Risk Management after Mergers and Acquisitions. Evidence from the Greek Banking System

Dr. Kyriazopoulos Georgios[1], Dr. Drympetas Evaggelos[2] and Kollias Konstantinos[3]

Abstract

The purpose of this paper is to reflect as fully as possible the concept of banking risk and how it was formed after the mergers and acquisitions, domestic or cross-border, in Greek Systemic Banks since the Global Financial Crisis came to Greece. Risk assessment is a particularly important and difficult process, used by banks and businesses to improve the final performance of their project and ensure its success, avoiding unpleasant situations for their operation. The banking sector, which is one of the dominant branches of the economy in the modern reality, has undergone drastic changes and rearrangements in recent decades. The rapid evolution of technology, the internationalization of markets and the liberalization of capital have created a highly competitive and uncertain climate, as evidenced by the recent global financial crisis. Its risk and management, following the recent financial crisis that directly affected the banking sector, is one of the key concerns of the industry. For this reason, in recent years various methods and decisions have been developed, the most important of which are the rules of the Basel Committee III. In this paper we present VaR method in portfolio of four Greek systemic banks during 2010-2017.

---

[1] Assistant Professor, Department of Accounting and Finance, University of Western Macedonia, Koila-Kozani, Greece, Vice President of International Conference of Development and Economy (I.CO.D.ECON). Correspondent Author.
[2] Professor Dean of Department of Economics, Democritus University of Thrace, Komotini, Greece.
[3] President of the Greek Economic Chamber, Athens, Greece.

1. Introduction

The concepts of risk and its management in firms and banks have been a huge area of economic science research, which has been increasingly employed by scientists in recent years. Risk is an unforeseen fact that we do not know if and when it will occur and what its consequences will be. Risk management can be applied in many sectors of industry, commerce, service companies and financial companies. Banks play a very important role in the economy. They are in fact the intermediary between surplus and deficit counterparties. In the late 1970s and early 1980s and as the internationalization of the financial system progressed rapidly, there was a need to introduce new methods to hedge risk in the industry.

The complete liberalization of the financial system and the huge diversification of investment and banking products have dramatically increased the risks in the financial sector. (Barth et al., 2004).

Risk management has now become an important and critical issue for commercial, investment and co-operative banks. The lack of rational risk forecasts and appropriate risk management methods and decisions (credit or market) have been a key factor for all financial disasters in the past years. The risks faced by financial institutions are mainly related to the credit risk arising from the possible loss of payment of the financial products issued to the defective entities.

For a good and efficient long-term path, banks should first identify the different types of banking risks and then look for ways to deal with them. (Bessis, 2003).

Banking risks are the challenges a bank faces and are usually used to determine losses from various sources of uncertainty. The key to addressing and limiting the impact of risks on the banking sector is to find the source of uncertainty and the magnitude of the potential adverse impact on profitability. Each risk requires a different approach, so a clear definition helps better quantify and manage them. Therefore, the risk management techniques used by the commercial banking sector are based on the list of risks that the banking industry has chosen to manage and on how the process of managing them is applied in each region.[4]

The purpose of risk management is to avoid losses on investment, but above all, to avoid volatility in the financial sector. In order for risk management to be effective, it is necessary to forecast, identify, evaluate, measure and then appropriately eliminate or diversify so that financial institutions do not face bankruptcy. Through risk management, banking organizations approach and make rational decisions to deal with the risks associated with their operating activities. The purpose of risk management is to classify by height and category of risk all debts owed to the bank and to predict the possible threats of all factors that may adversely affect a banking

---

[4] Noulas A., (2019). "Financial Management Investment and Financing Decisions". Tziolas Publishing Athens, Greece.

organization. Risk management is a very important part of banking, as without it the bank is unlikely to succeed in its long-term profitable strategy, which will render it insolvent.

This paper examines the course of credit risk of the four systemic Greek banks by the method VaR after all the mergers and acquisitions (domestic or cross-border) that have taken place since the global financial crisis came in Greece. We can see if and how these domestic mergers and acquisitions helped reduce the credit risk of four Greek systemic banks.

2. Literature Review

Risk management has increased over the last three decades due to the increased demand for such services and the increased availability of financial tools available for this purpose. Two factors have contributed to this: (i) the highly changing international exchange rate system and (ii) the increasing internationalization of trade.

The combination of the probability of an event and its consequences can be defined as a risk. In particular, the financial risk to a banking organization is the probability that the outcome of an action could have an adverse effect on profitability. This could either lead to immediate loss of revenue / capital or may lead to difficulties in the bank's ability to achieve its goals. Such difficulties increase the bank's chances of being unable to manage its current business operations or seizing opportunities to enhance its operations.[5]

The main risks that the financial institutions face are interest rate risk, market risk, credit risk, off-balance sheet risk, foreign exchange risk, country or territory risk, operational and technological risk, liquidity risk and insolvency or capital adequacy risk. Some of them are also concern the big firms of any Stock Market. Obviously the credit risk is one of the main risk. Credit risk is the risk that arise when borrowers' debts are not paid in full in the financial institutions as it must be. Another significant risk is liquidity risk. Occurs when a financial institution has to borrow or sell assets in a short period of time. It can cause massive withdrawals of deposits. Mass withdrawals can turn a liquidity problem into an insolvency problem. Another important risk is insolvency risk that extract when a financial institution has insufficient funds to offset an unforeseen decrease in the value of assets relative to liabilities.[6]

Banks often classify the risks associated with banking risks into expected or traditional and unexpected or non-traditional. Expected / traditional losses are those that the bank is confident that will occur and result from the core functions of the banks (eg expected loan default rate). Unexpected / non-traditional losses are those associated with unforeseen events arising from developments in the domestic or international banking environment (eg new ones adjustments, losses due to a sudden shift in the economy or a fall in interest rates). Banks usually use their funds to deal

---

[5] ISO / IEC Guide 73 https://www.iso.org/standard/44651.html
[6] www.bis.org

with these types of losses.

