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NON-PERFORMING LOANS, GOVERNANCE INDICATORS AND SYSTEMIC LIQUIDITY RISK: EVIDENCE FROM GREECE

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Abstract

In this study we propose a new determinant of non-performing loans for the case of the Greek banking sector. We employ aggregate yearly data for the period 1996-2016 and we conduct a Principal Component Analysis for all the Worldwide Governance Indicators (WGI) for Greece, aiming to isolate the common component and thus to create the GOVERNANCE indicator. We find that the GOVERNANCE indicator is a significant determinant of Greek banks' non-performing loans indicating that both political and governance factors impact on the level of the Greek non-performing loans. An additional variable that also has a statistically significant impact on the level of Greek non-performing loans, when combined with WGI in the dynamic specification of our model, is systemic liquidity risk. Our results could be of interest to policy makers and regulators as a macro prudential policy tool.

Keywords: Credit risk; Greek banking sector; Non-performing loans; Systemic liquidity risk; Worldwide Governance Indicators.

JEL Classification: C51, G21, G2, G38.

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1. Introduction

A banking crisis can impact the national economy in many ways, reducing the growth rate of real GDP, or undermining investors' confidence in the country. Moreover, a banking crisis constitutes a serious problem for economies like Greece.[1] One factor which can increase the probability of such a crisis is the ratio of non-performing loans to total loans (hereafter NPLs). There is indeed an extensive literature on the determinants of NPLs. However, to the best of our knowledge, the relationship between NPLs and governance indicators, at regional or national level, has not yet been studied. The main purpose of this paper is to investigate whether governance indicators (such as political stability and absence of violence, government effectiveness, regulatory quality etc.) in Greece influence the aggregate level of NPLs. In addition, we deem appropriate to control for other important factors such as systemic banking risk (expressed here in terms of systemic liquidity risk). Our study could provide useful information to both policy makers and regulators in their efforts to tackle credit risk in the banking sector.

But why does the health of a banking system matter? The banking sector of a country is one of the most important components of its economy. Systemic banking crises can have a dramatic impact, given that they involve risks that arise because of the structure of the financial system and interactions between financial institutions (Liu and Staum, 2010). The cost of systemic banking risk is high. Kupiec and Ramirez (2009), by examining the cost of systemic risk in the banking sector, found that bank failures create significant negative externalities that reduce economic growth. In Greece economic crisis started initially as a sovereign debt crisis evolving into a banking sector crisis (see Mody and Sandri, 2012)[2]. In this sense, the Greek banking system played an important role in the performance of the Greek economy. Specifically, Greece experienced an idiosyncratic contagion banking crisis which

[1] According to the Bank of Greece (2018), total NPEs (non-performing exposures) and NPL ratios of the Greek banking sector were 50.5% and 37.0%, respectively, as of June 2016.

[2] In addition, Beck et al. (2016) mention that there is a significant interaction between sovereign default risk and systemic banking risk; although the Greek crisis was mainly a sovereign debt crisis, the systemic risk of the Greek and the European banking sector quickly increased after Greece's bailout agreement in May 2010 and reached its highest level in late 2011 (due mainly to sovereign default risk).

resulted in an output loss and a fiscal cost (as a proportion to GDP) of 43.0% and 27.3%, respectively; these figures represent the highest cost of systemic banking system crisis among 18 European countries during crisis excluding Ireland with 106.0% and 40.7%, respectively (see Laeven and Valencia, 2013; Dungey and Gajurel, 2015).

The rest of this paper is organized as follows: Section 2 reviews relevant literature. Section 3 describes data, variables and methodology. Section 4 presents the results, and finally Section 5 presents our conclusions.

2. Related Literature

There exists an extensive literature on the determinants of NPLs. The literature on the determinants of NPLs has identified two main sets of drivers: country-specific and bank-specific. Berger and DeYoung (1997) conclude that the bad management and moral hazard hypotheses explain a significant part of NPLs. Ghosh (2006) finds that banks' leverage with a lag of one period affects NPLs. Espinoza and Prasad (2010) and Kauko (2012) examine the importance of macroeconomic factors on NPLs showing that NPLs are negatively related to economic growth and positively related to fiscal and external deficits. Louzis et al. (2012) examine the determinants that influence NPLs for each loan category (that is, business, mortgage, and consumer) separately. According to their findings, NPLs are significantly related to both macro variables and the quality of banks' management. Other significant studies related to the NPL literature are those of Nkusu (2011), Messai and Jouini (2013), Cifter (2015), Ghosh (2015), Anastasiou et. al. (2016), Zhang et. al. (2016), Vithessonthi (2016), Anastasiou (2017), Tarchouna et. al. (2017), Alandejani and Asutay (2017), and Anastasiou et al. (2018).

The WGI, first introduced by Kaufmann and Kraay (2007)[3], are aggregate indicators which are based on hundreds of specific and disaggregated individual variables describing various dimensions of governance, taken from 33 data sources provided by 30 different organizations. The data reflect the quality of governance, as

[3] Source: http://info.worldbank.org/governance/wgi/index.aspx#home.

reflected in the views of public sector, private sector and non-governmental organization (NGO), as well as citizens and firms. They report six dimensions of governance (see below) for more than 200 countries starting from 1996. The WGI are[4]: Voice and Accountability (VA), Political Stability and Absence of Violence (PV), Government Effectiveness (GE), Regulatory Quality (RQ), Rule of Law (RL), and Control of Corruption (CC) (Kaufmann et al., 2007). Doumpos et al. (2015) by examining how bank soundness is influenced by central bank independence, central bank involvement in prudential regulation and supervisory unification, employed also a number of additional explanatory variables, one of them being "institutional development" which is calculated in terms of the six WGI; this variable was found to be statistically significant and with the proper sign in at least one specification of their model.

