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# The impact of macroeconomic and bank-specific factors of non-performing loans (NPLs): evidence from Greece

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#### Abstract

The problem of the non-performing loans (NPLs) has been a long-standing issue for the Greek economy and its banking system and continues to remain to its broader extent unresolved. It was originated in the Greek crisis and the subsequent domestic banking crisis when the sharp drop in demand, the contraction of income and the rising unemployment made domestic borrowers, both corporations and households, incapable of fulfilling their contractual bank debt obligations. The Thesis attempts to examine and quantify the major determinant factors of the NPLs in the Greek case applying a statistical analysis based on simple correlation and regression exercises. The results extracted proved to be in line with the literature review and the bibliography presented as they identified a number of statistically significant variables affecting both the evolution and the growth of NPLs. Such factors were among others the unemployment rate, the GDP growth as well as some bank specific parameters. Finally the Thesis draws out some recommendations which can be made on the policy of preventing the phenomenon of high NPLs in the economy.

Keywords: Non-performing loans; Greek banking system; Macroeconomic determinants; Bank specific determinants;

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#### **CHAPTER 1: INTRODUCTION**

#### **Purpose of the Thesis**

The present Thesis deals with the phenomenon of the non-performing loans (NPLs) which increased dramatically during the past global financial crisis and with the determinants factors of this phenomenon. It then shifts its focus to the Greek case of NPLs attempting to identify their most influential factors through the statistical analysis of a series of variables based on data drawn from the Greek economy and the domestic banking system.

The purpose of the Thesis can be described as follows:

- ✓ To examine via a top down approach the broader economic environment as well as the economic cycle during which the phenomenon of NPLs occurred in the global economy.
- ✓ To explore and discuss the potential factors, both macroeconomic and bank specific ones, that may have played a key role in the occurrence of the above event.
- ✓ To statistically test these factors in the Greek banking market and draw out whether there are statistically significant relationships between the NPLs and those factors.

#### **1.2 Structure of the Thesis**

The Thesis is structured into 6 sections or chapters which are in synopsis described below: The second chapter deals with the major characteristics of the global financial crisis and the US credit crisis in years 2007 - 2008 and then shifts its focus toward the major highlights of the Eurozone crisis, the Greek economic crisis and the emergence of nonperforming loans (NPLs) on international, European and Greek level.

The third chapter deals with the broader definition and explanation of the nonperforming loans in the international banking system whereas it proceeds to demonstrate the conditions of the Greek banking system with regard to the NPLs. For this purpose, selected data concerning the non performing loans of the Greek economy are presented from the most recent period, 2014 - 2016. The presentation of the relevant data and information takes place in order to highlight the large and negative repercussions of the country's economic crisis on the loan portfolios of the Greek banks. The fourth chapter includes a discussion of specific economic and financial factors affecting the non-performing loans in the international economies and also makes a special reference with

regard to the importance of the credit risk for banks and with regard to the quality standards / characteristics of their loan portfolios. It also includes a literature review discussing the main conclusions drawn out of research works with regard to the most determinant factors of NPLs, whereas a separate discussion takes place regarding the domestic currency depreciation and the NPLs. In the fifth chapter, the potential relationship between macroeconomic parameters and the development of NPLs in Greece is being further explored and also statistically tested based on a combined methodology consisting of both correlation and regression exercises. Based on a list of determinants and for the purposes of performing a statistical analysis, there is a selection of factors which are examined and tested as potential determinants of the non-performing loans in the Greek economy and market. The time period covered is from the year 2005 until the year 2015, thus encompassing both normal and abnormal economic sub-periods, namely the growth period until 2008 and the subsequent recession period until 2015.

The selection of factors is based on data and respective sources that can be made easily available in the Greek market. For the purposes of the current Thesis, the selected data, meaning the time series of the selected factors, have been mainly derived from the archives and records of Bank of Greece, the country's central bank authority. The statistical analysis is performed with the objective to identify which of the selected factors are statistically significant in relation to the formation and development of the non-performing loans in the Greek market over time, namely the period under consideration (2005 – 2015).

Any statistically significant relations that are identified are then discussed and compared with the findings of the literature review for additional comments and discussion. Finally the sixth chapter presents a synopsis of the major observations and conclusions drawn out in the previous sections while it proceeds with a parallel reference on some recommendations which can be made on the policy of preventing the phenomenon of high NPLs in the economy.

#### **CHAPTER 2 THE GLOBAL FINANCIAL CRISIS OF 2008 & GREECE**

This chapter highlights the major events of the global financial crisis of years 2007 - 2008and its decisive effects on the creation of the Greek fiscal, debt, economic and banking crisis unfolding in successive phases from 2010 up to the year 2015. The global financial crisis of the years 2007 – 2008 was an unprecedented period of high uncertainty and volatility in the international economies, capital markets and money markets. The crisis originated in the United States of America (USA), and specifically within the country's mortgage market, and then transformed into a spiral financial and credit crisis affecting geographic regions and countries across the globe. In particular the US credit crisis had a strong effect on the European integrated economy, the Eurozone, and especially on the weakest economies in the south part of the continent, such as the Portuguese, Spanish, Italian and Greek economies. Those were countries with economies relying heavily on external debt financing in order to continue smoothly running their budget deficits and fiscal debts, an ability that was diminished after the credit crunch occurred in the US economy. In the case of Greece, the crisis began in 2010 as a fiscal one and continued into the form of a deep economic crisis probably the most calamitous of the last 50 years. The crisis was geometrically spread out to the whole economy and market affecting every business sector and every household in the country. Subsequently due to the abrupt loss of income, it affected the Greek banking system due to the inability of companies and households to repay their loans to the banks given the tough economic conditions. Furthermore the political and economic uncertainty raised doubts and fears over the country's willingness as well as ability to remain a Eurozone member, whereas at the same time billions of Euros of bank deposits "flew out" the country amid fears of the abolition of the Euro and of the adoption of new domestic currency. Later in theperiod 2015 – 2016, the Greek crisis became mostly a debt crisis and as of today it continues to considerably affect the ability of the economy to recover and return to the pre-crisis growth performance.

The present chapter deals with the major characteristics of the global financial crisis and the US credit crisis in years 2007 – 2008 and then shifts its focus toward the major highlights of the Eurozone crisis, the Greek economic crisis and the emergence of nonperforming loans (NPLs) on international, European and Greek level.

#### 2.1 The Global Financial Crisis

The global financial crisis of years 2007 - 2008 emerged from an unprecedented and unexpected burst of the US mortgage market bubble which in turn exposed the entire financial and banking sector of the country to serious financial problems that could not be healed. The US crisis comprised the major source of volatility and uncertainty in the global capital and money markets creating the symptoms and finally the occurrence of an international financial crisis where banks and sovereign states were unwilling to continue lending one another thus creating funding gaps for both corporations and governments. The crisis then hit the European economy as well as other regional economies and the effects continued to unfold even more prominent as the state governments were losing the ability to access external funding. This was mostly felt in the weakest economies of Europe, with the case of Greece becoming the most characteristic one as well as the most lasting in terms of the duration and the severity of the crisis.

#### 2.2 The US Credit Crisis

The roots of the US mortgage and credit crisis were mostly related to the Federal Reserve Bank's policy of unleashing credit in the domestic economy during the first years of 2000s in an effort to recover the economy from the recent burst of its stock market bubble. During that period, with interest rates remaining very low in the US economy, the domestic mortgage market continued to grow dynamically with the leverage ratio of households and private borrowers reaching new highs. At the same time, the investment banking sector took the opportunity to repackage the US mortgage loans and generate derivative products, such as synthetics mortgage backed securities and bonds, which were allocated to institutional and private investors domestically and abroad thus putting more risks not only on the US but also on the global economy in case a default was to occur in the domestic housing market. Moreover the traditional US banking sector continued to lend money to borrowers based on relaxed audit criteria concerning borrowers' credibility thus further inflating the mortgage market bubble. However when the Federal Reserve Bank began to increase short-term interest rates from the year 2004 and going forward, the rising cost of money resulted into the need of higher mortgage payments from the borrowers. In other words it became less affordable for them to continue making such payments given also the harder economic environment that was unveiling by that time. This chain of events essentially resulted into the burst of the US mortgage loan market bubble in the period 2007 - 2008 and also to the bankruptcy of several traditional as well as investment banking institutions.

#### THE THREE MAJOR SOURCES OF THE US CRISIS

- 1. Inflated Mortgage Loan Market
- 2. Weak Audit-Based Lending Practices by the Domestic Banking Sector
- 3. Generation of a Derivative Market with Synthetic Bonds

The burst of the US mortgage loan market bubble led to the following events among others:

- Foreclosure of properties of the borrowers who became unable to continue fulfilling their mortgage obligations.
- Generation of losses for the country's traditional lending institutions.
- Bankruptcy of historic and prominent US investment banks and other entities of the financial services sector.
- An unprecedented credit crunch in the US economy affecting also the liquidity conditions of the global economy and mostly the European economy.
- Successive collapses of fiscal budgets and banking systems for several countries on international level.

#### 2.3 The European Fiscal Crisis

As mentioned earlier, the European economy was mostly hit by the US credit crisis due to the fact that its southern economies were largely dependent on external financing in order to smoothly run their fiscal deficit-based budgets and to serve their large public debts. With the credit crunch being felt across the globe during the financially tough years of 2007 and 2008, the European economies and their banking systems were largely affected by the notion that systemic risk was increasing and by the fact that no entity was willing to lend money for the fear of having to sustain high losses in a world where there was an extraordinary lack of credit.



Graph 2.1:Debt Levels as % of Gross Domestic Product (GDP) of Selected European Economies in 2010 - 2011 Source: Statistical offices, Eurostat.

In that unfavorable environment, Ireland and its banking system were the first to "take the heat", followed by Eurozone's southern economies, and namely by Portugal, Spain and Greece. In those countries there was mainly a lurking fiscal and public debt crisis which was later on evolved into a banking crisis. Economies such as Portugal and Greece had to resort to emergency financing from the European Union (EU), the International Monetary Fund (IMF) and the European Central Bank (ECB).

#### 2.4 Greece in the Crisis Environment

At the dawn of the global financial crisis, Greece was an economy posting strong GDP (gross domestic product) growth rates on annual basis but on the other hand the country was characterized by long lasting structural problems such as budget deficits, high public

debt compared to its GDP, inelastic employment market and very low competitive advantages with a considerably high trade deficit. All these structural issues "came ashore" after the global crisis hit the markets, most notably between the years 2009 and 2010, and Greece had no other option but to request a bailout package of funds in exchange for a reshuffling of its problematic public finances.



Graph 2.2:Greece's GDP Growth compared to the Eurozone, Period 1992 – 2009 (%) Source: Hellenic Statistical Service, Eurostat.

