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Full length article

Credit risk determinants in Sub-Saharan banking systems: Evidence from five countries and lessons learnt from Central East and South East European countries

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Abstract

Banking systems in Sub-Saharan Africa (SSA) have grown notably over the past decades due to benign macroeconomic, regulatory and financial trends. Nonetheless, downside risks remain elevated by structural issues, commodity price fluctuations, reversal of capital flows and spill-over effects from external shocks in a manner similar to the Central East and South East European (CESEE) countries. In the light of the 2008–2009 Global Financial Crisis, great attention has been given to understanding the causes of banking instability with most of the research focusing on advanced economies and, to a lesser extent, large emerging markets while little attention has been paid to the bank-based financial sectors of Sub-Saharan Africa. Furthermore, there is scarcity of studies aiming at knowledge-sharing among different emerging economies. This paper aims to identify the determinants of bank credit risk by focusing on five SSA countries: Kenya, Namibia, South Africa, Zambia and Uganda. Using the ARDL approach to cointegration, findings indicate that increased money supply conditions have a decreasing effect on NPLs in all counties, banking industry-specific variables play a significant role in the case of South Africa and Uganda while NPLs are driven by country-specific variables in the case of Kenya, South Africa and Zambia. The effect of the Global Financial Crisis is evidenced indirectly. Drawing on evidence from CESEE countries with long experience in banking crises, reforms and financial deepening process, the paper provides lessons for SSA countries and offers policy recommendations in the direction of strengthening banks' balance sheets to ensure financial stability.

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Keywords: Non-performing loans; Sub-Saharan Africa; ARDL; Central East and South East European countries

1. Introduction

In most SSA countries, the bank-dominated financial sectors are in a developing stage. Supported by reform efforts, the depth and coverage of financial systems has been gradually increasing over the past decade, but still remains at low level (Kasekende

et al., 2010). As EIB (2013) highlights, the scale of financial intermediation in the region remains significantly lower than in other developing regions of the world, while access to financial services is also relatively limited. The Global Financial Crisis of 2008 did not hit badly the African banking systems as they tend to have adequate capitalisation, low leverage, excess liquidity and limited dependence on external funding. However, most SSA countries' banking systems were indirectly affected by the crisis through trade linkages and exchange rate depreciations, which increase the borrowers' financial problems resulting to increasing Non-Performing Loans (NPLs hereafter).

Any policy response in the resolution of NPLs first requires identifying their underlying determinants. Motivated by the scarcity of case studies on the determinants of bank credit risk (including the effect of the Global Financial Crisis) in the SSA banking systems, this paper focuses on five SSA countries in order to empirically investigate the macroeconomic, banking industry-specific, country-specific and external factors that affect NPLs. Specifically, the paper considers five SSA countries that are found at different levels of economic development. These are: Kenya and Zambia (lower-middle income countries),

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South Africa and Namibia (upper-middle income countries) and Uganda (low income country). The selection of these countries was driven by data availability/reliability issues as well as by the need to include countries of different income levels. Furthermore, drawing on the experience of CESEE countries that went through similar processes of financial reforms and liberalization and severe sovereign debt and banking crises, the paper aims to compare the findings and experience of these regions and allow lessons to be learnt. Thus, the contribution of this paper is four-fold: First, it provides empirical evidence on the determinants of credit risk in five SSA countries on a case by case basis. This allows examining the country-specific aspects, which is missing from panel data studies. Second, it uses an extensive number of macroeconomic, banking industry-specific, country-specific as well external factors (including the Global Financial Crisis) and employs a systematic methodological approach in order to reach a model that best explains credit risk in each country. Third, it compares the experiences and findings of the SSA countries to those of CESEE countries in order to allow lessons to be learnt. Finally, it provides recommendations that can be utilised by policymakers and regulators in identifying and dealing with credit risk which can have a devastating impact on the stability of the banking sector and in turn can adversely affect the real economy. The rest of the paper is structured as follows: Section 2 briefly reviews the literature while Section 3 gives an overview of the five countries' economies and banking sectors. Then, Section 4 describes the data and the methodology employed followed by the empirical findings in Section 5. Section 6 summarises the lessons to be learnt from CESEE countries and lastly, Section 7 provides the main conclusions and policy recommendations.

2. Literature overview

The deterioration of banks' asset quality has been at the core of costly banking crises in both emerging and advanced economies. The bitter reality is that elevating non-performing loans dampens economic growth. Hence, deteriorating asset quality has been generally considered as the channel for macroeconomic shocks to banks' balance sheets. The empirical literature on the determinants of credit risk and the interaction with the macroeconomic conditions is grounded in theoretical models that deal with the business cycle with an explicit role for financial intermediation. In the spirit of these models, the financial accelerator theory as discussed in [Bernanke and Gertler \(1989\)](#), [Bernanke et al. \(1999\)](#) and [Kiyotaki and Moore \(1997\)](#) has become the most influential theoretical framework for modelling macro-financial linkages.

The empirical literature identifies two broad sets of drivers that explain NPLs: the macroeconomic and the bank-specific or institutional factors. In the former case, benign economic conditions captured by real GDP or other indicators such as industrial production, construction, rising commodities or food prices, depending on the specificities of each country, imply that borrowers can service their loans and as such, NPLs decrease ([Ghosh, 2015](#); [Beck et al., 2015](#)).

As for the bank-specific determinants of NPLs, the literature identifies, among others the 'bad management' hypothesis¹ captured by low efficiency, low capital, excess lending typically undertaken by riskier banks. Specifically, banks with low cost-efficiency tend to be badly managed with poor loan underwriting, poor monitoring and control which results in increasing NPLs ([Berger and DeYoung, 1997](#); [Podpiera and Weill, 2008](#)). On the contrary, high costs could imply that banks are not allocating enough resources to monitor risks and as a result NPLs increase while certain profitability ratios are associated inversely with NPLs. Banks with low capital tend to be riskier and tend to have higher NPLs according to the 'moral hazard hypothesis' ([Keeton and Morris, 1987](#)). Equally, banks with low liquidity as measured by the loan to asset ratio or loan to deposits ratio are expected to face higher NPLs as they are unable to cover funding gaps.

