THE SENSITIVITY OF BANK CREDIT RISK INDICATORS TO MACROECONOMIC VARIABLES

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A dissertation submitted to the Faculty of Commerce, Law and Management University of the Witwatersrand Business School

In fulfillment of the requirements for the degree

of

Master of Management in Finance and Investment

Johannesburg, 2016

DECLARATION

I, Cyprian Mcwayizeni Thwala declare that this dissertation is my own work. It is being submitted for the degree of Master of Management in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

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ABSTRACT

This study uses a dynamic panel data method to examine the sensitivity of non-performing loans (NPLs) and bank capital buffer (BCB) to macroeconomic variables. This approach is motivated by the hypothesis that says macroeconomic variables have an effect on the bank's balance sheet, and this effect varies across developed and emerging economies.

The results show that NPLs are sensitive to GDP growth, interest rate, public debt, sovereign debt and unemployment in developed economies. However, NPLs are sensitive to GDP growth, exchange rate, interest rate, sovereign debt, unemployment and volume of imports in emerging economies. Public debt is not statistically significant in explaining the sensitivity of NPLs in emerging economies. Similarly, exchange rate and volume of imports have no significant influence on NPLs in developed economies.

In relation to the BCB we find GDP growth, exchange rate, interest rate, sovereign debt, unemployment and volume of imports as significant macroeconomic variables driving the sensitivity of capital buffer in emerging economies. Conversely, interest rate, sovereign debt and unemployment are macroeconomic variables responsible for the sensitivity of the buffer in developed economies. GDP growth, exchange rate and volume of imports have no significant influence.

Considering the liquidity risk imposed to the banks' balance sheet by this set of macroeconomic variables. It seems plausible that their dynamics should be given attention when conceiving any policy mix to cope with credit expansion. Without such exercise, the goal of financial stability in the global banking system will be difficult to achieve.

DEDICATION

To my family

“The great Mostert”

ACKNOWLEDGEMENTS

1. I wish to express my heartfelt gratitude to my supervisor, Prof Malikane without your assistance and constructive inputs I could not have completed this dissertation.

2. I would like to extend my gratitude to the funding bodies from which I have received financial assistance for the duration of my degree, the University of the Witwatersrand Postgraduate Merit Award and Golden Key Graduate Award.

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LIST OF ABBREVIATIONS

BCB……...…… Bank capital buffer

EXP01…….Volume of exports

EXR…….…….Exchange rates

GMM……...Generalized Method of Moments

GDP……...… Gross Domestic Product

GCC……. ...Gulf Cooperation Council

HUN……Hungary

INF…….…….Inflation

IMF……...International monitory fund

INT……..……..Interest rates

JB……Jarque-Bera

NPLs ……..…. ..Non-performing Loans

PUD……... Public debt

RLR……...…...Real Lending rates

RUS……. ….Russia

SPA…….Spain

SOD…….……. ..Sovereign debt

Std Dev…….....Standard Deviation

UNR……...Unemployment rates

USA…….……United States of America

LIST OF SYMBOLS

α……...Alpha

β……..……..…….Beta

i……Cross sectional

Δ……..……...…..Delta

*Y*it ……..…..……..Depended variable

ε_{it}……Error term

η_i ……Individual bank specific effects

β(L)……Polynomial vector

s……Set of explanatory variables

Σ……..……Sigma(sum)

t……..……Time

Xit ……..……Vector of explanatory variables

CHAPTER 1

1.1 INTRODUCTION

This study investigates the relationships between bank credit risk indicators and macroeconomic variables in developed and emerging economies. As highlighted by Stolz & Widow (2011), the deterioration in banks performance after the 2008 global financial crisis has unveiled some unknown economic factors. Building from this understanding, our study analyses the aggregate levels of bank capital buffer (BCB) and non-performing loans (NPLs) across the global banking system. The macroeconomic knowledge that informs the sensitivity of these two credit risk indicators is indispensable. Such knowledge presents the macroeconomic mechanisms of achieving global financial stability (Bolt et al., 2012).

Most empirical papers mainly from developed economies have emerged. These papers link increases in non-performing loans (NPLs) to macroeconomic environment (Louzis et al., 2012 and Bolt et al., 2012). Other studies explore the formation of bank capital buffer (BCB) at different business cycles (Coffinet et al., 2012; and Gauthier et al., 2012). In both instances, the literature agrees that the upswing in NPLs and the depletion of BCB affect credit supply and induce macro financial vulnerabilities. However, Nkusu, (2011) and Benes & Kumho, (2015) argue that the extent to which macroeconomic variables are responsible for these changes is not yet fully understood.

Limited work has been done to compare the macroeconomic interactions with the credit risk indicators across economies. This thesis seeks to address this gap. We decided to model the impact of the following macroeconomic variables: (GDP growth, volume of exports, volume of imports, exchange rate, public debt, sovereign debt, unemployment and real interest rate) to bank credit risk indicators proxied by BCB and NPLs.These macroeconomic variables are selected based on their significant influence to the global economy (Dabrowsk et al., 2005). Therefore, by capturing their dynamic influences to credit risk indicators, we contributes positively in pushing the streams of this literature with realistic economic insight arising from macroeconomic performance.

1.2 AIM OF THE STUDY

Our aim is to assess the extent of differences in the sensitivity of BCB and NPLs to macroeconomic variables. At the same time, we seek to identify possible (dis)similarities in the macroeconomic interaction with bank credit risk indicators between the two broad economies. Panel studies directed in this approach have been scarcely conducted as noted in the main stream journals. Most papers that constitute the current body of knowledge are mainly isolated and individual country-focused. (Glen & Velez, 2011 and Gauthier et al., 2012).Moreover, these papers have analysed mainly the NPLs but not both indicators concurrently. The current study is innovative in a sense that it combines both indicators (BCB and NPLs) to explain their sensitivity to macroeconomic variables. Against this background, we are embracing a deeper investigation using a dual analysis approach.

1.3 OBJECTIVES OF THE STUDY

There is no standardized objective approach to analyze the factors that influences bank credit risk indicators in the literature. Data availability presents a major challenge that constrains the methodological options (Louzis et al., 2012). In our underlying macroeconomic framework, we have followed the recent models and adopted an integrated panel approach. This approach uses a Generalized Method of Moments (GMM) to quantify the dynamics of the macroeconomic variables annually . This procedure allows us to study the gradual long term shifts in bank credit risk indicators across the two broad economies. In addition to that, the GMM estimation takes all necessary precautions of controlling possible biasness arising from endogeneity of explanatory variables. This delivers robust results which are acceptable in the literature (Louzis et al., 2012).

1.4 HYPOTHESIS OF THE STUDY

The current results are naturally expected to have not been documented before especial in the context of emerging economies. This makes it difficult to hypothesize the possible outcome of the study. For example, empirical evidence is provided to show that the relationship between exchange rates and NPLs is unknown in both advanced and emerging economies (Nkusu 2011). Equally unknown, is also the relationship between BCB to general macroeconomic variables across economies (Gauthier et al., 2012).In modeling these unknown factors, we contribute positively in pushing the streams of the literature a step further.

In addition to these unknown factors, our investigation also reviews the consistency of some documented relationships. The current study expects GDP growth and public debt (PUD) to negatively relate with NPLs (Festic et al., 2011). Also, we expect unemployment rates (UNR) to positively relate with NPLs (Berge & Boye 2007). The relationships between these macroeconomic variables (GDP, PUD and UNR) and NPLs are well documented in the literature from advanced economies (Festic et al., 2011; Nkusu, 2011 and Sirtaine & Skamnelos 2007).Therefore, the current paper expect the consistency of these relationships to prevail once again in our investigation.

1.5 SIGNIFICANCE OF THE STUDY

The significance of this study stems from the comprehensive coverage of less studied emerging economies. The current analysis identifies possible (dis)similarities in the macroeconomic interaction with credit risk indicators between the two broad economies. As recommended by Bolt et al., (2012) and Nkusu, (2011), such enquiry is significant in helping emerging economies to uncover macrofinancial vulnerabilities that are associated with their banks. From our analysis, we are addressing this recommendation and present the dynamic differences in systematic risk of the two broad economies. This comprehends the basic strategies needed to avert global financial instabilities . Certainly, the assessment of this magnitude is of benefit to the regulatory authorities and managers of the vast financial institutions.

The thesis proceeds as follows: chapter two gives an overview of the literature focusing on BCB and NPLs. chapter three outlines the methodology. Chapter four details the empirical analysis and the description of the data. Chapter five includes the estimated results. Chapter six discusses the results and the last section concludes.

CHAPTER 2

2.1 INTRODUCTION

The aftermath of the recent global financial meltdown highlighted the importance of macro-financial linkages and the role played by the banking sector in financial markets (Bolt et al., 2012). The Basel Accord was established in 1988 (Basel I), the aim was to build a safety net for banks against business cycle fluctuations and market risks by assuring that banks would hold adequate levels of capital. The banking sectors of countries incorporated into the Basel I Accord were required to hold at least 8% of their risk-weighted assets (RWA) in capital. Basel I was replaced by Basel II in 2004 to ensure that minimum capital requirements were more closely linked to banks' risk profiles and supervisory interventions were implied in case of bank failures (Basel 2011).

Capital buffers are capital holdings of banks that exceed the regulatory minimum. The incentives for banks to hold capital in excess of the required minimum are many: to avoid costly intervention during economic down turn, to signal financial soundness to the market, to take advantage of profitable market opportunities and to create a cushion against recessions which bring increases in the non-performing loans (NPLs) (Borio & Zhu, 2012).. When banks fail to accumulate capital buffers in times of economic booms, they could be trapped with insufficient level of capital during an economic downturn. Under these circumstances banks are forced to reduce their lending practice to the market in order to meet the regulatory minimum capital requirements . Since it is costlier to raise capital through new equities during economic slowdown . Hence, the cyclical behavior of capital buffers amplifies the impact of shocks on economic stability through reduced lending .

