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WHAT ARE THE KEY DETERMINANTS OF NON PERFORMING LOANS?

ΣΩΤΗΡΙΟΥ ΔΗΜΗΤΡΑ

Εργασία υποβληθείσα στο

Τμήμα Λογιστικής & Χρηματοοικονομικής

του Οικονομικού Πανεπιστημίου Αθηνών

ως μέρος των απαιτήσεων για την απόκτηση

Μεταπτυχιακού Διπλώματος Ειδίκευσης

Αθήνα

{Ιούλιος, 2017}

Εγκρίνουμε την εργασία της

ΣΩΤΗΡΙΟΥ ΔΗΜΗΤΡΑΣ

[ΟΝΟΜΑ ΕΠΙΒΛΕΠΟΝΤΟΣ ΚΑΘΗΓΗΤΗ]	**[ΥΠΟΓΡΑΦΗ]**
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Ιούλιος, 2017

ΒΕΒΑΙΩΣΗ ΕΚΠΟΝΗΣΗΣ ΔΙΠΛΩΜΑΤΙΚΗΣ ΕΡΓΑΣΙΑΣ

«Δηλώνω υπεύθυνα ότι η συγκεκριμένη πτυχιακή εργασία για τη λήψη του Μεταπτυχιακού Διπλώματος Ειδίκευσης στη Λογιστική και Χρηματοοικονομική έχει συγγραφεί από εμένα προσωπικά και δεν έχει υποβληθεί ούτε έχει εγκριθεί στο πλαίσιο κάποιου άλλου μεταπτυχιακού ή προπτυχιακού τίτλου σπουδών, στην Ελλάδα ή στο εξωτερικό. Η εργασία αυτή έχοντας εκπονηθεί από εμένα, αντιπροσωπεύει τις προσωπικές μου απόψεις επί του θέματος. Οι πηγές στις οποίες ανέτρεξα για την εκπόνηση της συγκεκριμένης διπλωματικής αναφέρονται στο σύνολό τους, δίνοντας πλήρεις αναφορές στους συγγραφείς, συμπεριλαμβανομένων και των πηγών που ενδεχομένως χρησιμοποιήθηκαν από το διαδίκτυο».

[ΟΝΟΜΑΤΕΠΩΝΥΜΟ ΦΟΙΤΗΤΡΙΑΣ]	**[ΥΠΟΓΡΑΦΗ]**
ΣΩΤΗΡΙΟΥ ΔΗΜΗΤΡΑ	**……**

Πίνακας περιεχομένων

ABSTRACT

In times of financial crisis NPL is the main banking preoccupation. According to (Anastasiou et al., 2016) bank insolvency has been a significant problem in many countries around the globe. One of the main reasons for insolvent banks is the asset quality deterioration especially after the start of the economic crisis of 2007. Euro-area non-performing loans, i.e., loans past due > 90 days (NPLs), exceeded 12% in 2015 and put increasing pressure on banks' balance sheets preventing them from pursuing their intermediation role and creating further growth (Anastasiou et al., 2016). In the present thesis author will attempt to mention all possible NPL determinants and will focus on advanced economies (the Euro area, USA and Japan) trying through an econometric model with panel data to estimate the impact of the most important NPL macroeconomic and geographical determinants on the NPL ratio. Our sample includes the following countries: Austria (2000-2014), Belgium (2000-2014), Denmark (2000-2014), Finland (2000-2012), France (2000-2014), Germany (2000-2014), Greece (2000-2014), Ireland (2000-2014), Italy (2000-2014), Japan (2000-2014), Netherlands (2000-2014), Norway (2000-2014), Portugal (2000-2014), Spain (2000-2014), Sweden (2000-2014), UK (2000-2014) and US (2000-2014).Thus, the total sample size is 253. To this end Eviews software package will be used. The capital structure is as follows. In capital 1 is the introduction. In chapter 2 the most important NPL determinant factors are explained and they are classified as macroeconomic, microeconomic, geographical and other determinant factors. In chapter 3 the research hypothesis is formulated. In chapter 4 the econometric model is defined, data are selected and estimation of the model is made. Besides, various tests for the robustness of the model are made regarding unit roots, normality, heteroskedasticity, correlation, multicollinearity and reset. Finally, in chapter 5 conclusions are derived. After that, there are the references and the appendix.

In this thesis it is pointed out that, using Eviews software and applying the method: Panel EGLS (Cross-section SUR), the per head GDP at constant prices does not have any impact on non-performing loans. Economic growth at constant prices has a negative impact on non-performing loans. Gross fixed capital formation % GDP has a negative impact on non-performing loans. Unemployment has a positive impact on

non-performing loans. Government consumption % GDP has a negative impact on non-performing loans. Inflation has a negative impact on non-performing loans. South EU has a positive impact on non-performing loans. Besides, according to the results of our econometric model the following the following issues must be taken care of by the policy makers: At first: economic growth must be fostered, second: consumption must be fostered, third: banks should help companies to adopt high technology, fourth: taxation must be lower, fifth: efficient spending on infrastructure is needed, sixth: international standards of auditing must be adopted, seventh: uncertainty must be reduced, eighth: ageing problem must be solved and ninth: trade liberalization is required.

My contribution is that I introduced a panel data regression model in order to examine the NPL determinant factors from the macroeconomic and geographical point of view. However, it is also suggested that apart the macro economic and geographical factors, many micro economic factors also play a role in the NPL determination. It must be noted that a comprehensive understanding of the NPL issue requires the examination of many factors of macroeconomic, microeconomic and geographical nature.

Key Words: NPLs, Consumption, Economic Growth, Banking, Economic crisis, Unemployment, Technology, Entrepreneurship, Taxation, Ageing, Econometric model with panel data.

ΠΕΡΙΛΗΨΗ

Στην περίοδο της οικονομικής κρίσης τα μη εξυπηρετούμενα δάνεια (NPL) είναι το βασικό πρόβλημα των τραπεζών. Σύμφωνα με (Anastasiou et al., 2016) η έλλειψη της ρευστότατος στις τράπεζες είναι σοβαρό πρόβλημα σε πολλές χώρες του κόσμου. Ένας από τους σοβαρότερους λόγους για αυτό είναι η ποιοτική χειροτέρευση του ενεργητικού των τραπεζών και ειδικά μετά από την κρίση του 2007. Στην ΕΕ τα μη εξυπηρετούμενα δάνεια (μη πληρωμένα δάνεια για περισσότερες από 90 ημέρες) υπερβαίνουν το 12% (2015) με συνέπεια να πιέζονται οι ισολογισμοί των τραπεζών έτσι ώστε οι τράπεζες να εμποδίζονται εκ των πραγμάτων να ασκήσουν τον διαμεσολαβητικό τους ρόλο και να βοηθήσουν την επίτευξη της οικονομικής ανάπτυξης (Anastasiou et al., 2016).

Στην παρούσα εργασία ο συγγραφέας θα προσπαθήσει να αναφέρει όλους τους πιθανούς παράγοντες που δημιουργούν τα μη εξυπηρετούμενα δάνεια και θα επικεντρωθεί στια ανεπτυγμένες οικονομίες (ΕΕ, ΗΠΑ και Ιαπωνία) και θα προσπαθήσει με την βοήθεια ενός οικονομομετρικού υποδείγματος (μοντέλου) με panel data να εκτιμήσει ποσοτικά την επίδραση των πιο σημαντικών μακροοικονομικών και γεωγραφικών παραγόντων πάνω στο ποσοστό των μη εξυπηρετούμενων δανείων. Το εξεταζόμενο δείγμα περιέχει τις ακόλουθες χώρες: Αυστρία (2000-2014), Βέλγιο (2000-2014), Δανία (2000-2014), Φιλανδία (2000-2012), Γαλλία (2000-2014), Γερμανία (2000-2014), Ελλάδα (2000-2014), Ιρλανδία (2000-2014), Ιταλία (2000-2014), Ιαπωνία (2000-2014), Ολλανδία (2000-2014), Νορβηγία (2000-2014), Πορτογαλία (2000-2014), Ισπανία (2000-2014), Σουηδία (2000-2014), Βρετανία (2000-2014) και ΗΠΑ (2000-2014). Έτσι το δείγμα έχει μέγεθος 253. Για την επίλυση του μοντέλου χρησιμοποιήθηκε το πακέτο λογισμικού Eviews.

Η διάρθρωση των κεφαλαίων έχει ως έξης: Εισαγωγή στο κεφάλαιο 1. Στο κεφάλαιο 2 αναλύονται οι πιο σημαντικοί παράγοντες δημιουργίας μη εξυπηρετούμενων δανείων και χωρίζονται σε τέσσερις κατηγορίες: μακροοικονομικοί, μικροοικονομικοί, γεωγραφικοί και άλλοι παράγοντες. Κατόπιν στο κεφάλαιο 3 θα οριστεί η ερευνητική υπόθεση. Ύστερα, στο κεφάλαιο 4 θα οριστεί το οικονομομετρικά υποδειγμα (μοντέλο), θα οριστούν τα στατιστικά

δεδομένα και οι πηγές τους, και θα γινει η εκτίμηση του μοντέλου. Επιπλέον θα γινουν και οι έλεγχοι για την απόδειξη της εγκυρότητας του μοντέλου (έλεγχος για μοναδιαία ρίζα, έλεγχος για κανονικότητα, έλεγχος για ετεροσκεδαστικότητα, έλεγχος για συσχέτιση, έλεγχος για πολυσυγγραμικότητα και έλεγχος για εξειδίκευση). Τέλος στο κεφάλαιο 5 θα αναλυθούν τα συμπεράσματα. Ακολουθούν οι αναφορές και το παράρτημα.