WGI have received wide criticism that is mainly based on methodological grounds (e.g. WGI are ill-suited for comparisons over time and between countries; they suffer from lack of transparency, existence of sample bias, likelihood of correlation of errors among sources used etc.) (GSDRC, 2010). In response to these criticisms, Kaufmann and Kraay (2007) mention, among others, that all governance indicators have weaknesses and there are no easy solutions in measuring governance. In addition, Kaufmann et al. (2007) argue that there are inherent limitations in measuring governance and that most of the data employed are in the public domain. Finally, Charron (2010) finds that WGI, despite their weaknesses, are internally consistent and remarkably robust to adjustments in the weighting and aggregation scheme of the underlying data and to the exclusion of any one underlying indicator.

Systemic banking risk is evidenced by high correlation and clustering of bank failures (because of simultaneous deposits withdrawals', asset prices fall etc.) in a single country, in a number of counties and even beyond (see Kaufman and Scott, 2003; Allen and Carletti, 2013) and it is classified into systemic credit risk[5] and

[4] See Table 1 for detailed definition of each indicator.

[5] Which arises when banks move credit risk from their balance sheets to other financial institutions and finally to the financial system through Credit Default Swaps (CDS) and Collateralized Loan Obligations (CLOs) (see Nijskens and Wagner, 2011).

systemic liquidity risk[6]. The importance of systemic banking risk is underlined by Moratis and Sakellaris (2017) who studied the systemic importance of banks for the period June 2008 to June 2017 and found, among others, that European banks have been the major sources of global systemic risk with strong interconnections to US banks.

3. Data and methodology

In the present study we use a sample of yearly observations from 1996 to 2016 (covering both pre- and post- crisis period). The variables used include the six Worldwide Governance Indicators (hereafter WGI), aggregate NPLs plus additional control variables for Greece. The main novelty of our study is that we construct a new variable (GOVERNANCE index), created by obtaining the first component of a principal component analysis that we performed for the six WGI.

As the dependent variable we employ the ratio of non-performing loans to total loans of the Greek banking sector (NPLs), which can be considered as a measure of the aggregate credit risk of the Greek banking sector (see e.g. Chaibi and Ftiti, 2015). As for the main independent variables, we use the first component after a principal component analysis (PCA for short; see below) that we conducted for the six WGI. The six WGI which capture six key dimensions of governance were provided by the World Bank database.

Apart from the main variable of interest, we also employ in our regressions some additional factors as control variables that are expected to affect NPLs. The selection of these variables was not only based on our identification assumption but also on the relevant literature (see e.g. Berger and DeYoung, 1997; Espinoza and Prasad, 2010; Louzis et. al., 2012; Malandrakis, 2014; Anastasiou et. al., 2016; Anastasiou et. al., 2018).

The data for all the control variables (C_i) along with the dependent variable were obtained from the Federal Reserve Bank of St. Louis, except those for systemic

[6] This is defined as an aggregate shortage of liquidity i.e. a situation in which many financial institutions face liquidity shortages simultaneously (see Barnhill and Schumacher, 2011).

banking risk which were obtained from The Bank of Greece. More specifically, the control variables (C_i) are defined as follows:

(a) Banks deposits/GDP % (DEPOSITS_GDP), used as a measure of the financial system's development and importance (relative to the size of the economy) (see e.g. Beck and Demirgüç-Kunt, 2009; Beck et al., 2010), where a greater ratio of deposits to GDP implies a prosperous country with a reliable banking system and hence a country with lower NPLs levels. Thus, a negative sign is expected.

(b) GDP growth % (GDP_GROWTH) where a country with higher GDP growth has also lower NPLs. Hence, a negative sign is expected (see e.g. Nkusu, 2011; Louzis et al., 2012 and Anastasiou et. al., 2018).

(c) Unemployment rate (UNEMP) where a higher unemployment rate signifies that there are more people who cannot serve their debt obligations against banks and thus a positive sign is anticipated (see e.g. Nkusu, 2011; Louzis et al., 2012 and Anastasiou et. al., 2018).

(d) The aggregate Return on Assets (ROA). We anticipate that ROA will have a negative impact on NPLs because a higher ROA suggests a bank with higher profitability and better performance in general and thus lower NPLs (see e.g. Berger and DeYoung, 1997; Podpiera and Weil, 2008; Louzis et al., 2012 and Anastasiou et. al., 2018).

(e) Banking sector concentration (BANK_CONCENTRATION) which is calculated by taking the assets of the three largest - Greek - commercial banks as a share of the total commercial banking assets. The expected sign could be either negative or positive (see e.g. Cifter, 2015 and Dungey and Gajurel, 2015)[7].

(f) Crisis (CRISIS_DUMMY) denotes a dummy variable which takes values 0 before the 2008 financial crisis and 1 otherwise. Consequently, our priors are that the financial crisis increased NPLs and therefore a positive sign should be expected (see e.g. Anastasiou et. al., 2018).