Aiming to prevent these destabilizing cyclical impacts of capital buffers fluctuations, Basel III requires banks to increase capital buffers during economic booms through a "mandatory capital conservation buffer" of 2.5% and through a "discretionary counter-cyclical buffer" of up to another 2.5% in times of credit booms (figure 1). Ayuso & Saurina (2004) further show that capital requirements should be varying over the cycle by deriving the capital requirements of Basel II for each unit of loan for Spanish Banks over the period 1987–2007 to estimate probabilities of default. Hence, considering the impact of Basel Accords on economic stability through capital requirements, it is crucial to assess the cyclical behavior of capital buffers for a successful implementation of Basel III.

Regarding the cyclical behavior of capital buffers, the empirical evidence is inconclusive. Ayuso & Saurina (2004), Bikker & Metzemakers (2005) find evidence in favor of counter-cyclical fluctuation of capital buffers in advanced economies. On the other hand, Jokipii & Milne (2009) study commercial, savings, and co-operative banks separately, as well as small and large banks, and find that the capital buffers of different banks exhibit different cyclical behaviors. Their results show that the capital buffers of commercial, savings, and large banks fluctuate counter-cyclically, while those of co-operative and smaller banks fluctuate pro-cyclically. Fonseca & Gonzalez (2010) find differentiated patterns in the levels of capital buffer holdings across and within developed and developing countries.

By the beginning of the 2000s, when most of the banking systems adopted for Basel I standards, the impact of these standards on the cyclical behavior of capital buffer became the center of attention in the literature. Questions were raised regarding the cyclical effects of Basel Accord. Flannery & Rangan (2008.) examine the economic effects of Basel I in the banking systems of the region. Although they find evidence of increased lending activity and capitalization after its implementation, they also find that growth in lending is more sensitive to changes in banks' capital ratios. Consequently, the authors expected lending growth to become more pro-cyclical after Basel II implementation as capital ratios under the Accord were expected to reflect risk factors that vary with the cycle.

Numerous countries were expected to adapt Basel II progressively after the agreed date for implementing the second Accord in 2007. Many policy analysts and economists declared their concerns over the effects of Basel II on the competitive landscape of the region before the initial date of adaption. De Nicolo et al.,(2003) claim that the multiple options for regulatory capital determination contained in the proposal would create regulatory divergence in the region due to the different levels of market penetration, standardized approaches adopted by credit rating institutions and internal risk systems.

However, the global financial crisis in 2008 postponed the adoption of the second Accord in most emerging economies . According to a Financial Stability Institute questionnaire sent to the region's supervisory authorities in 2004, eleven out of the 15 major economies in the region had plans to adapt Basel II over the period 2007–2009 (Beatty & Liao, 2011). However, according to the World Bank global Survey Banking Regulation in 2012, only Brazil, Mexico, Peru, Uruguay, Costa Rica, South Africa and Cayman Islands had fully implemented Basel II in 2011. The majority of developing countries declared Basel I to be the regulatory standard in place.

Currently, plans for the full implementation of Basel III are underway to all member states of the Basel Committee on Banking Supervision and the G-20.Other countries such as Uruguay and Colombia have been modifying their regulatory chapters to incorporate elements of Basel III, whereas the rest of the region shows reform delay. Hence, because of the timing of implementation and of the drastic regulatory reformulation after the crisis, the current state of banking regulation in the world is characterized by non-convergent, with some countries caught in the middle of incomplete implementation of both Basel II and III.

It should be noted nevertheless that the formal adoption of Basel III does not seem to pose a disproportionate challenge for developing countries. Espinoza & Prasad, (2010) examine the initial conditions for the implementation of Basel III in Andean countries, Bolivia, Colombia, Ecuador and Peru. They find that these countries would have little difficulty adapting their banking systems to the new standards of Basel III, and would even be reducing their current level of regulatory capital.

However, little attention has been paid to conditions of the developing countries banks and to the implications of the new philosophy and measures proposed by Basel III. The constitution of counter cyclical capital buffers is a central element of the new regulatory package. As capital ratios under Basel I and II were designed to reflect underlying risks in bank's portfolios more closely, and given the cyclical nature of those risks, the frameworks proposed by the first two versions of the Accord might have contributed to procyclical behavior over business cycles since their global implementation.

The main objective of this literature review is to assess the cyclical patterns of capital buffers in a panel of banks from developed and emerging economies . The contribution of our thesis to the literature is to provide new information on the behavior of capital buffers using data from emerging markets and developed countries. There are a limited number of studies on this issue in the literature. Previous research has mostly focused on developed countries' banking sectors. A few studies use single country data to investigate the behavior of capital buffers for emerging markets.

To our knowledge, this is the first analysis on the topic that uses cross country data from an emerging market region. Examining the cyclical behavior of capital buffers for the banking markets of developing countries contributes to the literature. Hence, this study would allow the comparison of results for emerging economies with those of developed economies. Moreover, empirical results of this study would provide valuable inputs for both regulators and researchers.

2.2 LITERATURE REVIEW

The literature on banking credit risk uses either macroeconomic variables, or bank specific variables or both variables in explaining NPLs. Berger & De Young, (1997) have combined both macroeconomic and bank specific variables to explain aggregate NPLs. According to their paper, bank specific variable proxied by efficiency ratios serves as early warning indicators for future changes in NPLs. Other similar studies include Clair (1992) and Louzis et al., (2012). However, Salas & Saurina (2002) report the lagged efficiency variables as statistically insignificant in explaining NPLs. According to their findings, NPLs are statistically negatively affected by solvency ratios. Based on these inconsistencies, more cross sectional studies are still needed to validate the robustness of this branch of literature.

Most papers from advanced economies examine the influence of the macroeconomic environment on NPLs. Rinaldi & Sanchis-Arellano, (2006) analyse NPLs in a panel of European countries. This paper provide empirical evidence showing that disposable income, unemployment and monetary conditions have a strong impact on NPLs. Berge & Boye, (2007) report that NPLs are highly sensitive to the real interest rates and unemployment for the Nordic banking system over the period 1993–2005. Other studies focusing on the macroeconomic determinants of NPLs include Cifter et al., (2009) and Segoviano et al., (2006). Again, a sharp increase in NPLs is associated with the weakening of macroeconomic performance.

Espinoza & Prasad, (2010) uses a sample of 80 banks of the Gulf Cooperation Council (GCC) region and reports that NPL ratio worsens when economic growth weakens and interest rates increase. In their paper, the effect of increases in NPLs suggests that there is a strong link between adverse losses in banks' balance sheets and low economic activity. Louzis et al., (2012) conduct similar analysis and further links sovereign debt (SOD) to NPLs. According to their analysis, banking crises most often either precede or coincide with sovereign debt crises.

In this context, banks become reluctant to lend thus compromises investors and debtor's ability to refinance their debts. Moreover, a rise in public debt leads to fiscal measures, especially cuts in social expenditure and the wage component of government consumption (De Nicolo et al., 2003).This situation renders unserviceable number of outstanding loans, as household's income experience a negative shock. Louzis et al., (2012) draws the conclusion that a rise in sovereign debt (SOD) leads to increases in NPLs.

Overall, this branch of literature concludes that a rise in gross domestic growth (GDP) and public debt (PUD) is negatively associated with NPLs (Festic el al. 2011 and Gauthier et al. 2012). In explaining this relationship, the literature shows that GPD growth most often entails positive employment prospect and reduced financial distress. Based on this scenario an inverse relationship should always hold. Unemployment (UNR) an indicator of economic downturn is positively related with NPLs (Festic el al., 2011 and Sirtaine & Skamnelos, 2007). Lastly, lending rate (RLR) hike is also positively related with NPLs (Calvo & Mendoza, 2000; Barseghyan, 2010 and Nkusu, 2011).

Fofack, (2005) argues that exchange rates fluctuations have mixed implications to the volume of exports and imports. On one hand, it weakens the competitiveness of export-oriented firms and adversely affects their ability to service their debt. On the other, it improves the debt-servicing capacity of borrowers who borrow in foreign currency. The sign of the relationship between exchange rates (EXR), volume of imports (IMP), volume of exports (EXP01) and NPLs is unknown (Gauthier et al., 2012 and Nkusi , 2011).

Although the current literature on banking credit risk does explains the macroeconomic variables that are associated with increases in NPLs, another branch of literature is equally important in highlighting the financial health of banks (Gauthier, Lehar and Souiss, 2012; Suaza et al., 2012). This branch of literature focuses on understanding the fluctuations of bank capital buffer (BCB) at different business cycles. Bank capital buffer is defined as the excess capital maintained by financial institutions at a given point in time. Banks hold different levels of capital depending on the individual characteristic of the bank and the business cycle (Suaza et al. 2012).

The dependence of capital buffers on the business cycle has a negative impact on macroeconomic stability (Borio & Zhu 2012). Empirical studies shows that bank capital buffers of Western European banks fluctuates countercyclical over the business cycle (Ayuso & Saurina, 2004; and Stolz & Wedow 2011).The argument is that banks undertake a riskier behavior during times of economic growth, expanding their loan portfolio without building up their capital buffers accordingly (Coffinet et al., 2012).

In economic downturn, when banks observe the realization of credit risk, those poorly capitalized face the possibility of falling below the minimum required levels (Borio & Zhu, 2012 and Coffinet et al., 2012). Therefore, they have to either issue new equity or increase their capital buffers through reducing lending. Given that raising capital is too difficult during economic slowdown, many banks resort in cutting lending in a significant proportion (Coffinet et al., 2012). The resulting reduction in loanable funds experienced by firms and households fuels the magnitude of the economic downturn and contributes significantly in increases in NPLs (Stolz & Wedow 2011).