Σε αυτή την εργασία αποδείχτηκε, με την χρήση του λογισμικού Eviews software και χρησιμοποιώντας την μέθοδο εκτίμησης Panel EGLS (Cross-section SUR), ότι το κατά κεφαλήν ΑΕΠ σε σταθερές τιμές δεν επιδρά στα μη εξυπηρετούμενα δάνεια. Η οικονομική ανάπτυξη σε σταθερές τιμές επιδρά αρνητικά στα μη εξυπηρετούμενα δάνεια. Οι ακαθάριστες επενδύσεις παγίου κεφαλαίου % ΑΕΠ επιδρούν αρνητικά στα μη εξυπηρετούμενα δάνεια. Η ανεργία επιδρά θετικά στα μη εξυπηρετούμενα δάνεια. Η κυβερνητική κατανάλωση % ΑΕΠ επιδρά αρνητικά στα μη εξυπηρετούμενα δάνεια. Ο πληθωρισμός επιδρά αρνητικά στα μη εξυπηρετούμενα δάνεια. Η νότια ΕΕ επιδρά θετικά στα μη εξυπηρετούμενα δάνεια. Εκτός από τα πιο πάνω, με βάση το χρησιμοποιημένο μοντέλο προκύπτει ότι οι ασκούντες την οικονομική πολιτική θα πρέπει να φροντίσουν για τα ακόλουθα θέματα: η οικονομική ανάπτυξη πρέπει να προωθηθεί, επίσης η κατανάλωση πρέπει να τονωθεί, οι τράπεζες θα πρέπει να βοηθήσουν τις επιχειρήσεις για να υιοθετήσουν στην παραγωγική τους διαδικασία την υψηλή τεχνολογία, να μειωθεί η φορολογία, να γινει ορθολογική και αποτελεσματική δαπάνη για έργα υποδομής, να υιοθετηθεί το διεθνές σύστημα λογιστικού ελέγχου, να μειωθεί η αβεβαιότητα, να λυθεί το πρόβλημα της πληθυσμιακής γήρανσης και τέλος να γινει η απελευθέρωση του εμπορίου.

Η συνεισφορά μου είναι ότι χρησιμοποίησα πολλαπλή παλινδρόμηση με panel data για να εξετάσω τους παράγοντες που δημιουργούν τα μη εξυπηρετούμενα δάνεια από την μακροοικονομική και γεωγραφική άποψη. Παρόλα αυτά, εκτός από τους πιο πάνω παράγοντες υπάρχουν και οι μικροοικονομικοί παράγοντες οι οποίοι διαδραματίζουν επίσης ένα ρόλο στη δημιουργία των μη εξυπηρετούμενων δανείων. Θα πρέπει να τονιστεί ότι μια συνολική κατανόηση του προβλήματος των μη εξυπηρετούμενων δανείων απαιτεί την εξέταση όλων των παραγόντων (μακροοικονομικής, μικροοικονομικής, γεωγραφικής και λοιπής φύσεως).

Λέξεις κλειδιά: Μη εξυπηρετούμενα δάνεια, Κατανάλωση, Οικονομική ανάπτυξη, Τράπεζες, Οικονομική κρίση, Ανεργία, Τεχνολογία, Επιχειρηματικότητα, Φορολογία, Πληθυσμιακή γήρανση, Οικονομομετρικό υποδειγμα με panel data.

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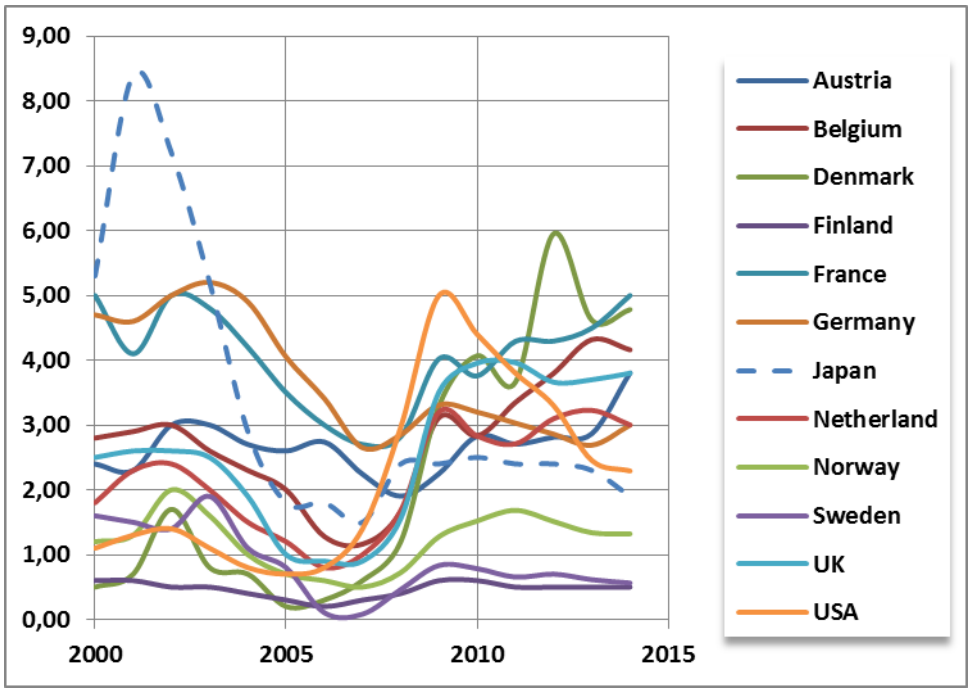
1. INTRODUCTION

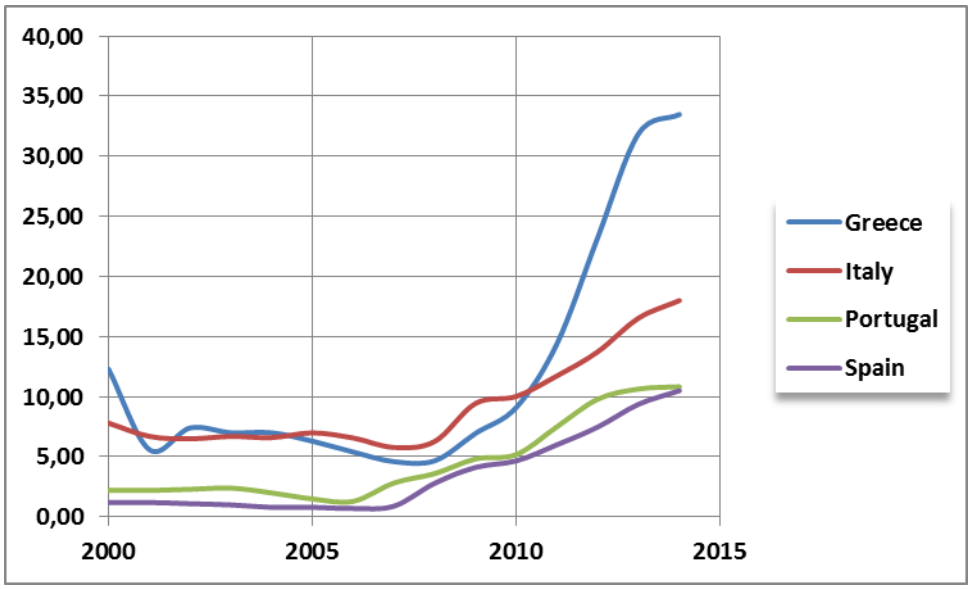
In times of financial crisis NPL is the main banking preoccupation. According to (Anastasiou et al., 2016) bank insolvency has been a significant problem in many countries around the globe. One of the main reasons for insolvent banks is the asset quality deterioration especially after the start of the economic crisis of 2007. Euro-area non-performing loans, i.e., loans past due > 90 days (NPLs), exceeded 12% in 2015 and put increasing pressure on banks' balance sheets preventing them from pursuing their intermediation role and creating further growth (Anastasiou et al., 2016). In the present thesis author will attempt to mention all possible NPL determinants and will focus on the Euro area trying through an econometric model with panel data to estimate the impact of the most important NPL determinants on the NPL ratio. In fact NPL tend to increase in many countries and this can be seen in graphs 1 and 2.

Graph 1. NPLs (%). All Sample except for southern EU



Source: World Bank

Graph 2. NPLs (%). Only southern EU



Source: World Bank

2. NPL DETERMINANTS

According to (Anastasiou et al., 2016) the various NPL determinants can fall into two broad categories: bank-specific (micro economic approach) and country-specific (macro-economic approach). Hence, in chapter 2 author will try to analyze all possible types of NPL determinants.

2.1 MICRO-ECONOMIC APPROACH

2.1.1 Management

Berger and DeYoung (1997) used Granger-causality techniques to test four bank management-related hypotheses regarding the relationship among loan quality, cost efficiency and bank capital (Anastasiou et al., 2016). They concluded that the bad management and moral hazard hypotheses explained a significant part of NPLs (Anastasiou et al., 2016). Podpiera and Weill (2008) also estimated a causal relationship between NPLs and cost efficiency (indication of bad management), while Ghosh (2006) found that lagged leverage affects NPLs (Anastasiou et al., 2016).

Further, CEO's talent plays a significant role regarding company's performance (in our case banking performance). In fact, Companies having talented CEOs have higher profitability than the other companies (Lehmann et al., 2007). Further, the same happens in the banking sector (Kose and Yiming, 2003). Finally, according to the study of (Halkos and Georgiou, 2005), banking profitability should not be based only on an eternal sales increase, but also on a better knowledge of various "market segments", which requires a talented CEO. Besides, a talented CEO can reduce banking NPLs (Georgiou, 2017). In other words, a talented bank CEO can manage the bank and protect it among the others from various types of risk bank is exposed to (see various types of bank risk in section 2.2 "(Macro-economic approach")).