[7] For instance, Dungey and Gajurel (2015) found that higher market concentration led to a reduced probability of banking crisis even in the presence of contagion effects, the dependent variable being systemic banking crisis (dummy variable).

(g) Systemic liquidity risk (SYSTEMIC_LIQ_RISK) as a measure of systemic risk. This is consistent with the approaches described in Malandrakis (2014)[8] and Papadopoulos et al. (2016).[9] Systemic liquidity risk is represented by a dummy variable, which takes values 0 (no-systemic liquidity risk) before 2010 and 1 (systemic liquidity risk exists) after 2010.[10] We use as cut-off point the time at which deposits volume begins to decline[11] and lending from the central bank starts to increase, i.e. by the end of 2010 onwards (see Figure 1).

[Insert Figure 1 here]

Main variables (i.e. the WGI) definitions are reported in Table 1 while the definitions of the control variables are presented in Table 2. In Table 3 we provide the main descriptive statistics for each of our variables in their initial form. All of the above-mentioned variables (apart from the dummy variables) are included as percentage changes in the regression models. In addition, because of the fact that variable NPLs was found to have unit root, we transformed it into first differences before we include it in our model.

[Insert Tables 1, 2 and 3 here]

The correlation matrix between the six governance variables is presented in Table 4. Due to the fact that all these variables were found to be highly correlated with each other, we performed a PCA in order to isolate the common component. We name this new variable GOVERNANCE. We do not find any extreme correlations between our main explanatory variables and thus multicollinearity problems are not anticipated.

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[8] He mentions that the introduction of systemic liquidity risk as an additional explanatory variable is linked with the expectation that it has a negative effect on banks' liquidity and a positive effect on NPLs. Thus a positive sign is expected.

[9] They mention that one important sign of a systemic banking crisis is the adoption of significant banking policy intervention measures in response to significant losses in the banking system.

[10] In order to determine whether systemic liquidity risk exists or not, the volume of deposits and repos of non-monetary financial institutions (households, businesses, central government deposits, etc.) and the volume of lending from the central bank (Bank of Greece), for the period January 1998 – December 2016, are compared. The data used are the monthly reports on aggregate liabilities for the Greek banks from The Bank of Greece (https://www.bankofgreece.gr/Pages/en/Statistics/monetary/nxi.aspx), transformed into yearly data by taking the averages.

[11] This is also true for interbank lending. According to Rochet and Tirole (1996) one of the main components of systemic liquidity risk is interbank lending.

[Insert Table 4 here]

In particular, PCA has several advantages. To begin with, this analysis helps us to aggregate the existing information in the six different Governance Indicators into a unique governance index[12]. Moreover, PCA is able to deal with multicollinearity problems which may exist when many highly correlated variables are separately introduced in the same regression (Wooldridge, 2010). A further benefit of PCA is the fact that it produces the weights for each variable automatically, implying that the GOVERNANCE index that we constructed explains as much of the variance in the set of the different governance variables as possible. As a consequence, it is not necessary to pre-determine the weights for each variable (Wooldridge, 2010).

After computing the principal components, we have to determine how many components must be kept. A useful tool for that job is the so-called scree plot. In Figure 2 we depict the scree plot of the eigenvalues after the PCA. The scree plot shows the proportion of variance explained by each component. We wish to retain the components associated with the high part of the scree plot and drop the components associated with the lower flat part of the scree plot. Figure 2 shows that only the first component is in the high part of the scree plot and hence this first component will be the variable GOVERNANCE.

[Insert Figure 2 here]

In figures 3 and 4 we depict the trajectory between each Governance Indicator (before the PCA) and NPLs, and the trajectory between the GOVERNANCE index (after the PCA) and NPLs, respectively. Both figures give us preliminary evidence supporting an inverse relationship between NPLs and GOVERNANCE, especially after the 2008 financial crisis.

[Insert Figures 3 and 4 here]

Moving to the econometric modeling part, we estimate the following two econometric specifications (one static and one dynamic model) with OLS and using robust standard errors (Wooldridge, 2010):

[12] This is also consistent with The University of Gothenburg (2010; p.31-34) approach.

Static model: $NPLS_t = a + \beta \mathrm{GOVERNANCE}_t + \sum_{i=1}^{6} \delta_i C_{it} + \varepsilon_t$ (1)

Dynamic model: $NPLS_t = a + \beta \mathrm{GOVERNANCE}_t + \gamma NPLS_{t-1} + \sum_{i=1}^{6} \delta_i C_{it} + \varepsilon_t$ (2)

where NPLs, GOVERNANCE and Ci denote non-performing loans to total loans of the Greek banking sector, the first component from the PCA of WGI and all the above-mentioned control variables (DEPOSITS_GDP, GDP_GROWTH, UNEMP, ROA, BANK_CONCENTRATION, CRISIS_DUMMY and SYSTEMIC_LIQ_RISK) respectively.

At this point it should be noted that because the variables CRISIS_DUMMY and SYSTEMIC_LIQ_RISK are highly correlated and hence in order to avoid any possible multicollinearity problems, we do not include both of them in the same model. That is, we estimate the above two econometric specifications twice, once for each variable respectively.

4. Empirical results

The time series properties of the variables are initially evaluated employing the Augmented Dickey-Fuller (1981) and DF-GLS (Elliot, 1996) unit-root tests.[13] All the variables are included as percentage changes in the regression models and the hypothesis of a unit root is rejected in all cases in favour of the alternative of stationarity with only exception the variable of NPLs, that was found to have unit root and it is transformed into first differences.

