Journal of Applied Economics and Business

OPEN ACCESS ARTICLE

THE EFFECTS OF NON-PERFORMING LOANS REDUCTION MEASURES ON SYSTEMIC RISK IN EUROPEAN BANKING SYSTEM

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Disclaimer: The views expressed in this paper are solely of the author and do not necessarily reflect any stance of the SRB. Responsibility for the content lies entirely with the author.

Abstract

The current paper presents a quantitative analysis of the future relationship of loans regarded as dormant with established reduction measures on systemic risk of banks in the European banking system. The reduction measures are a legal framework sought to be put in place to ensure Non-Performing Loans (NPLs) in the region are managed in a better way and, where possible, minimise their crippling effects on the banking industry. The paper is the starting point of further evaluation as the regulations have not been fully implemented and require more input from all banking industry stakeholders.

Keywords: *Risk Reduction Measures; NPLs; Systemic Risk; European Union; Banking.*

INTRODUCTION

The main challenges facing banks include effective management of non-performing loans (NPLs), which directly affect their overall financial sustainability. Putting regulatory policies in place to control NPLs is a sound move by governments and stakeholders and will work towards making the banking sector more stable and prudent in lending. The NPLs reduction measures in the European Union are macroprudential milestones that, if well executed, can safeguard the industry from arbitrary collapse and uncertainties.

The present study provides a critical analysis and evaluation of the effects of NPLs reduction measures on systemic risk. In the EU banking system, credit purchasers and credit servicers are prevented from benefiting by barriers generated by divergent national legislation; thus, a focused and coherent regulatory and

supervisory regime is lacking. In addition, non-bank purchasers of credit are faced with regulations in some Member States, creating obstacles to purchasing credits. The same issue limits competition in the internal market due to the decreasing number of interested purchasers. On the other hand, such low competition leads to an inefficient and competitive NPLs market. As held, markets for NPLs feature small trade volumes (European Commission, 2018). In general, differences embedded in regulatory standards in the Member States lead to heightened fragmentation in the market, which limits the free flow of capital and services in the EU. Other effects include insufficient competition in and weak performance of the secondary market for bank credits. The limited involvement of investors and servicers signifies weak competitive pressures in the dual markets, i.e. the market for purchasing and the market for credit servicing. This results in higher fees for credit servicing to purchasers; thus banks bidding for low prices may discover that selling NPLs to non-bank investors weakens their incentives for offloading high-stock NPLs (European Commission, 2018).

The paper has five sections: the first section introduces the study, the problem statement, the research questions and the main contribution. The second section presents the conceptual framework and especially a critical review of the NPLs reduction measures in Europe and empirical studies that have evaluated the effects of NPLs on systemic risk of banks. Section three presents the methodological approach used to implement the econometric model proposed in the research and key variables, i.e. dependent and independent variables. Section four presents results generated using the STATA program. Section five presents the findings of the research, recommendations, limitations and direction for future research.

The following research questions have guided the study's investigation:

> Q_1: What are the future effects of NPLs Reduction Measures on Systemic Risk in the European Union banking system?; and
>
> Q_2: How efficient will NPLs Reduction Measures be in controlling Non-Performing Loans of Banks in the European Union?

The NPLs legal framework has gaps due to its failure to achieve the intended goals. For instance, such failures could be orchestrated by poor implementation of the regulations or mismatch of the regulations with NPLs (KPMG, 2018). Therefore, NPLs reduction measures must be adequate to address the adverse effects of non-performing loans at the policy level. According to Cerulli et al., (2017), legal uncertainties, including a lengthy foreclosure process, suppresses the options for reordering in a direct way the influence of the time required to recover NPLs in a given country. For instance, inefficient judicial forum increases the amount of time for recovery, which in turn increases the NPLs. On the other hand, it is reasonable to believe that the efficiency in the judicial system will have a positive impact on the NPLs ratio.

The present study illustrates the future effects of NPLs Reduction Measures on Systemic Risk on a sample of EU banks. A number of studies have evaluated the relationship between NPLs and systemic risk but not on the grounds of the regulatory framework such as the ones currently proposed in the EU (See KPMG, 2018). Therefore, the findings are expected to add value in narrowing the gaps in knowledge in section two; and much more in establishing the significant effects of reduction measures adopted in the EU towards systemic risk.