In principle, banks may have private incentives to institute capital buffers (Coffinet et al., 2012; Berger & Boye, 2008, and Flannery & Rangan, 2008). However, the debated question is whether these capital buffers are built in a pro-cyclical way, meaning that the capital buffer should decrease during good economic times and increase in bad ones. If so, they would not be able to fuel the risks of credit restrictions, thus contributing to worsening output fluctuations (Coffinet et al., 2012). The existing literature is much divided. For example, Bikker & Metzemakers, (2005) report a weak relationship between BCB and the business cycle.

However, Jokipii & Milne, (2009) argue a positive relationship in European Union accession countries. Fonseca & Gonzáles, (2010) report a non-significant effect of the business cycle on BCB across 59 out of 71 countries, while negative for seven of them and positive for five others. Based on this mixed economic literature, it is difficult to project precisely the sensitivity BCB to macroeconomic variables. In general, there is a deficit in understanding the macroeconomic variables responsible for the sensitivity of BCB. A census of empirical papers is yet to be discovered.

The work on the interaction between prudential regulation, macroeconomic variables and BCB is still rather limited (Borio & Zhu, 2012). Despite some welcome progress in recent years, the literature that analyses the implications of the sensitivity of BCB and NPLs to macroeconomic variables across economies is scarce (Angelina et al.,2003; and Suaza et al.,2012). Our study fulfills this task and assesses the extent of differences in the sensitivity of NPLs and BCB. This assessment will inform the banks and regulatory authorities of the imbedded risks inherited from macroeconomic performance.

CHAPTER 3

3.1 INTRODUCTION

This study adopted a dynamic panel approach as embraced in recent panel studies (Salas & Saurina, 2002 and Louzis et al., 2012). This dynamic panel data specification is generally given by:

$$Y_{it} = \alpha Y_{it-1} + \beta (L) X_{it} + \eta_i + \varepsilon_{it} , |\alpha| <1, I = 1,.....N, t = 1,...,T, \quad (1)$$

The subscripts i and t denote the cross sectional and time dimensions of the panel sample respectively. Y_{it} represents the aggregate NPLs or BCB, $\beta(L)$ represents the 1 x k lag polynomial vector, X_{it} denote the k x1 vector of explanatory variables other than Y_{it-1}, η_i represent the unobserved individual bank specific effects and lastly ε_{it} represents the error term. The study adopted the estimation of equation (1) using the Generalized Method of Moments (GMM) as proposed by Arellano and Bond (1991). The GMM estimation of Arellano and Bond is based on the transformation of equation (1) and the subsequent elimination of bank specific effects, giving rise to equation 2:

$$\Delta Y_{it} = \alpha \Delta Y_{it-1} + \beta(L) \Delta X_{it} + \Delta \varepsilon_{it} , \quad (2)$$

In equation 2, ΔY_{it} denotes the first difference operator; ΔY_{it-1} represents the lagged depended variable and $\Delta\varepsilon_{i}t$, represents the error term. According to Louzis et al., (2012), ΔY_{it-1} is constructed to correlate with the error term thereby imposing biasness in the estimation of the model. Nevertheless, ΔY_{it-2}, which is expected to be correlated with ΔY_{it-1} and not correlated with $\Delta\ \varepsilon_{i}$ it for t = 3,. . . ,T, can be used as an instrument in the estimation of equation (2). This suggests that lags of order two and more of the dependent variables satisfy the following condition (Louzis et al., 2012):

$$E\ [X_{it}\ \varepsilon_{i}{}_{it}] = 0\ t = 3,\ldots,\ T \text{ and } S \geq 2. \quad (3)$$

A second source of biasness from the possible endogeneity of the explanatory variables has been highlighted by Stolz & Merkl, (2011). This is suggested to result in correlation with the error term. In the case of strictly exogenous variables, all past and future values of the explanatory variables are uncorrelated with the error term, implying the following moment conditions:

$$E\ [X_{it}\ \varepsilon_{i}{}_{it}] = 0\ t = 3,\ldots,\ T \text{ and for all } S \quad (4)$$

This assumption of strict exogeneity is described by Louzis et al., (2012) as restrictive and invalid in the presence of reverse causality when $E\ [X_{it}\ \varepsilon_{i}{}_{it}] \neq 0$ for $t < s$. The argument is that for the predetermined set of explanatory variables only current and lagged values of X_{it} are valid instruments .Then the following moment condition should be adopted (Louzis et al., 2012):

$$E\ [X_{it}\ \varepsilon_{i}{}_{it}] = 0\ t = 3,\ldots,\ T \text{ and for } s \geq 2 \quad (5)$$

The restrictions described in equation (3) – (5) provide the basics of the GMM estimation noted in the literature (Salas & Saurina, 2002 and Stolz & Merkl, 2011). In addition, Louzis et al., (2012) provides information about testing the overall validity of the results by implementing the Sargan specification test, which under the null hypothesis is asymptotically distributed as Chi- square (Arellano & Bond, 1991). This study adopted the recommendation by Louzis et al., (2012). All our results are reported with Sargan specification test.

3.2 ECONOMETRIC SPECIFICATION

Equation (1) takes the following form in the baseline model:

$$\Delta BCB_{it} = \alpha\Delta BCB_{it-1}+\beta 1j\Delta GDP_{t-j} +\beta 2j\Delta UNR_{t-j} + \beta 3j\Delta RLR_{t-j} + \beta 4j\Delta IMP_{t-j} + \beta 5j\Delta SOD_{t-j} +\beta 6j\Delta PUD_{t-j} +\beta 7j\Delta EXP01_{t-j}+\beta 8j\Delta EXR_{t-j} + \varepsilon_{,it} \quad (6)$$

$$\Delta NPL_{it} = \alpha\Delta NPL_{it-1}+\beta 1j\Delta GDP_{t-j} + \beta 2j\Delta UNR_{t-j} + \beta 3j\Delta EXR_{t-j} + \beta 4j\Delta RLR_{t-j} + \beta 5j\Delta IMP_{t-j} +\beta 6j\Delta SOD_{t-j} + \beta 7j\Delta EXP01_{t-j} +\beta 8j\Delta PUD_{t-j} + \varepsilon_{,it} \quad (7)$$

With $|\alpha|<1$, $i = 1,\ldots..,$ 45 and $t = 1,\ldots\ldots,$ 11.

In both equation 6 and 7, ΔNPL_{it-1} is the first lag of the aggregate non-performing loans, while ΔBCB_{it-1} denote the first lag of the aggregate bank capital buffer.ΔGDP_t is the percentage change in gross domestic product, ΔUNR_t is the percentage change in the unemployment rates, ΔRLR_t is the percentage change in the lending rates, ΔEXR_t is the percentage change in exchange rates, ΔIMP_t is the percentage change in volume of imports, $\Delta EXP0_t$ is the percentage change in volume of exports, ΔPUD_t represents a percentage change in public debt while ΔSOD_t represents percentage changes in sovereign debt.

As reported in the literature, a rise in real gross domestic growth (GDP) and public debt (PUD) is expected to negatively relate with NPLs (Festic el al., 2011 and Gauthier et al., 2012). Unemployment (UNR) is expected to relate positively with NPLs (Festic el al., 2011 and Sirtaine & Skamnelos 2007).Lending rate (RLR) hike is equally expected to positively relate with NPLs (Calvo & Mendoza 2000; Barseghyan 2010 & Nkusu 2011). Lastly, sovereign debt (SOD) is also expected to positively related with NPLs (Louzis et al., 2012).The sign of the relationship between exchange rates (EXR), volume of imports (IMP), volume of exports (EXP01) and NPLs is unknown (Gauthier et al., 2012 and Nkusi 2011). Equally unknown, is also the interactions between these selected macroeconomic variables and BCB (Borio & Zhu, 2012). Based on this limitation, it is difficult to project precisely the sensitivity BCB to these macroeconomic variables.

CHAPTER 4

4.1 EMPIRICAL ANALYSES

DATA SET

The current study employs a balanced panel sample consisting of supervisory data from 21 advanced countries and 24 emerging countries spanning from 2000 to 2011. Macroeconomic variables for each country are retracted from the IMF World Economic Outlook Database. Data for aggregate NPLs and aggregate BCB per country is obtained from Bank scope and World Bank Global Financial Indicators Database. The study analyzed separately the advanced and emerging countries using an econometrics software package E-views version 12, so to identify possible (dis)similarities in the interaction of the macroeconomic variables and the credit risk indicators. Table 4.1.1 shows the list of countries analyzed in our investigation.

Table 4. 1.1.Sample of countries analysed in our investigation.

Developed Economies
Austria, Australia, Belgium, Canada,Denmark,Finland,Germany,Iceland,Ireland,Israel, Italy, Japan, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and United States of America.
Emerging Economies
Argentina,Bosnia,Brazil,Chile,China,Colombia,Egypt,Estonia,Hungary,India,Indonesia, Kenya,Mexico,Nigeria,Paraguay,Philippine,Poland,Russia,Singapore,Slovak,SouthAfrica, Thailand and Turkey.

The study started its empirical analysis by examining the descriptive statistics in both economies. Table 4.1.2 presents the descriptive statistics of advanced economies, while table 4.1.3 presents the same statistics in a context of emerging economies. The advanced economies shows low average levels of BCB and NPLs compared to their emerging counterparts. Furthermore, the BCB and NPLs of advanced economies are more volatile presenting high positive skewness and excess kurtosis compared to emerging economies. This is attributed to the level of economic activity these banks are subjected too (Lipschitz, 2011 and Kodongo & Ojah, 2012). As expected from the literature, banks in advanced economies are more efficient and are more involve in taking risks to finance the larger share of global economy. This explains the higher volatility and skewness compared to their emerging counterparts (Lipschitz, 2011).