From a statistical point of view it should be noted that all estimated equations reveal relative good degrees of fit and pass all diagnostic χ^2 tests for the hypotheses that there is no serial correlation, the residuals follow the normal distribution and finally the equations are well specified (see Table 5 and 6).

One remaining issue concerns the stability of the estimated parameters against small sample size. For this reason, we also carried out a set of stability tests in order to test the robustness of the estimated models given the relative short sample size due to the data availability. In particular, the CUSUM and CUSUM Square tests for

[13] Those results are available upon request.

the stability of the estimated parameters were applied to all models.[14] As Figure 5 and 6 shows, the null hypothesis of the parameter stability cannot be rejected at the 5% significance level in all cases.

[Insert Figure 5 here]

[Insert Figure 6 here]

In respect to the baseline regression results which are reported in Table 5, we find that GOVERNANCE exerts a significantly negative impact on Greek NPLs in both models (see Table 5, model 1 and model 2). More specifically, our results show that when Greece has higher levels of GOVERNANCE (that is higher levels of Voice and Accountability, Political Stability, Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption) it also potentially has a more stable banking system and thus a lower level of NPLs will be expected. Relating to the control variables DEPOSITS_GDP, GDP_GROWTH and BANK_ CONCENTRATION, our results show that they do not have any impact on NPLs even though they have the proper signs. Variables UNEMP, ROA and CRISIS_DUMMY have a statistically significant impact on NPLs, with the coefficient of CRISIS_DUMMY to be the one with the greatest magnitude (albeit significant at the 10% level only) and thus the one with the highest impact on Greek NPLs. Such results are consistent with those of Anastasiou et. al. (2018) who also found that the recent financial crisis significantly influenced NPLs in the euro area.

With respect to the additional regression results which are reported in Table 6, we find that GOVERNANCE has a significantly negative impact only in the dynamic model (see Table 6, model 4). SYSTEMIC_LIQ_RISK variable is statistically significant and has a positive impact on NPLs in both models. Hence, with the outbreak of the systemic liquidity risk, NPLs started to rise, a result which is in line with our prior

[14] The CUSUM test is based on the cumulative sum of the recursive residuals. We plot the cumulative sum together with the 5% critical lines. The test indicates parameter stability if the cumulative sum goes inside the area between the two critical lines. Respectively, CUSUM test of Square tests is based on the cumulative sum of squares of the recursive residuals and the test indicates parameter stability if the cumulative sum of squares goes inside the area between the two critical lines.

beliefs[15] and the economic theory. These results for the dynamic model may further imply that systemic liquidity risk (as a measure of systemic banking risk) moves independently from governance indicators, i.e. higher levels of governance indicators in a country do not necessarily affect systemic banking risks (i.e. either systemic credit risk or systemic liquidity risk or both). As for the rest of the variables, our results presented in Table 6 are in line with these previously mentioned at Table 5. Thus, we can infer that our findings are robust to alternative model specifications. Finally, it should be mentioned here that our results related to the GOVERNANCE variable are in line with those of Gozgor (2018)[16].

[Insert Tables 5 and 6 here]

5. Conclusions

NPL determinants - both at bank and macroeconomic level – are a favorite subject among researchers. This paper aims to contribute to this field of literature by investigating a hitherto rather unexplored area, that is how the aggregate level of NPLs in a country (in our case Greece) is affected by the governance indicators along with some additional macro factors, one of them being systemic liquidity risk.

Using aggregate annual data for the period 1996-2016, we perform a Principal Component Analysis for all the Worldwide Governance Indicators (WGI) for Greece in order to isolate the common component, and we create a new variable (GOVERNANCE). Our study produces two main findings: (a) GOVERNANCE is statistically significant and with the expected negative sign, implying that higher levels of these governance indicators signify a relatively stronger and more stable banking system and hence lower levels of NPLs; and (b) the additional control variable employed, namely "systemic liquidity risk", is statistically significant and exerts a positive impact on NPLs. Another very interesting finding of our research is that CRISIS_DUMMY is the variable with the greatest magnitude and thus the one

[15] Malandrakis (2014) finds, among others, that as credit risk increases then liquidity risk also increases when systemic liquidity risk exists (which is likely to affect more big-sized rather than small sized banks).

[16] Gozgor (2018) shows that socioeconomic conditions (such as poverty, unemployment rate, corruption and political stability) affect the domestic credits of 61 developing economies.

with the highest impact on Greek NPLs. Hence, the recent financial crisis led to increased NPLs in Greece probably due to the fact that after its outburst, higher unemployment rate occurred and thus more people were unable to meet their debt obligations. Our results could be of interest to policy makers and regulators as a macro prudential policy tool.

In terms of future research, the current study can be extended in many ways. First, a larger dataset could be implemented for more than one country and probably with additional explanatory variables. Second, alternative econometric techniques could be explored. Finally, a cointegration analysis could be performed in order to test the long-term impacts of the governance indicators on NPLs, either for the Greek banking system case or beyond.