LITERATURE REVIEW

A number of studies in the past have been developed to examine the effects of reduction measures in the banking system. The notable issue has been that non-performing loans across the world are negatively impacting on banking systems. Therefore, this has led to the establishment of numerous creative solutions, including well-formulated risk techniques, with the hope that they would reduce non-performing loans to a commendable degree. For instance, the study by Chih-Ching (2016, pg.34) indicated that regulations should be supported by incentives to facilitate target banks to undertake the "non-performing loan reduction task".

Other studies have debated regulatory plans adopted to reduce NPLs. Further, related studies have examined the impact of creative regulatory solutions on NPLs control. For instance, the study by Erdinc and Gurov (2016) analysed the enactment of risk management protocols that are advanced guided by Basel Capital Accord towards the reduction of NPLs. In addition, Saga and others (2016, pg.45) proposed a "knowledge-based automated compliance auditing system" to be used to process loans and determine whether the applications of the loan are riskier. Stijepović (2014) recommended a model referred to as the Podgorica Approach that relied on the quantitative assessment of NPLs which could be reversed back to performing mode via a process of restructuring. Further reviews that may be mentioned refer to those evaluating NPLs remedies by establishing their key antecedents (for example Louzis et al., (2012), Ghosh (2015) and Vithes-sonthi (2016).

NPLs Reduction Measures and Systemic Risk

SRISK estimates the amount of capital which a bank will require to overcome insolvency in a financial crisis scenario; furthermore, it relies on accounting data to estimate liabilities and market data related to equities and equity volatility (Shin and Zigrand, 2013). According to Adrian and Brunnemeier (2011), systemic risk takes place during high credit demand since the market is optimistic about the risk level and the manner in which it amplifies industry damage during a crisis, referred to as the spillover effect (Andrian & Brunnermeier, 2011). On the other hand, Danielsson

et al., (2013) perceived systemic risk as the "aggregation of the risk of market volatility from major market participants" (pg.33).

Patro, Qi and Sun (2013) viewed systemic risk to be the capacity of a large-scale breakdown within a financial system triggered by a number of systemic events such as the bankruptcy of major financial institutions. According to Gorvett (2015), systemic risk is not equal to the aggregate total of individual risks, since the latter does not incorporate account risks linked to portfolio activities across financial institutions; which include those that lead to destructive procyclicality as well as high linearity in terms of asset returns that amplifies economic shocks and causing disruptions to macroeconomic policies (Ouhibi et al., 2017).

In the present study, such outcomes are attributable to increased non-performing loans during the Eurozone crisis. In fact, systemic risk and systematic risk are completely distinct concepts since the latter focuses more on market risk, and may not be reducible through diversification (Danielsson et al., 2013). In the study, systemic risk was computed based on the "capital shortfall" approach; according to Acharya et al., (2012), the method emphasises the contribution of the bank towards the overall financial failure as opposed to individual failures. In the same vein, systemic risk (SRISK) has been defined as the capital fund an enterprise is required to have in the event of another financial crisis. Systemic risk can be modelled as follows (Ouhibi et al., 2017):

$$SRISKi,t = E\ t\text{-}1\ (Capital\ Shortfalli \setminus Crisis)$$

Vukovic and Domazet (2013) examined the effects of dormant loans on systemic risk: for instance, NPLs had a causal impact on systemic risk with rapid effect in Serbia's banking industry. Further results of the study indicated that absolute and selected magnification of dormant loans led to increased occurrence of systemic risk in the Serbian banking industry.

In recent years, the emphasis has been on literature evaluating NPLs), since most researchers seek to understand the factors leading to systemic risk (Mejra et al., 2010). On the other hand, the relationship or causal effects of dormant Loans with systemic risk have also been of concern (Hassad & Ghak, 2010). In the study by Faward and Taqodus (2013), the authors used an OLS regression and established that there is significant relationship between NPLs and macroeconomic variables such as FDI, unemployment, GDP annual growth, inflation, the CPI, real interest rates, effective exchange rates, industrial production, and exports.

