio of 8%, Eurobank's minimum capital should be of 2.24 M Euros (28 Meuros multiplied by 8%) in order to accomplish the minimum capital adequacy ratio. If we consider the ratio of the consolidated average of the examined period, (51%), for 100 M Euros real asset the weighted ratio is 51 M Euros and consequently, the capital needed to accomplish capital adequacy is 4.1 Meuros, (51 Meuros multiplied by 8%).

As it appears in **Table 3**, on a consolidated basis, the evolution of the ratio WA/RA is influenced by the relative growth of exposures with 100% risk weighting during the years 2013-2015, contrary to the decrease of exposures with 75% risk weighting related mainly to retail banking.

Table 2. Ratio of weighted assets to real asset: four systemic banks, (%).

	2010	2011	2012	2013	2014	2015	Average 2010/15
Average Consolidated (*)	48.9%	47.3%	49.8%	49.6%	50.9%	55.5%	50.8%
Alpha Bank	63.0%	62.2%	56.9%	61.1%	63.7%	67.1%	62.3%
Eurobank	29.4%	28.4%	25.2%	25.1%	25.2%	35.6%	28.1%
Piraeus Bank	60.7%	64.8%	61.7%	63.7%	61.8%	58.9%	61.9%
NBG	n.a	50.4%	51.8%	46.2%	n.a	n.a	49.5%

(*) National bank of Greece, only years 2011, 2012, 2013; Source: Idem **Table 1**.

Table 3. Part of weighted assets to real asset: average of consolidated asset, (%).

Weighted class	2010	2011	2012	2013	2014	2015	Average 2010/15
0%	0%	0%	0%	0%	0%	0%	0%
20%	1%	1%	1%	1%	1%	1%	1%
35%	3%	2%	3%	3%	4%	4%	3%
50%	3%	4%	4%	4%	3%	3%	3%
75%	8%	13%	12%	9%	6%	5%	9%
100%	30%	25%	25%	27%	30%	38%	29%
150%	4%	5%	5%	5%	7%	5%	5%
Total	48.9%	50.2%	49.8%	49.6%	50.9%	55.5%	51%

Source: Idem **Table 1**.

A main question is whether the evolution on a consolidated basis reflects the evolution for every bank separately or, on the contrary, differences appear A. between banks, B. during the examined period within the same bank. Further, a main issue could be the reasons for the evolution and to what extent these reasons are the same for all banks.

A. Importance of risk weighting exposures: a comparison between banks and the consolidated average **Table 4** presents the exposures by risk weighting considering the consolidated average and those of every bank; the same table presents the differences between the consolidated average and that for every bank. It shows a concentration of banks' exposures on 0% and 100% risk weighting. Considerable differences appear between banks, in some cases showing a different credit policy during the crisis period.

Eurobank follows a low risk policy because 57% of total exposures is placed at 0% risk and 13% of exposures is placed at 20% risk. Together, these two categories of exposures are 30 units higher than those in the consolidated average, **Table 4**. On the other hand, Alpha Bank and Piraeus Bank have exposures 100% of risk weighting, which represent 40% and 37% respectively of the total exposures, which is 11 and 8 units higher than the consolidated average. The National Bank of Greece presents an image quite similar to that of the consolidated, as regards the low risk class (0% and 20%), but quite different to the medium and high risk classes. The bank's exposures to 75% risk weighting, reflecting the retail banking, represent 30% of the bank's exposures, which is 18 units higher compared to the consolidated average. On the other hand, exposures with 100% risk represent only 19% of the total exposures, which is 10 units lower than the consolidated average, **Table 4**.

During the examined period non-homogenous comportment appeared between banks. Two of them concentrate more exposures to high risk, one concentrates more exposures to low risk and another has a more balanced comportment.

B. Evolution during the crisis period

Table 4. Exposures by risk weighting and difference to consolidated average, (average of the period 2010-2015 (*)).

	Exposures by risk weighting (%)					Difference to consolidated average			
Weighted class	Consolidated	Alpha Bank	Eurobank	NBG	Piraeus bank	Alpha Bank	Eurobank	NBG	Piraeus Bank
0%	35%	23%	57%	36%	25%	−12	22	1	−10
20%	5%	2%	13%	4%	2%	−3	8	−1	−3
35%	9%	13%	5%	4%	10%	4	−4	−5	1
50%	6%	9%	3%	5%	10%	3	−3	−1	4
75%	12%	10%	6%	30%	10%	−2	−6	18	−2
100%	29%	40%	16%	19%	37%	11	−13	−10	8
150%	4%	4%	2%	2%	6%	0	−2	−2	2

(*) National Bank of Greece (NBG): period 2011-2013; Source: Idem **Table 1**.