2.1   Value at risk (VaR)

VaR is a statistic that measures and quantifies the level of financial risk within a firm, portfolio or position over a specific time frame. This metric is most commonly used by investment and commercial banks to determine the extent and occurrence ratio of potential losses in their institutional portfolios.[7]

Value at Risk-VaR is the estimate of the maximum potential loss on a portfolio's net present value, which may occur with a predetermined probability (confidence level) within a given time period. This method is considered to produce satisfactory results in cases where there are no significant non-linear risk factors, such as in cases where the portfolio contains significant options in options. (Jorion P., 2007). The figure 1 below represents schematically the distribution of possible outcomes of a stochastic process.
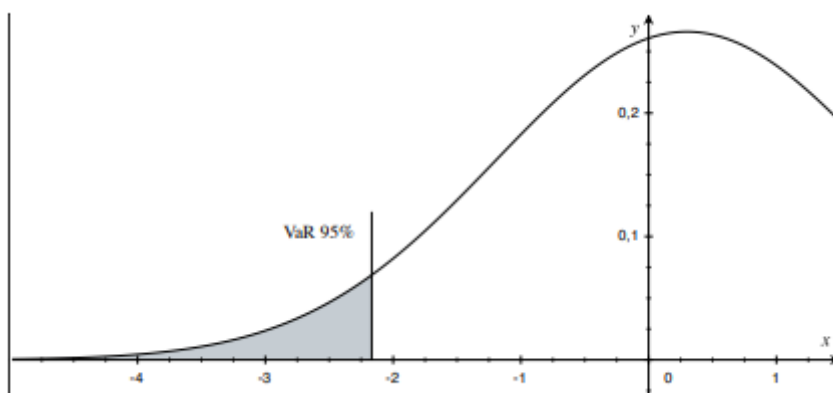

Figure 1: A graphical presentation of the VaR measure

Source: http://salserver.org.aalto.fi/vanhat_sivut/Opinnot/Mat-2.4108/pdf-files/epek10.pdf

The VaR threshold value limits the left tail of the distribution. The outcome of the process hits the grayed out portion only in 5% of cases. This general approach can be applied to uncertain returns of financial assets as well as to different physical processes whose risks need to be quantified. (Timo Pekkala, 2010).

Value at Risk (VaR) is the maximum amount of money a portfolio can lose over a given period of time, in a specific level of confidence. The disadvantages of the VaR method is that it can predict the maximum possible damage, but cannot quantify accurately, especially in the case of extreme price changes. For this purpose we use stress testing method. Also it may give undervalued results if the returns of an asset or portfolio suddenly change unpredictably, due to a test of

---

[7] https://www.investopedia.com/terms/v/var.asp

changing a country's underlying economy. Losses are calculated assuming that the assets can be sold at current market prices, which is not the case if the business has a large amount of non-liquid assets in its possession. Thus VaR may underestimate actual losses, as these items may need to be sold at a discount. The advantages VaR method takes into account the spread in the portfolio, that is, the different composition of the portfolio. The longer the duration of the portfolios, the greater the difference in burden between those portfolios. Another advantage of VaR is that it takes into account volatility. At times when market volatility increases, so does the risk of a portfolio even if there are no changes in duration. It is characterized by simplicity and clarity and can be used immediately. Banks can set limits on foreign exchange and securities traders in VaR terms. The risk-return relationship is now studied under another alternative measure of risk contributing to the efficient allocation of funds between different types of securities. The VaR is calculated by following the five steps below: (Jorion P., 2007).

1. Evaluate the current value of the portfolio
2. Calculate the volatility of the factors that influence the risk, e.g. standard deviation
3. Define the holding time of the portfolio
4. Set a period of confidence
5. We calculate the potential damage using the information in the previous steps.

According to Engle and Manganelli (2001) we can divide the various methodologies into three general categories of non-parametric methods (eg the Historical Simulation and the Hybrid Model), the parametric (eg the Risk Metrics). and semi-parametric (eg Extreme Value Theory).

Value at Risk reflects the exposure of the banking institution to market risks. Therefore, both bank managers and shareholders can decide whether the level of risk is acceptable.

The Basel Committee on Banking Supervision, the Central Banks and the Supervisory Authorities of European countries converge on the acceptance of VaR as an appropriate method of risk assessment.[8]

The Value at Risk calculation of equity risk is performed using the beta mapping method that uses the beta coefficients in relation to the stock market indices of which they belong (Piraeus Bank). This method works well when the portfolio of shares for which it is used is diversified. A disadvantage of the method is that if the portfolio is not adequately diversified the risk may be underestimated or overestimated.

The approach to Value at Risk (VaR) methodology that has been evolving in recent years with the support of information systems is one of the most well-known and accepted by both financial institutions and supervisors worldwide. It is a method originally developed to measure market risk, but today covers many more areas and is the most basic tool by which financial institutions control and manage their credit

---

[8] https://www.bis.org/bcbs/

and operating risk.