In the study by Mejra et al., (2011), the authors used Panel regression models to analyze the macroeconomic sources in relation to systemic risk. The key independent variables included exports of goods and services, fixed capital formation, disposable income, FDI, real GDP, net foreign assets, principles of Bale, ratio of asset loans, and deposit loans. In the studies, the authors examined the

effects of macroeconomic sources on systemic risk in the banking industry taking the case review of newer members of the EU. The results depicted that macroeconomic sources significantly worsened the loans considered to be non-performing in the region. The study by Vukovic and Domazet (2013) established that NPLs were the main generator of systemic risk in Serbia's domestic banking sector and similar results were affirmed in other countries in transition.

In a study by Cerulli et al., (2017) the authors examined the relationship between NPLs and systemic factors in banks. The focus was on three major NPLs determinants namely: the adequacy of the judicial system, degree of interest rates, and economic growth. For instance, inefficient judicial systems increase the recovery time and hence worsen NPLs. On the other hand, economic growth has an impact on household cash flows when there is a recession, which in the end causes difficulties in the repayment of bank loans. According to Salas and Saurina (2012), GDP growth negatively impacts on NPLs while interest rates raise the actual value of the borrower's debt; rendering debt servicing much expensive. In fact, high interest rates lead to loan defaults and in the long run aggravate NPLs.

TABLE 1. SUMMARY OF KEY LITERATURE

Author	Key Findings
Erdinic & Gurov, 2016	Advanced risk management techniques using Basel Capital Accord to reduce NPLs
Saga et al., 2016	Knowledge-based automated compliance auditing system-detect risk in loan applications
Stijepović, 2014	Podgorica Approach to examine quantitative assessment of NPLs
Louzis et al., 2012; Vithes-sonthi, 2016	Reduce NPLs by establishing their determinants
Vukovic & Domazet, 2013	NPLs increase systemic risk
Merja et al., 2011	Macroeconomic factors significantly increase NPLs
Cerulli et al., 2017	Adequacy of the judicial system, decreased interest rates and economic growth are the major determinants of NPL

The key summary of the literature is as shown in Table 1 with indications that several authors have supported the significant effects of NPLs towards systemic risk. The notion from each of the authors is that NPLs are not a spontaneous outcome but that they are influenced by external factors such as the judicial system, decreased interest rates, and economic growth. Therefore, there is concurrence among the authors that some measures ought to be taken to eradicate the risks of NPLs The authors that provided methodologies to control or reduce NPLs indicate a higher link to risk and detection. Thus, the concern has been much more on how to capture the likelihood of risk occurrence and take mitigation measures. The authors seem to propose a remedy that alleviates the risk of NPLs from their source. In fact, Cerulli et

al., have reflected on three factors that serve as the determinants of NPLs. The judicial system factor is important for the present research because reduction measures adopted in the EU for the banking sector should be based on efficient protocols in order to be successful. In a similar context, the study by Merja et al., linksmacroeconomic factors to increased NPLs, which means they also believe causes come from external factors.

The major gap in the literature is that inasmuch as most scholars examined the effects of NPLs towards systemic risk in the banking sector, none contemplated the moderating effects of NPLs reduction measures. There is still minimal literature that has examined the legal framework of NPLs in the banking sector beyond the European Union and its effects on systemic risk. It is still a new debate in the EU and an area requiring more exploration now and in the future.

A number of assumptions can be made when building the conceptual framework to guide the study: the relationship between NPLs and systemic risk is positive and causal. As a hypothesis, it can be inferred that increased NPLs lead to increased systemic risk. However, the conformity with NPLs reduction measures proposed in the EU should be expected to moderate the increasing effects of NPLs on systemic risk. Thus, the moderating effects of NPLs reduction measures are key to this research. The conceptual model is as shown in Appendix A.

The proposed model depicts the relationship between NPLs reduction measures proposed in the EU and their effects on SRISK. The model states that the reduction measures may not directly affect systemic risk but they would have moderating effects on the actual relationship between NPLs performance and SRISK. On the other hand, the effect of NPLs towards SRISK would also be affected by macroeconomic forces, including economic growth and the level of economic uncertainty index in the EU. Against this backdrop the following provisional hypotheses hold:

H_1: NPLs significantly increases SRISK in EU banks;

H_2: NPLs moderated by NPLs Reduction Measures will decrease SRISK in EU Banks;

H_3: NPLs mediated by macroeconomic factors i.e. GDP and economic uncertainty increase SRISK in EU Banks; and

H_4: Mediation effects of macroeconomic factors i.e. GDP and economic uncertainty when moderated by NPL reduction measures will decrease NPLs effects to SRISK in EU Banks.