2.1.2 Credit information

Georgiou (2013) pointed out that credit information about bank clients can reduce non-performing loans. In fact a better information can reduce the risk of default. Information is crucial for all banks, since banks face many types of risks (see various types of bank risk in section 2.2 "(Macro-economic approach")).

2.1.3 Company driven NPLs

2.1.3.a Company size

The company size is found to be negatively related to company's leverage ratio. (Rajan and Zingales, 1995) claim that big companies tend to be more diversified and empirically face default less often than the small ones. In fact, more diversified companies usually have a more diversified cash flow, that consequently reduced the cost of debt obligations and thus enabled these firms to take on more debt for the same interest cost. Further, it should not be ignored that big companies usually have better access to credit, which according to (Degryse, de Goeij and Kappert, 2012) reduces the risk of bankruptcy. Several studies confirm that firm size has a positive impact on firm performance in terms of profitability (Hall and Weiss, 1967); (Scherer, 1973); (Lee, 2009). Economists however, do not agree on the impact of firm size on firm's leverage. Small companies have lower leverage ratios, because of additional equity financing (Byoun, 2007). According to Delcoure (2007), examining a sample of companies in Central Eastern Europe, it is concluded that the effect of the company's size on total and short-term debt is positive and statistically significant. (Antoniou, Guney, & Paudyal, 2008) asserted that the leverage ratio is positively affected by the size of the firm. However, according to (Hallajian & Tilehnouei, 2016), in a sample of 139 firms from 14 economic sectors listed on National Stock Exchange of India, there is no significant effect of company's size on company's leverage, except for some sectors (like: Energy, Chemicals and Fertilizers, Textiles, as well as Consumer Durables) where this impact is statistically significant and positive.

Tangibility has a positive impact on company leverage ratio. This conclusion is based on the value of tangible assets. In fact, in case of liquidation, tangible assets have more value if the firm is liquidized then non-tangibles. From the lenders (bankers) point of view, the risk will be lower (lower agency cost as well as lower risk premium). Hence, higher tangibility enables companies to receive a higher loan (have higher leverage ratio) (Rajan and Zingales, 1995). Company's growth is a very interesting factor to explain company's leverage. Company leverage is negatively affected by company growth (Lang et al., 1996); (Huynh and Petrunia, 2010); Wu (2013).

2.1.3.b Company Profitability

Company's profitability plays a significant role in the leverage ratio. In fact, profitability has a negative impact on leverage (Li-Ju Chen and Shun-Yu Chen, 2011). This opinion is also followed by (Yapa Abeywardhana & Dilrukshi Krishanthi, 2016). On the contrary, during crisis period according to the research of (Iqbal Abdullah and Kume Ortenca, 2015) leverage ratios have increased in relation to the pre-crisis period, due to consumption decline. Therefore, it becomes clear that consumption is a very important factor for the creation of economic growth and the survival of companies.

2.1.3.d Import Penetration

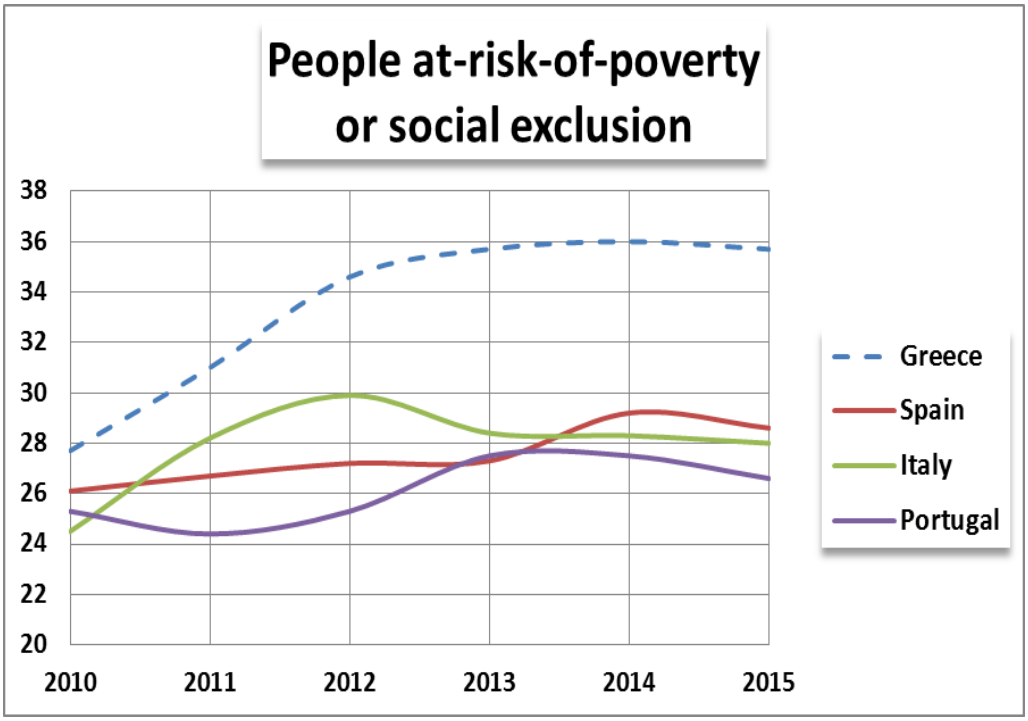
The imports from low labour cost countries (like China) resulted in (due to the increased competition) a remarkable decline of industrial product prices in the EU. Consequently, other things held constant, the profitability of EU companies declined (Chen, Imbs, & Scott, 2004). Besides, in EU during the period 1995-2004 in 15 industrial sectors import penetration from low labour cost countries had a negative impact on EU company (Peltonen, Skala, Santos Rivera, & Pula, 2008). Besides, this import penetration resulted in an unemployment increase (Köllner, 2016).

2.1.4 Household driven NPLs

In Greece the ongoing tough austerity measures (salary and pensions cuts, unbearable taxation, etc.) resulted in a remarkable household income reduction.

Consequently, consumption dropped considerably and the depression became even more severe (Theodoropoulou & Watt, 2011). Hence, Greek households became unable to meet their debt obligations (housing loans, etc). Southern Europe and especially Greece are mostly hit by the crisis. This can be seen by observing the index "People at-risk-of-poverty or social exclusion" (see graph 3).

Graph 3. People at-risk-of-poverty or social exclusion (Southern EU)

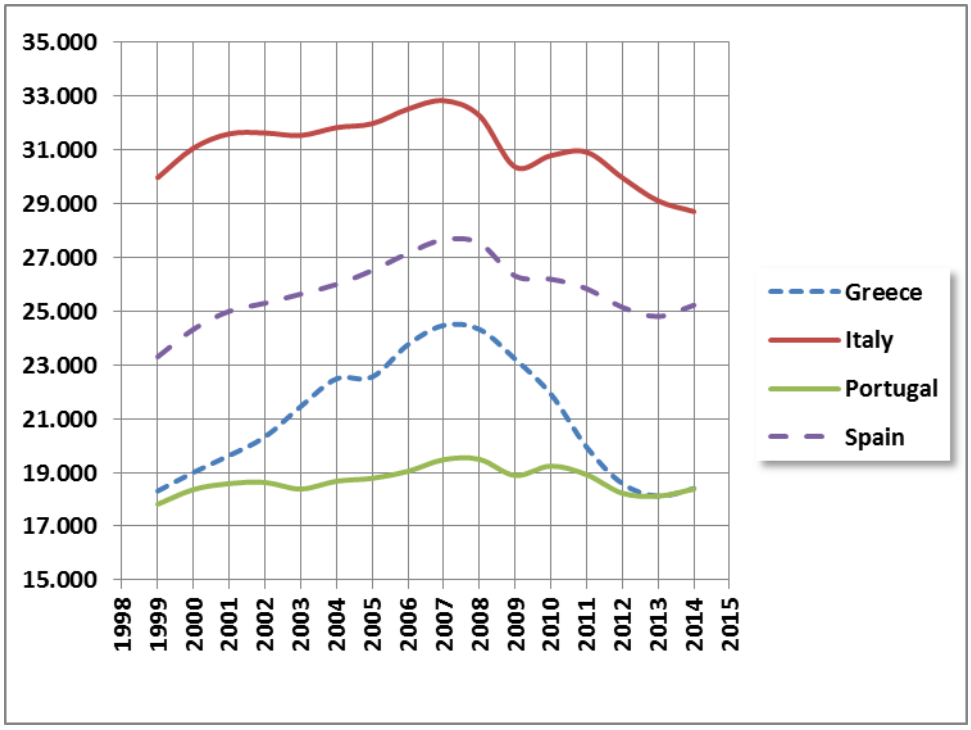


Source: Eurostat

2.1.5 Housing Loans driven NPLs

As explained in 2.1.4 the housing loans driven NPLs are due to the considerable GDPper capita decline in the households and especially in Greece (see graph 4). Households in Greece before the outburst of financial crisis were able to pay their mortgage debt obligations, but after the crisis and the tough salary cuts they became unfortunately unable to meet their debt obligations to the banks. Consequently NPLs increased.

Graph 4. GDP per head at constant 2005US$ in southern EU countries



Source: World Bank

2.1.6 Bankruptcy Forecast

Banks are in a position to forecast firm bankruptcy so as take the appropriate steps to minimize default risk of their clients (company borrowers). A useful tool to forecast the company bankruptcy probability is the worldwide known z-score by Altman (1968) as well as the Logit analysis by (Ohlson, 1980); (Lau, 1987); (Keasey and McGuinness, 1990).

2.2 MACRO-ECONOMIC APPROACH

Louzis et al. (2010), estimated the factors that affect NPLs for each loan category (mortgage, business and consumer) individually. The found out that NPLs are significantly related to macro variables. Apart from that, Ghosh (2015) noted that the variables related to NPL increases are poor credit quality, liquidity risk, inefficiency cost, larger capitalization and the size of the banking industry as well as unemployment, inflation, and public debt. Finally, Ozili (2015) tried to mention the issue of the interaction between non-performing loans and the stage of the business cycle.