Table 4.1.2.Descriptive statistics for NPLs and BCB in developed economies.

	NPLs	BCB
Mean	3.08	6.02
Median	1.80	5.70
Maximum	42.20	14.40
Minimum	0.20	2.70
Std Dev	5.12	3.80
Skewness	5.93	1.35
Kurtosis	5.78	5.95
JB test	125.6	114.08
p-Value	(0.00)	(0.00)

Note: JB denotes the Jarque-Bera normality test .The *p*-Values of the JB test are shown in brackets.

Table 4.1.3. Descriptive statistics for NPLs and BCB in emerging economies.

	NPLs	BCB
Mean	8.25	9.68
Median	5.25	9.60
Maximum	34.90	20.10
Minimum	0.20	2.12
Std Dev	4.69	3.13
Skewness	1.46	0.32
Kurtosis	4.46	2.98
JB test	118.1	104.5
p-Value	(0.00)	(0.01)

Note: JB denotes the Jarque-Bera normality test .The *p*-Values of the JB test are shown in brackets.

The second part of the empirical analysis investigates the sensitivity of NPLs to GDP fluctuations. Figure 1 shows sensitivity trends of NPLs to GDP growth for United States of America (USA) and Spain (SPA), while Figure 2 shows similar trends using two emerging countries Russia (RUS) and Hungary (HUN).Following the 2008 banking crises, studies have debated a sensible marker for the onset of the banking crisis . This debate emanates from the collapse of some banks despite having maintained the minimum requirements recommended by the Basil I (Bikker & Metzemakers, 2005).

Reinhart & Rogoff, (2010) advocates for NPLs to be used as a sensible marker for the onset of the banking crises in advanced economies. According to their paper, NPLs responds almost instantaneously to economic fluctuations. A slight deep in GDP growth result in positive uptake in NPLs. The trend presented in the current study shows similar pertains in both economies. Certainly, our study supports the argument by Reinhart & Rogoff, (2010) in calling for NPLs to be adopted as a sensible marker for the onset of banking crises.

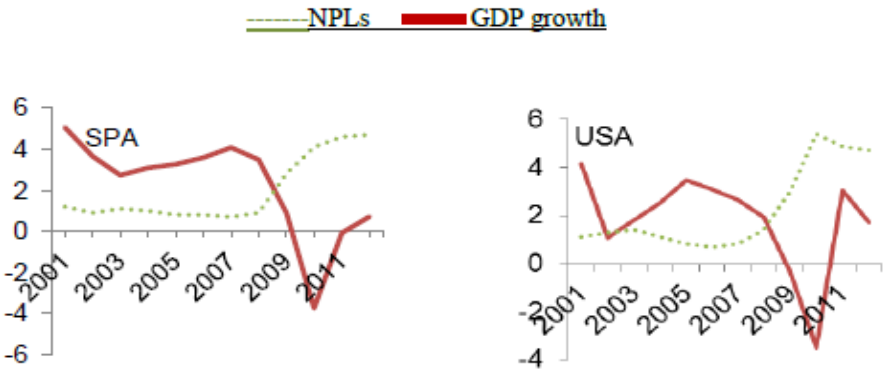


Figure 1. NPLs and GDP growth for Spain (SPA) and United States of America (USA) 2000-2011.A clear inverse relationship between the two variables occurring almost instantaneously.Monitoring the NPLs will serve as a good yardstick for macrofinancial risk inherited from macroeconomic performance.

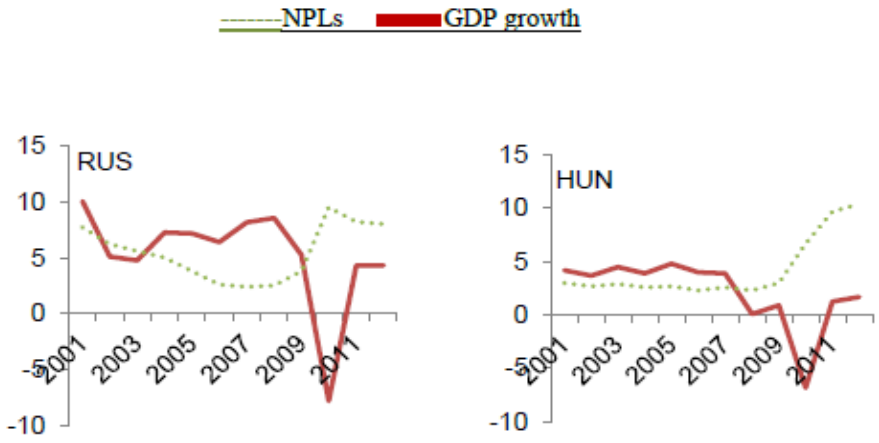


Figure 2. NPLs and GDP growth for Russia (RUS) and Hungary (HUN) 2000-2011. A clear inverse relationship between the two variables occurring almost instantaneously. Monitoring the NPLs will serve as a good yardstick for macrofinancial risk inherited from macroeconomic performance.

CHAPTER 5

5.1 DYNAMIC PANEL DATA ESTIMATION

The study begins the panel estimation by exploring the relationships between the variables. Table 5.1.1(a) and table 5.1.1(b) present the correlation matrices for advanced and emerging economies respectively. In both economies, the relationships among the variables are consistent with the existing literature. GDP growth and public debt (PUD) are negatively related with NPLs and BCB (Festic el al., 2011).This paper also observe positive relationships between NPLs, interest rates (INT), inflation (INF) and unemployment (UNR) (Nkusu, 2011). In line with Louzis et al., (2012) findings, our study also shows a positive relationship between SOD and NPLs.

Table 5.1.1(a).Correlation matrices for advanced economies.

	NPL	BCB	PUD	EXP01	EXR	GDP	IMP	INF	INT	SOD	UNR
NPL	1										
BCB	-0.44	1									
PUD	-0.02	-0.02	1								
EXP01	0.03	0.01	-0.07	1							
EXR	-0.30	-0.27	0.07	-0.10	1						
GDP	-0.27	-0.01	-0.17	0.68	0.09	1					
IMP	-0.32	-0.08	-0.04	0.73	0.11	0.73	1				
INF	0.43	0.34	-0.11	0.12	-0.49	0.13	-0.06	1			
INT	0.41	0.27	-0.16	0.06	-0.34	0.11	-0.05	0.61	1		
SOD	0.25	-0.69	0.06	0.04	0.05	-0.08	-0.13	-0.02	0.03	1	
UNR	0.13	0.01	-0.20	-0.07	0.08	-0.19	-0.14	-0.12	-0.12	0.38	1

Table 5.1.1(b).Correlation matrices for emerging economies.

	NPL	BCB	PUD	EXP01	EXR	GDP	IMP	INF	INT	SOD	UNR
NPL	1										
BCB	-0.05	1									
PUD	-0.03	-0.01	1								
EXP01	-0.24	-0.21	-0.57	1							
EXR	0.84	-0.68	0.01	-0.13	1						
GDP	-0.98	-0.20	-0.81	0.10	-0.04	1					
IMP	-0.09	-0.72	-0.98	0.10	0.11	0.10	1				
INF	0.13	0.54	-0.73	-0.49	-0.49	0.41	-0.46	1			
INT	0.41	0.27	-0.45	0.06	-0.34	0.46	-0.45	0.61	1		
SOD	0.02	-0.59	0.13	0.04	0.05	-0.08	-0.43	-0.21	0.03	1	
UNR	0.13	0.01	-0.19	-0.07	0.19	-0.24	-0.14	-0.42	-0.12	0.38	1

A negative relationship between sovereign debt (SOD) and BCB is observed in our analysis. Festic et al., (2011) argues that the macroeconomic shocks of 2008 reduced cash flows and lengthened payback periods. This has contributed in increases in sovereign debt (SOD). Borio and Zhu (2012) recommend that banks should adjust their loan portfolios or capital buffers over the cycle to guard against the risk of sharper erosion. Equally important, these two papers further invited regulators to critical demand higher cushions during economic expansions. Such recommendation is viewed as future policy tool that should be executed to prevent bank failures. Our correlation results are in line with these papers. It appears as if the more indebt the countries become (SOD), the higher is NPLs and the harder it is to institute the BCB.

In light of the unknown relationships between exchange rates (EXR), volume of imports (IMP), volume of exports (EXP01) and both credit risk indicators (Gauthier et al., 2012 and Nkusi 2011). The current study observes the following relationships. In advanced economies, the results shows that exchange rate (EXR) relates negatively with both BCB and NPLs. However, in emerging economies exchange rate (EXR) relates positively with NPLs but negative with BCB. According to Jacques, (2008), this behavior might be caused by investor's perceptive and the direction of economy growth. Appreciation of domestic currency during economic crisis drives some foreign investors out in search for other economies with competitive lesser currency value. This capital flight phenomenon slows the economy down and contributes in increases in NPLs. Due to extensive foreign investor participation in emerging markets. This scenario is plausible and explains the positive relationship between EXR and NPLs in our analysis.

A negative relationship between volume of imports (IMP) and both credit risk indicators is observed in both economies. However, the volume of exports (EXP01) shows some discrepancy in the two economies. In advanced countries, the volume of exports (EXP01) is positively related to both credit risk indicators. However, in emerging countries the volume of exports (EXP01) is negatively related with both indicators. These relationships explain the structural nature of both economies. For example, most emerging countries lack diversity in their economies and relies mostly on exporting primary products to advanced economies. These exports contributes significantly in GDP growth and boost employment. Therefore, any shock in volume of exports result in shrinks in the GDP growth , employment prospect, and earnings in foreign currency. This contributes in increases in NPLs and the depletion of BCB.