The country's structural problems were seen to persist for many years, actually since the start of the 1980s when Greece entered the European Community (the previous form of the European Union) and continued to characterize the economy up until the country's acceptance to the European Union in 2001 when Greece adopted the union's single currency the Euro. The country's finances remained imbalanced even for the following years whereas the organization of the Olympics 2004 in Athens (Greece's capital) put further strain on the size of the already high public debt held by the State. The fact that the Greek economy posted very high growth rates on average basis during the period 1998 – 2007 made the above fiscal imbalance tolerable for a period of time. The Greek economic authorities apart from issuing government bonds to fund the country's deficits, they were also enjoying higher flows from tax revenues and therefore they were in better position to manage both the fiscal deficit and the public debt burden. It seems like

everybody, namely the economic authorities, knew that such economic policy was not sustainable but for years nobody did anything to improve the situation and prevent the ultimate collapse of the Greek economy.

However with the dawn of the crisis in 2007 – 2008 and the credit crunch that hit almost every single economy across the globe, Greece could not be the exception given the already rising structural economic problems. By the year 2010, the country became incapable of meeting its capital needs, the budget deficit surged to above 10% of GDP and the Greek economic authorities requested an emergency assistance from the European Union, the International Monetary Fund and the European Central Bank.

As noted in a previous section, the Greek crisis started as a fiscal crisis due to the high budget deficit and public debt of the country, it then continued as economic crisis where the problematic public finances resulted into rising unemployment and loss of income, and it was finally transformed into a financial and banking crisis as the country's banking system was hit by the phenomenon of NPLs and the "transfer" of bank deposits outside the country. The Greek crisis in its various versions and episodes lasted from 2010 until 2016 and resulted in a 7-8 year economic recession with Greece losing at least 25% of its GDP and never recovering it.

During the entire period of the Greek crisis, which without exaggeration became a saga due to its various phases, Greece and its economic authorities had to resort three times to external financial aid in the form of bailouts which came from the European Union, the International Monetary Fund and the European Central Bank. Greece received its initial bailout package of EUR 110 billion in 2010, a second one of EUR 130 billion by the end of 2012 and a third one of almost EUR 80 billion in the middle of 2015, bringing the total amount of aid to the level of EUR 320 billion which has been the largest bailout of a country in the recent global economic history. The current debt level of Greece stands at over EUR 310 billion or over 170% of its GDP.

The major events and trends observed during the above tough economic period for Greece can be highlighted as follows:

- There was a surge in the annual government budget deficits whereas the bailout packages led the already high public debt to unseen, and until today unmanageable, levels.
- There was a rapid contraction of GDP for at least 7 consecutive years resulting into significant loss of income for households and corporations, high unemployment and ultimately into stagnation (combined with over 2 years of deflation in the economy).
- The crisis generated from time to time great political as well as economic uncertainty due to the three general elections that took place in the period 2012 2015 and which greatly affected the capability of the economy to recover from its crisis conditions.
- Business climate and consumer confidence touched their lows and remained pessimistic throughout the crisis and the recession periods.



Graph 2.3: Business Climate and Consumer Confidence in Greece, Period 2010 - 2015 Source: Foundation for Economic & Industrial Research (IOVE)

• The crisis exposed Greece's low competitiveness and large trade deficit. Policies adopted during the crisis period in co-operation with the country's creditors (the so

called institutions) aimed at improving the competitive advantages of the Greek economy.

- Public and private investment expenditures declined considerably or in certain periods settled at almost zero levels thus further aggravating the broader economic conditions.
- The Greek banking system was hit in its heart following the surge in the non-performing loans (NPLs) and the large outflows of bank deposits abroad due to the persisting political and economic uncertainty.
- Overall the status of Greece as member of the European Union and the Euro was put in jeopardy during the entire crisis and recession periods.
- Following the three packages of external financial assistance which Greece had to request during the period 2010 – 2015, the country's public debt as percentage of the gross domestic product (GDP) exceeded 170%.

In other words the Greek economy which was posting strong growth rates prior to the crisis despite its large structural problems, was seriously "exposed" with the emergence of the global financial crisis and the so-called credit crunch, almost approaching to bankruptcy level. Without the external financial aid the country ultimately received, the Greek economy would have been in a condition of lacking resources to continue funding its fiscal budget and would have defaulted on the repayment of its debt obligations. By accepting the external aid, Greece was put in a path of restructuring its public finances, of taking measures to balance its budget by curtailing public spending on various fronts and also of working closely with its creditors in order to improve its competitive advantages as an economy. However, the crisis and its effects were so severe that it did not only hurt the country's public finances but also the core of its banking system through a chain of reactions in the economy with one major consequence being the generation of very high non-performing loans.

#### 2.5 The Phenomenon of High Non-Performing Loans

It is generally accepted that the smooth balance of a banking system, meaning the maintenance of a good quality of loans that have been granted and the normal servicing of these loans by their borrowers depends on the economic cycle. During favorable economic

periods, the loans of a banking system tend to be repaid smoothly and thus the credit risk can be sustained at relatively low levels. On the other hand, when economic conditions become tougher and especially when a crisis occurs, such as in the case of the global financial crisis of years 2007 - 2008, the credit risk of a banking system deteriorates considerably and there is the phenomenon of high non-performing loans.

As noted previously, the global financial crisis affected many economies and banking systems due to the credit crunch that occurred in the international economic and financial environment. Looking at the conditions of various countries and their economies on pre crisis and on post crisis levels (see graph below), it is easily observed the dramatic change of the landscape as far as the non-performing loans (NPLs) were concerned during those two different economic cycles.



Graph 2.4:NPL Rates in Various Countries (%)Pre Crisis (Year 2007) and Post Crisis (Year 2013)Source: International Monetary Fund.

From the one-digit and quite low NPL rates in 2007 for example, the crisis "brought" especially high levels of NPLs (two-digit and in some cases above 15%) in several countries such as in the economies of Italy, Hungary, Bulgaria, Ireland, Cyprus and

Greece, which was the country with the highest NPL rate among a large group of economies in 2013.

In Greece, prior to the crisis, the rate of non-performing loans compared to the total loans of the domestic banking system used to range at very low levels, namely less than 7% encouraging the Greek banks to continue lending out money to borrowers, both corporations and households. However when the country and its economy was starting to show signs of weakness due to the occurrence of the global crisis, the domestic NPL rates started to move upward on gradual but steady pace. When the fiscal crisis occurred in Greece during the year 2010, the aggregate NPL rate of the banking system had already climbed at above 10% level. As the years passed by and the economic crisis was deepening, the NPL rate settled at a territory exceeding 30%, signaling the weak and risky conditions under which the Greek banking system operated.





Source: Bank of Greece, 2014: Alpha Bank estimates

# Graph 2.5: Greece, Non-Performing Loans per Category, Period 2005 - 2014 (Corporate, Housing and Consumer Loans – Total Loans) Source: Bank of Greece, Alpha Bank Research.

During the above examined period, the most notable surge in NPLs was observed in the area of consumer loans, with their NPL rate approaching in certain periods thelevel of 50%. As second category in terms of the level of NPL rate appeared the corporate loans which exceeded 30% and followed a similar path or pattern with the aggregate NPL rate of the Greek banking sector. Finally, the housing loans proved to be more resilient than the other two categories as their NPL rate remained below 30% throughout the core period, 2010 - 2014, of the crisis. However looking at the general trend of the NPLs in the Greek economy it was observed a steepening pattern in the evolution of NPL rates per loan category as the crisis became tougher and deeper.

As presented in the current chapter, the intense and successive events that were initiated from the US credit crisis of years 2007 - 2008, from the generation of the global crisis and from its contagion into the European economy during the period 2009 - 2010, seriously tested and finally undermined the endurance of the already fragile Greek economy. The above events resulted into a long lasting and extended Greek crisis taking various forms – fiscal, economic, banking and debt crisis – leading the economy to a default status and affecting every single aspect and sector of the domestic environment.

Unavoidably, the country's banking system was largely affected by the course of events with the most notable developments being the surge in non-performing loans and the unprecedented deposit outflows observed in the economy. In particular, the creation of non-performing loans resulted from the consequences of the severe economic crisis on the generated income of both households and corporations, as well as on the employment level of the economy.

# CHAPTER 3 NON-PERFORMING LOANS (DEFINITION – INTERPRETATION), NON-PERFORMING LOANS IN THE GREEK BANKING SYSTEM

This chapter presents the official definition of the non-performing loans which may be generated from time to time or amid tough economic conditions in a country's banking system whereas at a later stage it highlights information, data and the latest trends of the non-performing loans in the Greek market and economy.

Since the international economies are characterized by various economic cycles, which as discussed in the previous chapter are not only favorable (such as growth / recovery) but also unfavorable (such as recession and / or crisis), the potential inability on behalf of borrowers to repay their loans to the banking system is a very important risk which must be always considered and evaluated. This risk, as it has been the case in the most recent global financial crisis, has fueled the growth of non-performing loans (NPLs) in the economies, whereas in the cases of the weakest countries such as in the southern part of the Eurozone it has generated a large quantity of not only NPLs but also defaulted loans coming from both corporations and households. Indeed due to the weak economic growth, NPLs increased in the Eurozone countries since the dawn of the crisis to more than  $\notin$  900 billion at the end of 2014. Greece has been probably the country that was hit to the largest degree, among other economies, in terms of NPLs from the recent economic crisis given the fact that the crisis has been the case for several years now in the particular country.

The present chapter deals with the broader definition and explanation of the nonperforming loans in the international banking system whereas it proceeds to demonstrate the conditions of the Greek banking system with regard to the NPLs. For this purpose, selected data concerning the non performing loans of the Greek economy are presented from the most recent period, 2014 - 2016. The presentation of the relevant data and information takes place in order to highlight the large and negative repercussions of the country's economic crisis on the loan portfolios of the Greek banks. In a later chapter, the potential relationship between macroeconomic parameters and the development of NPLs in Greece will be further explored and also statistically tested based on a combined methodology consisting of both correlation and regression exercises.



Graph 3.1: Real Output in the Economy in Different Countries and Points in Time Note: Index, pre-crisis peak = 100 / Pre-crisis peaks are 2007 for Greece, 1997 for Asian crisis, 2008 for Eurozone crisis and 1929 for Great Depression. Source: Eurostat, IMF, Haver Analytics.

The proliferation of the non-performing loans in the Greek economy along the period of the crisis was so severe that significantly affected the asset structure and profitability of the banking system. Furthermore as the above chart illustrates, it was the persistence of the crisis environment and the long-lasting, up until recently, macroeconomic deterioration in terms of output and demand that exacerbated the effects of both the crisis and the subsequent recession upon the Greek banking system. Both corporations and households became gradually unable to repay back their loans given the gaps that were experienced in economic activity, income and employment level in the domestic economic environment. Under all those tough economic and financial conditions, the Greek banks incurred huge deficits in terms of profitability and equity, and as a result they proceeded into successive, four in fact, phases of recapitalization in order to revive and strengthen their especially weak capital adequacy ratios.