[Claessens and Kose \(2013\)](#) suggest that financial crises can have multiple causes either fundamental (fiscal policy, slowdown in GDP growth, increase in interest rates or inflation) or exogenous. Similarly, [Cull and Martínez Pería \(2012\)](#) indicate that most banking crises have macroeconomic roots and occur in environments troubled by fiscal or trade deficits. Although, the country -specific factors are equally important, [Llewellyn \(2002\)](#) suggests that several common elements are visible in many crises. Although macro -instability has been a common feature, and may often have been the proximate cause, banking crises usually emerge because instability in the economy reveals existing weaknesses within the banking system.

Numerous panel data studies explain non-performing loans in a cross-country context ([Rinaldi and Sanchis-Arellano, 2006](#); [Nkusu, 2011](#); [Klein, 2013](#); [Castro, 2013](#); [Beck et al., 2015](#)) while other studies focus on a country's financial sector ([De Bock and Demyanets, 2012](#); [Louzis et al., 2012](#); [Ghosh, 2015](#)). [Castro \(2013\)](#) finds that the macroeconomic environment significantly affects the banks' credit risk, especially during the recent financial crisis and documents a significant impact of GDP growth, share price indices, unemployment rate, interest rates, credit growth and the real exchange rate. [Kavkler and Festić \(2010\)](#) results support the hypothesis that excessive growth of finance deteriorates NPL dynamics due to the overheating of the economies and find a pronounced role of current account deficits in financial instability. [Klein's \(2013\)](#) panel regressions also confirm the stylised facts in line with findings of other studies ([Nkusu, 2011](#); [Espinoza and Prasad, 2010](#); [Castro, 2013](#); [De Bock and Demyanets, 2013](#)). [Ghosh \(2015\)](#) finds that liquidity risks and operating inefficiencies increase NPLs, while increasing profitability lowers NPLs. As for macroeconomic variables, [Ghosh \(2015\)](#) results suggest that higher real GDP and real personal income growth rates reduce NPLs while inflation, unemployment and public debt significantly increase NPLs.

Through the use of VAR models, [Espinoza and Prasad \(2010\)](#), [Nkusu \(2011\)](#) and [Klein \(2013\)](#) document a feedback effect from NPLs to the macroeconomy. Thus, it appears that banks' asset quality reinforces the business cycle in a pro-cyclical man-

¹ The bad management hypothesis was coined by [Berger and DeYoung \(1997\)](#).

ner (Nkusu, 2011) and the high NPLs that many countries face adversely complicates the process of economic recovery (Klein, 2013).

Contrary to the VAR methodology, cointegration analysis has received less attention in the literature although a number of methods are available for exploring cointegrating relationships. Against this backdrop, the autoregressive distributed lag approach (ARDL) as re-examined by Pesaran and Shin (1999) has become popular in recent years owing to its flexibility but also other favourable features that cannot be found in other cointegration techniques. In the asset quality empirical literature, cointegration analyses are generally limited with the ARDL approach being almost non-existent since it is a relatively new approach. Among the few studies that use cointegration techniques, Delgado and Saurina (2004) and Zeman and Jurca (2008) employ vector error correction models to assess the impact of a slowdown in real GDP, interest rates and exchange rate on the NPLs of the Spanish and Slovak banking systems respectively. Among the scarce studies that use the ARDL approach to cointegration, Abedola et al. (2011) investigate the determinants of NPLs in Malaysia, Greenidge and Grosvenor (2009) forecast the level of NPLs in Barbados and Nikolaidou and Vogiazas (2014) investigate the Bulgarian credit risk. Greenidge and Grosvenor (2009) find a significant long-run impact of interest rates on NPLs whilst Nikolaidou and Vogiazas (2013) provide evidence that the lending growth jointly with money supply and unemployment are significant determinants of Romania's credit risk in the long-run.

As is the case in most developing economies, the empirical evidence on the determinants of credit risk in African banking systems is scarce. Among these studies, Fofack (2005) investigates the determinants of NPLs in 16 SSA countries. In consistence with Flamini et al. (2009), findings suggest that macroeconomic volatility is the main driver of NPLs. In addition, Fofack (2005) identifies causality links between NPLs and terms of trade, inflation, real interest rate, GDP per capita, and return on assets.

Kangogo and Asienga (2014) panel study of banks in Kenya in the period 2000–2012 find a negative relationship between GDP growth, unemployment and non-performing personal loans and a positive one between inflation rate, interest rates and NPLs. Similarly, Mawili's (2013) study provides evidence of a negative relationship between M2 and capital inflows on NPLs in Kenya while CPI was found to have a negative relation in the short-run and a positive one in the long-run on NPLs. Warue's (2013) panel data study in the period 1995–2009 finds that bank-specific factors contribute to NPLs at higher magnitude compared to macroeconomic factors, in line with Fofack (2005) and Flamini et al. (2009). Furthermore, Warue (2013) provides evidence of a positive and significant correlation between lending rate and NPLs, but no clear evidence that inflation was related to NPLs in Kenyan banks except for large and government banks. In the same train of thought, Waweru and Kalani (2009) and Washington (2014) posit that unfavorable economic conditions negatively affect NPLs in Kenya, jointly with the lack of risk assessment skills and the high lending rates charged. Specifically, Washington (2014) provides evidence of a negative and

significant effect of GDP per capita growth rate and inflation on credit risk and a positive and significant effect of lending interest rates while the effect of the exchange rates on Kenyan bank's NPLs was positive but insignificant.

3. Overview of the economies and banking systems

Over the last decade, growth in SSA countries has been driven by economic diversification, greater trade integration and improving political and macroeconomic stability. However, the outlook can be obscured by downside risks arising from violent insurgencies, lower commodity prices, and volatile global financial conditions. This section discusses the economies and the banking sectors of the SSA countries under investigation drawing parallels to the respective sectors of the CESEE countries.