2.2.1 Wages and NPLs

Besides, wages play a role in NPLs. In fact, a negative relationship is found between net wages and NPL ratio (Olaya Bonilla, 2012). The reason is that higher net wages can increase households' ability to pay back debts. However, on the other hand, the impact of higher net wages can have an opposite effect on firms since higher wages can worsen their ability to pay their debts. Companies usually decrease wages during periods of financial difficulties and increase them during periods of financial growth. This effect is highly connected with economic growth (Mahmudi, 2013).

2.2.2 Overlending and NPLs

According to Georgiou (2009) over-lending (too much credit to private sector/GDP) increases the risk of default, which in turn causes bankruptcies and higher NPLs.

2.2.3 Fiscal and external deficits increase NPLs

Espinoza and Prasad (2010) and Kauko (2012) found that fiscal and external deficits have a positive impact on NPLs.

2.2.4 Besides interest rates increase NPLs

Espinoza and Prasad (2010) and Kauko (2012) after examining macro variables found that interest rates have a positive impact on NPLs. The same conclusion is reached by Beck et al. (2015). Further, the findings of Messai (2013) show that the real interest rate worsen NPLs problems.

2.2.5 Besides economic crisis and austerity measures increase NPLs especially in south EU

Southern EU members have an increased ratio of company leverage, since south EU is mostly hit by the economic crisis. This is a result of the following situation. According to the study of (Santana & Fougo, 2015) northern EU countries are richer and have lower amounts of sovereign debt, while southern EU countries have higher amounts of sovereign debt. Hence, companies of southern Europe have higher leverage (gearing) in their capital structures than the firms of northern Europe. Besides, northern firms are larger than those of the southern EU and are more profitable than those of the southern EU. It is also mentioned above that that there is a highly significant positive relationship between size and the company performance. Hence, companies of the northern EU as larger in size they have a better performance and a lower leverage ratio than the southern ones. Besides, it should be mentioned that crisis was not the same across EU countries. Taking the above findings into account, one can conclude that the corporations of the southern EU have higher leverage ratio than the northern ones. (Rajan and Zingales, 1995) claim that big companies, which are mainly in northern EU, tend to be more diversified and empirically face default less often than the small ones. More diversified companies usually have a more diversified cash flow, which in turn reduced the cost of debt obligations and thus

enabled these firms to take on more debt for the same interest cost. In addition, it should not be forgotten that large firms usually have better access to credit, which according to (Degryse, de Goeij and Kappert, 2012) reduces the risks of bankruptcy. Besides, crisis did not hit evenly all EU. The southern EU countries are most hit by this crisis (EIOPA, 2015). The GDP per capita at fixed prices has shown a considerable decline in south EU member states. This reflects the significant fall in household demand in the southern EU countries relative to the rest of EU. This implies that the consumption declines differently between countries and this will cause a different reduction in company sales across EU countries. Greece, Spain, Italy and Portugal are most hit by this crisis. Greece particularly suffers most by the strict austerity measures that reduced household disposable income and caused a remarkable decline in consumption. Thus, sales in southern Europe fell considerably thus causing a remarkable increase in the leverage in these countries. Economic crisis had many repercussions in SMEs and mainly in the southern EU. It is worth mentioning that in southern EU the proportion of SMEs is higher than in the northern EU (Santana & Fougo, 2015). According to the work of Liu et al. (2015), that refers to Europe, Europe still has, after the financial crisis, high levels of business debts and high levels of non-performing loans (NPLs). This problem appears mainly in in the small and medium enterprises (SMEs). This situation is very serious, since SMEs are the cornerstone of the total EU economy. It should be noted that SME are mainly in the south EU. In fact, in EU SMEs are the 99% of the total number of companies and they employ about the 66% of total labour power of the EU. A firm falls within the category of SME if it employs less than 250 persons and has a turnover not higher than €50 million per annum. SMEs face a serious problem, which is their small size. Further, SMEs do not usually have a highly qualified personnel. In addition, the common problem of SMEs is the red-tape as well as the real difficulty of the banking sector to give credit, due to banking liquidity problems (cash-strapped banks) (Liu et al., 2015). In spite of the measures taken by EU and ECB (European Central Bank), the problem of the restructuring of SMEs debts has not been solved yet. According to the findings of Bergthaler et al., (2015), the solution of the afore mentioned SME problems requires the following measures to be taken: stricter regulations on NPLs of SMEs to be implemented, solution for the liquidity problem of SMEs to be found, as well as appropriate economic policy to be applied in order to help SMEs to survive. In international level, banks face a serious problem of NPLs. In the southern EU Greece

has the highest level of NPLs followed by Italy. According to (Louzis et al., 2012) the increase of the non-performing loans ratio (NPL) in Greece is mainly attributed to variables of macroeconomic nature such as: the real GDP growth rate, the unemployment rate, the lending rates as well as public debt. Similar conclusions have been made by (Rinaldi and Sanchis-Arellano, 2006) that in many European countries household disposable income, unemployment rate as well as and monetary conditions have a significantly positive impact on NPLs. The remaining EU countries face the problem of NPLs but not by as much.

2.2.6 Economic growth reduces NPLs

Espinoza and Prasad (2010) and Kauko (2012) after examining macro variables found that economic growth has a negative impact on NPLs.

Beck et al. (2015), estimated that the most significant factors affecting NPLs are GDP growth (major driver during the last decade), share prices[1], and the exchange rate.

Further, Nkusu (2011) asserted that an aggravation in the macroeconomic environment as proxied by sluggish growth, decreasing asset prices or higher unemployment is interrelated with NPLs problems.

2.2.7 Consumption decreases NPLs

Before the beginning of crisis banks used to offer credit easier than they do today for new investment projects as well as for exports. But after the start of the crisis, the economic environment has been changed. In fact during the period 2008-2009 economies of EU members faced difficult times. The high level of the percentage of country debt in the GDP caused recession.

Following the study of Checherita and Rother (2010), it is found that for the EU countries there is a negative relationship between the share of the country debt in own GDP and the economic growth rate. This study was based on a sample including

[1] Because share prices have a positive relation with economic growth (Georgiou, 2010a)

twelve countries of EU (southern as well as northern) which are: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain during a period 1970-2011. EIOPA (2015) asserts that economic growth is very weak in EU, especially in the southern regions of EU. Besides, according to OECD (2016) global economy is not expected to show a better recovery in 2016 than in 2015. Trade and investments are not yet enough to boost the economy and cause economic growth. Demand is very low and yields a low inflation, low levels of wages and salaries, while there are not chances to increase employment.

The share of loans to private sector as a percentage of GDP (financial deepening) has been very high in many countries. Besides, according to (Jarmuzek and Rozenov, 2017) the debt of non-financial private sector had increased considerably in advanced economies even before the outburst of the global financial crisis. If this percentage goes beyond a critical level, then economic crisis will come up and unemployment will rise (Georgiou, 2009). This could be triggered by an "exogenous factor" which could make the payment of loans more difficult or impossible. It has been observed by OECD (2009) that the growth rate of loans to private sector has exceeded the growth rate of GDP. Hence, one might think that an excessive financial deepening could explain the creation of the present economic crisis.

Hence, it is noticed by OECD (2016) that the weak consumer demand is the problem. In fact, without a strong consumer demand entrepreneurs will not invest and consequently economic growth will not be realized. It is worth mentioning that based on Georgiou (2012) credit terms should be not very strict so as to be not off-putting for the would-be investors. Only, with a less strict credit terms entrepreneurs will start to invest. Apart from that, it must not be neglected the fact that the household-income should not be further reduced, so as to enable households to increase demand.

2.2.8 Exchange rate increases NPLs

Beck *et al.* (2015), estimated that the exchange rate affects NPLs.

2.2.9 Bank concentration

Cifter (2015) focused on how bank concentration affects NPLs but without reaching clear results.

2.2.10 Unemployment worsens NPLs

Further, the findings of Messai (2013) show that unemployment worsens NPLs problems.

2.2.11 Bank profitability reduces NPLs

Further, the findings of Messai (2013) show that ROA has a negative effect on NPLs.

2.2.12 Banks face many types of risk

According to (Bessis, 2015) financial risks are defined according to the sources of uncertainty. The examination of risks is very important for the survival of banks especially after the outburst of economic crisis.

Credit Risk. According to (Bessis, 2015) "Credit risk is the risk of losses due to borrowers' default or deterioration of credit standing. Default risk is the risk that borrowers fail to comply with their debt obligations".

Market Risk. According to (Bessis, 2015) "Market risk is the risk of losses due to adverse market movements depressing the values of the positions held by market players".

Liquidity Risk. According to (Bessis, 2015) "Liquidity risk is broadly defined as the risk of not being able to raise cash when needed. Banking firms raise cash by borrowing or by selling financial assets in the market. Funding liquidity refers to borrowing for raising cash. Funding liquidity risk materializes when borrowers are unable to borrow, or to do so at normal conditions." Hence, a severe lack of liquidity causes failure. It should be noted that such an extreme situation is a result of various types of risks (like credit risk, or interest rate risk). In other words, all types of risks are inter-related.

Interest Rate Risk. According to (Bessis, 2015) "The interest rate risk is the risk of declines of net interest income, or interest revenues minus interest cost, due to the movements of interest rates". As an example, one could mention the sudden

decline of short-term interest rates (Mishkin, 1996); (Velasco, 1987); (Kaminsky &. Reinhart, 1996).

Foreign Exchange Risk. According to (Bessis, 2015) "Foreign exchange risk is the risk of incurring losses due to fluctuations of exchange rates".