2.2   Mergers and Acquisitions

A merger is the merger of two or more companies into one. It happens when one company buys another and absorbs it into a single business structure, usually retaining the original corporate identity of the acquiring company. Banking mergers and acquisitions are a fairly old phenomenon that has always existed especially because of the great importance of the banking system to the economy.[9]

Mergers and Acquisitions (M&A) are being increasingly used the world over, for improving competitiveness of companies through gaining greater market share, broadening the portfolio to reduce business risk, for entering new markets and geographies, and capitalizing on economies of scale etc. Merger and acquisition for long have been an important phenomenon in the US and UK economics.[10]

A merger is the merger of two or more companies or banks into one. It happens when one company buys another and absorbs it into a single business structure, usually retaining the original corporate identity of the acquiring company. According to Hubbard (1999), companies that merge are of similar size and influence. The effort is on the creation of a new partnership, in which both parties have the same rights to negotiate their merger decisions (Weston, Mitchell, & Mulherin, 2004). Mergers correspond to different forms of business integration. Thus, mergers can be (according to Borghese & Borgese, 2002), horizontal, vertical, or a combination of motile activities.

Acquisitions relate to the transfer of all or a majority of the ownership of one business (redeemed) to another (redeemer), which pays the corresponding consideration. The buyer usually pays in cash to buy another business (Sherman & Hart, 2006).

The main factors driving the mergers and acquisitions are [11]:
1. Technological progress
2. Globalization
3. The liberalization of financial markets
4. Increase of credit system supervisory controls
5. Regularization
6. The creation of a single financial market in the European Union with the introduction of the Euro facilitated the large expansion of banks through acquisitions and mergers with banks in other European Union countries.

The Euro has also been an important catalyst for the consolidation and consolidation of banks in the European Union, due to the ease with which banks can now enter markets in the Euro area without the risk of currency exchange.

The most important reason for a bank's management decision to acquire or merge

---

[9] White, E.N., 1985, "The Merger Movement in Banking, 1919-1933", The Journal of Economic History, 45, 2, 285-291

[10] Nirmala S., Aruna. G., (2013). "A Literature Review of Mergers and Acquisitions". International Journal of Management & Information Technology Vol. 5, No. 1

[11] Huizinga P., Nelissen M., Vennet V., 2001, "Efficiency Effects of banks mergers and acquisitions in Europe". Discussion paper Ti-2001 088/3 Tinbergen Institute

is usually to increase shareholders' wealth with less risk.

The main purpose of domestic mergers and acquisitions in the Greek banking system, after the implementation of the global financial crisis in Greece in 2009, was to build big banks in capital and assets so as to be protected from credit risk avoid bankruptcy.

Even during the period of widespread uncertainty about the fate of Greece or the period of stress tests, the existence of systemic banks with European standards proved to be a decisive development for the rescue of the banking industry. The logic is that the bigger the bank, the less likely it is to let it go bankrupt. If mergers and acquisitions had not taken place in the Greek banking sector since 2009 and then the shock of bankruptcy would have swept the entire banking system into chaos. The assessment of the aggressive concentration in the Greek banking system in terms of free competition leads to the conclusion that Greece presented a prototype, having the most centralized banking system in Europe and the second largest after 2009[12]. This concentration of the Greek banking system after 2009 is given by the graph 1 below.

The figure 2 below describes the consolidation of the Greek Banking System year per year since 1996 until 2016. We can observe that after all banking mergers and acquisitions took place in Greece remained only four Systemic Banks.

---

[12] www.bankingnews.gr

Greek Bank Consolidation Over 20 Years

Eurobank
Interbank
Bank of Athens
Bank of Crete
Ergasias Bank
Telesis Investment Bank
Dorian Bank
Unit Bank
Hellenic Postbank
Aspis
ABN Amro
Standard Chartered Bank
Proton Bank
Omega Bank
NBG
National Mortgage Bank
National Housing Bank
ETEBA (Industrial Credit Bank)
Probank
First Business Bank
Co-op Bank of Peloponnese
Alpha Bank
Ionian and Popular Bank
Emporiki Bank
Investment Bank
Citi
Piraeus Bank
Chase Manhattan
Credit Lyonnais
Nat. Westminster
Chios Bank
Macedonia-Thrace Bank
ETBA
ATE
Millenium Bank
Bank of Cyprus
Hellenic Bank
Marfin Bank
Egnatia Bank
Bank of Central Greece
Popular Bank
Geniki Bank
Panhellenic Bank

Eurobank
NBG
Alpha Bank
Piraeus Bank

1996   2000   2004   2008   2012   2016

Πηγή: PwC, Deloitte, Στοιχεία Ισολογισμών

Figure 2: Greek Bank Consolidation Over 20 Years.