Graph 3.2: Banks' Non-Performing Loans

Note: Percent of total loans, Q2 2013 or latest. NPLs are payments 90 days or more overdue. / Source: IMF, Economist.

At the same time Greek banks' major strategy has been up until now to restructure most of their NPLs and thus prevent situations where they would be forced once again to recapitalize their balance sheets. As of today, the strongest efforts made by the Greek banks are not towards growth but mainly towards achieving the reduction of their non-performing exposure, utilizing various policies or techniques such as the reduction of interest rates, the activation of grace periods, the extension of loan maturities as well as other measures.

#### 3.1 Definition of Non-Performing Loans (NPLs)

There are various versions as far as the detailed definition of the Non-Performing Loans in the international banking system is concerned however until today there appears to be an agreement in terms of the general definition of the NPLs. Based on the definition provided by the European Banking Authority (EBA) "...A non-performing exposure is an exposure that is 90 days past-due (material exposure) or unlikely to be repaid in full without collateral realization (irrespective of any past-due amount or of the number of days past-due), or impaired or defaulted according to the applicable accounting or regulatory frameworks." In other words, non-performing is a loan which has not been repaid to the bank under its contractual terms for at least a considerable period of time, in this case a period of three months (90 days).

On interchangeable basis, the non-performing loans (NPLs) are also called as nonperforming exposures (NPEs) in the financial literature and bibliography where NPEs may be exactly the same with the NPLs but also they may imply a larger pool of "bad" loans including debt securities, other debt instruments as well as loans which have not been repaid even for a shorter period of time than the 90 days mentioned in the above definition. In this context, the definition of NPEs may be considered as strict and demanding compared to the one of the NPLs. In fact and with regard to the case of the Eurozone, the use of the term NPEs was necessitated a couple of years ago by the European Central Bank (ECB). At that time the central bank authority viewed that European banks had to report their nonperforming loans on a more conservative basis in order for the European banking system to be able to precisely calculate and evaluate its credit risk as well as its overall stability.

Also as of today, the broader definition of NPEs depends on additional factors referring to country policies as well as international or domestic accounting standards among others. However what is common in all those alternative approaches is the number of days namely the 90 days that have to be past due in order for a loan to be considered or classified by a banking institution as non-performing exposure.

In Greece, which is the subject country of the current Thesis, there is a unified application concerning the definition of NPLs by all the major banking institutions in line with what has been presented above. The country has four major, systemic, banks namely Alpha Bank, National Bank (NBG), Piraeus Bank and Eurobank, and one medium bank namely Attica Bank, and they all apply the general criteria in defining their NPLs with the most important being the number of days past due (90 days). The NPL time series which will be presented in a later chapter of the Thesis have been based on the respective data collected, updated and held by the Bank of Greece (BoG), the country's central bank, according to the above presented definition of NPLs / NPEs.

Furthermore with regard to Greece, according to the guidance issued by both the BoG and the EBA, especially after the crisis' multiple effects on the Greek banking system, the banking institutions are now imposed to report analytical data and information concerning their NPL / NPE positions towards the supervisory authorities (Bank of Greece Executive Committee Act 42/30 May 2014 and Act 47/9 February 2015).

#### **3.2 Non-Performing Loans: The Greek Case**

The Non-Performing Exposures in the Greek market were approaching EUR 110 billion during the year 2016 consisting of a mixture of corporate, housing as well as consumer loans with the latter being the most non-recoverable loan category. The following table highlights the most updated figures and ratios with regard to the non-performing exposures and assets in Greece during the year 2016.

#### **GREEK BANKING SYSTEM**

**Indicative Figures & Ratios** 

NPE (Non-Performing Exposures): EUR 105-110 billions NPE (Non-Performing Exposures) Ratio: 45% (September 2016) NPL Ratio: 33% (June 2016) NPL Ratio of Consumer Loans: 45%-46% NPL Ratio o Housing Loans: 31% NPL Ratio of Corporate Loans: 31%

Source: Bank of Greece.

The non-performing loans that were generated in the Greek market following the persistent economic crisis affected on a relatively balance manner the balance sheets and asset structures of all four systemic banks of the country, namely Alpha Bank, National Bank (NBG), Piraeus Bank and Eurobank. In 2015, NPL ratios (meaning non-performing loans as percentage of total loans) ranged from 35% in the case of NBG to 52% in the case of Piraeus, whereas the coverage ratios (meaning total loan loss provisions as percentage of NPLs) ranged from 44% in the case of Piraeus to53% in the case of NBG and Eurobank. The following graph depicts the respective ratios of all four systemic banks during the year of 2015 for indication purposes.





Corporate loans were notably hit in terms of defaults from the very dawn of the Greek crisis with their levels rising steadily despite the efforts made by the banking institutions towards restructuring and rearrangement of their contractual terms.





By the year 2014, Greek non-performing loans reached especially high levels, in fact unprecedented for several decades in the Greek economy. Consumer loans were the most problematic loan category followed by corporate loans and housing loans.



Graph 3.5: Greece, Non-Performing Loan Ratios per Major Category (%)

Indicative Year: 2014, Source: Bank of Greece



#### Graph 3.6: Greece, Sectors with Low NPL Ratio

(% of Total Number of Non-Performing Loans), Indicative Year: 2014, Source: Bank of

Greece

In the case of Greek corporate loans, the sectors of energy, shipping and health care proved to be more resilient against the creation of NPLs than other sectors such as the textiles, agriculture, commerce, construction and manufacturing.



Graph 3.7: Greece, Sectors with High NPL Ratio

(% of Total Number of Non-Performing Loans), Indicative Year: 2014, Source: Bank of



Greece

## Graph 3.8: Greece, Sectors with High NPL Ratio

(% of Total Value of Non-Performing Loans), Indicative Year: 2014, Source: Bank of

Greece

During the period 2015 – 2016 and despite the political and economic uncertainty prevailing in the country -especially in year 2015- the growth of NPLs in the Greek banking system was somehow set in deceleration mode with the respective NPL ratios per major loan category (corporate, housing and consumer) evolving lower from their peak levels at the core of the economic crisis. In their efforts to tackle the unfavorable and ongoing phenomenon of NPL generation, Greek systemic banks continued to adopt a variety of policies in order to restructure their problematic loans.

These policies included among other the following actions:

- Capitalization of overdue payments and restructuring of loans in a manner that would more properly fit the ever changing profile of the borrowing entity, meaning household or corporate entity.
- Long-term actions such as extension of loan maturities and renegotiation of interest rates on the respective loans towards a lower level.
- Selective haircuts in consumer loans and credit card obligations based on income criteria.

As of the year 2016, the Greek systemic banks had escalated their efforts to attain more permanent and sustainable arrangements concerning the NPLs of their loan portfolios, setting at the same time specific targets with regard to the reduction of NPLs in the following 2-3 years. Those targets to the extent they were recently announced appear to be quite optimistic as they assume a very favorable political and economic environment in the country. However, and as an insight for the purposes of the current Thesis, the management of the Greek banks through the release of those targets implied that with the improvement of the broader economic and market conditions the reduction of NPLs would be made more feasible and attainable. This implied relationship between macroeconomic factors and NPLs is precisely what the current Thesis is going to test in a later chapter.

In synopsis, the present chapter dealt with the definition of the non-performing loans (NPLs) in the current international economic and financial landscape whereas it proceeded to present the main data and information with regard to the NPLs of the Greek economy as this comprises the subject matter of the Thesis. The chapter also touched on the relevant actions taken by the Greek systemic banks in order to more effectively handle and ultimately reduce the NPLs in the domestic economy. The data and information presented in this chapter assisted in the initial understanding of the evolution of NPLs in Greece amid the country's severe economic crisis, whereas the potential determinant factors of NPLs will be more analytically discussed and explored in the following two chapters of the Thesis.

# CHAPTER 4 MACROECONOMIC AND BANK-SPECIFIC DETERMINANTS OF NON-PERFORMING LOANS

The following sections refer to the Thesis's "Macroeconomic and Bank-Specific Determinants of Non-Performing Loans (NPLs)" Chapter which includes the literature and bibliography review of the Thesis. In this context there is a quite analytical discussion about the determinants of the non-performing loans as they are presented in selected academic papers, in scientific articles and in selected bibliography concerning the international as well as the Greek economy. The literature review and discussion facilitates the formation of a list of factors that can be viewed as determinants of the growth and the evolution of NPLs in the economy.

Over very long periods of time (3-5 decades or even longer), the non-performing loans (NPLs) evolve according to the various economic cycles occurring in the global economy or in national economies. In periods when economic conditions are normal, NPLs will be ranging at low levels, whereas when economic conditions aggravate dramatically, NPLs will be surging to high or unexpected levels. The last economic cycle which experienced the extreme international crisis conditions saw NPLs to climb, depending on the economy, at above average, or high or record levels. The latter occurred especially at vulnerable economies such as the Greek economy of the period 2010-2015. It is clear that the growth pattern of NPLs in every economy is linked to a number of factors which can be easily identified based on pure economic logic and without performing any statistical analysis. These factors can be treated for the purposes of any analysis as determinants of NPLs. For example such factors are the growth of economic activity (Gross Domestic Product - GDP) and the level of unemployment as they both determine the level of income that can be utilized for the repayment of loans in a banking system and broadly in an economy.

The present Chapter is formulated as follows:

- There is a discussion of specific economic and financial factors affecting the nonperforming loans in the international economies;
- Also a special reference is made with regard to the importance of the credit risk for banks and with regard to the quality standards / characteristics of their loan portfolios;

- There is also a literature review discussing the main conclusions drawn out of research works with regard to the most determinant factors of NPLs;
- Finally a separate discussion takes place regarding the domestic currency depreciation and the NPLs.

#### 4.1 Economic Variables & Non-Performing Loans (NPLs)

As it was illustrated in the previous sections and chapters, the sharp decline of the Greek GDP by 25% over the crisis years and the subsequent economic recession were the main reasons of the inability of domestic companies and households to smoothly repay their loans towards the Greek banking system. The weakening economic activity due to the significantly lower demand and the loss of income led to a sudden surge of the unemployment rate in the economy and tightened the liquidity conditions of both households and companies (Karamouzis N., Chardouvelis Gk., 2011). As result the NPLs increased on an unprecedented rate and until today continue to hamper the recovery and the growth potential of the domestic banking sector as well as the broader economy.