Solvency Risk. According to (Bessis, 2015) "Solvency risk is the risk of being unable to absorb losses with the available capital". Solvency risk triggered the creation of capital adequacy ratio which is analyzed in next chapter. In the times of crisis banks must be protected against failure, because if banks are "healthy" then they will be able to cause economic growth.

Operational Risk. According to (Bessis, 2015) "Operational risks are those of malfunctions of the information system, of reporting systems, of internal risk monitoring rules and of procedures designed to take corrective actions on a timely basis". Regarding the information system it should be noticed that an efficient information system regarding bank clients contributes towards the reduction of NPLs (Georgiou, 2013).

Other types of Risk. Apart from the afore mentioned types of risk it is worth referring to some other types of risk, that might indirectly cause problems in the banking sector. To begin with, another type of risk is the political risk, which causes uncertainty in banking profits (Busse & Hefeker, 2007). In fact political uncertainty has a negative impact on company's leverage (Cao et al., 2013). Political uncertainty is also an obstacle to entrepreneurship, for investment plans are not realized (Yonce, 2009); (Julio and Yook, 2012). In other words, political uncertainty has a negative effect on investment and it is an obstacle to economic growth. It is thus believed that uncertainty has a negative impact on investment (Carruth et al., 2000). On the contrary, political stability means a stable legal system, as well as a fixed taxation system, so as to enable would-be investors to realize their long term investment plans. These investment plans come to fruition in the long run, so in a stable economic environment the risk is minimized and in thus more investors will be attracted to invest. Consequently, economic growth will start, unemployment will be reduced and household consumption will go up. Hence, firm sales will be higher and this will cause a reduction in firm's leverage. It is recalled that firm profitability (as a result of a high consumption) has a negative impact on leverage (Li-Ju Chen and Shun-Yu Chen, 2011); (Lyubcho Milushev, 2016). In other words, profitable firms will be in a position to meet their obligations to their lenders (banks) and thus banks will make

profits too. Besides, country risk should not be neglected. This type of risk with the trade balance must be taken seriously into consideration by banks (Melvin, 1985); (Eaton et al., 1986); (Citron & Nickelsburg, 1987); (Cosset, & Roy, 1991). Globalization increases banking risk (Georgiou, 2011).

2.2.13 The NPLs in ex-communist countries (CESEE)

In the paper of (Jakubík & Reininger, 2014) the problem of NPLs is analysed in the CESEE ("ex-communist countries", or "economies in transition") and in their model they took into account the following NPL determinants: a) NPL (lagged), b) Real GDP (lagged), c) Private sector credit/GDP (lagged), d) National Stock Index (lagged), e) Exchange rate. In other words, they examined the following phenomena:

a) The NPL(lagged) shows the situation as a continuous phenpomenon.

b) The real GDP (lagged) shows the deflated GDP as a continuous phenomenon

c) The Private sector credit/GDP (lagged) indicates if the private sector is over-borrowed

d) The national stock index more precisely represents (national and international) investors' perception of the international environment and of its future impact on the financial and economic development in the relevant CESEE country. However, given the relatively limited role of stock exchange markets in CESEE countries compared to the advanced economies, we do not claim that the stock market constitutes an import source of direct financing (through new equity issues) for economic growth in CESEE (Jakubík & Reininger, 2014). On the contrary, in the advanced economies stock market is a sound indicator of economic growth (Georgiou, 2010a).

e) It should not be forgotten that in the transition economies (CESEE), according to (Zouboulakis and Kyriazis, 2008), entrepreneurship, especially in the Balkans, still faces many barriers such as a too high percentage of agriculture in the GDP, obsolete technology, too high energy consumption, unskilled labour, a not clear legal system, lack of the spirit of competition, delay to attract foreign investments (Georgiou, and Kyriazis, 2009).

f) With respect to the impact of the exchange rate, our results are in line with the results of other macro-studies on NPLs and with the results of Klein (2013). Moreover, our results confirm the following observation by the ESRB (2011): "In some countries, foreign currency loans have higher non-performing loan (NPL) ratios and higher levels of loan restructuring (for example Hungary and Romania). This conclusion is reached when the vintage of loans is taken into account, i.e. generally borrowers that took out a foreign currency-denominated mortgage loan at a stronger exchange rate tend to have higher default ratios. This further demonstrates that, most likely, at least some borrowers are unaware of the risks in which they engage when taking out a foreign currency loan." (Jakubík & Reininger, 2014).

2.3 GEOGRAPHICAL APPROACH

2.3.1 Southern EU

It must be mentioned that "family ties" are much stronger in southern EU members than in the northern ones EU and the USA ones (David et al., 2007). This can be one of the many reasons, which makes unemployment rate to rise further in southern EU, since it hinders labour mobility. The labour mobility, is lower in EU than in the USA (Jacoby and Matthew, 2004). In Greece particularly, there are not motives that could encourage entrepreneurship to invest in Greece. At first, taxation is sky-high. Second, there is high uncertainty, that is off-putting for future investment plans (Georgellis & Wall, 2002). Third, red tape (bureaucracy) is also a serious problem. Thus, economic growth is hindered and unemployment rises (Georgiou, 2015). In sum, Greece unfortunately does not foster entrepreneurship. On the contrary, it should be mentioned that in the USA companies enjoy from the Government a lot of support in order to grow (Thurik & Grilo, 2005). It is worth mentioning that in Greece which suffers most due to memorandum and imposed austerity measures, banking sector is unable to help business sector and entrepreneurship to invest and create economic growth. Instead, Greek banks mainly aim to eliminate NPLs and try to manage to have solvency (Ivashina & Scharfstein, 2009). It should be mentioned that "capital controls" are barriers to entrepreneurship and hinder economic growth (Georgiou, 2010); (Kelesidou & Mastroyiannis, 2016). In this way depression goes on. It is a pity that banks usually help economy and

contribute to economic growth creation, but this is done only when banking sector does not undergo a crisis himself (Cappiello et al., 2010).

Economic crisis had many repercussions in SMEs and mainly in the southern EU. According to the study of Liu et al. (2015), that refers to Europe, Europe still has, after the financial crisis, high levels of business debts and high levels of non-performing loans (NPLs). According to the study of (Santana & Fougo, 2015) northern countries are richer and have lower amounts of sovereign debt, while southern countries have higher amounts of sovereign debt. Hence, firms of southern Europe have higher leverage (gearing) in their capital structures than the firms of northern Europe. Besides, northern corporations are larger than those of the southern Europe and are more profitable than those of the southern Europe.

2.3.2 Measures taken for the south EU NPLs

As it is mentioned above, economic crisis had many repercussions in small and medium enterprises (SMEs) and mainly in the southern EU. This phenomenon is very serious, since SMEs are the cornerstone of the total European economy. It should be noted that SME are mainly in the south EU. In fact, in EU SMEs are the 99% of the total number of companies and they employ about the 66% of total labour power of the EU. A firm falls within the category of SME if it employs less than 250 persons and has a turnover not higher than €50 million per annum. SMEs face a serious problem, that is their small size. Further, SMEs do not usually employ a highly qualified personnel. Apart from the above, the common problem of SMEs is the red-tape as well as the real difficulty of the banking sector to give credit, due to banking liquidity problems (cash-strapped banks) (Liu et al., 2015). In spite of the measures taken by EU and ECB (European Central Bank), the problem of the restructuring of SMEs debts has not been solved yet. According to the findings of Bergthaler et al., (2015), the solution of the afore mentioned SME problems requires the following measures to be taken: stricter regulations on NPLs of SMEs to be implemented, solution for the liquidity problem of SMEs to be found, as well as appropriate economic policy to be applied in order to help SMEs to survive.

2.4 OTHER

2.4.1 The behavior of banks after crisis

Under the conditions of the present economic crisis banks resorted to stricter credit terms, due to the increasing volume of NPLs (Kerry et al., 2014). Consequently, trade finance is more difficult to get. (Coulibaly et al., 2011) studied the impacts of the restrictions in trade finance in six emerging economies of Asia during the period 2008-2009 and have the following findings: (a) Sales of the most robust and bigger firms showed a smaller decline in relation to the remaining firms. SMEs suffered a lot due to the significant reduction in finance to them (Giovanni & Pierluigi, 2014), (b) firms that relied considerably on their exports, had a considerable and sudden shrink in their sales volume.

In crisis periods the size of firms usually shrinks in general because of a general fall in company profitability.

Furthermore, during crisis, access to credit became harder for everbody, including big as well as small firms. Before the beginning of crisis banks used to offer credit easier than they do today (for new investment as well as for exports). But after the start of the crisis, the economic environment has been changed. In fact, during the period 2008-2009 economies of EU members faced hard times. The high level of the percentage of country's debt in the GDP triggered recession. Following the study of Checherita and Rother (2010), it is estimated that for the EU countries there is a negative relationship between the share of the country debt in own GDP and the economic growth rate. Economic crisis had many repercussions in SMEs and mainly in the southern EU. According to the study of Liu et al. (2015), that refers to Europe, Europe still has, after the financial crisis, high levels of business debts and high levels of non-performing loans (NPLs). This problem appears mainly in in the small and medium enterprises (SMEs). This phenomenon is very serious, since SMEs are the cornerstone of the total EU economy. It should also be noted that SME are mainly in the south EU member states.

2.4.2 After crisis banks are unable to foster economic growth

It is worth mentioning that in Greece which suffers most due to memorandum and imposed austerity measures, banking sector is unable to help business sector and entrepreneurship to invest and create economic growth. Instead, Greek banks mainly aim to eliminate NPLs and try to manage to have solvency (Ivashina & Scharfstein, 2009). It should be mentioned that "capital controls" are barriers to entrepreneurship and hinder economic growth (Georgiou, 2010); (Kelesidou & Mastroyiannis, 2016). In this way depression goes on. It is a pity that banks usually help economy and contribute to economic growth creation, but this is done only when banking sector does not undergo a crisis himself (Cappiello et al., 2010).