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Tables

Table 1: Main variables: WGI

Acronym	Variable name	Definition	Source
VA	Voice and Accountability	Measures the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and freedom of the media.	World Bank database
PV	Political Stability and Absence of Violence	Measures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including domestic violence and terrorism.	World Bank database
GE	Government Effectiveness	Measures the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.	World Bank database
RQ	Regulatory Quality	Measures the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	World Bank database
RL	Rule of Law	Measures the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence.	World Bank database
CC	Control of Corruption	Measures the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.	World Bank database

Note: WGIs definitions are from Kaufmann et al. (2007).

Table 2: Control variables

Acronym	Variable name	Definition	Source
NPLs	Non-performing loans as % to total loans	The ratio of Non-performing loans to Total loans of the Greek banking sector	FRB of St. Louis
DEPOSITS_GDP	Banks deposits/GDP %	Banks deposits to GDP.	FRB of St. Louis
GDP_GROWTH	GDP growth %	The year over year percentage change of real GDP.	FRB of St. Louis
UNEMP	Unemployment rate %	Unemployment rate	FRB of St. Louis
ROA	Aggregate Return on Assets %	ROA of the whole Greek banking system	FRB of St. Louis
BANK_CONCENTRATION	Banking sector concentration%	Assets of the three largest Greek commercial banks to total commercial banking assets	FRB of St. Louis
CRISIS_DUMMY	Crisis	Stands for financial crisis, with values 0 before 2008 and 1 after 2008	
SYSTEMIC_LIQ_RISK	Systemic Liquidity Risk	Stands for systemic liquidity risk with values 0 before 2010 and 1 after 2010	

Table 3: Summary Statistics

Variables	Mean	Std. Dev.	Min	Max
NPLs	14.627	11.495	4.060	37.000
GOVERNANCE	0.011	1.000	-1.757	1.475
DEPOSITS_GDP	77.551	18.889	45.800	100.200
GDP_GROWTH	0.201	1.198	-1.750	3.126
UNEMP	14.859	6.984	7.875	27.675
ROA	-0.753	2.306	-8.520	1.630
BANK_CONCENTRATION	76.909	15.431	59.930	100.00
VA	0.930	0.177	0.618	1.191
PV	0.320	0.414	-0.230	0.875
GE	0.604	0.191	0.211	0.837
RQ	0.682	0230	0.148	1.019
RL	0.711	0.245	0.196	1.053
CC	0.256	0.311	-0.189	0.787

Note: The six government variables (that is, VA, PV, GE, RQ, RL and CC) are measured on a scale from -2.5 to +2.5 (Kaufmann and Kraay, 2007). Higher values correspond to better governance.

Table 4: Correlation matrix between the six Worldwide Governance Indicators

	VA	PV	GE	RQ	RL	CC
VA	1.000					
PV	0.828	1.000				
GE	0.901	0.777	1.000			
RQ	0.718	0.540	0.611	1.0000		
RL	0.853	0.795	0.886	0.629	1.000	
CC	0.833	0.930	0.747	0.460	0.718	1.000

Note: VA, PV, GE, RQ, RL and CC denote Voice and Accountability, Political Stability and Lack of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption, respectively

Table 5: Baseline Regression Results

VARIABLES	STATIC MODEL (1)	DYNAMIC MODEL (2)
$NPLs_{t-1}$	-	-0.034
		[0.249]
$GOVERNANCE_t$	**-0.001****	**-0.002****
	[0.0005]	**[0.0008]**
$DEPOSITS\_GDP_t$	-0.029	-0.029
	[0.020]	[0.021]
GDP_GROWTH_t	0.148	0.108
	[0.577]	[0. 675]
$UNEMP_t$	**0.161*****	**0.172*****
	[0.038]	**[0.043]**
ROA_t	**-0.003*****	**-0.003*****
	[0.001]	**[0.001]**
$BANK\_CONCENTRATION_t$	0.034	0.052
	[0.024]	[0.038]
$CRISIS\_DUMMY_t$	3.306*	3.058
	[1.656]	[2.633]
Constant	-0.138	0.123
	[0.956]	[1.393]
Diagnostics		
R-squared adjusted	0.800	0.769
F-test (p-value)	0.000	0.000
Durbin-Watson (d-statistic)	2.101	1.996
LM test (p-value)	0.336	0.058
Ramsey Reset test	no omitted variable bias	no omitted variables bias
Jarque-Bera test (p-value)	0.982	0.938

Notes: 1. Dependent variable is Non-performing loans to Total loans of the Greek banking sector (NPLs). **2.** Robust standard errors in brackets. **3.** ***p<0.01, ** p<0.05, * p<0.1. **4.** The null hypothesis for the 1st order Breusch-Godfrey LM test for autocorrelation is that there is no serial correlation. **5.** The null hypothesis for the Jarque-Bera normality test is that the residuals are normally distributed.