3.1. Overview of the economies

Broadly, the CESEE economies have gone through a remarkable transformation since 1989. This has been considered as the seal of transition from centrally-planned to market economies. During the 1990s, several countries in the region suffered high inflationary periods and episodes of sovereign crises due to macroeconomic imbalances and policy uncertainty. However, over the period 2000–2007 the economic performance of most CESEE countries has been impressive with real GDP growth reaching an average of about 5.9%. In the pre-crisis years, growth in the region was driven by the booming property and financial sectors fueled by ample credit. In 2008, several countries were in a state of overheating. A credit boom and bust cycle ensued as private debt stocks across CESEE increased much faster than GDP, opening up credit gaps. The current account deficits have been financed by large FDI inflows and many countries were running budget deficits. Thus, in spite of the remarkable economic performance of CESEE countries overall, macroeconomic imbalances were still prevalent. In the fall of 2008, several countries in the region were severely hit by the Global Financial Crisis. Many lessons can be drawn from their diverse economies and reforms, as the crisis made the unthinkable possible (Aslund, 2012). Output plunged and unemployment soared as several countries slipped in recession. Despite many differences, in most CESEE countries private investment and growth remain below pre-crisis levels reflecting uncertainty about economic recovery and private sector balance sheet weaknesses reflected in the stock of NPLs.

Since the 1990s, SSA has been among the world's fastest-growing regions. The majority of SSA countries experienced accelerated growth post-2000, led by mining and hydrocarbon exports. The acceleration in growth has been accompanied, and facilitated, by a sharp reduction in inflation, which in most SSA economies is now typically in the single-digit range, despite persistent vulnerabilities to food and fuel price shocks (Mecagni et al., 2015). Among the key factors contributing to this turnaround in economic fortunes were the improved macroeconomic policies in many countries. Table 1 provides a concise overview of the GDP and the GDP per capita along with the

Table 1
GDP, GDP per capita in 2014, growth rate and volatility over the period 2000–14.

Country	GDP per capita (in 2005 USD)	GDP per capita average growth rate	GDP (in 2005 bn USD)	GDP average growth rate	World Bank classification (per income)
Kenya	658.7	1.7% (2.4%)	29.6	4.4% (2.5%)	Lower-middle
Namibia	4674.6	3.1% (2.9%)	11.2	4.9% (2.9%)	Upper-middle
South Africa	6086.4	1.6% (1.8%)	328.7	3.2% (1.8%)	Upper-middle
Uganda	435.5	3.1% (2.2%)	16.5	6.6% (2.3%)	Low
Zambia	1032.8	4.0% (1.6%)	16.2	7.0% (1.7%)	Lower-middle
SSA countries	1034.1	1.9% (1.6%)	1729.0	4.7% (1.7%)	All income levels
CESEE countries	7966.2	4.0% (1.3%)	2986.0	3.7% (1.1%)	All income levels

Source: World Bank and authors' calculations.

Note: In parentheses, the volatility of GDP growth in the period 2000–2014.

Table 2
Ownership structure and market share in the focal SSA countries.

	Kenya	South Africa	Namibia	Zambia	Uganda
Number of banks	43	74	4	19	25
Ownership (%)					
Foreign	33	60	75	37	84
Local	67	30	25	63	16
Mutual	–	10	–	–	–
Asset size (%)					
Foreign	34	27	80	67	88
Local	66	73	20	33	12
Market share (%)	52% (top-6)	90% (top-5)	62% (top-2)	58% (top-4)	60% (top-5)

Source: Focal Countries' Central Banks.

average growth rate and volatility for each of the focal SSA countries as well as the averages for SSA and CESEE countries.

3.2. Overview of the banking systems

Developing modern and market-oriented banking sector was a challenge for the transition economies of CESEE following a long period of monobank systems, where credit evaluation and risk management were irrelevant (IMF, 2013). The early phases of transition were marred by frequent banking crises episodes followed by privatization efforts and foreign control of a large share of CESEE banking systems. From the early 2000s, the incidence of crises in CESEE declined sharply. Foreign ownership brought greater financial stability but also generated boom–bust cycles and transmitted international shocks. Foreign ownership has been a strength factor in CESEE banks, as foreign-parent banks supported their subsidiaries prior to and through the financial crisis of 2008. The process of financial deepening was facilitated by capital inflows which funded a rapid growth in credit, consumption, and external debt. The Global Financial Crisis triggered a sudden stop in capital inflows, credit growth came to a halt and investment collapsed across the region with few only exceptions. External demand slumped and negative feedback loop pushed most of the CESEE countries in recession. Banks were not able to absorb losses from non-performing loans to facilitate a fresh reallocation of credit to the economy. Many CESEE banking systems were saddled with sizeable non-performing loans. The share of these loans rose above 10% in many countries and even exceeded 20% in some cases undermin-

ing banks' profitability. Given the systemic importance of the euro area banks' subsidiaries in CESEE along with the funding shocks faced by the parent banks, contagion from the euro area became a major risk for CESEE banks. Broadly, the boom–bust cycle has left a legacy of non-performing loans in various CESEE countries. A high credit growth during 2003–2008 gave rise to an unsustainable boom that ended abruptly with the Global Financial Crisis. The deep recession that followed brought to the front several accumulated underlying problems while countries with more pronounced boom–bust cycles were considerably worse off. Retrospectively, neither the banking sectors proved to be sufficiently resilient nor the institutions were sufficiently flexible to deal with the debt stock problem and design supportive macroeconomic policies.

The acceleration of economic growth in Sub Saharan Africa has been accompanied by an expansion of access to financial services, mainly through commercial banks, which have been traditionally the backbone of financial systems of the SSA countries. Banking in SSA has undergone dramatic changes over the past 20 years (Mecagni et al., 2015). In a manner similar to the CESEE countries, financial liberalization and related reforms, improved regulatory capacity and expansion of cross border activities have significantly changed the SSA banking landscape. Once dominated by state-owned institutions, banking systems in SSA became more stable as evidenced by the dramatic decline of incidences of banking crises in the past two decades (Mecagni et al., 2015). Since 1990, banking systems in SSA have steadily shifted from majority state-owned to private-owned ones, with increasing levels of foreign ownership. The ownership structure