2.4.3 The economic situation in EU banks related to that of the USA banks

(Schildbach and Wenzel, 2013) claim that USA banks are more profitable than the those in the EU. This is attributed to three reasons. First, the fact that the economy of the USA recovers constantly compared to the deep depression of the EU. Second, banks in the EU need more capital than the banks of the USA and third the uncertainty about the future of the EU and the debt crisis in EU triggered a fall in the market value of the EU banks (Acharya and Steffen, 2014).

2.5 CONCLUDING CHAPTER 2

After having analysed the main NPL determinant factors author will formulate the research hypothesis focusing only on macroeconomic and geographical factors

3. THE RESEARCH HYPOTHESIS

From the above analysis one can finally formulate the following research hypothesis Ho:

"Per head GDP at constant prices does not affect NPLs

and

Real economic growth does not affect NPLs

and

Gross fixed capital formation % GDP does not affect NPLs

and

Unemployment rate (total) does not affect NPLs

and

Government consumption % GDP does not affect NPLs

and

Annual inflation does not affect NPLs

and

south EU does not affect NPLs".

This Hypothesis can be more explicitly expressed as follows.

- **H1: "Per head GDP at constant prices does not affect NPLs"**
- **H2: "Real economic growth does not affect NPLs"**
- **H3: "Gross fixed capital formation % GDP does not affect NPLs"**
- **H4: "Unemployment rate (total) does not affect NPLs"**
- **H5: "Government consumption % GDP does not affect NPLs"**
- **H6: "Annual inflation does not affect NPLs"**
- **H7: "south EU does not affect NPLs".**

4. THE MODEL

The model estimation will be made through the Eviews software package and will be based on Brooks (2008). It must be mentioned that our model will focus only on macro-economic factors and geographical factors. In the appendix there are detailed tables derived from Eviews.

4.1 DATA COLLECTION

Table 1. The Definition of Variables

variable	meaning
x	per head GDP at constant prices
z	economic growth at constant prices
GFCF_GDP	gross fixed capital formation % GDP
Utotal	unemployment rate (total)
GovConGDP	government consumption % GDP
inflation	annual inflation
south	south EU
NPL	non performing loans % loans

Annual data per country (i) taken from: http://data.worldbank.org/

The countries of our sample are in alphabetical order: Austria (2000-2014), Belgium (2000-2014), Denmark (2000-2014), Finland (2000-2012), France (2000-2014), Germany (2000-2014), Greece (2000-2014), Ireland (2000-2014), Italy (2000-2014), Japan (2000-2014), Netherlands (2000-2014), Norway (2000-2014), Portugal (2000-2014), Spain (2000-2014), Sweden (2000-2014), UK (2000-2014) and US (2000-2014).Thus, the total sample size is 253.

4.2 MODEL FORMULATION

Hence, our model will be expressed by equation (1)

$$\mathbf{NPL}_{it} = c_0 + c_1\mathbf{x}_{it} + c_2\mathbf{z}_{it} + c_3\,\mathbf{GFCF\_GDP}_{it} + c_4\,\mathbf{Utotal}_{it} + c_5\,\mathbf{GovConGDP}_{it} + c_6\,\mathbf{inflation}_{it} + c_7\,\mathbf{south}_{it} + \text{error}_{it} \quad (1)$$

It is noted that the model estimation will be feasible through the Eviews software package and the level of significance is 5% ($\alpha = 0.05$).

4.3 UNIT ROOT TESTS

Before estimating equation (1) unit root tests will be made for all variables.

Table 2. Summary Unit Root Test

PP - Fisher x^2	**p-value**
NPL	*0,0046*
X	*0,0000*
Z	*0,0000*
GFCF_GDP	*0,0000*
UTOTAL	*0,0001*
GOVCONGDP	*0,0000*
INFLATION	*0,0000*

We make the hypothesis: Ho: There is a unit root in any variable. But since according to the PP-Fisher test the p-value of each variable is less than α, then we do not accept Ho. In other words, there is no unit root in the variables of our model. In other words all variables are stationary. Consequently one can proceed with the estimation of model (1) (Choi, 2001); (Levin et al., 2002); (Maddala & Shaowen, 1999).

4.4 MODEL ESTIMATION

Since there is no unit root in the variables in the following table 3 one can see the summary regression results.

Table 3. Summary Regression Results

Variable	Coefficient	p-value
C	14,525	*0,0000*
X	0,000	*0,6432*
Z	-2,505	*0,0097*
GFCF_GDP	-0,522	*0,0000*
UTOTAL	0,386	*0,0000*
GOVCONGDP	-0,143	*0,0007*
INFLATION	-0,331	*0,0000*
SOUTH	2,110	*0,0000*

R^2	0,855	…
F-statistic	207,003	*0,0000*
Durbin-Watson	1,984	…

Comments: From table 3 one can observe that the constant term is positive and statistically significant, for p-value < α.

H1 is accepted. In our model the coefficient of variable x is not statistically significant, because p-value > α. In other words, per head GDP at constant prices does not have any impact on non-performing loans. This means that per head GDP *per se* at constant prices does not matter, but economic growth matters.

H2 is rejected. According to Espinoza and Prasad (2010) and Kauko (2012) economic growth has a negative impact on NPLs. Besides, Beck *et al.* (2015), estimated that the most significant factors affecting NPLs are GDP growth. Further, Nkusu (2011) asserted that an aggravation in the macroeconomic environment as proxied by sluggish growth, decreasing asset prices or higher unemployment is interrelated with NPLs problems. It must be also explained that per head GDP at constant prices does not express only economic growth but is also an indicator of the disposable per head income. In fact, a negative relationship is found between net wages and NPL ratio (Olaya Bonilla, 2012). In our model it is found that the coefficient of variable z is negative and statistically significant, for p-value < α. It implies that economic growth at constant prices has a negative impact on non-

performing loans. This finding is in agreement with Espinoza and Prasad (2010), Kauko (2012), Beck et *al.* (2015) and Nkusu (2011).

H3 is rejected. In fact, gross fixed capital formation refers to the level of investments which in turn is an economic growth determinant. Consequently, as mentioned above in section 3.2 gross fixed capital formation is expected to cause a decrease in NPLs. Similarly, it is found in our model that the coefficient of variable GFCF_GDP is negative and statistically significant, for p-value < α. In other words, gross fixed capital formation % GDP has a negative impact on non-performing loans. This finding is in agreement with Espinoza and Prasad (2010), Kauko (2012), Beck et *al.* (2015) and Nkusu (2011), because gross fixed capital formation causes economic growth.

H4 is rejected. In fact, according to Messai (2013) unemployment worsens NPLs problems. Besides, it is found in our model that the coefficient of Utotal is positive and statistically significant, for p-value < α. It means that unemployment has a positive impact on non-performing loans. This finding is in agreement with Messai (2013).

H5 is rejected. Government consumption fosters economic growth as pointed out by Dowrick (1996). It is found in our model that the coefficient of the variable GOVCONGDP is negative and statistically significant, for p-value < α. In other words, government consumption % GDP has a negative impact on non performing loans. This finding is in agreement with Dowrick (1996).

H6 is rejected. Ghosh (2015) supported that NPL increases are due to inflation as well as poor credit quality, liquidity risk, inefficiency cost, larger capitalization and the size of the banking industry as well as unemployment, and public debt. It is found in our model that the coefficient of the variable inflation is negative and statistically significant, for p-value < α. In other words, inflation has a negative impact on non performing loans. Since wages are linked to inflation, it is expected that higher wages can increase households' ability to pay back debts. Thus, our finding is in agreement with (Olaya Bonilla, 2012).

H7 is rejected. It must be mentioned that "*family ties*" are much stronger in southern EU members than in the northern ones EU and the USA ones (David et *al.*, 2007). This can be one of the many reasons, which makes unemployment rate to rise further in southern EU, since it hinders labour mobility. The *labour mobility*, is lower in EU than in the USA (Jacoby and Matthew, 2004). Finally, southern EU countries,

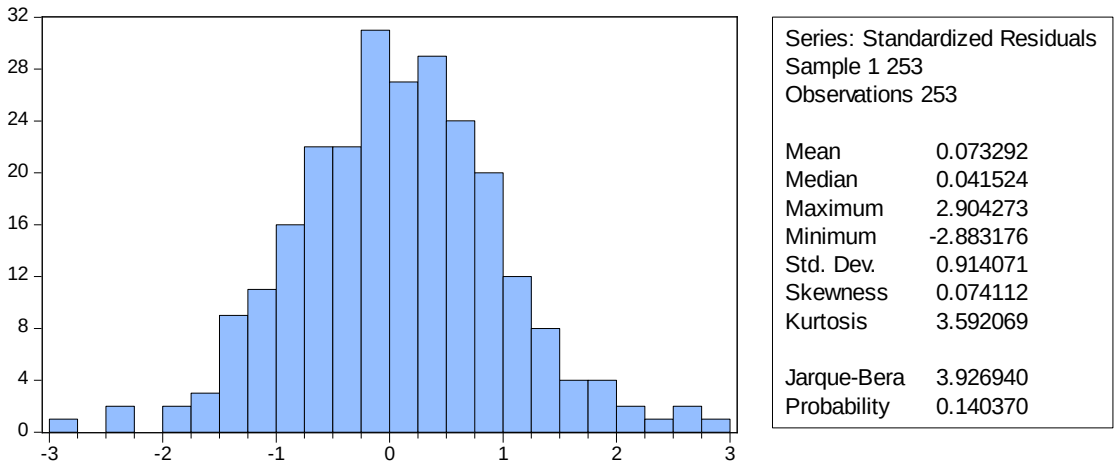
are mostly hit by the economic crisis EIOPA (2015). It is found in our model that the coefficient of the dummy variable south is positive and statistically significant, which means that south EU has a positive impact on non performing loans. This is in agreement with EIOPA (2015).