METHODS, MODEL AND VARIABLES DEVELOPMENT

The preferred method was quantitative research because of the ability to work with numerical data and, based on such an approach, test or reject formulated hypotheses

(Willis, 2007). In order to test the hypotheses, the first review was the establishment of the relationship between NPLs reduction measures as a statutory framework and systemic risk; thus, a quantitative approach was most suitable due to its ability to provide an objective standpoint over the analysed data (Watzlawik & Born, 2007).

SRISK in the study was computed as:

$$SRISK_{i,t} = E\,(k\,(Debt + Equity) - Equity) / Crisis) = k\,Debt_{i,t} - (1\text{-}k)(1\text{-}LRMES_{i,t}) * Equity_{i,t}$$

The model parameter can be interpreted in the following manner: *k* signifies the capital ratio of the company, *debt* points to the book value of debt for the firm, *equity* signifies the firm's equity market value on a daily basis, and *LRMES* will be used to signify the Long Run Marginal Expected Shortfall.

The hypothesis formulated is based on the fact that NPLs serve as the driving force towards heightened systemic risk at EU commercial banks.

> *Ha:* NPLs performance with mediation of NPLs reduction measures will lower systemic risk of commercial banks in the European Union region.

Further, the 1st econometric model proposed in the study was as follows:

$$(SRISK / MKT\_CAP)_{i,t} = \alpha i + \beta_1 * NPL\%_{i,t} + \beta_2 * NIM\%_{i,t} + \beta_3 * NII\%_{i,t} + \beta_4 * LDR\%_{i,t} + \beta 5 * ln(PU)_t + \beta 6 * ln(GDP)_t + \lambda_{i,t}$$

As indicated, the dependent variable was the systemic risk and in the proposed model, it can be deduced that SRISK value highly links to the bank size: due to this the author normalised SRISK using Market Capitalisation to eliminate the size effect in the panel regression results. MKT CAP was collected from the annual reports of the selected banks for the respective periods. As per the second model, the NPLs ratio was considered as the independent variable ahead of inclusion of another control variable derived from the NPLs regulatory framework. The same shall be re-evaluated in the third econometric model proposed in due course. In order to render the results of NPLs more robust, consideration was given towards adding two kinds of control variables.

The first type included bank characteristics that may also determine SRISK performance. For instance:

> *NIM (%)*: Net Interest Margin was computed by virtue of dividing interest returns by earnings assets on average. In this paper, the author held the assumption that NIM has positive correlation to bank performance in EU and so may be deemed as a SRISK buffer.
>
> *NII (%)*: Non-interest income is used to denote the banks' participation in various market activities such as investment, intermediary operations and

consultancy. The author holds that non-interest income in EU banks has contributed greatly towards higher profitability and in stabilising the earnings base of the entire banking system.

LDR (%): Loan-to-deposit ratio shall evaluate the liquidity condition of EU banks; thus, where the ratio shall be too high then the banks may face the risk of inadequate money to pay back loans whenever customers demand withdrawal requests. On the other hand, where the ratio is too low, the banks in EU would have difficulty in generating optimal earnings. As a result, a lower LDR may be a pointer to safe liquidity hence lower SRISK level.

The second type shall be macro indicators which will be used to clarify whether the variations in SRISK derive from banks controlling NPLs at individual level or whether this is triggered by the region's economic condition.

Log (PU): uncertainty deriving from economic policy triggers stock market volatility and weakens investment activities in regions that are policy-sensitive like the EU banking sector. According to Patro and Sun (2013), economic uncertainty may be measured based on newspaper coverage frequency. Therefore, larger policy uncertainty may increase market panic and suppress the capital required to be achieved within a crisis scenario. The data was derived from the Economic Policy Uncertainty Index covering the EU for the specified period.

Log (GDP): The variable was adopted to test or rather examine whether economy size in the European region makes a noticeable contribution towards SRISK. Based on this, real GDP for EU as a region was recorded in US $ million.