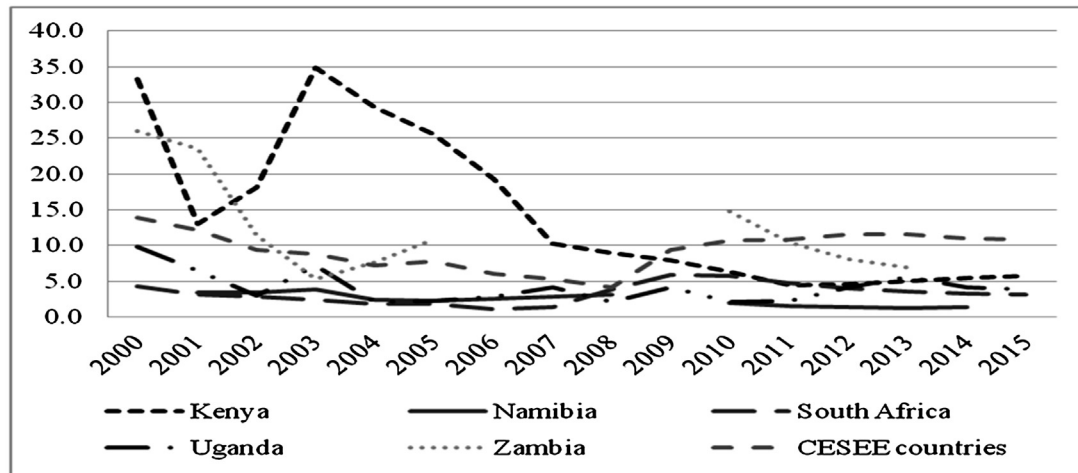


Fig. 1. Non-performing loans in the focal SSA and the CESEE countries.

Source: World Bank and authors' calculations.

and the market share controlled by the largest banks in each of the focal SSA countries are presented in Table 2.

4. Data and methodology

The availability of reliable, consistent and sufficiently long time-series is identified as a key limitation in studies dealing with developing countries. Data limitations make conducting analytical work difficult and restrict economic analysis. Furthermore, the lack of a harmonised definition of credit risk proxies across countries could result in measurement issues which may obscure the interpretation of the empirical findings.

Indeed, this was also a concern for this study where the availability of data has driven, to some extent, the selection of SSA countries. At the same time, the study aimed at including countries undergoing through different phases of economic development. Given these considerations, a number of indicators² were collected for each country from publicly available sources such as the World Bank/IMF, Central Banks and other sources. Monthly data were used in South Africa (June 2008–June 2014), Kenya (December 2004–June 2014), and Zambia (December 2008–December 2013). Quarterly data were used for Uganda (2001Q1–2014Q2) and Namibia (2001Q4–2014Q2). Fig. 1 presents the non-performing loans as a share of total loans in the focal SSA countries and the CESEE region.

Evidently, non-performing loans in Kenya and Zambia were more volatile compared to the other SSA countries. In the case of Namibia, South Africa and Uganda, non-performing loans were on average 2.4%, 3.3% and 4.2%, respectively in the period 2000–2015. Overall, in these three countries non-performing loans remained below 10%. Kenya experienced exceptionally high non-performing loans in 2003 (standard deviation: 10.8%) while Zambia's non-performing loans peaked in 2000 and grad-

ually fell until 2003 when they began rising again, having a standard deviation of 7%.

4.1. Methodology and model specification

Determining the order of integration of the variables is not necessary for the ARDL approach to cointegration as both $I(1)$ and $I(0)$ variables can be used. In order to confirm that series are not $I(2)$, all variables are tested for unit roots using the augmented Dickey and Fuller (1979) test, known as the ADF test. However, recent studies provide evidence that in the presence of structural breaks, the standard ADF test becomes biased towards the non-rejection of the null hypothesis (Perron, 1989). For this reason additional standard unit root tests were considered (Phillips and Perron, 1988; Kwiatkowski et al., 1992) jointly with tests that allow for the endogenous determination of structural breaks (Perron, 1997; Zivot and Andrews, 1992).

The standard unit root tests suggest that all variables are either $I(0)$ or $I(1)$ while the tests that account for structural breaks³ provide evidence of at least one structural break during the sample period for some of the countries. In the case of Kenya (March–2009), South Africa (September 2009), Uganda (Q2 2013) and Zambia (March 2013), there is evidence of at least one structural break in the period shown in parentheses. These structural breaks are accounted for in the econometric analysis by the use of dummy variables.

Having established the integration properties of all variables for each country, the next step is to identify the indicators with explanatory power on NPLs. Following Kalirai and Scheicher (2002), univariate OLS regressions⁴ were initially performed where the NPL ratio is regressed against each indicator. The univariate regressions provide solid ground for the identification of the factors that affect credit risk. In this process, the

³ The unit root tests, not presented in the paper are available from the authors upon request.

⁴ The results of the univariate regressions, not presented in the paper, are available upon request.

² To save space, the full list of variables is not given in the paper, but is available from the authors upon request.

Table 3
Long-run estimates of the ARDL models.

Kenya ⁷
$NPL = -1.74 - 0.21LM2 + 0.33LGED - 0.07LREM$
(4.03)*** (6.18)*** (6.02)*** (2.37)**
Namibia
$NPL = 0.08 - 0.004LM2 - 0.001REER + 0.001TBILL$
(3.42)*** (2.14)** (2.31)** (2.04)**
South Africa ⁸
$NPL = 0.33 - 0.02LM2 - 0.02LGOLD - 0.001TBILL + 0.03LASS$
(6.21)*** (2.27)** (4.11)*** (0.46) (0.65)
Uganda
$NPL = 0.01 - 0.02LM3 + 0.005TBILL + 0.04LDP - 0.15ROA + 0.10DUM$
(0.47) (1.82)* (4.04)*** (2.23)** (3.27)*** (3.25)***
Zambia
$NPL = 114.77 - 9.97LM1 - 0.65TBILL - 0.04METAL$
(7.10)*** (6.44)*** (5.29)*** (1.98)*

Note: t-ratios are given in parentheses. *, **, *** indicate 10%, 5% and 1% level of significance respectively.

where:

NPL is the ratio of non-performing loans to total loans;

LM1, LM2, LM3 are the logs of M1, M2 and M3 respectively;

LGED is the log of the Kenya's gross external debt;

LREM is the log of private flows (remittances);

LGOLD is the log of South Africa's gold production;

LASS is the ratio of loans to assets;

LDP: loan to deposit ratio;

METAL is the commodity metals price index;

ROA is the return on assets ratio;

REER: real effective exchange rate;

TBILL stands for the 90-day Treasury bill rate for South Africa, Uganda and Namibia and the average interest rate on 1-year T-bill for Zambia, and DUM denotes a dummy variable for Uganda that captures the MDI Act 2003. It takes the value of 1 in Q2 2003 and 0 elsewhere.

dependent variable (credit risk proxied by NPLs) is regressed against each indicator at time t but also at all lags up to one year. This systematic approach enables to capture any lagged effects of an explanatory variable on NPLs, suggesting that NPLs could appear on banks' accounts quite after the problem emerges. Thus, our approach enables to analyse the robustness of the model specifications as NPLs can be a noisy proxy⁵ for credit risk while at the same time contemporaneous variables may not be exogenous. The statistically significant variables are then introduced in a multivariate model using stepwise regressions. In the modeling process various specification attempts were sought on the basis of economic theory and prior empirical evidence. Using variable exclusion restrictions, the model that best explains each country's NPLs is estimated by the ARDL approach to cointegration.