The panel estimation follows a two-pronged approach aimed at identifying factors that explain the sensitivity of both credit risk indicators. The second phase assessed the impulse simulation among the credit risk indicators from the interactions with macroeconomic variables in a panel vector autoregressive (VAR) system. These two econometric approaches are complementary and are supported by Ashely & Tsang, (2014) and Nkusi, (2011).

5.2 GMM panel estimation

Table 5.1.2 and table 5.1.3 present the GMM estimation for NPLs and BCB in developed economies. The results show that NPLs are sensitive to GDP growth; unemployment (UNR), sovereign debt (SOD), interest rate (INT) and public debt (PUD). This supports the evidence of Berge & Boye, (2007); Nkusu, (2011); Cifter et al., (2009) and Segoviano et al., (2006). Exchange rate movements together with both volume of exports and imports are not significant in explaining the sensitivity of NPLs.

In relation to the BCB, we find sovereign debt (SOD), unemployment (UNR) and interest rate (INT) as significant macroeconomic variables responsible for the sensitivity of the buffer in developed economies. GDP growth (GDP), exchange rate (EXR), public debt (PUD), volume of exports (EXP) and imports (IMP) have no significant influence in the region.

Table 5.1.2. GMM Parameter estimation for the sensitivity of NPLs in developed economies.

Variables	Coefficient 1st lag	Coefficient 2nd lag	Coefficient 3rd lag
ΔGDP_t	-0.31***	-0.18***	
	(0.02)	(0.02)	
ΔUNR_t	0.40***	0.23***	0.31***
	(0.09)	(0.01)	(0.01)
ΔSOD_t	0.07***	0.05*	
	(0.02)	(0.03)	
ΔINT_t	0.31***	0.23***	0.21***
	(0.01)	(0.02)	(0.03)
ΔPUD_t	0.04*	0.02*	0.03**
	(0.02)	(0.01)	(0.01)
$\Delta NPLs$	0.50***	0.20*	0.30*
	(0.12)	(0.12)	(0.13)
No of observation	126		
Sargan test	(0.88)		
M_2	(0.05)		

Coefficient estimates marked ***, **, and * denote significance at 1 %, 5 %, and 10 % respectively. Standard error is given in brackets below each coefficient (). An omitted coefficient in the lag structure reflects insignificant parameters. ΔEXP_t, ΔEXR_t and ΔIMP_t are omitted from the estimation based on insignificance. The p-values of Sargan and M_2 specification test are given in brackets.

Table 5.1.3 GMM Parameter estimation for the sensitivity of BCB in developed economies.

Variables	Coefficient 1st lag	Coefficient 2nd lag	Coefficient 3rd lag
ΔUNR_t	-0.15***		-0.13***
	(0.02)		(0.01)
ΔSOD_t	-0.04**		
	(0.02)		
ΔINT_t	-0.15***	-0.10***	
	(0.03)	(0.02)	
ΔBCB	0.16***	0.06***	0.08*
	(0.03)	(0.01)	(0.03)
No of observation	126		
Sargan test	(0.78)		
M_2	(0.02)		

Coefficient estimates marked ***, **, and * denote significance at 1 %, 5 %, and 10 % respectively. Standard error is given in brackets below each coefficient (). An omitted coefficient in the lag structure reflects insignificant parameters. ΔEXP_t, ΔEXR_t, ΔGDP_t, ΔIMP_t and ΔPUD_t are omitted from the estimation based on insignificance. The p-values of Sargan and M_2 specification test are given in brackets.

In emerging economies we observe that exchange rate (EXR) is the main variable driving the sensitivity of both NPLs and BCB (table 5.1.4 and table 5.1.5).But, like in the developed region, NPLs are still sensitive to GDP growth; unemployment (UNR), sovereign debt (SOD) and interest rate (INT). This further supports the evidence of Berge & Boye, (2007); Nkusu (2011); Cifter et al., (2009) and Segoviano et al., (2006). However, public debt (PUD) and volume of exports (EXP) are not significant in explaining the sensitivity of NPLs.

Table 5.1.4 GMM Parameter estimation for the sensitivity of NPLs in emerging economies.

Variables	Coefficient 1st lag	Coefficient 2nd lag	Coefficient 3rd lag
ΔGDP_t	-0.11***	-0.05***	
	(0.02)	(0.02)	
ΔUNR_t	0.10*	0.03***	
	(0.09)	(0.01)	
ΔEXR_t	0.34**		0.21***
	(0.01)		(0.03)
ΔSOD_t	0.06***	0.08**	0.05**
	(0.01)	(0.03)	(0.02)
ΔINT_t	0.21***	0.26***	0.19***
	(0.01)	(0.02)	(0.03)
ΔIMP_t	-0.04**		-0.02**
	(0.02)		(0.01)
$\Delta NPLs$	0.44**	0.32***	0.31***
	(0.12)	(0.02)	(0.02)
No of observation	138		
Sargan test	(0.81)		
M_2	(0.04)		

Coefficient estimates marked ***, **, and * denote significance at 1 %, 5 %, and 10 % respectively. Standard error is given in brackets below each coefficient (). An omitted coefficient in the lag structure reflects insignificant parameters. ΔPUD_t and ΔEXP_t are omitted from the estimation based on insignificance. The p-values of Sargan and M_2 specification test are given in brackets.

Table 5.1.5 GMM Parameter estimation for the sensitivity of BCB in emerging economies.

Variables	Coefficient 1st lag	Coefficient 2nd lag	Coefficient 3rd lag
ΔGDP_t	0.21*	0.10***	0.12**
	(0.02)	(0.04)	(0.04)
ΔUNR_t		-0.10***	-0.12***
		(0.01)	(0.02)
ΔEXR_t	-0.24**		-0.22***
	(0.11)		(0.03)
ΔSOD_t	-0.04***		
	(0.01)		
ΔINT_t		-0.19***	-0.11***
		(0.02)	(0.03)
ΔIMP_t	0.22***	0.19***	
	(0.01)	(0.01)	
ΔBCB	0.42***	0.26*	0.31***
	(0.02)	(0.12)	(0.02)
No of observation	138		
Sargan test	(0.89)		
M_2	(0.03)		

Coefficient estimates marked ***, **, and * denote significance at 1 %, 5 %, and 10 % respectively. Standard error is given in brackets below each coefficient (). An omitted coefficient in the lag structure reflects insignificant parameters. ΔPUD_t and ΔEXP_t were omitted from the estimation based on insignificance. The p-values of Sargan and M_2 specification test are given in brackets.

Regarding the BCB, we noticed that sovereign debt (SOD), unemployment (UNR) and interest rate (INT) are macroeconomic variables responsible for the capitalisation of banks in emerging economies similar to the developed region. However, GDP growth, exchange rate (EXR) and volume of imports (IMP) also plays a more prominent role. This finding unveils the unique nature of emerging market banks compared to their developed counterparts (table 5.1.5).

Since we are interested in the cumulative impact of each explanatory variable on the NPL and BCB , we also calculate the respective long-run coefficients, defined in equation 8.

$$\beta lR = \sum_{j=1}^{4} (\beta)_{4j} / (1- \alpha) \quad (8)$$

This calculation of long run coefficients is also supported by Louzis et al.,(2012). It should be noted that the estimation of the long-run coefficient variance in equation (8) accounts for the covariance between the estimated parameters and providing accurate and robust statistical inference for the total effect of the four lagged coefficients. It is also evident that any multicollinearity between the lags of the regressors resulting in misleading statistical (in) significance is taken into account when we consider the long-run standard errors. The results for the Long-run coefficients are presented in table 5.1.10 and table 5.1.11 respectively.

5.3 GMM panel estimation robust tests

We also tested the auto correlation in the GMM estimation for both NPLs and BCB in the two respective economic groups. Two diagnostics tests for autocorrelation (AR) in the first-differenced errors are conducted using the Arellano and Bond procedure. One should reject the null of zero on the first order serial correlation and not reject the absence of the null of zero in the second order serial correlation. The p-values associated with AR (1) and AR (2) indicates that these requirements are met in all GMM estimations. Therefore we accepted the GMM models as valid estimations.

Table 5.1.6. Autocorrelation test for GMM estimations.

AR tests	P value
In table 5.1.2	
AR (1)	0.049***
AR (2)	0.012
In table 5.1.3	
AR (1)	0.041***
AR (2)	0.024
In table 5.1.4	
AR (1)	0.045***
AR (2)	0.014
In table 5.1.5	
AR (1)	0.047***
AR (2)	0.017

Coefficient estimates marked *** denote significance at 1%.

To inform model specification, we further assess the level of integration of the explanatory variables. The Fisher-ADF and Fisher-PP tests is utilised, which assume individual unit root processes across countries included in the panel. The Fisher-ADF test suggests that, all variables are stationary in level, except for exchange rate and volume of exports. However, the null of a unit root was rejected after the first differencing. We then consider all variables in the estimation at difference stationary level based on the Fisher-ADF test in order to maintain consistency. The different orders of integration of the variables point no interference (table 5.1.7). Hence, we accepted the specifications of the GMM models.

Table 5.1.7. Panel unit root tests.