Source: PwC, Deloitte and Financial Statements

From January 2008 to April 2018 banks in operation, through mergers, acquisitions and consolidations, decreased from 64 to 38 while almost all foreign banks with retail customer service networks, excluding HSBC and Citibank, mainly maintains its investment arm and corporate clients. The foreign banks that left were French banks Credit Agricole and Société Générale, which sold their Greek subsidiaries to Greek systemic banks. The same happened with the Portuguese Millennium BCP, which sold its subsidiary in Greece in the summer of 2013. Today, the four systemic banks and Attica Bank cover 97% of the Greek banking system (in assets) from 67,

7% which was the share of the five largest banks at the end of 2007. Within five years 21 credit institutions ceased to operate in Greece. Especially since October 2010 as of December 2015, seven commercial and seven cooperative banks were under consolidation. Among them were the Agricultural Bank and the Postal Savings Bank.[13]

In the table 1 below we can see the main mergers and acquisitions of the Greek Systemic banks from the implementation of the global financial crisis in Greek Economy 2009. As we can observe only in 2012 the Greek banks started to be strong against the financial crisis. In our paper we are going to examine how those consolidations affect the banks risks that extract from the global financial crisis.

Table 1: The main Mergers & Acquisitions Greek Systemic Banks from 2009

Years	Greek Systemic Bank Acquiror	Greek Banks / Targets
2012	Piraeus Bank	Agricaltural Bank
2013	Piraeus Bank	Panellinia Cooperation Bank
2013	Piraeus Bank	Bank of Cyprus in Greece
2013	Piraeus Bank	Cpb Popular Marfin Bank
2013	Piraeus Bank	Hellenic Bank
2013	Piraeus Bank	Millenioum Bank
2013	Alpha Bank	Commercial Bank
2013	Eurobank	New Postal Savings Greece
2013	Eurobank	New Proton Bank
2013	National Bank	Probank
2014	Piraeus Bank	Geniki Bank

Source: www.bankofgreece.gr

3. Methodology

Financial institutions have the ability to calculate the capital required to cover market risk either using standard methods or internal models. The standard methods are based on risk assessment estimates by banks, while banks using internal models are required to determine the risk level with their own estimates.

---

[13] https://www.hba.gr/UplDocs/90yearsEET/apologiamos_eet_GR_F_onepage_web.pdf

Value at Risk (VaR) methodology aims to quantify the level of the worst case outcomes in a situation where the future is uncertain. VaR is defined as a threshold value that the losses should not exceed in a given time period and a given confidence level. (Timo Pekkala, 2010).

The VaR measurement shows a normal distribution of past losses. The measure is often applied to an investment <u>portfolio</u> for which the calculation gives a confidence interval about the likelihood of exceeding a certain loss threshold. That data is used by investors to make decisions and set strategy. Stated simply, the VaR is a probability-based estimate of the *minimum* loss in dollar or Euro terms expected over a period. VaR is defined as:[14]

VaR = [Expected Weighted Return of the Portfolio − (Z-score of the confidence interval **X** standard deviation of the portfolio)] **X** portfolio value.   (1)

Typically, a timeframe is expressed in years. However, if the timeframe is being measured in weeks or days, we divide the expected return by the interval and the standard deviation by the square root of the interval.

There are three widely user VaR methodologies and their use in the industry are described in (Morgan, 1996) and their use in the industry is analyzed by Pearson and Smithson (2002), for example. These three categories are Historical Simulation, Monte Carlo Simulation and Analytic Delta-Gamma method. These methods along with their key characteristics are summarized in the upper part of table 2.

---

[14] https://www.investopedia.com/ask/answers/033115/how-can-you-calculate-value-risk-var-excel.asp

Table 2: Risk Metrics analysis of different VaR methodologies (Morgan, 1996).

		Value change estimation	
		Analytical	Full Valuation
Full VaR model	RiskMetrics	Covariance matrices and instrument mappings.	Covariance matrices used to define scenarios for Monte Carlo.
	Historical simulation	Not applicable.	Portfolios revalued under historical return distributions.
	Monte Carlo	Not applicable.	Statistical parameters determine stochastic processes.
Partial VaR model	Implied Volatilities	Covariance matrices and instrument mappings.	Covariance matrices used to define scenarios for Monte Carlo.
	User defined	Sensitivity analysis on single instruments.	Limited number of scenarios.

Source: Morgan J. (1996). "Risk Metrics Technical Document". Technical Report Fourth Edition, 1996.

The performance of bank VaR risk management tools has not been studied very thoroughly. The technical details of different implementation approaches have been researched more eagerly. This is probably due to the fact that bank internal figures are hard to come by. The subject is however studied by Berkowitz and O'Brien in 2002. They analyze the performance of VaR estimates of six large multinational US banks against their historical trading profit and loss (P&L). All six banks "meet the Basle 'large trader' criterion" and maintain P&L and VaR time series "to asses compliance with the Basle market risk capital requirements". The measure under inspection is the 99% Value at Risk for a one-day holding period. (Timo Pekkala, 2006).

Let say that V = the current market value of the portfolio

R = yield for the "H" period

m = E (R) expected return

R* = yield for period "H" corresponding to worst-case probability of 1-c [c=confidence level, eg 99%].

and

- $V^* = V(1+R^*)$ (2)
- $VaR(H,c) = E(V) - V^* = V(1+\mu) - V(1+R^*) = V(\mu - R^*)$ (3)

If R and $N(\mu, \sigma^2)$

- $Z = (R-\mu)/\sigma$ for N(0,1)   (4)
- $R = \sigma Z + \mu$ (5)
- $Prob(R<R^*) = Prob(\sigma Z + \mu < R^*) = Prob(Z < (R^*-\mu)/\sigma) = 1-c = N[(R^*-\mu)/\sigma]$ (6)
- $N[(R^*-\mu)/\sigma] = N(a)$ (7)
- $a = (R^*-\mu)/\sigma$ $R^* = \mu + a\sigma$ (8)
- $VaR(H, c) = -a\sigma V$ (9)

According to Tsay (2005), at time t and for probability p, the VaR of L subsequent seasons is defined as:

$p = Pr[\Delta V(L) \leq VaR] = FL(VaR)$ (10)

Where:

$\Delta V(L)$ = the change in the value of an asset for the period t to t + L

FL = the cumulative distribution function of $\Delta V(L)$.