Graph 4.1: Greek Market, Non-Performing Loan Ratios (%), 2010 - 2013 Source: https://www.ceicdata.com/en/blog/ceic-newslert-non-performing-loans-greece-surgerecordhigh Historically looking at the international economies, the changes in economic cycles and the abrupt emergence of economic or financial shocks lead to corresponding changes in the level of non-performing loans in the banking systems. During periods of economic growth or recovery, the level of NPLs remain under control or even very minimal as it was the case prior to the 2007 – 2008 crisis, whereas during periods of abnormal economic conditions the sudden explosion of NPLs becomes the most important concern of the banking systems and the respective economic authorities.

In this context, the academic research has shown over the past years the close relationship between the NPLs and specific economic or financial parameters prevailing during the economic cycles under consideration. Particularly during harsh economic conditions, as shown by the related literature, the most obvious factors that determine the generation of NPLs are the following:

- Growth level of the gross domestic product (GDP) of an economy,
- Unemployment rate,
- Interest rate on loans, and
- Foreign exchange rate fluctuations.

#### Non-performing Loan Ratios, 2008–2014

Green = less than 5% ; Yellow = between 5 and 10%; Red = above 10%



# **Graph 4.2:** Europe, NPLs after the Global Financial Crisis Source: Various country authorities including central banks.

By definition, the ability of borrowers to smoothly repay their loans is almost diminished in periods when the GDP in the economy contracts abruptly, thus creating unemployment and resulting into a significant loss of income for households and corporations alike (Beck, R., Jakubik, P. and Piloiu, A., 2013). The above chain of reactions was mostly evident in the case of the Greek economy and its banking system during the past years, whereas its repercussions are still felt as regards to the country's real economy fundamentals.

By looking at the actual events and facts, it has become clear that the GDP contraction is not necessary and sufficient condition for the generation of extensive NPLs in an economy. In other words, the GDP contraction has to be very sharp and also be accompanied by a high increase of unemployment in order to create high NPL rates in a banking and economic environment. For example, looking at the case of the Greek economy it becomes evident that the combination of the GDP contraction by 25% during the crisis years and the climbing of unemployment above the level of 30% was the dual factor that led to the "explosion" of the non-performing loans in the economy and severely affected the viability of the domestic banking system. The Greek banking system had

actually to undergo four phases of recapitalization in order to offset part of the deficits incurred from the high loan loss provisions that were recorded. Two other obvious factors that have historically determined the level of NPLs are the interest rates and the domestic currency devaluation. The interest rate determines the real cost of a loan and the monthly installment consisting of the capital and the interest that has to be repaid by the borrower.

The interest rate implies the credit profile of a borrower, the risk that accompanies the loan that was granted from the lending institution to the borrower, and the probability of the full repayment of the loan according to the borrower's special characteristics. Any increase or decrease in the interest rate automatically adjusts the monthly loan installment and consequently affects the ability of the borrower to repay the loan. For example in the U.S. loan market when the FED raised interest rates during the years 2004 - 2007, the monthly loan installments of American borrowers increased to a significant extent therefore affecting negatively those borrowers' ability to make the regular payments. In fact in some cases the above ability was diminished.



Graph 4.3: Share of NPLs Held by Banks in U.S.A., Period 1995 - 2015

Source: US Federal Reserve.

With the emergence of the credit crisis, the FED reversed its policy and lowered the short-term interest rates but it was too late to keep away the crisis' multiple effects. Soon the crisis became contagious affecting the global environment and the European continent, especially its more vulnerable economies in the south. As far as the US market is concerned, the above rate hikes created a new unprecedented generation of nonperforming loans in the domestic banking system. Looking at the Greek loan market over the past several years, it should be noted that interest rates charged on loans have been based on the Euribor (or an ECB related short-term interest rate) plus a spread which indicates the risk profile characterizing each borrower either corporation or individual. In other words the interest rates charged on the Greek loans (such as mortgages, corporate loans, consumer loans and credit cards) have been mostly floating rates as they change according to the economic cycles as well as according to the decisions made in terms of monetary policy.

During the Greek economic crisis, despite the fact that the ECB rates gradually declined to almost zero levels, the Greek lending rates continued to remain high as the domestic banks imposed large spreads on the interest rates of those loans in order to be compensated for the higher risk they had to assume. For example at the core of the crisis, namely the period 2012 - 2014, there was the phenomenon of interest rates on corporate loans ranging above 9% or 10% while the Euribor was ranging at around 0.5% or even lower. However these higher interest rates imposed due to the high risk environment surrounding the Greek loans was the main cause of the creation of even larger in number and in value problematic loans or NPLs.

The fourth major cause of NPLs that has been observed over the past decades refers to the domestic currency devaluation. This has been seen as a quite frequent phenomenon in countries where there has been a considerable depreciation of the domestic currency against a foreign currency on which the banking system has issued a significant quantity of loans in the domestic market. In this case, the domestic borrowers have to repay their loans by utilizing the domestic currency to buy the more expensive foreign currency thus becoming less capable of repaying the loan installments (capital plus interest) required in foreign currency. In other words when the foreign currency appreciates, domestic borrowers have to earn and spend larger amount of domestic currency in order to repay the same loan installment expressed in foreign currency. The above weakens the ability of the borrower to fulfill its debt obligations since it is not feasible for any borrower to adjust the domestically earned income in order to satisfy a plan of higher repayment needs in a more expensive foreign currency. Moreover with the foreign currency appreciation, the borrower reaches a point in time when the balance of the loan expressed in domestic currency (the capital remaining to be repaid) exceeds the initial amount of the loan that was collected when it was also expressed in domestic currency.

This phenomenon became evident in the Greek market over the past several years when the Swiss Franc began to considerably appreciate against the Euro and given the fact that the domestic banking system had previously issued thousands of loans denominated in Swiss Franc to Greek borrowers. Due to this unpredictable foreign currency development, a new generation of non-performing loans was created in the Greek market, in addition to the NPLs that were generated due to the economic crisis, the loss of income and the surge in unemployment. Apart from the above factors, namely the GDP growth, the unemployment rate, the level of interest rates and the domestic currency devaluation (M. Nkusu, "Nonperforming Loans and Macro financial Vulnerabilities in Advanced Economies", IMF Working Paper 11/161, 2011), there are additional factors, however of lesser importance, that have been observed to affect the formation of non-performing loans in an economy. These factors are mostly of micro-economic nature and relate to the banking sector's fundamentals and / or aspects. Such factors concern among others the following:

- The financial size of the bank granting the loan (smaller banks tend to issue riskier loans to generate higher returns);
- The bank's position in the market (banks with smaller market shares attract riskier borrowers);
- The efficiency of the bank's operations in terms or credit risk management (weak operating structures intensify the emergence of NPLs over the time);
- The strength of the bank's management team to identify the most effective business segments to grow its loan portfolio.

#### 4.2 Banks' Credit Risk

In terms of official definition and in accordance with the Basel Committee on Banking Supervision (or BCBS), a bank's credit risk originates from the probability that a borrower will not be able to repay the loan which the former granted to the latter based on the precise terms described in the respective contractual agreement. The credit risk refers both to the uncertainty of the repayment as well as to the timing of the loan repayment. This type of risk is considered to be the most significant for the banks' operations and constitutes the area which the banking system as a whole monitors and evaluates most closely (M. H. Pesaran, T. Schuermann, B. Treutler and S. M. Weiner, 2006).

The significance of this type of risk was also demonstrated during the last credit, financial and economic crisis when it hit the banking systems of both U.S.A. and Europe. The credit crisis of the years 2007 - 2008 resulted into the explosion of loans that were not finally repaid and were either indefinitely postponed or written-off. The realization of the credit risk makes the banking system especially fragile and susceptible to further deterioration of its core operation and existence. This is the reason why the timely monitoring of credit risk in order to avoid its occurrence in the banking system and consequently in the broader economy has become top priority for banks across the globe independently of the economic cycles. According to the works of academicians and finance practitioners, the recognition of the importance of credit risk helps the banking systems to bolster their operations and become more inelastic to external factors that could lead to credit risk generation (Boss, M., Krenn, G., Puhr, C., Summer, M., 2006).

Furthermore, economies and countries by having cautious and solid banking systems are in a better position to overcome credit and financial crises with the least possible repercussions in their operations. In this context it is crucial for banks to recognize and effectively manage the determinant factors of credit risk, factors which on a broader basis are liable for the creation of non-performing loans in a banking system. For example, such factors may relate to macroeconomic variables as well as to specific characteristics such as the sector, the type of business or the currency of the loan. The banks by monitoring and examining the effect of these particular factors become more capable in predicting credit risk events and thus increase the probability of avoiding such type of events or even
mitigating their broader consequences. Various banking institutions have also proceeded with studies (such as the one of A. Hamerle, T. Liebig and H. Scheule, 2004), which examine and analyze the behaviors of companies and households when it comes to the repayment of loans under normal or extreme economic conditions covering long-term periods beyond 10 years.

## 4.3 Quality of Loan Portfolios & Credit Crisis

There is no doubt that the credit and financial crisis of the years 2007 - 2008 was the main cause of NPLs generation in the international economies and mostly in the economies that were "violently" hurt from the credit crunch and the subsequent lack of external financing in their fiscal policies. Prior to the crisis and for many years, the international banking systems operated on a smooth basis and loans on behalf of both corporations and households were repaid according to what it was expected. In other words there had been no signs about a possible inability of borrowers to repay their loans. On contrary there was the certainty that the banking system would continue to function properly, that loans would be normally repaid and therefore it would be a "good idea" to even collateralize these loans. The certainty was evident across the U.S. and the European continents whereas the idea of collateralization came into existence mostly in the U.S. market. For all the years that preceded the crisis, the quality of the loan portfolios on the asset side of the banks, on internationally basis, was sound whereas the non-repayment rates and the loan loss provision ratios fluctuated at very low, specifically one-digit, levels. As mentioned above, due to these factors, the banks were able to collateralize the loans and resell them as separate portfolios in order to gain more liquidity.

However, with the dawn of the credit crisis, the scene of the global banking system changed dramatically and the axiom regarding the uninterrupted repayment of loans was crucially hit (Beck R., Jakubik P. and Piloiu A., February 2013). The U.S. economy initially and the European economies in later stage felt the burden of the nonperforming loans that were geometrically multiplied and affected the smooth operation of

## their banking systems.



Graph 4.4: Euro Area, Non-Performing Loans, Period 2009 – 2013 (EUR billions) Source: Central banks, IMF.