The determination coefficient is high and means that 85,5% od the variation of NPL is explained by the variables of the model (1). The remaining 14,5% is explained by factors not included in model (1). These factors can be variables of micro-economic nature, which are excluded from our model. The F-statistic is statistically significant for p-value < α. It means that the dependent variable NPL is indeed determined by the vector of independent variables.

4.5 NORMALITY TEST

Normality test examines if the regression residuals are normally distributed (Pindyck & Rubinfield, 1998). The assumption of normality is necessary in order to make statistical tests of significance of the parameter estimates as well to create confidence intervals (Koutsoyiannis, 1973). In graph 5 one can see the distribution of residuals of model (1).

Graph 5. The Distribution of Residuals of Model (1)



The normality test can be made feasible through the Jarque Bera statistic (JB), which has a x^2 distribution with two degrees of freedom, and is estimated by the formula (Vogelvang, 2005):

$$JB = n * \left[\frac{S^2}{6} + \frac{(K-3)^2}{24} \right]$$

Where: S (skewness), K (kurtosis) and n (the sample size).

This Jarque Bera statistic 3,927 is lower than the critical value (at α = 0,05) 5,991 which denotes that the regression residuals are normally distributed (see table 5).

4.6 SERIAL CORRELATION TEST

Serial correlation is traced by the world-wide accepted Durbin–Watson *d* statistic, which is defined as follows:

$$d = \frac{\sum_{t=2}^{t=n} (\hat{u}_t - \hat{u}_{t-1})^2}{\sum_{t=1}^{t=n} \hat{u}_t^2}$$

The variable $\hat{u}$ denotes the estimated residuals of the regression. This statistic is easy to calculate (Gujarati, 2003). Since (at α = 5%) d_U = 1,851 < *d* = 1,984 < 2, then there is no serial correlation in our model (Pindyck & Rubinfield, 1998); (Gujarati, 2003) (see table 3).

4.7 HETEROSKEDASTICITY TEST

Heteroskedasticity appears if the variance of the error term (residuals) is not equal among all cross sections. If the error term has a constant variance, then it is called homoskedastic, but if the variance is changing then we call this error heteroskedastic. Heteroskedasticity may happen when examining the variances of error terms across cross sections (Pindyck & Rubinfield, 1998). The consequences of heteroskedasticity are severe for the estimated coefficients are inefficient and the prediction will be inefficient too (Koutsoyiannis, 1973). Heteroskedasticity will be traced through the Harvey test (regression of the log of squared residuals on X).This robustness test is based on the study of Halkos (2003). The produced statistic ($n*R^2$) will be used, which has a x^2 distribution, where n denotes the sample size and R^2 is

this test's determination coefficient. As for this Harvey test, this statistic has three degrees of freedom. Since at α = 5% it's value 1,439 is lower than the critical value 7,815 we conclude that there is no heteroskedasticity in our model (see table 5).

4.8 RESET

The Reset test checks if the specification of a model (mathematical equation) is correct. If a model is correctly specified, then model estimation and model testing are relatively very straightforward. It is worth noticing that there are two main types of misspecification. The first kind refers to the case when relevant variables are omitted. The second exists when irrelevant variables are added to the model equation (Pindyck & Rubinfield, 1998). Hence, a (RESET) test (regression of residuals on $\hat{Y}^2$), based on the study of Halkos (2003), is used to trace if the specification of our model is correct. The statistic ($n*R^2$) will be used, which has a x^2 distribution, where n is the sample size and R^2 is this test's determination coefficient. As for this RESET, test this statistic has one degree of freedom. Since (at α = 5%) it's value 1,492 is lower than the critical value 3,841 we conclude that out model's specification is correct (see table 5).

4.9 MULTICOLLINEARITY TEST

Multicollinearity appears when two or more variables (or combinations of variables) are highly correlated (Pindyck & Rubinfield, 1998). In this section a test for multicollinearity will be applied. Each independent variable will be regressed on all the remaining independent variables. Hence, for each regression a VIF index will be estimated as follows:

$$VIF_k = \frac{1}{1 - R_k^2}$$

Variable k denotes the number of independent variables, k = 1, 2,….7. Variable R^2 is the coefficient of determination of each regression. The estimated VIF index is shown in table 4.

Table 4. VIF.

x	z	GFCF_GDP	Utotal	GovConGDP	inflation	south
1,80	1,20	1,40	2,00	1,20	1,20	2,20

In this thesis, it is required to test if multicollinearity exist among the explanatory variables of the regression model. Marquardt (1970) implies that variance inflation factor (VIF) estimates the gravity of multicollinearity based on ordinary least squares (OLS) regression analysis. This index shows how much the variance of an estimated regression coefficient is increased as a result of multicollinearity. Studenmund (2006) asserts that a common critical value is 10. In other words, if the value of VIF is higher than 10, then multicollinearity is very severe in the regression model under examination. Finally, (Gujarati, 2003) as well asserts that if VIF value exceeds 10 then there is a severe multicollinearity in the independent variables. After the afore-mentioned, since all VIF values are lower than 10, we conclude that there is no multicollinearity in our model.

4.10 CONCLUDING CHAPTER 4

After the above analysis we understand that our model is robust, for there are no unit roots, there is normality, homoskedasticity, there is no correlation, the specification of the model is correct and there is no multicollinearity. This can be nicely presented in table 5.

Table 5. Diagnostic Tests[2]

TESTS	Panel EGLS (Cross-section SUR)	Critical values (α = 0.05)
Heteroskedasticity	1,439	7,815
RESET	1,492	3,841
Normality	3,927	5,991

[2] The diagnostic tests are based on Halkos (2003)

5 CONCLUSIONS

5.1 ECONOMIC IMPLICATIONS

The countries of our examined sample are in alphabetical order: Austria (2000-2014), Belgium (2000-2014), Denmark (2000-2014), Finland (2000-2012), France (2000-2014), Germany (2000-2014), Greece (2000-2014), Ireland (2000-2014), Italy (2000-2014), Japan (2000-2014), Netherlands (2000-2014), Norway (2000-2014), Portugal (2000-2014), Spain (2000-2014), Sweden (2000-2014), UK (2000-2014) and US (2000-2014). In other words, our sample contains advanced economies like USA, EU and Japan and excludes former-communist countries (CESEE). Using Eviews software and applying the method "Panel EGLS (Cross-section SUR)" we found the following: Per head GDP at constant prices does not have any impact on non-performing loans. Economic growth at constant prices has a negative impact on non-performing loans. Gross fixed capital formation % GDP has a negative impact on non-performing loans. Unemployment has a positive impact on non-performing loans. Government consumption % GDP has a negative impact on non performing loans. Inflation has a negative impact on non performing loans. South EU has a positive impact on non performing loans. From the above conclusions policy makers should be aware of the following:

At first, economic growth must be fostered. In other words, barriers to entrepreneurship (high levels of inflation and interest rates, a lot of taxation, bureaucracy, etc.) must be reduced and political stability is required as a determinant factor for economic growth (Georgiou et al., 2015). Further, governments should help companies after their initial stage of start-up. It is worth mentioning that the level of confidence to the EU institutions has showed a remarkable decline and that this fall is faster in the southern EU countries, which are mostly hit by the economic crisis EIOPA (2015). The reduced confidence especially in the southern EU combined with the uncertainty increases economic depression, which is off-putting for the entrepreneurs and would be investors. Besides, the reduced confidence to the EU institutions might cause political instability and social unrest (Georgiou, 2014). It is also supported that political stability and economic growth are positively interrelated

(Aisen & Veiga, 2010). The level of confidence to the EU institutions should be also increased. Further, taxation should be lower, since taxation will reduce income and in turn reduce consumption (Keynes, 1935), causing a decline in economic growth, according to the well-known consumption led growth theory (Saito, 2007). Hence, instead of imposing taxation, it would be better to increase consumption. According to the study of (Georgellis and Wall, 2002) government legislation concerning taxation affects negatively entrepreneurial activities. Furthermore, there are various obstacles on entrepreneurship that differ across countries. These, according to the study of (Berthold and Fehn, 2003), are due to external factors, such as bureaucracy. Furthermore, based on Andersson (2000) there are also other types of obstacles such as market segmentation, inadequate information in technological progress, labour market, as well as money market. It is worth mentioning that a business entry into the market faces various sorts of barriers depending on the plans of the existing most important companies within this market (Broadway and Trembley, 2005). Finally, it should be mentioned that the cost to start-up a company as well as the related regulations and legislation status are off-putting (Djankov et al., 2002). Banks should offer better credit terms.

Second, consumption must be fostered. According to the consumption-led growth theory (Saito, 2007), consumption must be fostered. At the same time from the entrepreneurial point of view all credit terms must be better and barriers to entrepreneurship should be decreased in such a way as the entrepreneurs start to invest and create economic growth (Georgiou, 2012). From the consumer's point of view disposable income should not be decreased[3] so as to enable households to increase their consumption. It must not be neglected that austerity measures result in a dramatic reduction of household income, which in turn reduces consumption and finally causes recession. Hence, policy makers should take the required steps that wages and salaries should not be further cut. In other words, economic growth would be a result of consumption increase. Besides, consumption could also be fostered though investments in high technology, which in turn would increase household demand, since the embedded technology in the final commodity will improve it's quality. This could be made feasible through the introduction of new technology. Investments in new technology make firms more competitive internationally (Sener

[3] Due to austerity measures, household income has been decreased considerably in Greece.