On the basis of every bank, two parameters are examined: 1. Importance of exposures by risk weighting and 2. Importance of exposures by asset category.

These parameters are examined as part of the bank's total exposures. The differences in the evolution of the first parameter can be explained by the evolution of the second parameter. This explanation can indicate the bank's policy during the crisis period in Greece.

In the case of Alpha Bank, we observe movements from exposures of no risk or medium risk, especially 50%, to high risk exposures, (mainly of 100%), **Table 5**, due to the growth of exposures in default and the fall of exposures to central governments and central bank with 0% risk.

This indicates a change in the bank's policy by decreasing loans with no risk, (government bonds mainly), **Table 6**. In the same period, the bank suffers from the consequences of the crisis in the economy, especially through the non-paid loans, registered as exposures in default, which increased considerably during the examined period, especially in 2014 and 2015, **Table 6**.

Table 5. Part of weighted class on total exposure: Alpha Bank Greece, (%).

Weighted class	2010	2011	2012	2013	2014	2015	Average 2010/15
0%	23%	22%	28%	23%	22%	20%	23%
20%	2%	1%	3%	2%	4%	1%	2%
35%	13%	14%	13%	13%	12%	12%	13%
50%	6%	10%	11%	13%	7%	6%	9%
75%	14%	11%	8%	8%	10%	9%	10%
100%	40%	39%	34%	38%	38%	48%	40%
150%	4%	4%	4%	4%	6%	4%	4%
Total	100%	100%	100%	100%	100%	100%	100%

Source: Author's calculations, Alpha Bank, 2011, 2012, 2013, 2014, 2015, 2016.

Table 6. Part of asset categories on total exposure: Alpha Bank, (%).

Asset category	2010	2011	2012	2013	2014	2015
Central Governments or central banks, Regional governments or local authorities	20%	19%	20%	14%	15%	17%
Financial Institutions	4%	3%	6%	3%	5%	2%
International organizations	0%	0%	0%	0%	0%	6%
Corporate	31%	28%	22%	22%	16%	16%
Retail	14%	11%	8%	8%	10%	9%
Secured mortgages on immovable property	17%	20%	19%	19%	19%	18%
Equity exposures	0%	0%	0%	0%	0%	0%
Claims on CIU	0%	0%	0%	0%	0%	0%
Exposures in Default	0%	6%	9%	14%	22%	24%
Other items	14%	12%	16%	20%	13%	8%
Total	100%	100%	100%	100%	100%	100%

Source: Idem **Table 5**.

More than any other bank, Eurobank based its placements on exposures with very limited or zero risk. During the examined period, these exposures decrease and for the first time, in 2015, exposures with 0% risk are less than 50% of the total, **Table 7**. This fall results from the continuous decrease of loans to central government and central bank, **Table 8**. On the other hand, the bank developed its policy with loans to other financial institutions characterized by 20% risk weighting. A similar evolution is observed for high risk weighting loans, which fell in the period 2012-2014, due to the fall of corporate loans of the bank, with the exception of 2015, (Eurobank, 2015).

Table 7. Part of weighted class on total exposure: Eurobank, (%).

Weighted class	2010	2011	2012	2013	2014	2015	Average 2010/15
0%	54%	59%	65%	56%	56%	49%	57%
20%	12%	11%	7%	16%	18%	12%	13%
35%	6%	3%	2%	7%	5%	7%	5%
50%	3%	3%	4%	2%	2%	2%	3%
75%	8%	5%	5%	5%	6%	6%	6%
100%	16%	18%	16%	13%	11%	21%	16%
150%	1%	1%	1%	1%	2%	3%	2%
Total	100%	100%	100%	100%	100%	100%	100%

Source: Author's calculations, Eurobank, 2011, 2012, 2013, 2014, 2015, 2016.

Table 8. Part of asset categories on total exposure: Eurobank, (%).