The third model is NPLs reduction measures proposed in the EU region towards NPLs performance in the European Union region, and the identifiable effects on systemic risk. In other words, from the evaluation of the NPLs reduction measures in the EU, the central independent variable should be based on key applications of the provisions: hence, several proxies needed to be defined and represented using a dummy variable. In this regard, given the provisions evident in NPLs reduction measures, it was possible to build a "reform variable" denoted as "Rit" which was used to capture the applicability and effectiveness of the Reduction Measures: value 1 being the case where bank i is in full conformity with the Reduction Measures at any time t like a year, while zero if otherwise. Therefore, for bank groups there would be: Rit = 0 for 2008-2018 and Rit = 1 for 2008-2018. In addressing the hypothesis in that effective enforcement of NPLs Reduction Measures lead to decrease in NPLs hence lowering the SRISK, the following empirical specification was proposed:

$$SRISK_{i,t} = \alpha i + \beta_1 * NPL\ Reduction\ Measures + \beta 2 * NPL\%_{i,t} + \beta 3 * NIM\%_{i,t} + \beta 4 * NII\%_{i,t} + \beta 5 * LDR\%_{i,t} + \beta 6 * ln\ (PU)_t + \beta 7 * ln(GDP)_t + \lambda_{i,t}$$

The annual reports of selected banks i.e. EU-listed commercial banks, in the period 2008-2018 were used to gather key financial data required to implement the models; other data was derived from the World Bank and Compustat Financial Database. The data was based on 46 commercial banks in the EU with a focus on having at most 500 observations.

The analysis of data was implemented using the STATA program to run fixed effects and random effects estimations. Therefore, the two models were used to estimate the panel data regressions. A sensitivity analysis was carried out to justify the stability of the parameters selected. For instance, Hausman test, model specification Ramsey RESET, Multicollineairity (VIFs) and Durbin-Watson Test.

FINDINGS

In this section the main findings have been reported with output from Stata program explained guided by panel data regressions. Upon declaring the time-series it was established that the model data was a strongly balanced panel.

Descriptive statistics are reported in Appendix B. The general observation indicates that apart from the mean scores for NII (5.6892) and the dummy variable for NPLs reduction measures (.8192), GDP (.1328) and SRISK (-.4334) other variables such as NIM (.1198), LDR (.5174), and NPLs (2.5121) had their standard deviations lower than the average scores. The same results indicated that there was a negative mean value for systemic risk which represents the case for the European Banks. On this metric it can be affirmed that on average the banking sector has kept the trend for systemic risk in the negative and that is a good thing. The reason is that it signifies a low rate of collapse among the 46 banks in the region. Also, standard deviation scores below the mean values represented a consistent trend that did not deviate much from the mean performance.

Systemic risk indicates having a weak but positive linearity to NPLs reduction measures (.127) and a negative but weak linearity when correlated to non-performing loans (-.072). Another negative and weak linearity can be cited between systemic risk and loan-to-deposit ratio (-.108) and non-interest income (-.115).

Regression Analysis

In appendix C, the OLS regression indicates an F-Statistics with a probability value of .000 which affirms a statistical significant difference between systemic risk and the rest of the independent variables. However, the R Squared at 8.62% is reason to believe there exists a weak fitness between the dependent and independent

variables. The Anova results affirm that LDR (β = -.1007, P-Value = 0.018), NIM (β = .4737, P-Value = .000), NII (β = -.0408, P-Value = .013) are significant predictors of SRISK.

The Hausman test results rejected the alternate hypotheses, fixed effects panel regression were not used this paper. However, they have been provided in Appendix D for any future use.

In appendix E, the random effects panel regression results indicate a chi2 significance of .0025. Thus, the model is acceptable and the independent variables can be used to explain the trend in SRISK for the European Banks. However, an overall R squared at 8.53% means a low score goodness-of-fit across the dependent and independent variables. In the model, only NIM (β = .3858, P-Value = .002) and NII (β = -.0327, P-Value = .042) indicated havingpredictive significance to SRISK of the European commercial banks.

The hypotheses test results were based on the random effects panel regression just for purposes of comparison. The results are as summarised in Table 2.