The VaR of a portfolio is a function of two parameters: the holding period and the confidence level. According to Reuse 2010, in general, it can be reported that VaR will increase if the holding period becomes longer and the level of confidence becomes higher.

The probability of damage greater than VaR is shown in Figure 1 below as the area below the curve and to the left of VaR, that is, if cl is the selected confidence level, VaR refers to the 1-cl confidence level on the left side of the distribution (Corkalo, 2011).

This area is 5% of the total area under the curve. Thus, there is a 95% probability of damage not exceeding VaR. VaR models assume that the portfolio composition

does not change during the holding period. This hypothesis advocates the use of short retention periods, because the composition of portfolios is capable of changing frequently. Regarding the level of confidence, there are some commonly used levels of confidence, which are 95% and 99%.

In the figure 3 below we describe the measurement of market risk and how it can be done using the VaR methodology.
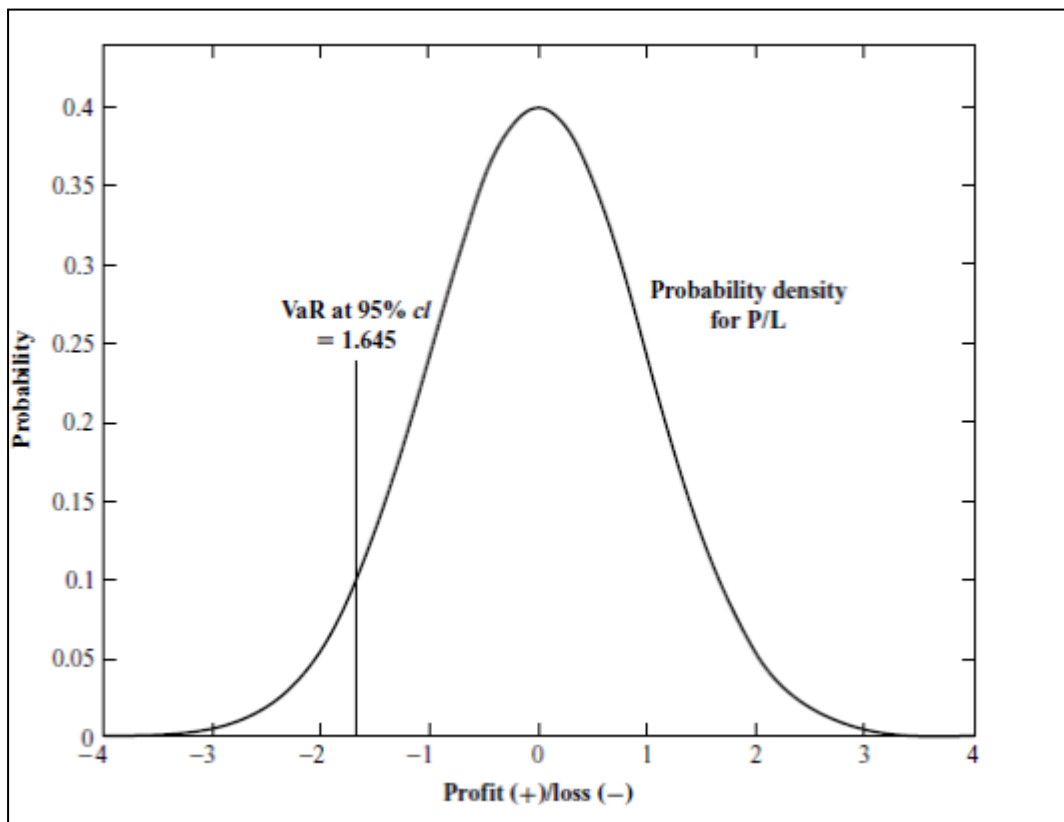

Figure 3: A Diagram of VaR

Source: Dowd, K. (2002). Measuring Market Risk. New York: John Wiley and Sons Ltd

There are three main companies which are Standard and Poors, Fitch and Moodys that evaluate banks, firms, countries and their bonds according to their risks. Below in table 3 we can see those ratings and the explanation of them.

Table 3: Standard and Poor's Value Rating

Rating	Explanation
AAA	The bank is fully capable of meeting its obligations
AA	The bank is particularly strong in meeting its obligations.
A	Despite the bank's strong position, it may be affected by changes in the financial environment.
BBB	It has sufficient capacity to meet its obligations
BB	There is increased uncertainty over changes for the bank in the economic environment.
B	Changes in the environment are very likely to cause an inability to respond in the bank.
CCC	The ability of a bank to respond is determined by the current business, economic and financial conditions.
CC	The ability of a bank to respond is particularly plausible and lucrative.
C	The bank has filed for bankruptcy..
D	There is already a default on the bank
+ or -	Used in categories from AA to CCC to indicate the relative position of the business within those categories.