Specifically, the ARDL bounds approach as advanced by Pesaran and Smith (1998), Pesaran and Shin (1999) and Pesaran et al. (2001) is used to identify and examine the long-run relationship between NPLs and the pre-identified macroeconomic and bank-specific variables jointly with other indicators that account for exogenous events (i.e. the Global Financial Crisis). The ARDL method has a number of advantages over other cointegration methods (Engle and Granger, 1987; Johansen, 1991, 1995; Johansen and Juselius, 1990) commonly met in empirical studies. Although the ARDL approach is popular in other areas of

economics such as the finance-growth nexus, it has been scarcely used in the banking stability literature. A key advantage of the ARDL approach is that it can be applied, regardless of whether the regressors are $I(0)$ or $I(1)$. While other cointegration techniques are sensitive to the size of the sample, the ARDL approach is suitable even if the sample size is small (Odhiambo, 2010), and it allows using a number of lags to capture the data generating process in a general-to-specific methodology. Also, it allows deriving a dynamic error correction model (ECM) that integrates short-run dynamics with the long-run equilibrium without losing long-run information (Shrestha and Chowdhury 2005; Mallick and Agarwal 2007; Masih and Hamdan 2008). Last, the ARDL approach generally provides unbiased estimates of the long-run model, even when some of the regressors are endogenous (Harris and Sollis, 2003). The generic equation that explains NPLs is the following:

$$NPL = f(NPL_{-t}, \text{CRISIS}, \text{BANK}, \text{MACRO}, \text{SHOCK})$$

where NPL is the ratio of non-performing loans to total loans, NPL_{-t} is the lagged value of NPL, CRISIS is a proxy of Global Financial Crisis, BANK denotes banking industry-specific variables, MACRO are macroeconomic variables, and SHOCK is a dummy variable that accounts for the effect of regulatory regime changes, reforms or other exogenous shocks.

5. Empirical results

For all countries, the ARDL lag selection was based on the Schwarz Bayesian criterion. The bounds testing approach con-

⁵ Weakness in problem loan reporting are well-documented in the literature given the lack of a universal and internationally binding definition, but also the material impact of NPLs on banks' results.

Table 4
Error Correction representation for the selected ARDL models.

Variables	Kenya 2005M3–2014M6	Namibia 2001Q3–2014Q2	South Africa 2008M10–2014M6	Uganda 2001Q1–2014Q2	Zambia 2009M6–2013M1
dLM1					–2.45***
dLM2	–0.02***	–0.002*	–0.02***		
dLM3				–0.04**	
dLGED	0.03***				
dLREM	–0.006***				
dLGOLD			–0.003***		
dMETAL					–0.009***
dREER		–0.001**			
dTBILL		0.001**	–0.001***	0.001	–0.22***
dTBILL1				–0.001	0.05
dTBILL2				–0.002***	0.21***
dLASS			0.02***		
dLASS1			0.02**		
dROA				–0.007***	
dLDP				0.03***	
dLDP1				–0.03***	
dLDP2				0.02**	
DUM				0.04***	
C	–0.14***	0.03***	0.05***	0.004***	28.21***
ECM(–1)	–0.09***	–0.41***	–0.15***	–0.45***	–0.25***
R ² adjusted	0.24	0.39	0.78	0.69	0.47
Serial correlation	X ² (12)=7.18	X ² (4)=6.47	X ² (12)=17.93	X ² (4)=7.89	X ² (12)=18.43

Note: The term d denotes taking first difference, i.e. dTBILL1 = TBILL(–1) – TBILL(–2).

***, **, * denote 1%, 5% and 10% level of significance.

firm the existence of long-run relationships for all countries.⁶ The rest of this section presents and discusses the long-run estimates in Table 3, and the error correction (ECM) estimates in Table 4 of the ARDL models for each of the five SSA countries.

Based on the results, in the long-run, NPLs for all countries apart from Uganda seem to be primarily driven by macroeconomic variables rather than industry-specific ones. This can be attributed to the stable, well-capitalised banking sector where credit expansion is primarily funded by deposits evidenced in the historically low loan-to-deposit ratios. However, in the short-run (see Table 4) banking industry factors do play a significant role in the case of South Africa. For all countries, the effect of money supply (M2 for Kenya, South Africa and Namibia;

M1 for Zambia and M3 for Uganda) is critical in determining NPLs. Broadly, the result is in line with the studies of Fofack (2005) in Sub-Saharan countries and Odhiambo (2010) in Kenya. Increasing domestic credit is typically associated with higher financial intermediation, as measured by M2, which in turn is expected to present a negative association with NPLs. In all countries, supportive monetary conditions offset most of the contraction associated with the Great Recession (Andrle et al., 2013). Broadly, the results suggest that easing monetary policy and increased money supply conditions that accelerate credit growth have a decreasing effect on NPLs for all focal countries.

Although, the money supply variable appears as a determinant of NPLs in all countries, this is not the case for other determinants which implies that NPLs are driven by country-specific variables. Starting with Kenya, results indicate a negative and significant effect of remittances on NPLs suggesting that increasing flow of remittances appears to minimise credit risk. Undoubtedly, private capital inflows (diaspora remittances) are a supportive factor for the economies of many developing countries (Aggarwal et al., 2006). Broadly, the effect of capital inflows on NPLs is in line with other studies in emerging markets (De Bock and Demyanets, 2012). Furthermore, remittances and private flows are identified as a transmission channel for external shocks, such as the Global Financial Crisis or the euro area crisis, in the host-country (Delechat et al., 2010). Inflows of remittances boost national income while recipients can use the money as source of debt-repayment. Furthermore, in Kenya, the external debt burden that indirectly incorporates the fluctuation in exchange rate appears to affect positively NPLs. Affordable debt levels can provide a degree of stability to Kenya's fiscal position,

⁶ The computed F-statistics for the five SSA countries, not shown here but available upon request, are found to be higher than the upper bound of the critical values of Pesaran et al. (2001) suggesting that the null hypothesis of no cointegration can be rejected

⁷ In the process of model construction following the general-to-specific methodology, variable deletion tests have been employed. Based on the results, the variables VIX and TBILL were dropped from the final model specification as they were insignificant. The introduction of a dummy variable to capture the effect of the post-election violence in 2009 on banks' credit risk proved significant at the 5% level, only in the short-run. These modeling results are available upon request.