Fisher ADF		Fisher PP	
NPL level 77.47***	NPL 1st dif -2.53***	NPL level 71.37***	NPL 1st dif 132.4***
BCB level 71. 32***	BCB 1st dif -8.03**	BCB level 70.11**	BCB 1st dif 104***
GDP level 81.92 ***	GDP 1st dif-1.48***	GDP level 73.54**	GDP 1st dif 148.76**
UNR level 58.49*	UNR1st dif-0.48**	UNR level 54.49*	UNR 1st dif 96.2*
INT level 116.81***	INT 1st dif -1.05**	INT level 75.90***	INT 1st dif 90.62**
IMP level 120.3***	IMP 1st dif -3.12**	IMP level 52.39***	IMP 1st dif 73.12**
SOD level 76.72**	SOD 1stdif -8.71**	SOD level 75.72**	SOD 1st dif 80.71**
PUB level 53.64**	PUB 1st dif -6.62**	PUB level 46.14*	PUB 1st dif 64.62**
EXR level 60.58	EXR 1st dif -8.64**	EXR level 79.58	EXR 1st dif 75.64**
EXP level 47.9	EXP 1st dif -3.89**	EXP level 113.6	EXP 1st dif 110

*, **, and *** denote significance at 10 %, 5 %, and 1 % respectively.

5.4 Panel VAR estimation

On the second analysis, the paper models the impulse response of both credit risk indicators from the interactions with the macroeconomic variables observed from the GMM estimations. An unrestricted VAR is utilised to uncover impulse simulations given by equation (9). This model is supported by Nkusi, (2011):

$$y_{it} = B(L)\, y_{it} + \varepsilon_{it}, \qquad (9)$$

y_{it} is a k x 1 vector including NPLs or BCB and the macrofinancial variables of interest discussed above, B(L) is a matrix in the lag operator; i =1,...,N is the cross-section indicator; t=1, ..., T is the time dimension; ε_{it} and is a vector of disturbances assumed to have zero mean and covariance matrix $\sum\varepsilon$. The dynamic interactions between credit risk indicators and macroeconomic variables are uncovered from impulse response functions (IRFs) presented by equation 10:

$$y_t = B(L)^{-1} \varepsilon_t = \varepsilon_t + \sum_{j=1}^{\infty} \phi_j \varepsilon_{t-j} \qquad (10)$$

In our exercise, the impacts of macroeconomic variables on the other bank credit indicators are obtained by shocking the error term and tracing its marginal effects through all equations in the system. As an impulse in one variable is likely to be accompanied by an impulse in another variable, orthogonalized impulses are considered. They are obtained from equation (10) by choosing some matrix A such that $AA=\sum\varepsilon$. The unit covariance matrix are then contemporaneously uncorrelated, allowing for the shocks to provide a more realistic representation (Lütkepohl, 2008).

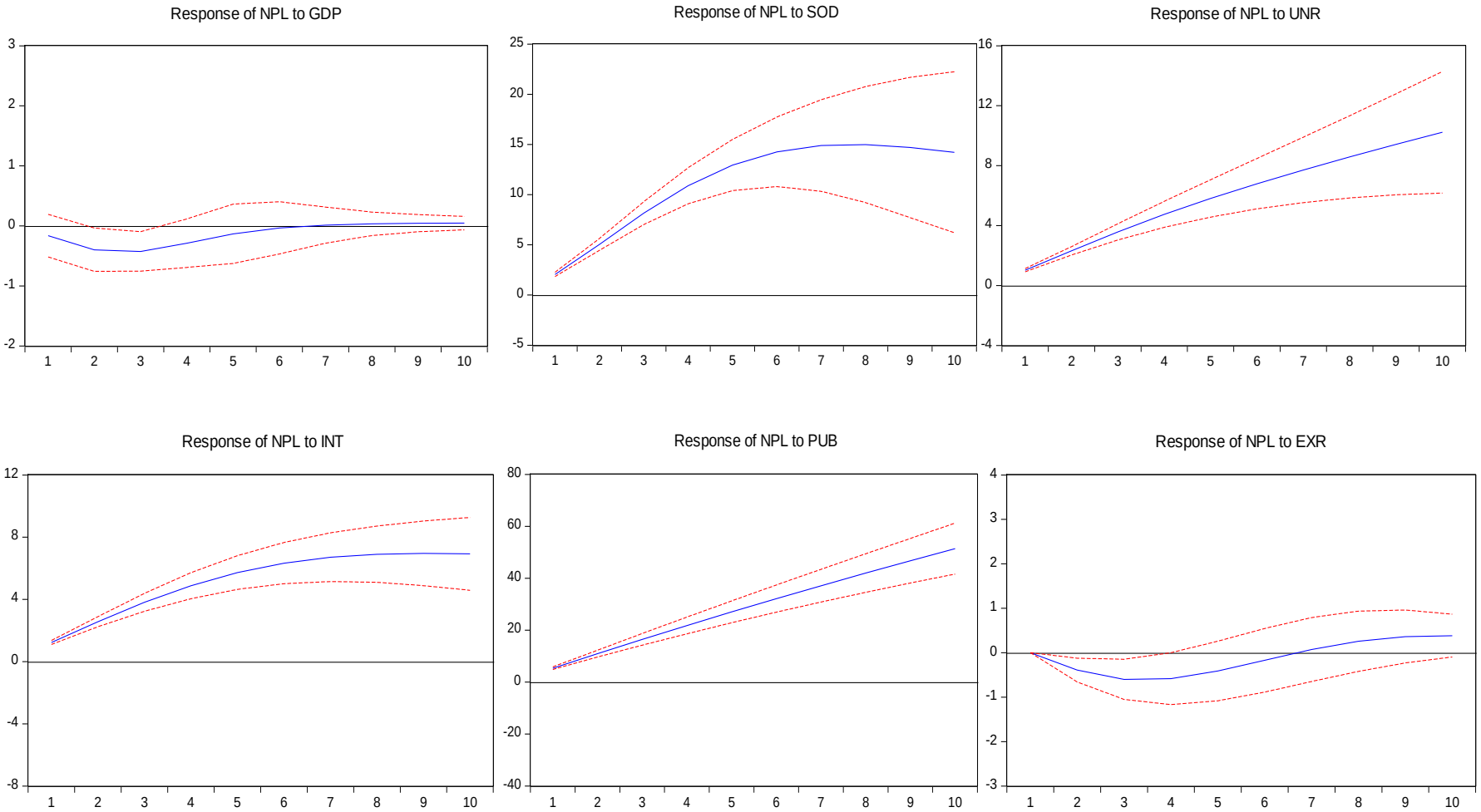
We also conducted cointegration tests on the panel VAR to ensure that inference is based on non-spurious relationships. The cointegration analysis is useful to the extent that the variables included in the VAR have different order of integration. The Johansen's trace and Maximum eigenvalue tests clearly supports the existence of cointegrating relationships, with the number of cointegrating vectors ranging from 5 to 10 (Table 5.1.8**).** The findings of cointegration in the system enable us to proceed with the examination of impulse interactions among variables.

Table 5.1.8. Panel VAR-Johansen cointegration test.

Assumptions on Integration Test Specification		
No trend in data		*No trend in data*
Test type : (no int, no trend)		***Test type (int, no trend)***
Trace	10	10
Max-eigenvalue	10	10
Linear trend in data		*Linear trend in data*
Test type : (no int, no trend)		***Test type (int, and trend)***
Trace	9	8
Max-eigenvalue	10	9
Quadratic trend in data		
Test type : (int and trend)		
Trace	5	
Max-eigenvalue	7	

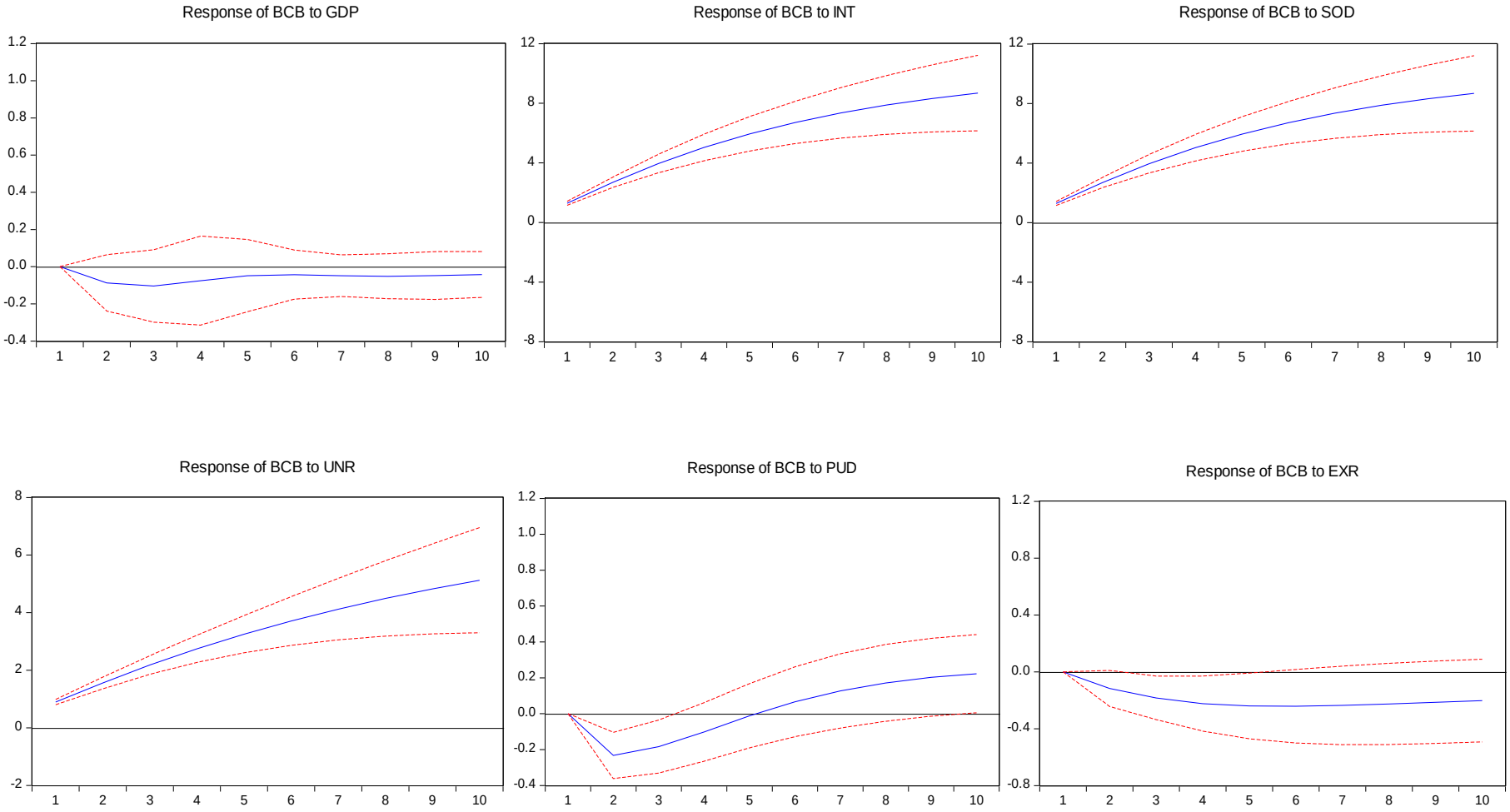
The figures in each column indicate the selected number of cointegration relations at the 5% significance level.