While the U.S. economy took drastic measures to clean up the non-performing or bad loans by strongly capitalizing the banking system, the European economies followed only a gradual and less determined action plan to tackle NPLs resulting in some cases into the significant deterioration of their own banking systems. The example of the Greek market and of its systemic banks is even nowadays one of the most illustrative ones with the non-performing exposures ranging at above 40% of total loans. Certainly, there are examples of other South European economies with notable problems of NPLs such as in the cases of Portugal, Spain and Italy. Other examples include the economies of the Baltic countries, such as the case of Latvia where the decline of GDP by 18% during the crisis resulted into the surge of NPLs by over 200%. On contrary in the stronger from a fiscal perspective European economies such the German economy, the emergence of NPLs was not so fierce and proved to be even more controllable.



Graph 4.5: Euro Area's Weaker Economies, Non-Performing Loan Stock Period 2009 – 2014 (EUR billions) Source: Central banks, IMF.

## **4.4 Literature Review**

The credit risk that lurks in the banking sector has been widely discussed and analyzed in both academic literature and scientific research works of practitioners. In extreme economic conditions, such as the global financial crisis of the years 2007 and 2008, the credit risk may take the form of generation of especially high portfolios of non-performing loans in the balance sheets of banks. In this context, academicians as well as practitioners have conducted various research works in order to illustrate the causes of credit risk events in various time periods across different economies and markets, i.e. meaning either developed or emerging ones. Some original works such as King & Plosser (1984), Bernanke & Gertler (1989), Kiyotaki & Moore (1997), as well as Bernanke, Gertler & Gilchrist (1998) deal with the interactions between the macroeconomic environment and the fundamentals of the banking sector by utilizing various theoretical as well as applied models. These pieces of works attempt to explore, among other things, the probabilities of credit hardships (non-performing loans) in the banking industry as result of unfavorable or extreme macroeconomic developments.

Another set of works, namely Wilson (1997), Benn, Redowood (2003), Peng, Lai, Leung & Shu (2003), Krenn, Schwaiger & Wegschaider (2004), Drehmann (2005), Pesola (2005) and Jakubík (2007) focus on the development of financial models that monitor and evaluate behaviors of both corporations and households with regard to loan repayment patterns whereas some of them examine the macroeconomic aspects and causes of credit risk.

Dullmann et al (2007) and Allen, Saunders (2004) concluded that the emergence of credit defaults in the economy, meaning the inability of companies and households to repay their loans, was strongly related to the cyclical characteristics of the economy itself. During periods of rising economic activity the probability of default would be decreasing whereas under extreme macroeconomic conditions the probability of credit default would substantially increase. Unavoidably and ultimately, credit defaults in the economy would hamper the smooth operation of the banking institutions and create significant deficits in the balance sheets resulting into the need for capital injections (recapitalizations) on behalf of banks.

The research papers of Peura, Jokivuolle (2004) and of Rosch, Scheule (2007) contributed to a better understanding of the variance of various credit risk parameters through the years as well as through different economic and financial cycles, even under extreme circumstances. In this context, the researchers also applied the technique of stress-testing of actual loan portfolios. Stress-testing models and techniques were also applied in the research works of Pesaran, Schuermann, Treutler & Weiner (2006), of Jakubík & Schmieder (2008) and of Schmieder, Puhr & Hasan (2011). These were applied on macroeconomic level by examining possible effects on non-performing loans (NPLs) and loan loss provisions due to significant changes in the macroeconomic conditions. In some cases it was proven that the main driver of NPLs may relate to the broader economic cycles and the financial performance of the corporate community within the economy. This would stand not only on national but also on international level. In other cases it was demonstrated that the effect of economic cycles is also felt on certain accounting items of the banks' balance sheets.

Research works dealing with stress-testing models were also conducted by various central banks' research departments and also by independent analysts. These stress tests mainly correlated macroeconomic variables with the growth patterns of nonperforming loans. Cihak ("Introduction to Applied Stress Testing", IMF Working Paper 07/59, 2007), and Jakubík & Sutton ("Thoughts on the proper design of macro stress tests", 2011) tested some variables as determinant factors of NPLs in the context of their efforts to guide monetary and economic authorities during the formulation of their corresponding action policies.

With regard to the recognition of certain factors affecting the generation of nonperforming loans in the economy, several research works, such as the cases of Virolainen (2004) and of Beck, R., Jakubik, P. and Piloiu, A. (2013), concluded towards a number of determinant variables naming among others the GDP growth and the level of interest rates. Especially in the U.S. credit crisis of 2007 - 2008, the increasing levels of interest rates of the FED over the years preceding the crisis were to large extend the trigger factor for the collapse of the mortgage loan market, whereas the GDP contraction, the high unemployment and the loss of income observed during the crisis exacerbated the phenomenon of defaults of both loans and other credit instruments. Other factors recognized as determinant factors of corporate NPLs, in similar literature works, were the level of corporate debt in the economy, the level of inflation, the real level of salary income, the employment level, and the equity market performance among others. In the case of retail or household loans, the determinant factors included once again the unemployment rate and the level of interest rates charged on the loans.

Furthermore in the research work of Pain (2003) factors mentioned were the GDP growth, the credit expansion of the economy, the interest rates and the concentration rate of loan portfolios. There have been also studies examining the banking sectors of different markets and economies in relation to the appearance of credit risk events and the creation of NPLs. For example, Beck R., Jakubik P. and Piloiu A (February 2013) reviewed the quality characteristics of various banks among different countries and over a longterm horizon (approximately 10 years or even longer) thus covering both normal and abnormal economic time periods. Particularly the researchers utilized data and information for 75

countries and detected several determinant factors of NPLs such as the level of economic activity, the precise patterns of the interest rates, and to asecondary degree, the possible depreciations of domestic currencies and the significant deteriorations in equity valuations. Nkusu (2011) conducted a similar research work by examining the fundamentals of 26 developed economies from the year 1988 to the year 2009 and quantified the relationships between the quality of bank loan portfolios (dependent variable) and various factors (independent variables) referring to macroeconomic and financial imbalances. Glen & Mondragón-Vélez ("Business Cycle Effects on Commercial Bank Loan Portfolio Performance in Developing Economies", 2011) examined 22 developed economies during the period 1996 – 2008 (meaning including the start of the most recent financial crisis) and found out that real GDP growth, the actual financial leverage of the private sector and the weak capitalization of the banks were the main causes for generation of high loan loss provisions in the economy.

Furthermore Espinoza and Prasad ("Nonperforming Loans in the GCC Banking System and their Macroeconomic Effects", 2010) studied a group of 80 banks during the period 1995 – 2008 concluding that lower economic activity and higher interest rates were leading to higher probability of non-performing loans (NPLs) generation. With regard to research papers focusing on certain geographic markets, it is noted that such works exist in the cases of Louzis, Vouldis, Metaxas ("Macroeconomic and bank specific determinants of non-performing loans in Greece: a comparative study of mortgage, business and consumer loan portfolios" 2010), Blavy, Souto (2009), Gerlach, Peng (2005), Quagliariello (2007) and Salas, Saurina (2002). Louzis, Vouldis, Metaxas (2010) dealt with the Greek market and examined the determinant factors of NPLs mainly concentrating on GDP growth, unemployment, interest rates and the quality of banking management. Quagliariello (2007) examined the Italian banking sector and the behavior of domestic banking institutions over the years and across different economic cycles. It was concluded that credit risks were dependent on macroeconomic conditions and broader cycles of economic activities whereas the vulnerability of the banks' profitability under tough macroeconomic conditions was recognized. Gerlach, Peng ("Bank lending and property prices in Hong Kong", 2005) dealt with credit market of Hong Kong and property prices attempting to explore relationships and cause / effect parameters as well as to test those findings. Blavy, Souto (2009) focused their research work in the Mexican banking sector and examined the sector's correlation with the macroeconomic conditions prevailing indifferent time periods, whereas Salas, Saurina (2002) dealt with the bad loans of the Spanish banks presenting the main determinant factors of loan loss provisions in the domestic market.

Such factors included, among others, various macroeconomic variables such as the yield spread, the capital adequacy of the banks, as well as the actual market "power" of each banking institution. In general, the above presented research works could also become objects of additional study for international economic and monetary authorities as well as for other supervisory bodies active in the global money and capital markets. Authorities which supervise and closely monitor the function of the markets have the duty to preserve their smooth and balanced operation in the short-term as well as in the longer-term horizon. Specifically in the case of the international banking systems, the supervisory authorities have to maintain the cautious policies in the issuance of loans to borrowers so that there are no phenomena of considerable or excessive generation of NPLs. That was the case in Greece as well as in other international economies such as in Cyprus, etc. over the past years and should have been avoided under a stricter supervision policy framework on behalf of the domestic authorities. In this context the authorities must always evaluate the credit risk of the banking systems as well as the quality of the loan portfolios of the member banks.

## 4.5 Domestic Currency Depreciation & NPLs

Another determinant factor of the non-performing loans refers to the depreciation of a domestic currency versus a foreign one. This factor mainly affects loans that have been granted in foreign currency and are repaid from income earned in the domestic currency. Over the years the policy on behalf of lending institutions to promote loans in foreign currency to companies and households alike has been evidenced in several European economies, mostly in the Eastern as well as Southeast Europe (Jakubik P., Schmieder C., September 2008). This policy was popular in certain periods of time due to the attractiveness of the lower interest rate offered (compared to the interest rates prevailing in the domestic economy) as well as due to the stronger domestic currency versus the foreign

one. For example, in Greece during the period 2010 - 2014 there was a considerable emergence of NPLs that concerned loan agreements that had been made in Swiss Franc. Those loans emerged from the mid 2000s, when the stronger Euro versus the Swiss Franc and the lower interest rates mainly the LIBOR paid for the foreign currency (compared to the EURIBOR paid for Euro denominated loans) made attractive such loans to companies and households.

After the year 2009, when the Swiss Franc began to considerably appreciate versus the Euro and along the Greek crisis period, the smooth repayment of those loans' installments (meaning capital plus interest) given the weaker Euro and the loss of income in the Greek economy was made very difficult, thus leading to the creation of a significant volume of NPLs. Similar cases concerning the generation of high NPLs due to domestic currency devaluation were seen in countries such as in Romania, Bulgaria and Czech Republic among others. With regard to the Greek case though, it should be noted that the vast majority of NPLs generated during the period 2005 - 2015 was not so due to the currency devaluation, but it was mainly due to the occurrence of the Greek crisis, the abrupt decrease of demand, the surge of unemployment and the substantial contraction of the average income per capita with regard to households and corporations.



Graph 4.7: Central & Eastern Europe, Non-Performing Loans Ratios (%) Pre-Crisis and Post-Crisis Source: Central banks, IMF.