Table 6: Additional Regression Results

VARIABLES	**STATIC MODEL (3)**	**DYNAMIC MODEL (4)**
$NPLs_{t-1}$	-	-0.258
		[0.162]
$GOVERNANCE_t$	**0.0001**	**-0.00005*** **
	[0.001]	**[0.0007]**
$DEPOSITS\_GDP_t$	-0.022	-0.016
	[0.017]	[0.019]
GDP_GROWTH_t	0.425	0.513
	[0.501]	[0.425]
$UNEMP_t$	**0.138*** **	**0.147*** **
	[0.034]	**[0.040]**
ROA_t	**-0.003*** **	**-0.003*** **
	[0.001]	[0.001]
$BANK\_CONCENTRATION_t$	0.037	0.047
	[0.020]	[0.039]
$SYSTEMIC\_LIQ\_RISK_t$	**4.569** **	**6.298** **
	[1.802]	**[1.840]**
Constant	-0.399	-0.626
	[0.800]	[0.796]
Diagnostics		
R-squared adjusted	0.750	0.867
F-test (p-value)	0.000	0.000
Durbin-Watson (d-statistic)	2.295	2.424
LM test (p-value)	0.124	0.117
Ramsey Reset test	no omitted variables bias	no omitted variables bias
Jarque-Bera test (p-value)	0.908	0.984

Notes: 1. Dependent variable is Non-performing loans to Total loans of the Greek banking sector (NPLs). **2.** Robust standard errors in brackets. **3.** ***p<0.01, ** p<0.05, * p<0.1. **4.** The null hypothesis for the 1st order Breusch-Godfrey LM test for autocorrelation is that there is no serial correlation. **5.** The null hypothesis for the Jarque-Bera normality test is that the residuals are normally distributed.

Figures

Figure 1:

Deposits and central bank lending in Greece: 1998 – 2016.

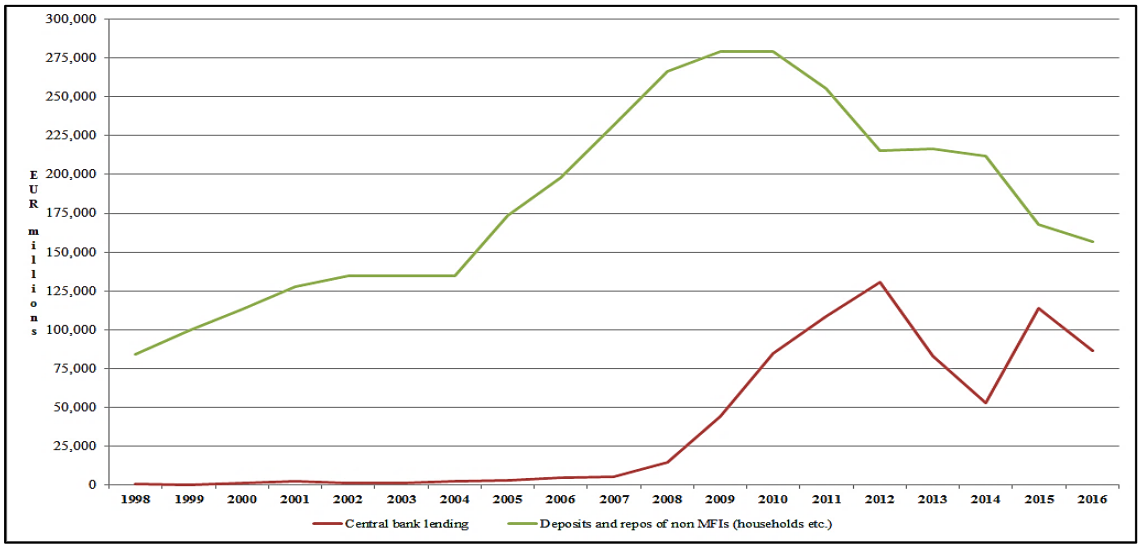


Figure 2:

Scree plot of eigenvalues after the PCA on the 6 Governance indicators.

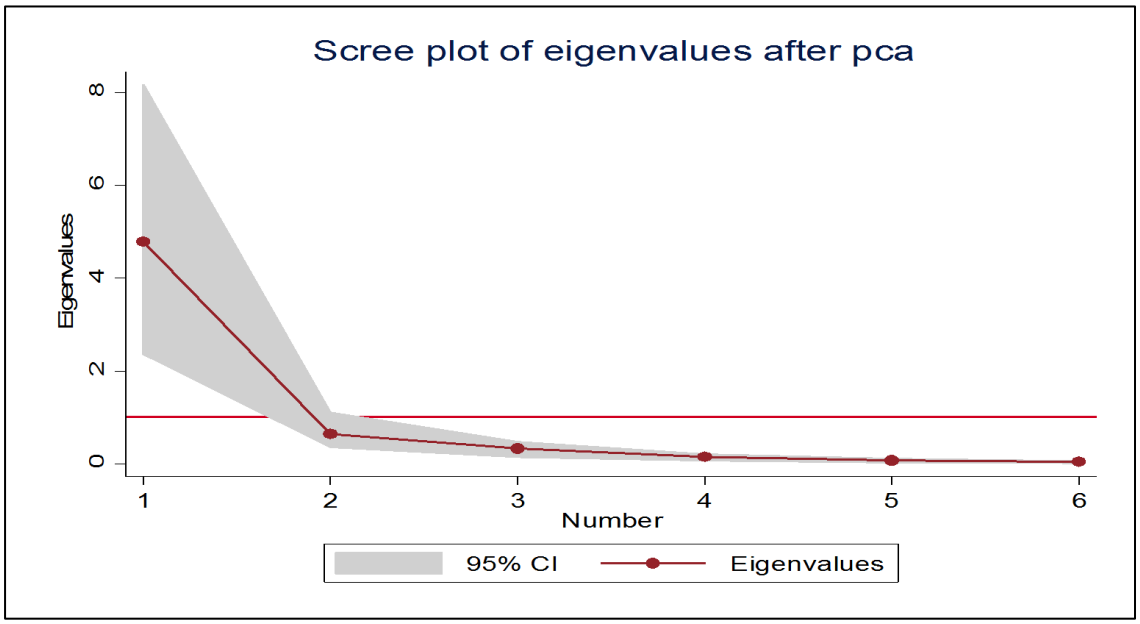


Figure 3:

The trajectory between each Governance Indicator (before the PCA) and NPLs.