Source: https://www.standardandpoors.com/

4. Results

As we argued before the VaR of a portfolio is defined as the maximum loss expected to occur in a portfolio over a certain period of time with a certain probability (confidence level eg 99%). VaR is an attempt to assess the total risk of a portfolio and to perform it in monetary terms with a single number. VaR is the answer to the question: What is the maximum loss over a given period so that the probability of even greater damage being reduced is (at least 1%). The calculation of VaR requires the allocation of portfolio values (returns) or returns over the selected time horizon. The distribution is either calculated from historical data (non-parametric) or assumed that the values or yields follow a detailed distribution (normal or otherwise). VaR is the average (expected yield) of the portfolio and the first percentile (for a 99% confidence level).

➢ VaR= Expected Profit/Loss- worst case loss at the 99% confidence level
➢ Alternatively (Absolute VaR): VaR'=Worst case loss at the 99% confidence level

The VaR determines the financial capital required to be paid by shareholders of a financial institution in order to protect against bankruptcy. Greek systemic banks applies the parametric VaR calculation method, with a one-day horizon and 99% confidence level. Value at Risk is estimated for the positions of the trading book and the Available-for-sale portfolio. The method used is considered to produce satisfactory results in cases where there are no significant non-linear risk factors, such as in cases where the portfolio contains significant options in options. The Trading portfolio and Available for sale portfolio do not include significant options and it is considered that the current VaR calculation method is satisfactory. The Value at Risk calculation of equity risk is performed using the beta mapping method that uses the beta coefficients in relation to the stock market indices of which they belong. This method works well when the portfolio of shares for which it is used is diversified. A disadvantage of the method is that if the portfolio is not adequately diversified the risk may be underestimated or overestimated. Also, for corporate bonds, the volatility and correlation coefficients used have been assigned to other interest rate curves, as the majority of corporate issuers do not have sufficient issuances to form an interest rate curve. Greek systemic banks usually apply the Value-at-Risk Back-testing procedure to evaluate the effectiveness of the risk assessment model for the trading portfolio. The purpose of the back-testing process is to compare the results of Value at Risk with the actual change for the next day of the value of the sites to which the measurement relates. If the results of the back testing provide continuous and unexplained exceptions, ie days in which the portfolio loss was greater than the VaR estimate, the risk assessment model is judged inadequate. The number of exceptions shows that the risk assessment model performs well, as two to three exceptions are expected per year based on the 99% confidence level and one day holding period. The backtesting procedure applied does not take into account intra-day trading or "clean" backtesting. In addition, the Greek banking groups monitor the evolution of the risks assumed using sensitivity indices by calculating the impact of market price changes on all on-balance sheet and off-balance sheet items, to form a complete and complete picture of the evolution of key risk factors and factors. Conducting regular crisis simulations and assessing the impact of extreme and adverse market price changes on the value of Greek banking groups' assets is an additional key tool for measuring the risks involved. Interest rate risk is an important risk category and concerns the possible adverse impact on the financial position of Greek banking groups due to their exposure to changes in the general level of interest rates. Taking this risk is considered an integral part of banking and can be an important source of profitability and increase in the value of Greek banking groups. However, high levels of interest rate risk may adversely affect their earnings and financial position. Changes in interest rates affect their results by changing the net interest rate and the value of other income or expense sensitive to interest rate changes. Interest rate fluctuations also affect the value of assets and liabilities, as the present value of

future finance (and in some cases the finance itself) changes when interest rates change. Therefore, an effective risk management process that assesses, monitors and helps maintain interest rate risk within acceptable limits (through effective hedging, where necessary) is critical to the financial soundness of Greek banking groups. Interest Rate Risk Analysis allows interest rate risk to be estimated through the "Interest Rate Interest Risk" index, which expresses the negative impact on the projected annual interest rate result from a parallel across-year interest rate fluctuation in all currencies. [15]

In the table 4 below we present the results for the total and sub-categories of the VaR for portfolio of Piraeus Bank.

Table 4: VaR Piraeus Bank Group - Trading Portfolio in million Euros

Years	Total VaR	VaR Interest Rate Risk	VaR Stock Risk	VaR Foreign Exchange Risk	VaR Commercial Portfolio Risk	Reduction Due to Portfolio Diversification
2010	4.05	0.86	3.08	2.68	0.16	-2.73
2011	8,81	8,06	0,04	2,41	0,21	-1,91
2012	1,32	0,46	0,01	1,13	0,1	-0,38
2013	1,27	0,42	0,01	1,14	0,05	-0,34
2014	4,15	3,33	0	2,64	0,07	-1,88
2015	3,81	2,81	0	2,68	0	-1,68
2016	0.81	0.37	0	0.82	0	-0.38
2017	0,52	0,21	0	0,48	0,01	-0,18

Source Bank's publications based on Pillar III of Basel Committee II and III - Edit and Own research

---

[15] Annual Financial Reports of Piraeus Bank (www.piraeusbank.gr), National Bank (www.nbg.gr), Eurobank (www.eurobank.gr) and Alpha Bank (www.alphabank.gr).

In the table 5 below we present the results for the total and sub-categories of the VaR for portfolio of National Bank of Greece.