TABLE 2. HYPOTHESES OUTCOMES

Hypotheses (Null)	Random Effects
NPLs will significantly increase SRISK in EU banks	Not Confirmed
NPLs moderated by NPLs Reduction Measures will decrease SRISK in EU Banks	Not Confirmed
NPLs mediated by macroeconomic factors i.e. GDP and economic uncertainty will increase SRISK in EU Banks	Not Confirmed
Mediation effects of macroeconomic factors i.e. GDP and economic uncertainty when moderate by NPL reduction measures will decrease NPLs effects to SRISK in EU Banks	Not Confirmed
NPLs performance, with mediation of NPL reduction measures, will lower the systemic risk of commercial banks in the European Union region	Not Confirmed

Robust Checks

The key hypothesis is:

Null: Random effects model is most suitable.

Alternate: Fixed effects model is most suitable.

The results in appendix G give a probability value of 0.0729 which means the null hypotheses is to be accepted. In that case, the random effects model is the most appropriate to use to interpret the future effects of NPLs reduction measures on systemic risk of EU commercial banks.

The results in Appendix H give a F statistic at 0.60 and the p-value at 0.6143; it means the null hypothesis has to be accepted by asserting that the powers of the independent variables do not jointly add that much explanatory power to the model. Hence, it may not be appropriate to include the designated independent variables into the model.

The test results are presented in Appendix I, where on average the coefficients are not more than 10 in the column for VIF. In that case, the model used does not have multicollinearity problems.

Discussion on Findings

As can be seen from the results, systemic risk indicates to have positive linearity to NPLs reduction measures. However, the nature of linearity is that it provides grounds to determine what is the direction of a relationship, hence it outlines the importance to policymakers in the banking sector in EU. For instance, positive linearity between the legal framework currently proposed in the EU should be in a position to reduce systemic risk and not increase it even in the slightest metrics. Weak linearity supports such a trend which should invite more scrutiny to the legal framework and be certain it would not be proportionate to systemic risk in the banking industry. In fact, the results should indicate that NPLs reduction should negatively influence systemic risk. In the random effects model, the beta results indicated that NPLs had a non-significant beta and it is actually a worrying establishment. The reason is that it does not state the relationship between NPLs reduction (β=.106,.149) hence it would not be possible to predict the exact effects to systemic risk.

The indications from the findings are that the effects of NPLs reduction measures to systemic risk of commercial banks in Europe cannot be taken for granted. However, the significant effects were not sufficiently or strongly emergent from the data findings.

CONCLUSION

In conclusion, the assertions that can be drawn from this study are that systemic risk is significantly affected by NPLs reduction measures or the statutory framework. In that regard, the ongoing review on its implementation in the European Union should be accorded maximum attention as, if well directed, it can support the banking industry ing addressing the proliferation of NPLs in the region. However, the analysis needs to be re-looked into and the conceptual model proposed in the study further explored to document the excluded factors in the current paper pertaining to NPLs reduction measures that have an effect on systemic risk to banks in the EU.

The decision to institute a legal framework to govern and oversee non-performing loans is a significant consideration with a high likelihood of addressing the challenges leading to systemic risks to commercial banks in the EU. Banking policymakers in the European Union may consider increasing the value of the secondary markets for credit and liberalising the security recovery requirements. In

order to re-formulate the findings of the study and justify its findings, it is better for future scholars to undertake a mixed methods research guided by surveys and interviews with industry experts. The importance of such a study would be to establish the exact effects of the proposed NPLs reduction measures on systemic risk by seeking the opinion of experienced professionals in the banking sector. The reason is that given NPLs reduction measures are still not fully executed, an econometric analysis may not provide the actual scenario in terms of the effects on systemic risk.