⁸ For South Africa, Perron's (1997) test provided evidence of a structural break during the sample period (the break month was September 2009). For this reason, a dummy variable that takes the value of 1 in the period September 2008 to September 2009, and the value of 0 elsewhere, to capture the crisis was introduced. However, in the model specification process, the dummy proved insignificant and was dropped. This might be due to the introduction of other variables that may have captured the same effect (i.e. price of gold).

which in turn translates to increasing banking stability. Overall, the Kenyan NPLs are found to be sensitive to money supply conditions, which provide a rough indication of the state of the economy, the flow of remittances and the country's external debt position.

In the case of Namibia, NPLs seem to be highly sensitive to macroeconomic shocks. More precisely, broad money supply (M2), the real effective exchange rate and the interest rate on 1-year T-bills play a significant role in the Namibian credit portfolio quality. In Namibia, a fall in real exchange rate adversely affects borrowers' creditworthiness. Although exports are the main driver of growth in Namibia, a persistent current account deficit makes the economy vulnerable to fluctuations in exchange rates. At the same time, bank lending in Namibia targets companies operating in the sectors of manufacturing, food, and transportation-logistics. Hence, credit concentration in secondary export-oriented sectors that significantly rely upon imports for their operations, increase the impact of real exchange rate fluctuations on credit risk. Clearly, there is a complex interaction between exchange rates and various economic and financial variables, many of which are determined exogenously. However, the empirical evidence suggests a strong association between the effective exchange rate and NPLs (Fofack, 2005; De Bock and Demyanets, 2012). The 1-year T-bill interest rate in Namibia seems to be positively related to NPLs. Indeed, T-bill interest rates are considered an indicator of the government's interest rate policy and a benchmark for the rates charged by commercial banks. Lower rates on T-bills could induce lower, more affordable lending rates which would result in lower NPLs.

South Africa, as an exporter of gold, should benefit from higher prices of gold. Indeed, long-run estimates indicate that an increase in the price of gold has a negative and highly significant effect on NPLs (see Table 3). This finding is in line with Havrylychuk (2010) study for South Africa over the period 2001–2008. Regarding the impact of the T-bill rate (TBILL), results point to a negative influence on NPLs only in the short-run (see Table 4) but no significant effect in the long-run (variable deletion tests for the short-run reject the hypothesis that TBILL is insignificant while the Wald test for TBILL in the long-run cannot be rejected). The negative short-run effect of the T-bill rate might suggest that higher rates in the lower-risk T-bills disincentivizes local banks from lending to the real sector, with the ultimate result being a reduction in NPLs. As IMF (2012) indicates, the persistently high lending rates in many SSA countries appear to distort credit allocation and constrain access to credit, particularly to SMEs. In this respect, as market rates increase, banks prefer to crowd out investments either because they are not considered bankable, or because the government debt is perceived as lower risk. Although it is difficult to disentangle loan-supply from loan-demand factors, in both cases the South African banks seem to prefer lower returns over higher NPLs. The industry-specific variable included in the model (Loan to asset ratio—LASS), appears to have a significant positive effect on NPLs in the short-run but not in the long-run. The positive effect of LASS is according to expectations as the higher this ratio is, the lower the liquidity and as such the higher the NPLs. But still, this is not a long-run determinant. Overall, South

Africa's NPLs seem to be driven by macroeconomic factors in the long-run but by both macroeconomic and industry-specific variables in the short-run.

The results for Uganda are broadly in line with the other countries regarding the monetary aggregate (M3 in the case of Uganda) that has a negative effect on NPLs. However, unlike the case of South Africa and Zambia, the T-bill rate (TBILL) positively affects NPLs. So, for Uganda, the T-bill rate as an indicator of the government's interest rate policy and a benchmark for the rates charged by commercial banks implies that higher rates on T-bills make repayment less affordable for debtors, and thus, increase NPLs. Furthermore, in Uganda, industry-specific variables also affect NPLs. Specifically, the loan to deposit ratio (LDP) exerts a positive effect on NPLs while the return on assets (ROA) has a negative effect on NPLs. A high LDP ratio which is an indicator of a bank's funding liquidity could imply increasing risk-taking or high reliance in market liquidity to cover unforeseen funding requirements, which could result in higher NPLs. On the other hand, ROA measures profitability as well as management's efficiency in utilising assets to generate earnings. As expected by economic theory, also evidenced in the case of Uganda, as ROA increases, NPLs are expected to decline. Finally, the dummy variable that accounts for the MDI Act 2003 had a significantly positive effect on NPLs, possibly implying that those institutions that converted into a plc status carried problematic loans.

Considering the limitation of a relatively small dataset, Zambia's NPLs seem to be primarily driven by macroeconomic variables as reflected in the T-bill interest rate and external factors such as the commodity metals' price index. The sector's credit risk appears to be susceptible to destabilizing economic cycles in view of Zambia's narrow economy, which is largely dependent on a single export commodity, copper.⁹ Noteworthy, the effect of other copper-related variables such as the country's earnings from copper or the copper's price in the London Metal Exchange were found to positively affect NPLs in Zambia. The result is consistent with an economy that is commodity-driven. Hence, the limited economic diversification seems not only to constrain the economic base of Zambia, but also to undermine the banks' asset quality. Conversely, commodity prices shape Zambia's credit risk in the period under investigation. In this respect, the Zambian banking sector is exposed to volatility in global metal commodity prices. The country's elevated vulnerability to external shocks seems to affect the borrowers' capacity in servicing their loans. The narrow money base as captured by M1 presents the expected negative relationship with Zambian credit risk. Interestingly, broader money supply indicators appear to also have a negative, yet insignificant effect on NPLs. The result can be attributed to the large share of the informal economy¹⁰ in Zambia. The market rate as captured by the aver-

⁹ Fiscal revenues in Zambia rely heavily on the mining sector. For instance, in the past five years, copper exports accounted for about 70% of total earnings from exports.