Table 5: VaR National Bank Group - Trading Portfolio in million Euros

Years	Total VaR	VaR Interest Rate Risk	VaR Stock Risk	VaR Foreign Exchange Risk	VaR Commercial Portfolio Risk	Reduction Due to Portfolio Diversification
2010	13.2	12.9	1.07	1.06	0	-1.83
2011	9.2	7.7	3.02	1.03	0	-2.55
2012	11.9	10.9	1.05	2.4	0	-2.45
2013	4.9	3.9	1.2	2.1	0	-2.3
2014	2.7	2.2	0.9	0.6	0	-1
2015	5.8	5.4	0.7	1.3	0	-1.7
2016	8,7	8,4	0,8	0,6	0	-1.1
2017	0.689	0.119	0.104	0.277	0	0.189

Source Bank's publications based on Pillar III of Basel Committee II and III - Edit and Own research

In the table 6 below we present the results for the total and sub-categories of the VaR for portfolio of Eurobank.

Table 6: VaR Eurobank Group - Trading Portfolio in million Euros

Years	Total VaR	VaR Interest Rate Risk	VaR Stock Risk	VaR Foreign Exchange Risk	VaR Commercial Portfolio Risk	Reduction Due to Portfolio Diversification
2010	3	2	0	2	0	-1
2011	3	2	0	2	0	-1
2012	2	1	0	1	0	0
2013	2	1	0	2	0	-1
2014	1	1	0	1	0	-1
2015	1	1	0	1	0	-1
2016	1	0	0	1	0	0
2017	0,85	0,29	0	0,48	0,8	-0.72

Source Bank's publications based on Pillar III of Basel Committee II and III - Edit and Own research

In the table 7 below we present the results for the total and sub-categories of the VaR for portfolio of Alpha Bank.

Table 7: VaR Alpha Bank Group - Trading Portfolio in million Euros

Years	Total VaR	VaR Interest Rate Risk	VaR Stock Risk	VaR Foreign Exchange Risk	VaR Commercia l Portfolio Risk	Reduction Due to Portfolio Diversification
2010	3.5	0.8	1.4	3.3	0	-2
2011	3.4	1.1	0.2	3.3	0	-1.2
2012	2.4	1.3	0	0,7	1,2	-0.8
2013	2.3	2.1	0.3	0.9	0	-1
2014	6.7	1	0.05	6.6	0	-0.95
2015	6.7	0.4	0.07	6.6	0	-0.37
2016	3.7	0.3	0.08	3.7	0	-0.38
2017	4	2	0	2	0	0

Source Bank's publications based on Pillar III of Basel Committee II and III - Edit and Own research

In the figure 4 below we can observe the total VaR of the 4 Greek systemic banks after all Mergers and Acquisitions after the implementation of the global financial crisis in Greek Economy. More stable bank is Eurobank from volatility option.
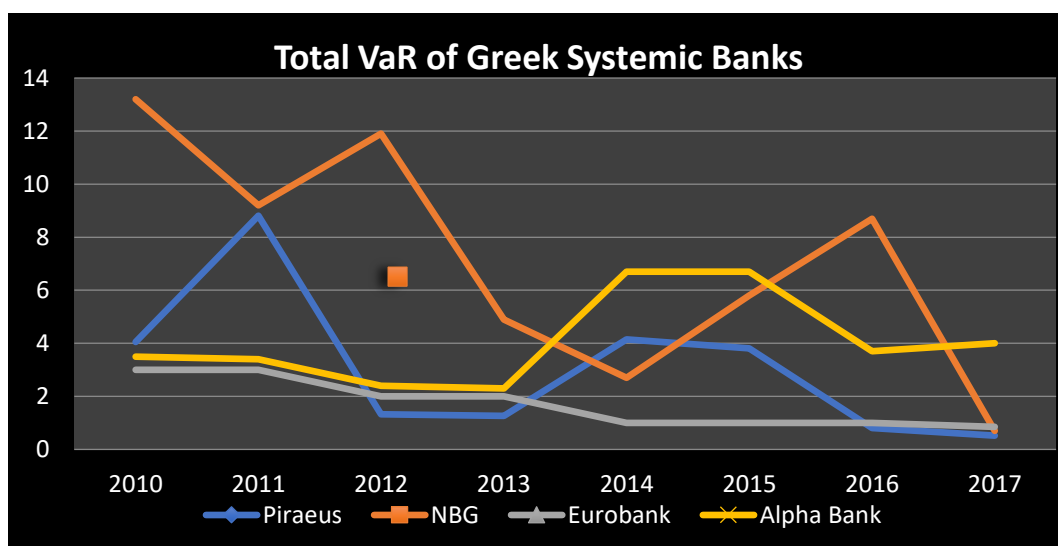

Figure 4: Total VaR of Greek Systemic Banks 2010-2017

Source: Tables 4-7

As shown in the above figure 4, Eurobank has the smallest results in predicting market risk value for the 4 systemic banks and therefore has the lowest market risk capital over time. Piraeus Bank also seems to have low capital and in the last two years it has the smallest of all banks (0.52 for 2017). National Bank and Alpha Bank are in a much better position and they have much higher capital than the other two (Piraeus and Eurobank). National Bank presents the biggest funds over time but Alpha Bank has more stability over time and its funds are quite high (in 2017 they reach 4 million Euros). The VaR with the most intents volatility is the one of National Bank. In the year 2017 the three Greek Banks have the lowest VaR except Alpha Bank, something that Alpha Bank need to be considered.