## 4.6 Determinants of Non-Performing Loans in a Snapshot

According to the previously presented academic literature and scientific research, the most notable influential factors of the non-performing loans in the economy can be highlighted as follows:

DETERMINANTS OF NON-PERFORMING LOANS (both Corporate Loans and Loans of Households)

- GDP Growth (or growth level of critical sectors in the economy)
- Level of Real Interest Rates
- Return Ratios of the Banking Sector
- Loans to Deposits Ratio of the Banking Sector
- Level of companies' debt exposure in the economy
- Inflation
- Depreciation of Domestic Currency
- Industrial Production
- Real Salaries & Employment Level
- Stock Market Index Equity Prices
- Credit Expansion
- Oil Prices
- Degree of aggregation of loan portfolio in the domestic market

In conclusion, the present chapter attempted to present the most notable views concerning the non-performing loans and their determinant factors as such have been noted in various academic and other literature works over the past several years. The identification of a group of determinant factors that was performed through these research papers covering the international economies will assist the statistical exercise that will be made in the following chapter with regard to the variables affecting the growth of NPLs in the Greek market over the past 10 years.

## **CHAPTER 5 DATA ANALYSIS**

The following sections elaborate the Thesis's "Data Analysis and Methodology" Chapter based on the accompanying statistical model prepared in Microsoft Excel. The variables examined over an 11-year period in the Greek market are the NPLs as dependent variable and 8 independent factors as potential determinants of NPLs. The statistical analysis is performed through correlation and regression exercises. The previous chapter demonstrated a spectrum of research works that have been conducted in the fields of credit risk and non-performing loans in the banking system and the economy. Those research works referred to alternative time periods, different economic cycles, as well as various geographic markets, countries and sectors. In this context the research papers dealt with the analysis of various problematic credit environments across the globe and with the real causes of NPLs thus extracting or naming specific factors as their determinants.

Those identified factors were not exhaustive however they were indicative of the real causes of NPLs in the international economies, with some factors being more important and other factors being less important. Also, the factors related to both macroeconomic as well as bank specific aspects and in the majority of the examined research papers, the factors resulted through statistical exercises and stress testing.

The list of the determinants of NPLs is presented again below, for the purposes of the current chapter. DETERMINANTS OF NON-PERFORMING LOANS (both Corporate Loans and Loans of Households)

- GDP Growth (or growth level of critical sectors in the economy)
- Level of Real Interest Rates
- Return Ratios of the Banking Sector
- Loans to Deposits Ratio of the Banking Sector
- Level of companies' debt exposure in the economy
- Inflation
- Depreciation of Domestic Currency
- Industrial Production
- Real Salaries & Employment Level

- Stock Market Index Equity Prices
- Credit Expansion
- Oil Prices
- Degree of aggregation of loan portfolio in the domestic market

Based on the above list of determinants (which as noted is precisely the same with the one presented in the end of the previous chapter) and for the purposes of performing a statistical analysis, there will be a selection of factors which will be examined and tested as potential determinants of the non-performing loans in the Greek economy and market. The time period covered will be from the year 2005 until the year 2015, thus encompassing both normal and abnormal economic sub-periods, namely the growth period until 2008 and the subsequent recession period until 2015.

The selection of factors has been based on data and respective sources that can be made easily available in the Greek market. For the purposes of the current Thesis, the selected data, meaning the time series of the selected factors, have been mainly derived from the archives and records of Bank of Greece, the country's central bank authority. The statistical analysis is to be performed with the objective to identify which of the selected factors are statistically significant in relation to the formation and development of the non-performing loans in the Greek market over time, namely theperiod under consideration (2005 - 2015). Any statistically significant relations that will be identified will be discussed and then compared with the findings of the literature review for additional comments and discussion. Certainly, one of the ultimate purposes of this statistical exercise is to draw conclusions with regard to the effective anticipation of such credit events and also with regard to the precautionary actions that must be taken by the pertinent economic and / or banking authorities.

## **5.1 Statistical Data (Time Series)**

As noted previously, the data of NPLs and their potential determinant factors concerning the Greek economy and the domestic banking sector have been selected for the purposes of the current Thesis from the publicly available databases of Bank of Greece, the country's central bank. The data are depicted as time series and refer to an extended time period that spans almost 11 years and begins in year 2005. They cover both the pre-crisis years as well as the crisis and prost-crisis years up to the fiscal year 2015. According to the literature and bibliography review presented in the previous chapter, as well as based on the list of determinant factors that was compiled, there was a similar selection of variables with regard to the statistical analysis of the Greek market. The variables selected are both of macroeconomic nature and bank-related ones, and will be utilized for testing their significance on the growth patterns of Greek NPLs (non-performing loans) over time.

These variables are the following (presented in random order):

- Unemployment Rate,
- GDP (gross domestic product) Growth,
- "Expenses/Income" Ratio of Banks,
- Construction Capital Growth,
- Return on Equity (ROE) of Banks,
- Return on Assets (ROA) of Banks,
- "Loans/Deposits" Ratio of Banks,
- Yield Spread.

As mentioned, these variables are selected according to guidance collected from the literature review section (Chapter 4) of the current Thesis and based on the availability of data with regard to the Greek market. Therefore, these eight (8) variables are to be utilized as independent variables ("X") for the purposes of the current statistical exercises, with the non-performing loans (NPLs) being utilized as the dependent variable ("Y"). It was also noted that the above statistical data, namely the eight independent variables and the one dependent variable, are presented as time series covering both the pre-crisis period, years 2005 - 2008, as well the crisis and post-crisis periods in Greece, meaning the years 2009 - 2015.

The data can be classified into macroeconomic variables such as GDP growth and unemployment, and also into bank-specific parameters such as the financial ratios of the banks (ROE, ROA, loans to deposits, etc.). The bank-specific parameters concern mainly Greece's four systemic banks (in terms of market capitalization namely Alpha Bank, National Bank, Piraeus Bank and EFG Eurobank). The data are expressed and presented on quarterly basis and they have been extracted from databases of the Bank of Greece and the Hellenic Statistical Authority. For example, during the 4th quarter of 2015 NPLs rate stood at 35.60% compared to a level of 7.16% during the first quarter of 2015. As second example, GDP growth settled at -9.86% in Q4 2011 compared to 0.35% in Q1 2005. The full data expressed in time series, starting from the 1st quarter of 2005 and ended in the 4th quarter of 2015 for the one dependent variable and the eight independent variables are exhibited in the Appendix of the current Thesis. In the following pages, the dependent variable of NPLs and the eight independent variables during the period under consideration are depicted as graphs:



Graph 5.1: Unemployment Rate, Period 2005 – 2015



Graph 5.2: Quarterly Change of GDP, Period 2005 – 2015



Graph 5.3: "Expenses/Income" Ratio, Period 2005 – 2015



Graph 5.4: Construction Capital Growth, Period 2005 – 2015



Graph 5.5: Bank's Return on Equity, Period 2005 – 2015



Graph 5.6: Banks' Return on Assets, Period 2005 - 2015



Graph 5.7: "Loans/Deposits" Ratio, Period 2005 - 2015



Graph 5.8: Banks' Yield Spread, Period 2005 - 2015



Graph 5.9: Non-Performing Loans (NPLs) Rate, Period 2005 - 2015

#### 5.2 Methodology

Following the selection of the potential determinants of NPLs in the Greek market and the subsequent collection of the respective data in the form of time series, the next stage refers to the application of a methodology in order to detect whether these factors are statistically significant or not. In this context the selected methodology will examine and test the relationship between the NPLs and the other eight potential determinant factors. This is performed in two ways, initially through a correlation exercise and secondly via a regression exercise. Both exercises are necessary as well as appropriate in order to quantify the relationship between the non-performing loans in the Greek economy and the macroeconomic as well as bank specific factors which were selected for the purposes of the Thesis. Correlation Exercise In general, the concept of correlation examines the statistical relationship between two or more variables.

The variable usually comprises a set of data where for example there is a factor such the NPLs evolving and being tagged with a price over the time, meaning a percentage rate per quarter in this case. The same applies for example for unemployment, GDP, etc. in the context of the selected sets of variables in the presented methodology. The ultimate objective of the correlation is to identify the extent to which two sets of variables have a linear relationship. A multiple correlation exercise takes place between the 9 variables in the software program Microsoft Excel, with the results presented in the following page:

	Unemployment	Nominal GDP	Expenses / Income	Construction	Return on Equity	Return on Assets	Loans / Deposits	Yield Spread	NPLs
Unemployment	1								
Nominal GDP	-0.3221	1							
Expenses / Income	0.6539	-0.5329	1						
Construction	-0.2731	0.2580	-0.2722	1					
Return on Equity	-0.6855	0.6734	-0.6994	0.1973	1				
Return on Assets	-0.5826	0.6058	-0.4886	0.2461	0.7951	1			
Loans / Deposits	0.5524	-0.7053	0.4689	-0.1509	-0.7902	-0.7315	1		
Yield Spread	-0.7562	0.3203	-0.6102	0.2371	0.5339	0.2772	-0.3999	1	
NPLs	0.9554	-0.1369	0.4714	-0.2507	-0.5176	-0.4714	0.4666	-0.7197	1

Note: Correlation: > 0.25 and <-0.25 is considered moderate, significant and / or strong. The general rule is that correlation coefficients whose magnitude are between 0.7 and 0.9 indicate variables which can be considered highly correlated whereas correlation coefficients whose magnitude are between 0.5 and 0.7 indicate variables which can be considered moderately correlated

Table 5.1: Correlation Results

The above results point to moderate or significant correlation between NPLs and Unemployment (positive, meaning the higher the Unemployment the higher the NPLs), between NPLs and Expenses/ Income (positive, meaning the higher the Expenses/Income the higher the NPLs), between NPLs and Return on Equity (negative, meaning the higher the ROE the lower the NPLs), between NPLs and Return on Assets (negative, meaning the higher the ROA the lower the NPLs), between NPLs and Loans/Deposits (positive, meaning the higher the Loans/Deposits the higher the NPLs), and between NPLs and Yield Spread (negative, meaning the higher the Yield Spread the lower the NPLs). The above results are indeed anticipated meaning that they make sense in terms of economic logic as well as they are aligned with the findings of the literature review in the previous chapter. The only relationship that was expected to be statistically significant, and is not, refers to the relationship between NPLs and GDP.

#### Regression Exercise

In general, the regression analysis comprises another statistical tool to evaluate and measure relationships between variables. Through this analysis, the focus is shifting towards the relationship between one dependent variable and a group of variables which are called as independent ones. Compared to the correlation analysis, the regression analysis assists the better understanding of the precise numerical change occurring to the dependent variable when one of the independent variables changes while the others are held fixed, meaning unchanged. The regression analysis carried out for the purposes of the current methodology is utilizing the non-performing loans as dependent variable, and the eight independent variables already presented in this chapter:

- Unemployment Rate,
- GDP (gross domestic product) Growth,
- Expenses/Income" Ratio of Banks,
- Construction Capital Growth,
- Return on Equity (ROE) of Banks,
- Return on Assets (ROA) of Banks,
- Loans/Deposits" Ratio of Banks,
- Yield Spread.