Asset category	2010	2011	2012	2013	2014	2015
Central Governments or central banks,	53%	55%	49%	35%	37%	34%
Regional governments or local authorities	0%	0%	0%	0%	0%	0%
Financial Institutions	13%	16%	12%	17%	20%	14%
International organizations	0%	0%	9%	13%	14%	18%
Corporate	9%	9%	7%	5%	5%	6%
Retail	8%	5%	5%	5%	6%	6%
Secured mortgages on immovable property	7%	4%	3%	7%	6%	8%
Multilateral Development banks	0%	0%	1%	1%	1%	1%
Covered bonds	0%	0%	0%	0%	0%	0%
Public entities	3%	0%	1%	2%	1%	0%
Claims on CIU	0%	0%	0%	0%	0%	0%
Exposures in Default	1%	1%	2%	2%	2%	3%
Other items	4%	7%	10%	10%	6%	8%
High risk exposures	1%	1%	1%	1%	2%	2%
Total	100%	100%	100%	100%	100%	100%

Source: Idem **Table 7**.

During the examined period, Eurobank remains a bank focusing on non-risk placements, especially of zero risk, despite their relative fall during the examined period.

In the case of Piraeus Bank, the evolution is characterized by a simultaneous growth in the ratio of high risk exposures, (100% risk weighting), and limited risk (0% weighting risk and 35% weighting risk), **Table 9**. This evolution is reflected in the first case by the growth of the exposures in default and in the second case by the growth of loans of zero risk to other financial institutions and central governments or central banks, (Piraeus Bank, 2012, 2013, 2014 and 2015), as well as to international organizations, **Table 10**.

On the contrary, since 2013, a fall in the part of medium risk exposures (of 50% and 75% risk weighting) is observed, which is related to the decrease of corporate and retail loans, **Table 10**.

Table 9. Part of weighted class on total exposure: Piraeus Bank of Greece, (%).

Weighted class	2010	2011	2012	2013	2014	2015	Average 2010/15
0%	25%	21%	24%	24%	27%	29%	25%
20%	3%	5%	2%	1%	1%	2%	2%
35%	8%	6%	12%	12%	12%	12%	10%
50%	12%	15%	9%	9%	7%	7%	10%
75%	9%	12%	11%	11%	8%	6%	10%
100%	37%	35%	34%	36%	39%	41%	37%
150%	5%	7%	6%	7%	6%	4%	6%
Total	100%	100%	100%	100%	100%	100%	100%

Source: Author's calculations, Piraeus Bank, 2011, 2012, 2013, 2014, 2015, 2016.

Table 10. Part of asset categories on total exposure: Piraeus Bank of Greece, (%).

Asset category	2010	2011	2012	2013	2014	2015
Central Governments or central banks,	24%	16%	12%	7%	9%	12%
Regional governments or local authorities	0%	0%	0%	0%	0%	0%
Financial Institutions	4%	3%	3%	2%	2%	2%
International organizations	0%	0%	9%	15%	17%	20%
Corporate	31%	28%	20%	20%	12%	10%
Retail	9%	12%	11%	11%	6%	4%
Secured mortgages on immovable property	15%	17%	20%	17%	23%	21%
Public entities	1%	0%	0%	0%	0%	0%
Claims on CIU	0%	0%	0%	0%	0%	0%
Exposures in Default	3%	7%	11%	17%	23%	22%
Other items	10%	14%	10%	7%	8%	8%
High risk exposures	2%	2%	3%	4%	0%	0%
Total	100%	100%	100%	100%	100%	100%

Source: Idem **Table 9**.

The structure of placements of the bank seems closer to that of Alpha Bank. The bank's policy seems oriented to less risky placements, especially those of zero risk, during the crisis period. On the other hand, the bank suffers as a result of the non-paid loans, which have a notable growth during the crisis.

In the case of the National Bank of Greece, data on risk weighting exposures are limited to the period 2011-2013, while they are extended to the period 2011-2015 on exposures by asset category. No significant changes are observed in the bank's credit policy with two exceptions; the decrease of medium risk exposures, (with 75% risk weighting), especially in 2013, **Table 11**, related to the decrease of retail loans, **Table 12**, and the growth of high risk exposures, (with 100% weighting risk), influenced by the growth of corporate loans.

Table 11. Part of weighted class on total exposure: National Bank of Greece, (%).

Weighted class	2010	2011	2012	2013	2014	2015	Average 2011/13
0%	n.a	35%	34%	39%	n.a	n.a	36%
20%	n.a	3%	2%	6%	n.a	n.a	4%
35%	n.a	4%	4%	4%	n.a	n.a	4%
50%	n.a	6%	5%	5%	n.a	n.a	5%
75%	n.a	33%	32%	24%	25%	25%	30%
100%	n.a	17%	19%	21%	n.a	n.a	19%
150%	n.a	3%	3%	1%	n.a	n.a	2%
Total		100%	100%	100%			100%

Source: Author's calculations, National Bank of Greece, 2011, 2012, 2013, 2014, 2015, 2016.