Figure 3. Impulse response of NPLs in the developed economies.



The x axis shows the number of years elapsed, where time zero is the year that the shock occurs. Dashed lines denote 95 percent confidence band s of the VAR impulse response.

Figure 4. Impulse response of BCB in the developed economies.



The x axis shows the number of years elapsed, where time zero is the year that the shock occurs. Dashed lines denote 95 percent confidence band s of the VAR impulse response.

Table 5.1.9 Long-run coefficients for the determinants of credit risk indicators in developed economies.

	NPLs	BCB	PUB	EXP	EXR	GDP	IMP	INF	INT	SOD
BCB	-0.29**									
PUB	0.31***									
EXP						0.42*				
EXR				0.13*						
GDP	-0.17**				0.09*					
IMP				0.03*	0.11*	0.11*				
INF			0.11***							
INT	0.22***	-0.23***	0.16**		-0.34*			0.61*		
SOD	0.05**	-0.05**				-0.08*		0.02*	0.03**	
UNR	0.44***	-0.07***	0.20**			-0.19*		0.02*	0.02*	0.38**

Coefficient estimates marked ***, **, and * denote significance at 1 %, 5 %, and 10 % respectively.

During large capital inflows periods, non-sterilized interventions on the developed economies increase the monetary base (Kaminsky et al., 2005).Moreover, the favourable interest rate environment have also foster easiness of banks to lend to the households due to good employment conditions with better growth forecast. As such, household's loans on aggregate induce major risk on the banks' balance sheets, resulting in unemployment and public debt to drive mostly the upswings in the NPLs during bad economic times.

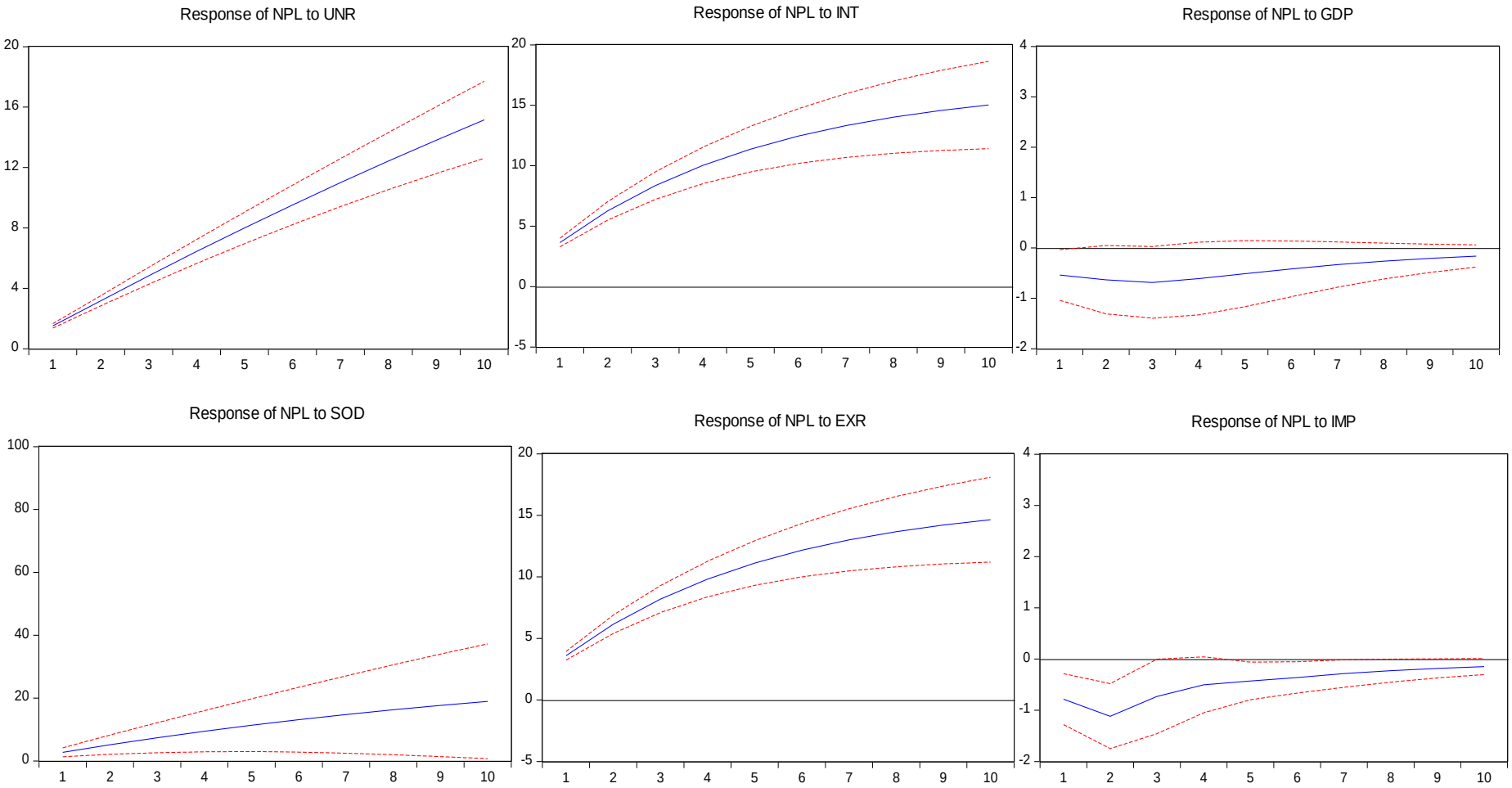
We observe that a percentage point increase in NPLs is related to the 0.44 percentage rise in unemployment in a long run management of the capital buffer (table 5.1.9).The magnitude of this upswing caused a significant 0.29 % depletion in BCB triggering a banking crisis as deposits runs dry. This evidence is also supported by Nkusu (2011). Increases in interest rate, sovereign debt and public debt also fuel the state of financial distress causing further losses in banks' balance sheets (figure 3).

Ideally, the bank capital buffer should be instrumental in dealing with the shortfalls as GDP output diminishes. But, Bikker & Metzemakers, (2005) reported a weak relationship between BCB and GDP growth as far back as 2005 in developed economies. The results in table 5.1.3 and figure 3 support the view of these authors. However, we noticed that interest rate, unemployment and sovereign debt give incentive for capitalisation of these banks in a feedback loop mechanism as presented in the long run estimation (table 5.1.9) . Hence, a 1% increase in buffer is associated with 0.23 % fall in interest rate as bank income experience a negative shock. Unemployment and sovereign debt reinforces the income shock, due to rises in NPLs creating a need to rescue the banking system.

Increasing the capital amount per individual loan granted by the banks is a genuine endeavour as recommended by Basil III. But, the strategy of keeping these capital buffers counter cyclical and responding almost instant from GDP growth shortfalls remains to be seen. The steep credit expansion to households, which occurred during this decade, also poses the question whether the quality of loans granted during this period was accurately evaluated by the banking system.

Consequently, unemployment and public debt should have not been the main drivers of the depletion in buffer as witnessed in figure 4. Ultimately, we must accept that without progressive counter cyclical policies in the capital buffer, the region might find itself in the same crisis zone with more severe consequences. Managing the credit risk through the unemployment channel is the most significant strategy for the stability of the banking system in the developed economies.

Figure 5. Impulse response of NPLs in the emerging economies.



The x axis shows the number of years elapsed, where time zero is the year that the shock occurs. Dashed lines denote 95 percent confidence band s of the VAR impulse response.

Figure 6. Impulse response of BCB in the emerging economies.