In this context, the multiple regression exercise between the above 9 variables takes place in the software program Microsoft Excel and the results extracted are as follows:

## Table 5.2: Regression Results

## SUMMARY OUTPUT

Regression Statistics					
Multiple R	0.988613519				
R Square	0.97735669				
Adjusted R Square	0.972181076				
Standard Error	0.019605484				
Observations	44				

#### Table 5.3: Regression Results

ANOVA								
	d	f	SS	MS	F	Significa	nce F	
Regression		8	0.580679322	0.072584915	188.838799	1.8	7953E-26	
Residual		35	0.013453125	0.000384375				
Total		43	0.594132448					
Critical Value 2.21668	"F" should be higher than the	critical value						
	Occillaterate	Oto a doub Essay	4.01-1	Dilaha	1 0.5%	11	1	110000 05 00/
Intercent	Coefficients	Standard Error	I SIBI 0.12	P-value 0.01	Lower 95%	0 109147057	Lower 95.0%	0 10914705
Unomployment	1.5961	0.092171142	10.12	0.91	1 420408500	1 751750062	-0.170000773	1 75175006
Nominal GDP	0.3907	0.110560249	3.53	0.00	0.166285381	0.615183855	0.166285381	0.61518385
Expenses / Income	-0.2598	0.074511951	-3.49	0.00	-0.41103035	-0.108495745	-0.41103035	-0.10849574
Construction	-0.0187	0.018855066	-0.99	0.33	-0.056962148	0.019593489	-0.056962148	0.01959348
Return on Equity	0.0763	0.02227367	3.43	0.00	0.031086777	0.121522686	0.031086777	0.12152268
Return on Assets	-0.2078	0.247644263	-0.84	0.41	-0.710526949	0.294962208	-0.710526949	0.29496220
Loans / Deposits	0.1301	0.041133533	3.16	0.00	0.046554063	0.213565083	0.046554063	0.21356508
Yield Spread	-3.8107	1.9244158	-1.98	0.06	-7.717465361	0.096078135	-7.717465361	0.09607813

Note: For a true relationship, "P-Value" must be < 0.05, whereas the "T" Statistic must be higher than +1.96 or lower than -1.96. Also R2 must be high in order for the independent variable to become strong contributor to the regression model and "F" must be higher than the Critical Value.

"P" is the Probability that there is not a true relationship. "P-VALUE" of less than 0.05 means that there is at least 95% chance that there is a true relationship between these variables in the population. For example there is 1 minus 0.000 = 100% chance that there is a true relationship between unemployment and NPLs. For example, the same holds for nominal GDP and for loans/deposits. Therefore, unemployment, nominal GDP and loans to deposits are strong

predictors. These are significant predictors in the regression equation. For a variable to become strong predictor, "t" must be higher than +1.96 or lower than -1.96.

The above regression results imply true relationships, based on "T" and "P" Values, with regard to the following pairs: NPLs and Unemployment, NPLs and Nominal GDP, NPLs and Expenses / Income, NPLs and Return on Equity, NPLs and Loans to Deposits, and finally NPLs and Yield Spread. Again, the above results are anticipated, meaning that they make sense in terms of economic logic and they are in agreement with the findings of the literature review in the previous chapter. Furthermore while the relationship between NPLs and GDP was not so significant according to the previous correlation exercise, now with the regression exercise it emerges a true relationship between the two variables. Regression Equation Based on the previous multiple regression exercise, the respective regression equation is drawn in the following page. Looking at the equation, the following points can be highlighted as examples with regard to the potential relationships between the non-performing loans and the other independent variables:

- With regard to the unemployment, the relationship emerges as follows: For each additional unit of unemployment, NPLs would be expected to increase by 1.59 units under the condition that the other dependent variables are held fixed.
- With regard to the yield spread the equation reveals the following relationship: For each additional unit of yield spread, NPLs would be expected to decrease by 3.81 units under the condition that the other dependent variables are held fixed.
- Finally with regard to other variables such as GDP and the return ratios of the banks, the relationship with the NPLs appears to be less notable and to imply a weaker effect.



The present chapter dealt with the selection of the potential determinants of NPLs in the Greek market and with the subsequent collection of their respective data in the form of time series. In following, the chapter dealt with the application of a methodology in order to detect whether these factors are statistically significant or not. In this context the selected methodology examined and tested the relationship between the NPLs and the other eight potential determinant factors. The period under consideration covered both the pre-crisis and the post-crisis era of the Greek economy, whereas the conclusions that were drawn referred to whether there have been statistically significant relations between the selected variables and the NPLs.

# CHAPTER 6: CONCLUDING REMARKS RECOMMENDATIONS ON PREDICTING AND POSSIBLY PREVENTING INCREASE IN NPLS

The global financial crisis of the years 2007 – 2008 was an unprecedented period of high uncertainty and volatility in the international economies, capital markets and money markets. The crisis originated in the United States of America (USA), and specifically within the country's mortgage market, and then transformed into a spiral financial and credit crisis affecting geographic regions and countries across the globe. In particular the US credit crisis had a strong effect on the European integrated economy, the Eurozone, and especially on the weakest economies in the south part of the continent, such as the Portuguese, Spanish, Italian and Greek economies. Those were countries with economies relying heavily on external debt financing in order to continue smoothly running their budget deficits and fiscal debts, an ability that was diminished after the credit crunch occurred in the US economy. In the case of Greece, the crisis began in 2010 as a fiscal one and continued into the form of a deep economic crisis probably the most calamitous of the last 50 years.

The crisis was geometrically spread out to the whole economy and market affecting every business sector and every household in the country. Subsequently due to the abrupt loss of income, it affected the Greek banking system due to the inability of companies and households to repay their loans to the banks given the tough economic conditions. Furthermore the political and economic uncertainty raised doubts and fears over the country's willingness as well as ability to remain a Eurozone member, whereas at the same time billions of Euros of bank deposits "flew out" the country amid fears of the abolition of the Euro and of the adoption of new domestic currency. Later in the period 2015 - 2016, the Greek crisis became mostly a debt crisis and as of today it continues to considerably affect the ability of the economy to recover and return to the pre-crisis growth performance.

At the dawn of the global financial crisis, Greece was an economy posting strong GDP (gross domestic product) growth rates on annual basis but on the other hand the country was characterized by long lasting structural problems such as budget deficits, high public debt compared to its GDP, inelastic employment market and very low competitive advantages with a considerably high trade deficit. All these structural issues "came ashore" after the global crisis hit

the markets, most notably between the years 2009 and 2010, and Greece had no other option but to request a bailout package of funds in exchange for a reshuffling of its problematic public finances. The Greek economy which was posting strong growth rates prior to the crisis despite its large structural problems, was seriously "exposed" with the emergence of the global financial crisis and the so-called credit crunch, almost approaching to bankruptcy level. Without the external financial aid the country ultimately received, the Greek economy would have been in a condition of lacking resources to continue funding its fiscal budget and would have defaulted on the repayment of its debt obligations. By accepting the external aid, Greece was put in a path of restructuring its public finances, of taking measures to balance its budget by curtailing public spending on various fronts and also of working closely with its creditors in order to improve its competitive advantages as an economy. However, the crisis and its effects were so severe that it did not only hurt the country's public finances but also the core of its banking system through a chain of reactions in the economy with one major consequence being the generation of very high non-performing loans.

The intense and successive events that were initiated from the US credit crisis of years 2007 - 2008, from the generation of the global crisis and from its contagion into the European economy during the period 2009 - 2010, seriously tested and finally undermined the endurance of the already fragile Greek economy. Those events resulted into a long lasting and extended Greek crisis taking various forms – fiscal, economic, banking and debt crisis – leading the economy to a default status and affecting every single aspect and sector of the domestic environment. Unavoidably, the country's banking system was largely affected by the course of events with the most notable developments being the surge in non-performing loans and the unprecedented deposit outflows observed in the economy. In particular, the creation of non-performing loans resulted from the consequences of the severe economic crisis on the generated income of both households and corporations, as well as on the employment level of the economy. Since the international economies are characterized by various economic cycles, which as discussed in previous sections are not only favorable (such as growth / recovery) but also unfavorable (such as recession and / or crisis), the potential inability on behalf of borrowers to repay their loans to the banking system is a very important risk which must be always considered and evaluated. This risk, as it has been the case in the most recent global financial crisis, has fueled the growth of nonperforming loans (NPLs) in the economies, whereas in the cases of the weakest countries such as in the southern

part of the Eurozone it has generated a large quantity of not only NPLs but also defaulted loans coming from both corporations and households. Indeed due to the weak economic growth, NPLs increased in the Eurozone countries since the dawn of the crisis to more than  $\notin$  900 billion at the end of 2014.

Greece has been probably the country that was hit to the largest degree, among other economies, in terms of NPLs from the economic crisis given the fact that the crisis has been the case for several years now in the particular country. There are various versions as far as the detailed definition of the Non-Performing Loans in the international banking system is concerned however until today there appears to be an agreement in terms of the general definition of the NPLs. Based on the definition provided by the European Banking Authority (EBA) "...A nonperforming exposure is an exposure that is 90 days past-due (material exposure) or unlikely to be repaid in full without collateral realization (irrespective of any past-due amount or of the number of days pastdue), or impaired or defaulted according to the applicable accounting or regulatory frameworks." In other words, non-performing is a loan which has not been repaid to the bank under its contractual terms for at least a considerable period of time, in this case a period of three months (90 days). On interchangeable basis, the non-performing loans (NPLs) are also called as nonperforming exposures (NPEs) in the financial literature and bibliography where NPEs may be exactly the same with the NPLs but also they may imply a larger pool of "bad" loans including debt securities, other debt instruments as well as loans which have not been repaid even for a shorter period of time than the 90 days mentioned in the previous definition. In this context, the definition of NPEs may be considered as strict and demanding compared to the one of the NPLs. In fact and with regard to the case of the Eurozone, the use of the term NPEs was necessitated a couple of years ago by the European Central Bank (ECB).

At that time the central bank authority viewed that European banks had to report their nonperforming loans on a more conservative basis in order for the European banking system to be able to precisely calculate and evaluate its credit risk as well as its overall stability. The Non-Performing Exposures in the Greek market were approaching EUR 110 billion during the year 2016 consisting of a mixture of corporate, housing as well as consumer loans with the latter being the most nonrecoverable loan category. The following table highlights the most updated figures and ratios with regard to the nonperforming exposures and assets in Greece during the year 2016.