5. Conclusion

Prior to the crisis and in the late 1990s, and especially since the early 2000s, due to the use of the Euro as a national currency, which greatly exacerbated the currency risk, the banking system in Greece showed strong growth and dynamics. Greek banks have been a dominant player in the Balkans. Given the low interest rates, the country's entry into the Euro zone and domestic prosperity, the Greek banks were dominant in the region until the crisis. Many report the unsatisfactory risk assessment during this period, which has led banks to the need for recapitalization in 2011 and the PSI. Red loans are still one of the biggest problems for the Greek banking system and this shows that risk management has not been the best in previous years.

Since 2012, the Greek banking system has made a significant effort to liquidate the loss-making banks through acquisitions by other major Greek banks. This effort was made on the one hand in order to strengthen the capital adequacy of the Greek banks and to protect them from aggressive acquisitions and on the other hand to reduce the risks undertaken. This is how the four Greek systemic banks were created. These lucrative banks were either Greek or foreign but operating in the Greek market and were greatly affected by the global financial crisis that hit Greece in 2009. At the same time, the four Greek systemic banks absorbed the losses and risks arising from them of the lucrative domestic banks, but also to increase their capital adequacy according to the pillars of the Basel Committee III began selling their subsidiary banks abroad. They also began to sell other types of businesses that held their portfolio both abroad and domestically with the first and foremost insurance companies. All this efforts started to bring the desirably results in case of VaR as we can see from the above figure 2.

Adherence to these rules for risk and capital adequacy is considered necessary by industry researchers, as the issue of red loans is still a major problem for Greek banks and an ongoing threat to their smooth operation. At the same time, this factor adversely affects the credit ratings of rating agencies.

References

[1] Barth J., Caprio G., and Ross Levine R., (2004). "Bank regulation and supervision: what works best?" Journal of Financial Intermediation, 2004, vol. 13, issue 2, 205-248

[2] Berkowitz J. and O'Brien J., (2002). "How Accurate are Value-at-Risk Models at Commercial Banks?" Journal of Finance, 57:1093–1112, 2002.

[3] Bessis, J. (2003). "Risk management in banking" (2nd edition). Wiley, Chichester

[4] Borghese, R.J. and Borgese, P.F., (2002), "M&A from Planning to Integration: Executing Acquisitions and Increasing Shareholder Value", McGraw-Hill, New York, NY.

[5] Čorkalo Š., (2011). "Comparison of Value at Risk Approaches on a Stock Portfolio". Croatian Operational Research Review (CRORR), Vol. 2

[6] Damodaran A., (2008). "Strategic Risk Taking: A Framework for Risk Management". Wharton School Publishing, Pearson Education, New Jersey, 2008.

[7] Dowd, K. (2002). "Measuring Market Risk." New York: John Wiley and Sons Ltd

[8] Huizinga P., Nelissen M., Vennet V., (2001), "Efficiency Effects of Banks Mergers & Acquisitions in Europe". Discussion paper Ti-2001 088/3 Tinbergen Institute.

[9] Hubbard, N., (1999). "Acquisition: Strategy and implementation". London: Macmillan

[10] Jorion P., (2007). "Value at Risk" 3nd Edition McGraw Hill USA

[11] Morgan J. (1996). "RiskMetrics - Technical Document". Technical Report Fourth   Edition, 1996.

[12] Manganelli S., and Engle F. R., (2001). "Value at Risk Models in Finance" Working Paper No.75 European Central Bank, August, 2001.

[13] Nirmala S., Aruna. G., (2013). "A Literature Review of Mergers and Acquisitions".   International Journal of Management & Information Technology Vol. 5, Is. 1

[14] Noulas A., (2019). "Financial Management Investment and Financing Decisions". Tziolas Publishing Athens, Greece.

[15] Pearson N. D., and Smithson C., (2002). "VaR: The State of Play". Review of Financial Economics, 11(3):175–189.

[16] Pekkala, T., (2010). "Value at Risk in Bank Risk Management" Mat-2.4108 Independent Research Projects in Applied Mathematics Helsinki.

[17] Reuse S., (2013). "Risk measurement with the key figure Value at Risk" Bankfachklasse e-journal Vol. 10 pp 25-27 Springer.

[18] Sherman A., Hart M., (2006). "Mergers and Acquisitions from A to Z" 2nd Edition by American Management Association (AMACOM) New York USA.

[19] Tsay S. R., (2005). "Analysis of Financial Time Series". 2nd edn A Wiley Interscience Publication John Wiley & Sons, Inc. Canada.

[20] Weston, J. F., Mitchell, M. L., & Mulherin, J. H., (2004), "Takeovers, Restructuring,   and Corporate Governance". Upper Saddle River: Perason Education Inc.

[21] White, E.N., (1985), "The Merger Movement in Banking, 1919-1933", The Journal of Economic History, Vol. 45, Issue 2, pp. 285-291

Internet Sites

https://www.hba.gr/UplDocs/90yearsEET/apologiamos_eet_GR_F_onepage_web.pdf

https://www2.deloitte.com

https://www.investopedia.com/ask/answers/033115/how-can-you-calculate-value-risk-var-excel.asp

https://www.investopedia.com/terms/v/var.asp

https://www.pwc.com

www.bankingnews.gr

www.bis.org and www.bis.org/bcbs/

ISO / IEC Guide 73 https://www.iso.org/standard/44651.html

https://www.standardandpoors.com/

Annual Financial Reports of Piraeus Bank (www.piraeusbank.gr)

Annual Financial Reports of National Bank (www.nbg.gr)

Annual Financial Reports of Eurobank (www.eurobank.gr)

Annual Financial Reports of Alpha Bank (www.alphabank.gr)