¹⁰ According to the Labour Force Survey in 2008, the informal sector accounted for 90% of total employment in Zambia.

age interest rate on 1-year T-bills is found to be negatively associated with NPLs which is in line with the finding for South Africa. On the other hand, the lending rate (LR) or the spread between average lending and average deposit rate were found to have a positive but insignificant effect on Zambian NPLs. As for the case of South Africa, this puzzling result should be viewed in the context of the relatively low domestic interest rates on Zambia's public debt and the fact that the concentrated domestic banking system holds the highest portion of government debt in local currency. In this framework, the results suggest that the Zambian banks seem to prefer lower returns over higher NPLs. Overall, higher interest rates on T-bills, which could reflect potential pressure on Zambia's financing requirements, affect negatively NPLs suggesting that holding T-bills instead of loans generates lower credit risk for the banks. Interestingly enough, industry-specific variables do not seem to affect Zambian banks' credit risk; this can be explained by the relatively good metrics of the banking system.

For all countries, the underlying ARDL equation passes all diagnostic tests. Furthermore, as Table 4 shows, the error correction term is statistically highly significant, has the correct sign, and suggests an increasing speed of convergence to equilibrium. Specifically, the error correction coefficient is estimated at -0.09 for Kenya, -0.41 for Namibia, -0.15 for South Africa, -0.45 for Uganda and -0.25 for Zambia. In other words, a deviation from the long-run equilibrium level of NPLs in Kenya in one month is corrected by about 10% the next month, in Zambia by about 25% in the next month, in South Africa by 15% while in Namibia and Uganda by 41% and 45% in one quarter respectively.

The analysis of the determinants of NPLs in the five SSA countries primarily points to the importance of macroeconomic factors and to a lesser extent industry factors. This should not come as a surprise given the countries' efforts to stabilise their banking systems after a series of reforms in the mid-1980s and early 1990s, to comply with the international regulations and to improve the efficiency of the banking industry as would be evidenced from the reduction of interest rate spreads. However, contrary to the expectations of the financial reforms, interest rate spreads have remained large and volatile in most of the countries. Furthermore, as the analysis has revealed (through the negative effect of the T-bill rate on NPLs), banks in South Africa and Zambia seem to prefer lower returns by investing in government safer instruments rather than issuing business loans.

So, although in SSA countries NPLs have been at low levels since 1990s, this is mainly due to banks' reluctance to provide credit (as they want to avoid risk or are not very good at risk screening and evaluation) and mainly invest in government assets. When a key problem for SSA countries is the limited access to finance (given by the large size of under-banked population), and many efforts are concentrated on improving this limitation to enhance economic growth, banks' reluctance to act as financial intermediaries at full could be a possible reason for the low level of NPLs in recent years. But this reluctance could be attributed to banks' inability to properly monitor and evaluate potential borrowers. Without this function, credit cannot be allocated to growth-promoting investments. At the same time, these

economies remain highly undiversified, relying on specific commodities' production and exports which leaves them vulnerable and exposed to external shocks. The increase in these loans is largely driven by macroeconomic volatility for the case of Kenya that relies on workers' remittances, while South Africa and Zambia as commodity exporters are exposed to volatile prices in gold and copper respectively.

6. Lessons from CESEE countries

The empirical analysis has focused on five SSA countries which present similarities as well as divergences with CESEE countries. Even in the absence of alarming NPLs in the SSA countries in the timeframe of the study, the premise of the comparison is that NPLs typically precede banking distress that could eventually reach systemic proportions (Demirgüç-Kunt and Detragiache, 1998). The key lessons from the experience in CESEE countries in the aftermath of the Global Financial Crisis and the subsequent paroxysms such as the euro area sovereign-debt crisis for the SSA countries can be summarized along the following points:

- a) *Risks lurk in the event of a sudden external shock:* Both regions have undergone a process of financial deepening in the past decades. SSA has experienced a renaissance in economic growth since mid-1990s driven by trade integration, improved political-economic stability, institutional reforms and supportive global conditions. In CESEE countries, the booming years were in the 2000's prior to Global Financial Crisis, facilitated by ample global liquidity that induced sizable capital inflows, mainly in the financial sector along with the prospects of EU/EMU accession. Growth in both regions has been accompanied by a rapid expansion of the banking sectors. But the promise of liberalization, privatisation and stabilization has been partly fulfilled in both regions. Vulnerabilities persist as the financial systems remain small and fragile compared to other developing countries in Europe, Latin America or Asia. On average, banks in SSA entered the crisis with high level of capital and liquidity. But similar was the case in most of the CESEE countries. NPLs in CESEE were attributed to both macroeconomic factors and bank-specific factors, though the latter set of factors has a relatively lower explanatory power as was broadly the case in SSA countries (De Bock and Demyanets, 2012; Klein, 2013). In the aftermath of the Global Financial Crisis, CESEE countries experienced a sudden stop in capital inflows; growth came to a halt and banks were saddled with surging NPLs owing to the high level of integration with international financial markets and home-grown fragility well-masked during the 'good times'. With a number of exceptions, NPLs in SSA remained stable despite the slowdown in economic growth. Similarly, SSA banks could be vulnerable in the event of reduced capital flows and sluggish economic growth. As large EU banks engage in a deleveraging process, financial markets in SSA can be affected by a potential reduction in credit supply through cross-border exposures with the EU or other financial-trade linkages in a manner similar to the one

experienced in CESEE countries. In both regions, institutions are not sufficiently flexible and banking sectors are not sufficiently resilient to absorb losses from NPLs in the event of external shocks which can dampen growth prospects. Hence, fiscal and monetary policies should focus on preserving the financial sectors' resilience, without undermining investment and employment, especially by minimizing the impact of private sector deleveraging in the event of a sudden stop.