#### **GREEK BANKING SYSTEM Indicative Figures & Ratios**

- NPE (Non-Performing Exposures): EUR 105-110 billions
- NPE (Non-Performing Exposures) Ratio: 45% (September 2016)
- NPL Ratio: 33% (June 2016)
- NPL Ratio of Consumer Loans: 45%-46% NPL Ratio o Housing Loans: 31%
- NPL Ratio of Corporate Loans: 31%

Over very long periods of time (3-5 decades or even longer), the non-performing loans (NPLs) evolve according to the various economic cycles occurring in the global economy or in national economies. In periods when economic conditions are normal,NPLs will be ranging at low levels, whereas when economic conditions aggravate dramatically, NPLs will be surging to high or unexpected levels. The last economic cycle which experienced the extreme international crisis conditions saw NPLs to climb, depending on the economy, at above average, or high or even at record levels. The latter occurred especially in vulnerable economies such as the Greek economy of the period 2010-2015. It is clear that the growth pattern of NPLs in every economy is linked to a number of factors which can be easily identified based on pure economic logic and without performing any statistical analysis. These factors can be treated for the purposes of any analysis as determinants of NPLs.

For example such factors are the growth of economic activity (Gross Domestic Product - GDP) and the level of unemployment as they both determine the level of income that can be utilized for the repayment of loans in a banking system and broadly in an economy. Historically looking at the international economies, the changes in economic cycles and the abrupt emergence of economic or financial shocks lead to corresponding changes in the level of non-performing loans in the banking systems. During periods of economic growth or recovery, the level of NPLs remain under control or even very minimal as it was the case prior to the 2007 – 2008 crisis, whereas during periods of abnormal economic conditions the sudden explosion of NPLs becomes the most important concern of the banking systems and the respective economic authorities. In this context, the academic research has shown over the past years the close relationship between the NPLs and specific economic or financial parameters prevailing during the economic cycles under

consideration. Particularly during harsh economic conditions, as shown by the related literature, the most obvious factors that determine the generation of NPLs are the following:

- Growth level of the gross domestic product (GDP) of an economy,
- Unemployment rate,
- Interest rate on loans, and
- Foreign exchange rate fluctuations.

The credit risk that lurks in the banking sector has been widely discussed and analyzed in both academic literature and scientific research works of practitioners. In extreme economic conditions, such as the global financial crisis of the years 2007 and 2008, the credit risk may take the form of generation of especially high portfolios of non-performing loans in the balance sheets of banks. In this context, academicians as well as practitioners have conducted various research works in order to illustrate the causes of credit risk events in various time periods across different economies and markets, i.e. meaning either developed or emerging ones. According to the presented academic literature and scientific research in this Thesis, the most notable influential factors of the non-performing loans in the economy can be highlighted as follows:

DETERMINANTS OF NON-PERFORMING LOANS (both Corporate Loans and Loans of Households)

- GDP Growth (or growth level of critical sectors in the economy)
- Level of Real Interest Rates
- Return Ratios of the Banking Sector
- Loans to Deposits Ratio of the Banking Sector
- Level of companies' debt exposure in the economy
- Inflation
- Depreciation of Domestic Currency
- Industrial Production
- Real Salaries & Employment Level
- Stock Market Index Equity Prices
- Credit Expansion
- Oil Prices

• Degree of aggregation of loan portfolio in the domestic market

Based on the above list of determinants and for the purposes of performing a statistical analysis, there was a selection of factors which were examined and tested as potential determinants of the non-performing loans in the Greek economy and market.

The time period covered was from the year 2005 until the year 2015, thus encompassing both normal and abnormal economic sub-periods, namely the growth period until 2008 and the subsequent recession period until 2015. The variables selected were both of macroeconomic nature and bank-related ones, and were utilized for testing their significance on the growth patterns of Greek NPLs (non-performing loans) over time. These variables were the following (presented in random order):

- Unemployment Rate,
- GDP (gross domestic product) Growth,
- Expenses/Income" Ratio of Banks,
- Construction Capital Growth,
- Return on Equity (ROE) of Banks,
- Return on Assets (ROA) of Banks,
- Loans/Deposits" Ratio of Banks,
- Yield Spread.

Following the selection of the potential determinants of NPLs in the Greek market and the subsequent collection of the respective data in the form of time series, the next stage of the Thesis referred to the application of a methodology in order to detect whether those factors were statistically significant or not. In this context the selected methodology examined and tested the relationship between the NPLs and the other eight potential determinant factors. The above was performed in two ways, initially through a correlation exercise and secondly via a regression exercise. Both exercises were deemed necessary as well as appropriate in order to quantify the relationship between the non-performing loans in the Greek economy and the macroeconomic as well as bank specific factors which were selected for the purposes of the Thesis.

The results of the correlation exercise pointed to moderate or significant correlation between NPLs and Unemployment (positive, meaning the higher the Unemployment the higher the NPLs), between NPLs and Expenses/ Income (positive, meaning the higher the Expenses/Income the higher the NPLs), between NPLs and Return on Equity (negative, meaning the higher the ROE the lower the NPLs), between NPLs and Return on Assets (negative, meaning the higher the ROA the lower the NPLs), between NPLs and Loans/Deposits (positive, meaning the higher the Loans/Deposits the higher the NPLs), and between NPLs and Yield Spread (negative, meaning the higher the Yield Spread the lower the NPLs). The above results were indeed anticipated meaning that they made sense in terms of economic logic as well as they were aligned with the findings of the literature review of the Thesis. The only relationship that was expected to be statistically significant, and was not, referred to the relationship between NPLs and GDP. The regression results implied true relationships, based on "T" and "P" Values, with regard to the following pairs: NPLs and Unemployment, NPLs and Nominal GDP, NPLs and Expenses / Income, NPLs and Return on Equity, NPLs and Loans to Deposits, and finally NPLs and Yield Spread.

Again, the above results were anticipated, meaning that they made sense in terms of economic logic and they were also in agreement with the findings of the literature review. Furthermore while the relationship between NPLs and GDP was not so significant according to the previous correlation exercise, with the regression exercise it emerged a true relationship between the two variables. The following three graphs cover the aggregate period 2005 - 2015 in the Greek market and depict, in certain sub-periods, the obvious relationship between the NPLs and unemployment, loans / deposits ratios and GDP respectively. As a first example, it can be observed that in the period when the unemployment rate posted its most steepening upward course it was followed by an equally steepening upward movement for the NPLs (period 2010 - 2012).



Graph 6.1: Greece, Non-Performing Loans and Unemployment, Period 2005 - 2015 Source: Bank of Greece.

The second example can be illustrated by the relationship between the nonperforming loans (NPLs) and the loans / deposits ratio through the following graph. It appears that the higher assumption of loans compared to the banking system's deposits implies the subsequent assumption of a higher risk and it therefore leads to a rising trend in NPLs in the banking system. The above chain of reactions occurred most notably during the period 2009 - 2012.



Graph 6.2: Greece, Non-Performing Loans and Loans/Deposits, Period 2005 - 2015 Source: Bank of Greece.

Finally, the third example is illustrated in the following graph where it appears that the most steepening upward course of the non-performing loans (NPLs) during the crisis period, most notably during the years 2010 - 2013, coincided with the most severe contraction of the Greek gross domestic product (GDP).



Graph 6.3: Greece, Non-Performing Loans and GDP, Period 2005 - 2015

## Source: Bank of Greece.

Therefore apart from the statistical analysis which was performed in the chapter of methodology in the current Thesis and which confirmed relationships between NPLs and selected variables, the same conclusions can be also drawn via a quite simplistic graphical analysis as it was presented above. As far as recommendations which can be made on the policy of preventing high NPLs in the economy, it should be initially stated that reducing the stockpile of nonperforming loans, whenever it exists, in the banking system has undoubtedly positive effects on the function of the broader economic environment. It has been shown (Balgova et al, October 2016, EBRD) that while countries that enjoy significant credit expansion tend to grow at a faster pace, other countries which are in a mode of massively tackling their high NPLs also tend to do comparatively well in terms of economic growth. Therefore one of the worse problems for both

the economy and itsbanking system is the persistence of a notable pool of NPLs that cannot be reduced and effectively managed. That exactly has been the issue, and is still lurking, in the Greek economy and its banking sector. Despite the efforts that have been made over the past couple of years by the Greek banks and the country's economic authorities, the non-performing loans have not been notably reduced and therefore continue to affect the domestic market and to deprive significant liquidity from the domestic banking system.

Over the past, the countries that took important steps to address and ultimately resolve the issue of high NPLs they immediately began to "enjoy" higher growth rates (on both aggregate and per capita basis), experienced more favorable employment conditions, and also realized a better investment climate that was translated into actual implementation of investments. Those conditions demonstrated in fact the importance of addressing the issue of NPLs in advance and of taking precautionary measures to prevent the appearance of high NPLs in the economy and the banking system. In this context some of the most important precautionary actions that can be taken and / or policy recommendations that can be followed, along with related conclusions, are highlighted below (presented in random order):

- ✓ Increase the monitoring applied by central banks on the credit expansion of the economy through effective supervision of the banking institutions active in the market.
- ✓ Closely monitoring, and also forecasting, of the most determinant factors of the non-performing loans such as the ones discussed in the present Thesis, namely unemployment rate, level of income, and bankspecific parameters among other factors.
- ✓ Formulation and enacting, in advance, of regulations and procedures for smoothly making arrangements in loans when they appear as NPLs in a banking system and well before they become too intolerable.
- ✓ Waiting for a notable economic recovery as alternative measure to reduce NPLs can be proven highly costly and in fact delay the economic recovery itself.
- ✓ Reducing high NPLs within an economy is almost certainly good news for governments and economic authorities as this policy is accompanied with the generation of significant economic benefits and competitive advantages for both the economy and its banking system.

- ✓ Capitalizing in time and strongly enough the banking institutions can be another precautionary action towards the more effective management of higher NPLs in cases where such an unfavorable upward trend of "bad" loans cannot be prevented in advance.
- ✓ Better understanding of the profile of borrowers, both households and corporations, from the economic and banking authorities as well as more efficient, direct or indirect, education of citizens on how they should make sound economic decisions with regard to request of a corporate, housing or consumer loan.
- ✓ Placement of certain and quantified boundaries upon credit expansion in terms of bank specific ratios and also setting specific criteria on the profiles of borrowers "entitled" to loan disbursements.

There is no doubt that forecasting, anticipating, preventing or even tackling the issue of high NPLs in the economy is not at all an easy task for any of the involved parties such as governments, economic authorities, central banks and banking institutions. However as the current Thesis discussed and analyzed to a quite extended degree, there is a number of indicators that could be studied and in a later stage utilized in order to better anticipate the phenomenon of high non-performing loans in the economy. These indicators relate to selected determinant factors of the NPLs, meaning variables that are statistically closely related to NPLs and affect them considerably during the economic cycles. It therefore remains to the hands of the economic and banking authorities, using both the above criteria as well as additional ones, on how much effective can become in encountering the important issue of high non-performing loans.

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