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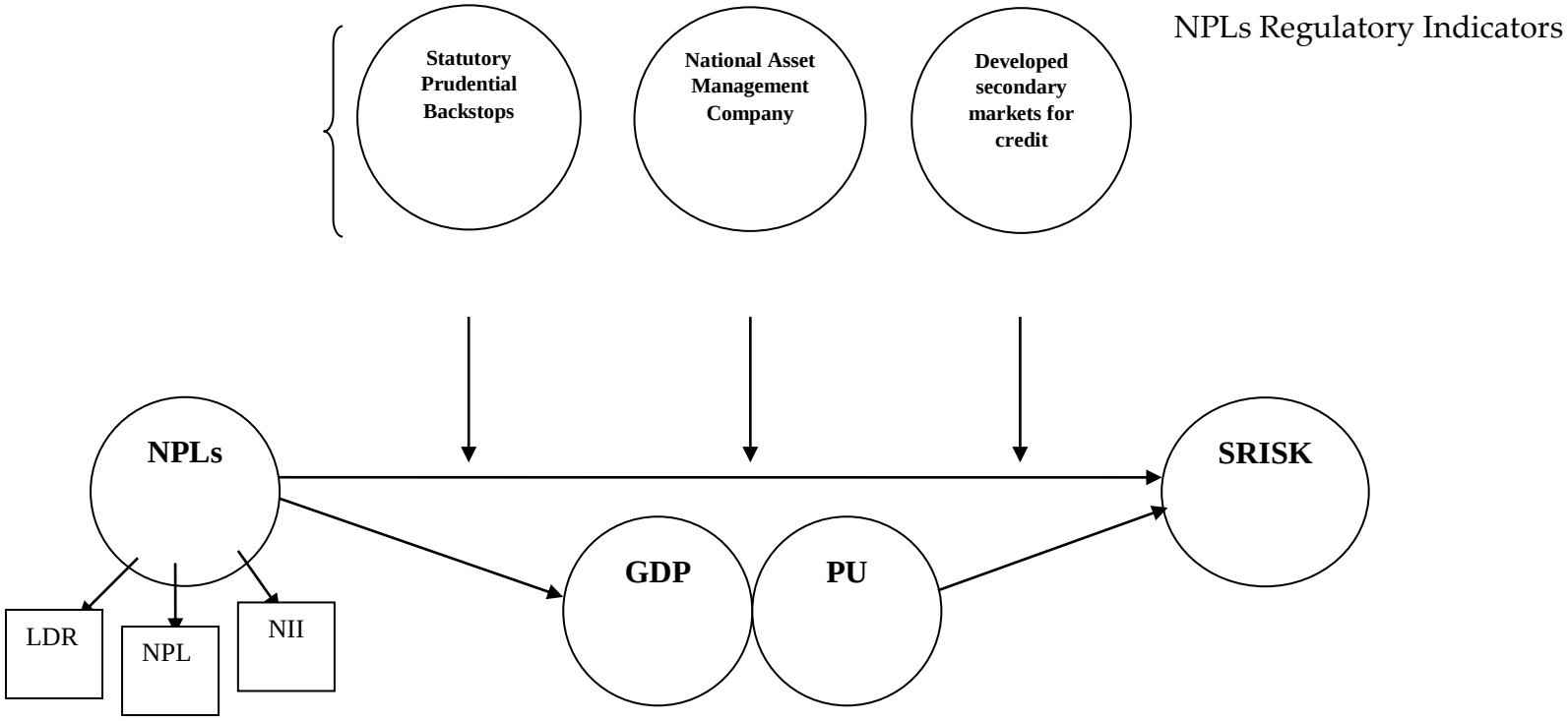
APPENDICES

APPENDIX A: CONCEPTUAL FRAMEWORK



APPENDIX B: DESCRIPTIVE STATISTICS

Variable	Obs	Mean	Std. Dev.	Min	Max
NIM	470	.1198428	.2043183	-1.0211	.6559
LDR	470	.5174083	.5279777	-1.8267	2.0518
NPL	470	2.512069	3.02751	-.5229	7.8001
NII	470	5.689162	1.352021	0	7.2798
MC	470	5.689162	1.352021	0	7.2798
Dummy	470	.8191489	.3853049	0	1
GDP	470	.1327849	1.152262	-2.6762	4.5813
SRISK	470	-.4334226	.4523768	-3.3161	.2404

Source: (Stata Program)

APPENDIX C: LINEARITY MATRIX

	NIM	LDR	NPL	NII	MC	Dummy	GDP	P.U.	SRISK
NIM	1.0000								
LDR	0.2008	1.0000							
NPL	-0.1979	0.1137	1.0000						
NII	0.2270	0.3780	0.0254	1.0000					
MC	0.2270	0.3780	0.0254	1.0000	1.0000				
Dummy	0.1996	0.0069	-0.0787	0.0050	0.0050	1.0000			
GDP	0.0620	0.1393	-0.0242	0.0392	0.0392	-0.1468	1.0000		
P.U.	0.003	0.005	-0.001	-0.046	-0.046	-0.1724	0.0751	1.0000	
SRISK	0.1890	-0.108	-0.072	-0.115	-0.115	0.127	0.066	0.012	1.0000