Table 12. Part of asset categories on total exposure: National Bank of Greece, (%).

Asset category	2010	2011	2012	2013		2014	2015
Central Governments or central banks,			32%	22%	25%	19%	25%
Regional governments or local authorities			1%	1%	1%	1%	1%
Financial Institutions			8%	5%	8%	9%	5%
International organizations			0%	10%	10%	10%	13%
Corporate			9%	10%	12%	13%	14%
Retail			32%	32%	24%	25%	25%
Secured mortgages on immovable property			7%	7%	7%	7%	8%
Multilateral Development banks			0%	0%	0%	0%	0%
Covered bonds			0%	0%	0%	0%	0%
Public entities			0%	0%	0%	0%	0%
Claims on CIU			0%	0%	0%	0%	0%
Exposures in Default			4%	5%	4%	4%	4%
Other items + Equities			6%	6%	8%	11%	6%
High risk exposures			1%	2%	1%	0%	0%
Total			100%	100%	100%	100%	100%

Source: Idem. **Table 11**.

6. Conclusions

Financial crisis has accentuated the process of the risk management strategies and the regulatory disclosures according to Basel II requirements. Greek banks face serious problems related to the economic crisis that have arisen due to the exposure in default and the items of high risk not being guaranteed. This paper aimed to examine the structure of exposures according to the risk weighting on a consolidated basis and for every bank separately. It also aimed to define whether the evolution of this structure indicates a different credit policy during the crisis. The paper was based on the four systemic banks that concentrate more than 98% of the assets of the Greek banking market.

The banks' placements are oriented mainly to exposures with 0% and 100% risk weighting. The first case is related to exposures to Central Government and Central banks while the second is mainly related to corporate customers not guaranteed by mortgages or any other guarantee. The exposures influence the need for capital. In the first case, the amount corresponding to 0% risk weighting is not calculated at the denominator of the capital adequacy ratio; this makes the ratio higher and therefore reduces the need for capital. In the second case, however, the whole amount is calculated to the denominator of the ratio; as a consequence, the capital adequacy ratio is lower; this can create the need for additional capital for the bank. One can observe, nevertheless, that in the case of haircut of Greek bonds, banks suffered losses that influenced their results and therefore their capital, which decreased. As a consequence, the capital adequacy ratio becomes lower because of the smaller nominator.

Two banks, Eurobank and the National Bank of Greece, followed a credit policy with no serious risk, based on zero or low risk placements, such as government bonds and treasury bills. On the other hand, Alpha Bank and Piraeus Bank followed a riskier credit policy, based on corporate and retail customers' placements.

During the period under review, a mixed picture emerges. On a consolidated basis, it shows a relative increase in the importance of high-risk exposures (100% and 150% of weighted risk), which is the influence of the non-paid loans. As a consequences of the recession of Greek economy, the non-paid loans (NPL) ratio was 44.2% by the end of 2015 in Greece, (Bank of Greece, 2016), while it was only 5.7%, as an average, on March 2016 for EU banks, (EBA, 2016).

A clearer observation concerns the decline of the importance of retail loans (75% weighting) during this period. By the end of the period, a fall in mortgage loans (50% weighting) also occurs. It has to be noticed that high NPL ratio affected those loans as well; it was 55.2% by the end of 2015 for retail loans, 44.6% for corporate loans and 44.2% for mortgage (Bank of Greece, 2016). After 2012, a remarkable drop in the openings section with 0% risk weight is displayed, as a result of the Greek banks' decision to accept a haircut of Greek bonds known as Private Sector Involvement, (PSI). Losses from PSI had severe results on the banks' capital adequacy that was dealt with the first recapitalization of banks; the increased provisions because of the growth on NPL resulted on two more reca-

pitalizations of banks (Bank of Greece, 2016). The decline in loans to government bonds, but also the problem of non-paid loans, characterizes the evolution of the policy of the two banks, Alpha Bank and Piraeus Bank, during the period. Eurobank remains a bank focusing on non-risk placements, especially risk-free, despite the decrease in the importance of these exposures. No significant changes are observed in the case of the policies of the National Bank of Greece, although the bank is suffering from the decline in retail loans and the development of risk exposures.

These findings differentiate our conclusions than those found by other authors because, in the case of Greek banks, we introduce the effect on the weighted assets. We have concentrated with higher resolution on the structure of the loans and their impact, but also on the policy of the banks during the crisis. This study was limited to one country's case and therefore the development of researches that are based on other countries could offer interesting comparisons on banking policy during a period of crisis.

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