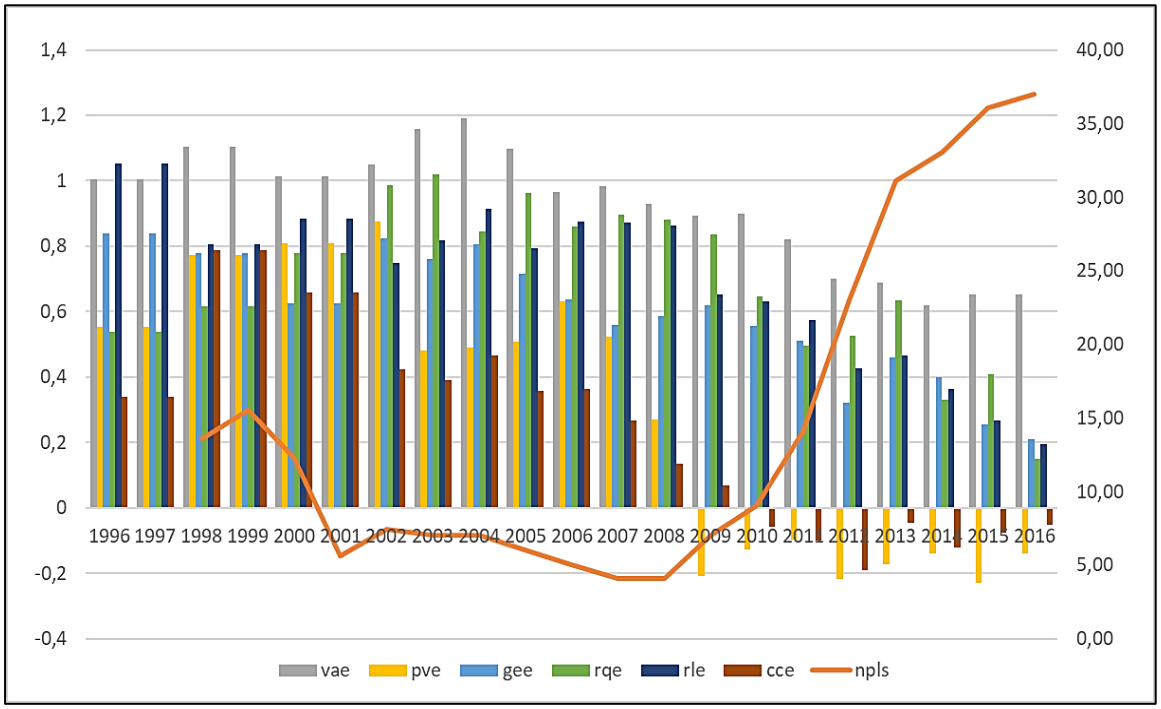
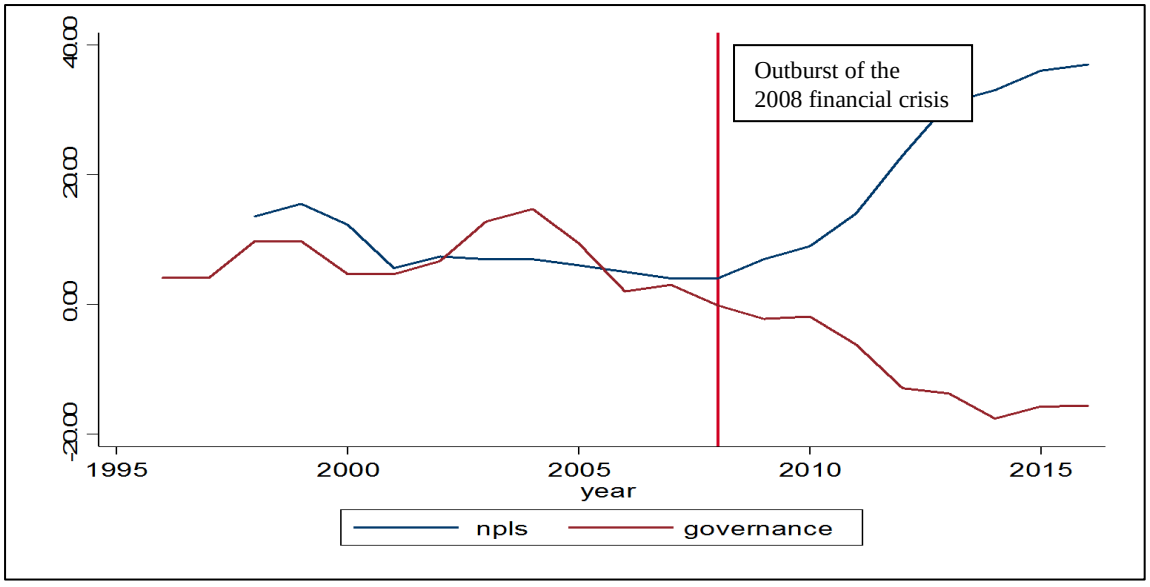


Figure 4:

The trajectory between the GOVERNANCE index (after the PCA) and NPLs.