Source: (Stata Program)

APPENDIX D: OLS REGRESSION MODEL

Source	SS	df MS	Number of Obs	470
		F (7, 462)	=6.23	
Model	8.27469779	7 1.18209968	Prob > F	=0.0000
Residual	87.703695	462.189834838	R^2	=0.0862
		Adj R^2	=0.0724	
Total	95.9783928	469.204644761	Root MSE	=0.4357

SRISK	Coef.	Std. Err. t	P>t	95% Conf.	Interval
Dummy	.1192466	.0548867 (2.17)	0.030	.011388	.2271051
LDR	-.1007209	.0423088 (-2.38)	0.018	-.1838624	-.0175794
NIM	.4737072	.106954 (4.43)	0.000	.2635307	.6838837
NPL	-.0004102	.0068786 (-0.06)	0.952	-.0139273	.013107
NPL	0	(omitted)			
NII	-.0407674	.016345 (-2.49)	0.013	-.0728871	-.0086476
GDP	.0343896	.017912 (1.92)	0.055	-.0008095	.0695886
P.U.	.0071973	.0192052 (0.37)	0.708	-.030543	.0449376
cons	-.3079425	.10158 (-3.03)	0.003	-.5075585	-.1083265

Source: (Stata Program)

APPENDIX E: FIXED EFFECTS MODEL

R^2: within	**0.0185**	**Obs per group: min**	**10**
Between	0.0248	**Avg**	10.0
Overall	0.0185	**Max**	10
		F (7,416)	1.12
Corr (u_i, Xb)	-0.1017	**Prob > F**	0.3497

Srisk	**Coef.**	**Std. Err.**	**P > |t|**	**[Interval]**
Dummy	-.0532378	.150442	0.724	.2424833
NIM	.2442843	.1677883	0.146	.574103
LDR	-.0489371	.0751357	0.515	.0987558
NPL	.0185116	.0248312	0.456	.0673219
NII	-.024107	.0166925	0.149	.0087052
GDP	.0263745	.0205043	0.199	.0666795
P.U.	.0231084	.0199537	0.247	.062331
cons	-.3084825	.1646149	0.062	.0150981
Sigma_u	.23732735			
Sigma_e	.40596388			
rho	.25471005	(fraction	of variance due to u_i)	

Source: (Stata Program)

APPENDIX F: RANDOM EFFECTS MODEL

Random-effects GLS regression	**Number of Obs**	**470**
Group variable: bank1	Number of groups	47
R^2: within = 0.0141	Obs per group: Min	10
Between = 0.3237	Avg	10.0
Overall = 0.0853	Max	10
	Wald chi2(7)	22.04
Corr (u_i, X) = 0 (assumed)	Prob > chi2	0.0025

Srisk	**Coef.**	**|P>z|**	**Interval]**
Dummy	.1056791	0.149	.2491127
NIM	.3858165	0.002	.6321575
LDR	-.076447	0.127	.0216246
NPL	.0001659	0.986	.0188466
NII	-.0326519	0.042	-.0011296
GDP	.0296456	0.112	.0662333
Pu	.0153471	0.418	.0525249
_cons	-.346498	0.002	-.1260757
Sigma_u	.15403097	-	-
Sigma_e	.40596388	-	-
rho.	12584343 (fraction of variance due to u_i)		

Source: (Stata Program)

APPENDIX G: HAUSMAN TEST RESULTS

Test:	Ho:	difference in coefficients not systematic
	chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)	
	= 12.97	
	Prob>chi2 = 0.0729	

Source: (Stata Program)

APPENDIX H: MODEL SPECIFICATION RAMSEY RESET

Ramsey RESET test using powers of the fitted values of srisk
Ho: model has no omitted variables
F(3, 459) = 0.60
Prob > F = 0.6143

Source: (Stata Program)

APPENDIX I: MULTICOLLINEAIRITY (VIFS)

Variable VIF	1/VIF	
LDR	1.23	0.811169
NII	1.21	0.828832
NIM	1.18	0.847607
Dummy	1.10	0.905023
NPL	1.07	0.933332
GDP	1.05	0.950196
Pu	1.04	0.963289
Mean VIF	1.13	

Source: (Stata Program)