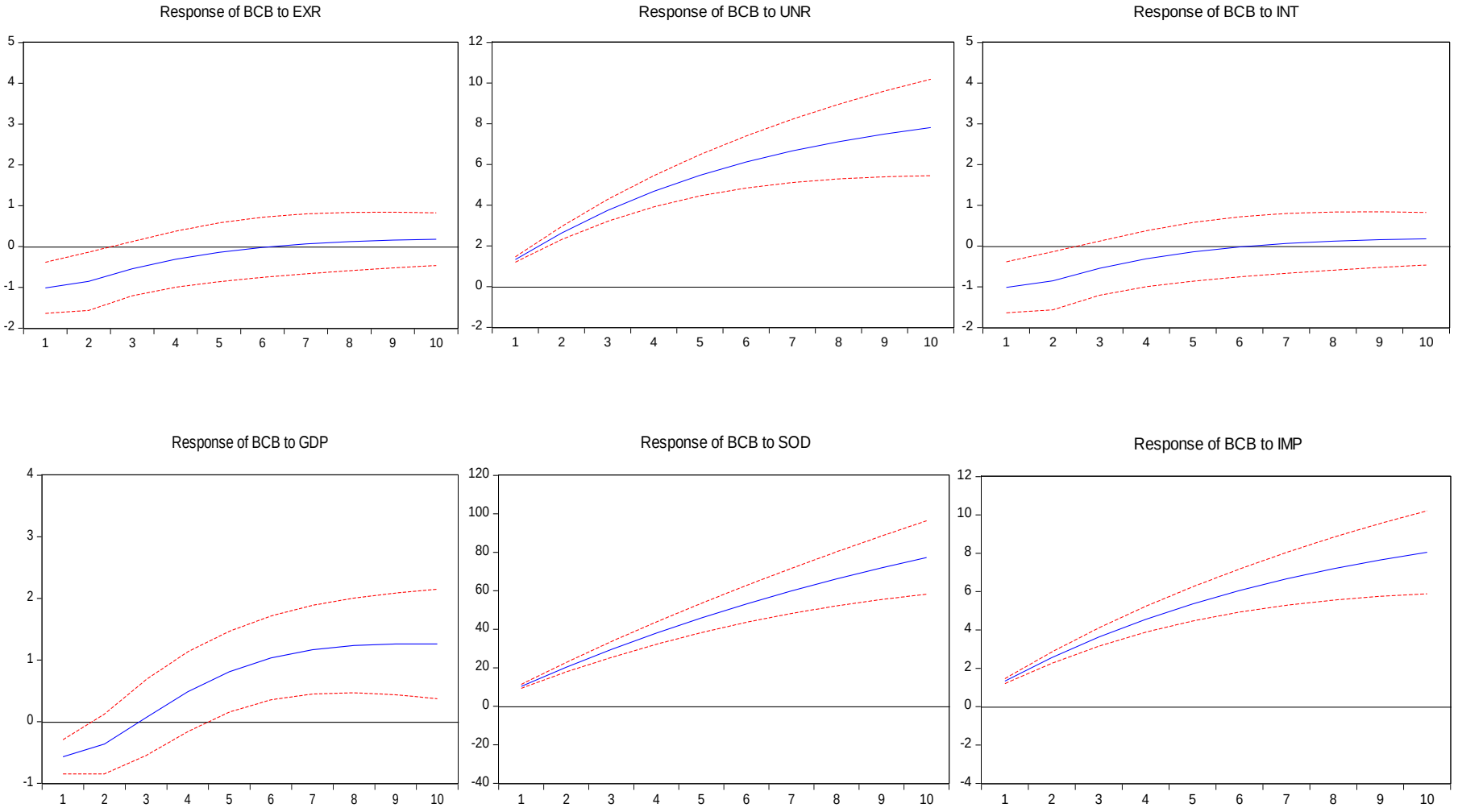


Table 5.1.10. Long-run coefficients for the determinants of credit risk indicators in emerging economies.

	NPLs	BCB	PUB	EXP	EXR	GDP	IMP	INF	INT	SOD
BCB	-0.22***									
PUB										
EXP										
EXR	0.38***	-0.27***		-0.01**						
GDP	-0.17*	-0.10**	-0.17**	0.08*	-0.09**			-0.02*		
IMP	-0.19***	-0.15**		0.13**	-0.11*	0.43*				
INF			0.11**		0.29**		-0.06*			
INT	0.09***	-0.05***						0.41**		
SOD	0.05***	-0.09**				-0.08*	-0.13**		0.03**	
UNR	0.09**	-0.08**	0.21**			-0.19*	-0.04**	0.12**	0.12*	0.31*

Coefficient estimates marked ***, **, and * denote significance at 1 %, 5 %, and 10 % respectively.

Credit expansion has improved significantly in banks of emerging economies. Such expansion has been biased nevertheless, targeting mainly corporates than the general households opposite to what we observed in developed economies. This is further supported by the Rey, (2013) showing an increase in loan-to-deposit ratios since the early 2000s targeted at corporates. For that reason, public debt is not insignificant in explaining the sensitivity of the aggregate NPLs in the emerging economies.

The negative relationship between volume of imports and NPLs reflects the vulnerability of emerging economies from the dynamics of global finance. For instance, majority of countries in the region are importing goods needed for extracting raw materials. Therefore, any shock in the volume of imports compromises GDP growth in a long run and earnings in foreign currency, through the export channel. This contributes in increases of NPLs as presented in table 5.1.10.

Benes & Kumho, (2015) points that foreign currency attraction was used in determining credit expansion during the period of large inflows episodes prior the 2008 financial crisis. As a result, we find exchange rate to be the main variable responsible for the sensitivity of both credit risk indicators(NPLs and BCB) .One should be concerned with the rise of foreign liabilities ratios in banks of emerging economies as hinted by Rey, (2013). As per our analysis, a 4 % increase in NPLs is associated with shockings increases in foreign currency (figure 5). This situation brings liquidity risk as banks battle to finance imports orientated activities. Inflation (INF) especially for imported goods starts rising up causing a slower GDP growth. This induces long term losses in the bank balance sheet as presented in table 5.1.10..

Another channel responsible for the upswing in NPLs comes from investors who reconsider their investment portfolios; with "flight to quality" as a main objective when foreign currency appreciate (Agosin & Huaita, 2010). Such capital outflow also puts pressure on banks as investors' opt out of emerging markets aiding a depletion of up to 0.6 % in BCB (figure 6). Rises in sovereign debt and unemployment reinforce the need to buffer the banks due to low volume of imports coupled with low GDP growth (table 5.1.10).

In future, the banks of the region may not be able to face their lending obligations when the cycle reverses because of exchange rate dynamics and foreign capital inflows. As the global economy struggle to recover, this may suggest a much longer deterioration in domestic economies (Ghosh et al., 2014). In addition, banks are usually likely to seek for foreign currency lending as foreign capital flows increase. This situation may further cause an "indirect currency mismatch", especially regarding domestic loans to households and small and medium-sized enterprises (Boudias 2015). Therefore, strategies to manage the exchange rate risk and foreign capital movement remain necessary in maintaining the financial health of emerging market banks.

CHAPTER 6

6.1 DISCUSSION

In this study, we have used a dynamic panel data method to examine the sensitivity of both BCB and NPLs comparatively between advanced and emerging countries. Firstly, we assess the degree of sensitivity of NPLs to GDP growth incorporating the deep recession of 2008 and the positive economic performance witnessed in the last ten years (BIS, 2008b). Our findings present a view that concurs with others papers in calling for NPLs to be equally used as a sensible marker for the onset of banking crisis. Equally important, the current investigation supports the use of both credit risk indicators (BCB and NPLs) in interrogating the financial health of banks.

The study has also enhanced the theoretical models that regresses multiple macroeconomic variables with bank credit risk indicators. Thus, we have succeeded in providing a macroeconomic framework that explains the sensitivity of credit risk indicators across economies. The results shows that NPLs in advanced economies are sensitive to GDP growth, sovereign debt (SOD), unemployment rates (UNR), real lending rates (RLR) and public debt (PUD). However, unemployment rates (UNR) is the main economic variable exerting the greatest impact in the sensitivity of NPLs. The same macroeconomic variables are responsible for the sensitivity of BCB. However, GDP growth exerts the strongest impact compared to the other macroeconomic variables.

Regarding emerging economies we find NPLs to be sensitive to exchange rates (EXR), GDP growth, volume of imports (IMP), real lending rates (RLR), sovereign debt (SOD), and unemployment (UNR). However, exchange rate (EXR) is the main economic variable responsible for positive upswing in the NPLs and the depletion of BCB. Other macroeconomic variables responsible for the sensitivity of BCB include unemployment (UNR), GDP growth, volume of imports (IMP), real lending rates (RLR) and sovereign debt (SOD).

For now, it must be accepted that the financial crisis presented a structural break down affect ing the interrelations between NPLs, BCB differently in both advance and emerging economies. Banks and regulators of these economies should monitor the modelled macroeconomic variables separately, to accurately understand the dynamics of the prevailing systematic risk and avert future financial instabilities.

CONCLUSION

The relationships uncovered in this study have a direct link in forecasting and stress testing purposes to the regulatory authorities. The GMM coefficients and the impulse responses can assist in assessing the likely change in liquidity and whether such changes could pose risk of financial instability. Policies and reforms should be geared towards avoiding sharper erosion of BCB though channels that set into motion the adverse increase in NPLs. Unemployment in developed economies and exchange rate in emerging economies should be given special attention when conceiving any policy mix to cope with credit expansion.

LIMITATIONS OF THE STUDY

Our analysis is subjected to a number of limitations. First, NPLs is a rough measure of credit quality. A decrease in NPLs can simply reflect the removal of unrecoverable loans from the banks' balance sheets. This might give a false interpretation about the liquidity risk of the bank. In this regard, the flow of debt classified as nonperforming for the first time would be more informative. However, due to unavailability of such data we could not explore this angle of analysis.

Secondly, the relationships derived from aggregate NPL or BCB, while useful, can mask important differences in feedback between these variables and the macro economy. Cautions should be exercise when interpreting these relationships. Lastly, bad loans can make a difference on banks' ability to continue lending after economic shocks. In this regard, data permitting an analysis of the linkages after crisis could enrich the understanding of the associated macrofinancial vulnerabilities.

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