& Sarıdogan, 2011) and besides the embedded technology in the products improves product quality (Greenhalgh and Rogers, 2010), thus increasings their demand in spite of the increase in product price Faruq (2006); (Shahiduzzaman and Alam, 2014); (Hudea and Stancu, 2012); (Lee and Becker, 2012); (Aoki & Yoshigawa, 2002); (Georgiou, 2012b). Further, it is claimed that product quality pushes up sales volume (Hanssens et al., 2002). Ultimately, the increase in consumer demand fosters the economic growth (consumption led growth) (Saito, 2007). It should be mentioned that price per se of the product does not matter regarding competition price-wise, but the percentage of embodied technology in the value added of the product does. Germany (as an example) has very high labour cost but it's share of technology cost in the value added of production is very high (in other words the proportion of the labour cost in value added of production is very low) (Georgiou, 2012e). Consumers prefer quality and prefer to buy the product having a good quality. In brief, to be a product competitive the share of the labour cost in value added of production should be low and not the product price per se (Georgiou, 2012e).

Third, banks should help companies to adopt high technology in their production process. Banking finance helps a lot companies to invest in new (high) technology. Indeed, high technology helped firms in many ways. First, equity capital increases as (Dos Santos et al., 1993) concluded for the USA manufacturing sector during the period 1981-1988. Second, logistics are improved (Slats et al., 1995). Third, share prices of firms investing and using high technology go up, since firm sales increase and profitability is improved (Bardhan et al., 2010). Fourth, firms investing and using high technology enjoy higher market shares abroad (Coe and Helpman, 1995); (Ioannidis & Schreyer, 1997); (Grenade & Moore, 2007).

Fourth, taxation must be lower. To solve the problem of depression OECD (2009) has suggested to impose property tax. The reasoning, according to OECD, is that before the outburst of crisis the loans to private sector used to increase faster than the GDP increase. This phenomenon is explained by the fact that people stopped making "productive investments" and resorted to the purchase of expensive houses (investment in real estate). In other words, according to OECD, property tax aimed to "discourage" people to invest in real estate and direct them into more "productive investments" instead (OECD, 2009). It must be mentioned however that people decided to invest in real estate in order to avoid risk (Feldstein, 2007). The so far risk avoidance to make productive investments can be explained by the fact that

consumption (at macroeconomic level) is almost saturated (especially in advanced economies). There are however some objections to the suggestion of (OECD, 2009). It is asserted that property tax will worsen depression (Georgiou, 2013a), since this type of taxation will reduce income and in turn shrink consumption (Keynes, 1935), causing a reduction in economic growth, according to the consumption led growth theory (Saito, 2007). Thus, instead of imposing property tax, it would be better to increase consumption. This could be made feasible through the introduction of new technology. In other words, the saturated and stagnant demand of the western world will increase if technology is further used in the production, and through the consumption led growth theory (Saito, 2007) economic growth will appear (Aoki & Yoshigawa, 2002). More specifically, it is supported that innovation by means of new technology improves the quality of the product (Greenhalgh and Rogers, 2010). Further, it is asserted that product quality increases sales volume (Hanssens et al., 2002), which in turn will create the consumption led economic growth (Saito, 2007).

Besides, some further measures must be taken in order to increase demand and thus foster economic growth. Efficient spending on infrastructure is needed for, during the last twenty years, the stock of public capital relative to GDP has declined in many advanced and emerging and developing economies (Gustavo et al., 2017). Strengthening the balance sheets. "Weak balance sheets still constrain access to credit, investment in intangibles"[4], and productivity growth in some countries. A balance sheet repair (mainly in Europe) would help towards the creation of economic growth (Gustavo et al., 2017). It is recalled that, (Allingham and Sandmo, 1972); (Srinivasan, 1973) had already claimed that international auditing standards are an important determinant factor for the elimination of tax evasion and the reduction of shadow economy. Hence, firm's income statements become trustworthy and more reliable information to the would-be investors. Thus, international investments will go up thus causing economic growth (Georgiou, 2013b).Reducing the economic policy uncertainty. Creating a greater certainty about future economic policy might also support investment decisions from entrepreneurship (Gustavo et al., 2017). Policies to

4 Read: https://www.oecd.org/sti/inno/46349020.pdf and http://mbsportal.bl.uk/secure/subjareas/accfinecon/bis/13639412_793_intangible_assets.pdf and http://ec.europa.eu/public_opinion/flash/fl_369_en.pdf

mitigate the impacts of population ageing are also required. In fact, the continuing current trends of population ageing, will further reduce productivity growth in advanced economies over the next decades (Gustavo et al., 2017). Consequently, ageing will be an obstacle to economic growth (Georgiou, 2012d) and will cause in the long run a change in the household consumption structure (Georgiou, 2012c). Regarding the change in the future consumption structure, this is an additional problem to be solved by companies, which must be prepared to adjust their supply accordingly to meet future household demand. Multilateral trade liberalization is needed. This would improve productivity and consequently foster economic growth (Gustavo et al., 2017). According to the research of (Ahn et al., 2016); (Dabla-Norris & Duval 2016) in advanced economies considerable productivity gains took place as a result of liberalization. Trade liberalization is also required. According to (Ahn et al., 2016) the productivity gains from tariff reductions are higher in countries having less restrictive FDI[5] systems. It should be also mentioned that a talented entrepreneur can attract FDI, thus countries should help entrepreneurship (Georgiou, 2006).

As for the geographical factor (south EU countries), this factor cannot change very easily and quickly, since it entails not only economic factors but also social factors.

5.2 MODEL ENHANCEMENTS

Our model has examined only macroeconomic factors and geographical factors and produced a satisfactory determination coefficient. However, this coefficient can be further increased by the inclusion in this model microeconomic factors a well. In other words, banking CEO talent could be a determinant factor. Besides, the correct appraisal of market risks can also be a determinant factor. Further, the market knowledge regarding the future of industrial sectors is also necessary. In other words, declining industrial sectors have a higher default risk.

[5] FDI = foreign direct investment

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APPENDIX

Table 7.1 Unit root test for variable NPL

Panel unit root test: Summary
Series: NPL
Sample: 1 253
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.30889	0.3787	15	223
Breitung t-stat	-5.55071	0.0000	15	208
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.07306	0.5291	15	223
ADF - Fisher Chi-square	22.6848	0.8280	15	223
PP - Fisher Chi-square	53.9959	0.0046	15	238

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table 7.2 Unit root test for variable x

Panel unit root test: Summary
Series: X
Sample: 1 253
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-8.72074	0.0000	15	223
Breitung t-stat	-11.2379	0.0000	15	208
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.19607	0.0000	15	223
ADF - Fisher Chi-square	65.3782	0.0002	15	223
PP - Fisher Chi-square	182.030	0.0000	15	238

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table 7.3 Unit root test for variable z

Panel unit root test: Summary
Series: Z
Sample: 1 253
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.21310	0.0000	15	223
Breitung t-stat	-5.30137	0.0000	15	208
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-3.70053	0.0001	15	223
ADF - Fisher Chi-square	61.0148	0.0007	15	223
PP - Fisher Chi-square	145.657	0.0000	15	238

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table 7.4 Unit root test for variable GFCF_GDP

Panel unit root test: Summary
Series: GFCF_GDP
Sample: 1 253
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-11.2716	0.0000	15	223
Breitung t-stat	-6.13776	0.0000	15	208
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-6.74060	0.0000	15	223
ADF - Fisher Chi-square	97.7062	0.0000	15	223
PP - Fisher Chi-square	144.011	0.0000	15	238

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table 7.5 Unit root test for variable Utotal

Panel unit root test: Summary
Series: UTOTAL
Sample: 1 253
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-4.10006	0.0000	15	223
Breitung t-stat	-4.79686	0.0000	15	208
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.56911	0.0583	15	223
ADF - Fisher Chi-square	37.6769	0.1582	15	223
PP - Fisher Chi-square	68.9248	0.0001	15	238

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table 7.6 Unit root test for variable GovConGDP

Panel unit root test: Summary
Series: GOVCONGDP
Sample: 1 253
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	2.11845	0.9829	15	223
Breitung t-stat	2.78751	0.9973	15	208
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-2.14376	0.0160	15	223
ADF - Fisher Chi-square	43.1569	0.0568	15	223
PP - Fisher Chi-square	75.5960	0.0000	15	238

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table 7.7 Unit root test for variable inflation

Panel unit root test: Summary
Series: INFLATION
Sample: 1 253
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.55882	0.0000	15	223
Breitung t-stat	-4.39296	0.0000	15	208
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-3.11556	0.0009	15	223
ADF - Fisher Chi-square	56.2631	0.0025	15	223
PP - Fisher Chi-square	107.938	0.0000	15	238

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table 7.8 Detailed Regression Results

Dependent Variable: NPL
Method: Panel EGLS (Cross-section SUR)
Sample: 1 253
Periods included: 17
Cross-sections included: 15
Total panel (unbalanced) observations: 253
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	14.52476	1.219982	11.90571	0.0000
X	5.41E-06	1.17E-05	0.463845	0.6432
Z	-2.504848	0.960864	-2.606872	0.0097
GFCF_GDP	-0.521520	0.019803	-26.33547	0.0000
UTOTAL	0.386412	0.028202	13.70164	0.0000
GOVCONGDP	-0.143300	0.041582	-3.446187	0.0007
INFLATION	-0.331274	0.029527	-11.21943	0.0000
SOUTH	2.109830	0.408205	5.168555	0.0000

Weighted Statistics

R-squared	0.855374	Mean dependent var	0.667316
Adjusted R-squared	0.851242	S.D. dependent var	2.339908
S.E. of regression	0.930024	Sum squared resid	211.9115
F-statistic	207.0031	Durbin-Watson stat	1.984257
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.573269	Mean dependent var	3.861800
Sum squared resid	2419.356	Durbin-Watson stat	0.982103