Note: In order to have a better representation of the figure above, we have multiplied GOVERNANCE index by 10.

Figure 5:

CUSUM tests

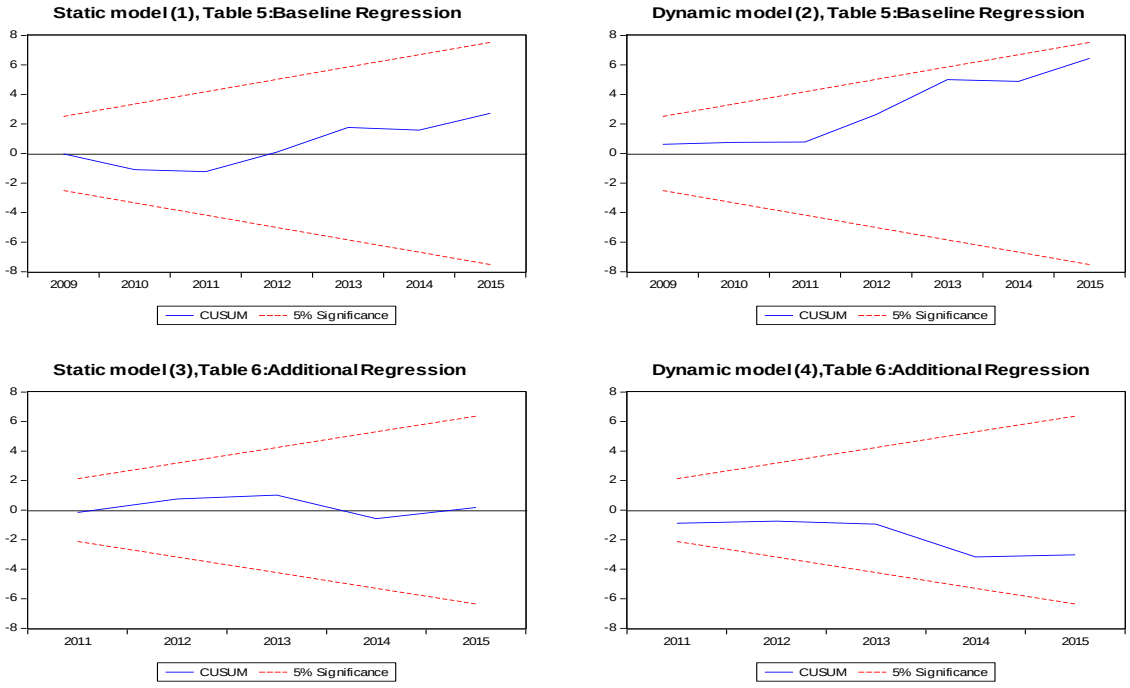
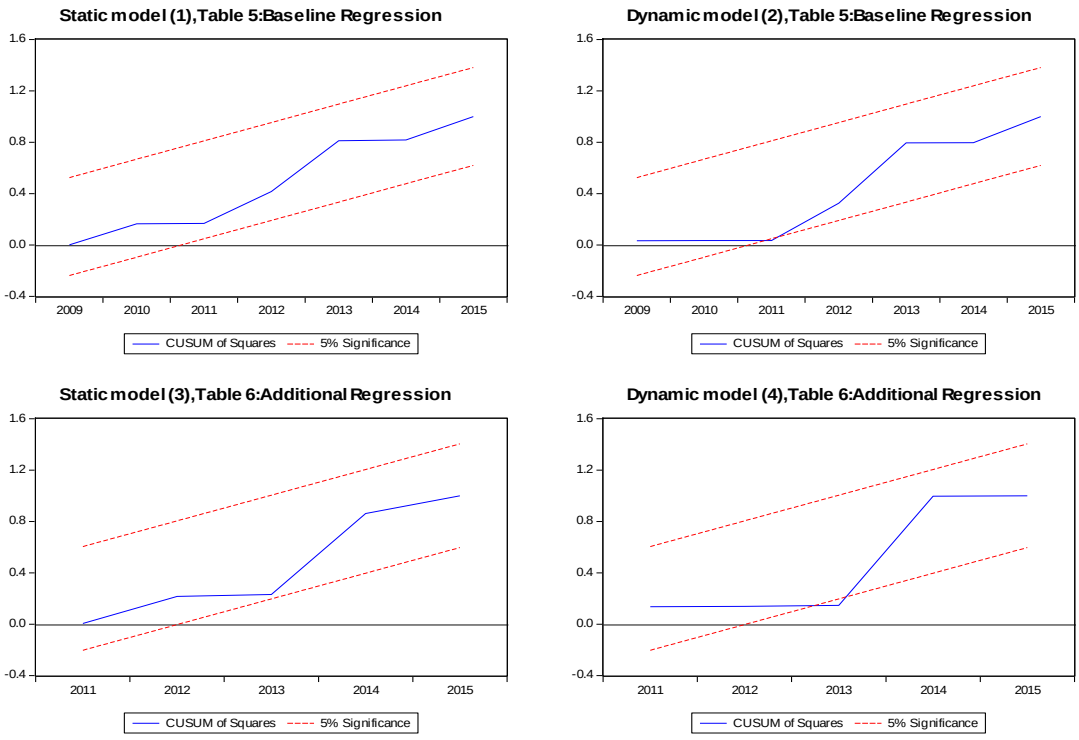


Figure 6:

CUSUM of Squares tests



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