- b) *Risks emanating from sovereign-debt crisis and feedback effects:* Empirical evidence in the CESEE countries has identified three main transmission channels of crisis: trade links, capital flows and bank flows (Balakrishnan et al., 2009; Melander et al., 2011; Nikolaidou and Vogiazas, 2013). Although, the linkages between the financial sectors in the euro area and SSA are relatively limited, some African markets have exposures to banks in EU which have experienced distress in the aftermath of the Global Financial Crisis. The banking systems across SSA have differing levels of exposure to European banks given their varying levels of development, and market structure. Despite the SSA country-specific mitigating factors, the financial and trade linkages continue to expose these countries to risks emanating from the European sovereign debt crisis suggesting increased vigilance and built-up of cushions that could prevent any financial shock from spreading to the SSA banking systems. In turn, the cross-border propagation of banking sector shocks impacts the real economy and increases the likelihood of intervention (bail-outs) with potentially significant implications for the fiscal balance sheets. Evidence in CESEE countries has also surfaced feedback effects from the banking sectors to the real economy, suggesting that high NPLs adversely affect the pace of economic growth (De Bock and Demyanets, 2012; Klein, 2013). In the case of some SSA countries, lower commodity prices, combined with a credit crunch could make the financing of investments more difficult. As investment falls, projects cannot be completed, causing them to be unproductive and saddling banks' balance sheets with NPLs. Increasing level of integration with international financial markets need to be closely monitored as it can become a channel of instability for the SSA financial systems. Typically, home-grown fragility in banks manifests only after a shock in the price of commodities or the yields of government securities takes place.
- c) *Risks arising from the financial sector:* Historically, both SSA and CESEE countries have been troubled by severe banking crises where the financial sectors experienced a large number of defaults or sharply increasing NPLs. Subsequently, a number of reforms stimulated the entry of foreign banks. The average share of foreign bank ownership in SSA has increased from 37% in 2000 to 54% in 2009, compared to 40% in Eastern Europe and Central Asian countries. But foreign banks are also exposed to home-grown problems. Before the Global Financial Crisis, the consensus was that the benefits of foreign banks outweigh costs in many dimensions (Claessens and Van Horen, 2014). However, the positive effect of the entry of foreign banks on economic development appears to depend on certain conditions including their

relative size (Demirgüç-Kunt et al., 2004). At the same time, studies have shown that foreign banks cherry pick borrowers or assets (Beck and Martinez-Peria, 2010), which can undermine the development of host banking systems and the access to financial services. The Global Financial Crisis has highlighted that the presence of foreign banks can be negatively related with domestic credit creation (Claessens and Van Horen, 2014). Furthermore, studies document that shocks to parent banks can be transmitted to their foreign subsidiaries with negative consequences for their lending operations (Peek et al., 1999). More important, other studies that focus on CESEE countries, point out the risks of foreign banks for financial stability (Popov and Udell, 2010; De Haas et al., 2012). The small size of several banking sectors in SSA may make foreign banks reluctant to incur the costs of introducing new products or increase competition in the market. Hence, authorities should properly monitor and supervise foreign banks which in turn should provide opportunities for financial inclusion without undermining the financial stability during crises episodes or by reinforcing boom-bust cycles as evidenced in CESEE countries.

Overall, most of the SSA countries investigated in this paper present relatively low NPLs compared to other geographical areas in the world. Still, an uncertain external environment, such as a potential slowdown in emerging markets poses downside risks to commodities export demand which in turn could give rise to NPLs. The presence of foreign banks should provide incentives for development through credit extension in productive investment, add to competition by lowering intermediation costs, and enhance stability rather than accentuating a distress under adverse economic conditions. The Global Financial Crisis served to remind policy makers how vulnerable Africa could be to external shocks. While the absence of financial sophistication may have helped SSA countries to reduce the contagion effects through financial market channels, it also prevented the banks from mitigating the impact of the shocks on the real economy. Hence, policy design should focus on addressing structural deficiencies in the banking sector.

7. Concluding remarks and policy recommendations

The kaleidoscope of risk is shifting continuously in the global economy in the wake of plunging commodities prices and the financial risks become harder to spot. Preventing the occurrence of banking problems is undoubtedly a key concern for policy-makers. Understanding the mechanisms at play behind NPLs, both in 'normal' and in 'distress' periods is a first step in this direction. An evolving number of studies aimed at analysing the determinants of NPLs in both developed and developing countries. Most of this work consists of panel models that fail to account for each country's specificities. Taking a country-by-country approach, this paper focuses on a sample of five SSA countries with the goal to investigate the factors that import fragility in the banking systems through higher credit risk.

The explanatory variables capture many of the factors suggested by the theory, including not only macroeconomic vari-

ables but also structural characteristics of the focal economies including the banking sectors. Since, the estimations involve reduced-form models, the results should be interpreted cautiously when it comes to policy-making. The empirical findings indicate that credit risk can be reduced in various ways without severely curtailing the role of banks as financial intermediaries. After all, the presence of NPLs is a phenomenon deeply entrenched in traditional banking. The key objective is to maintain NPLs at level before they become a disease. Hence, the key issue relates to monitoring and planning to prevent feedback effects to the real economy. In this direction, a number of recommendations are outlined that would be of benefit to policy makers:

- The development of diversified asset-bases for banks should be encouraged. Developing SSA countries should promote and incentivise prudent risk-taking in lending to the real economy. Allocating resources in the so-called risk-free assets constrain banks' role in the economy. The determinants of credit risk in the SSA along with other structural characteristics of the focal banking systems can explain to some extent, the persistence of high interest rate spreads as well as the financial inclusion thesis. At the same time, high exposure to government securities leaves banks vulnerable to the event of sovereign crises.
- Well-capitalised banking systems, (South Africa, Uganda) are less vulnerable to negative shocks that could result in higher NPLs. Solid capital buffers should be encouraged especially in emerging economies which are less diversified. Asset quality, as mirrored in NPLs for resource exporters such as South Africa and Zambia can be vulnerable to slowdowns in global demand or to volatile commodity prices. The same applies to Namibia, Uganda and Kenya that are equally affected by developments in demand from SSA countries. In this respect, a worsening in the economic conditions in China, considering the trade linkages in place, could affect the loan books of South African and Zambian banks. Equally, other countries such as Kenya, Namibia and Uganda can be vulnerable to intra-regional shocks or rising external debt levels (Kenya). In this respect, a banking distress in one economy could be transmitted to the financial sectors of the 'linked' economies in a similar manner to what has been observed in CESEE countries.
- Economic growth can heal wounds as it strengthens banks by reducing the volume of NPLs. The empirical findings for all countries in the paper indicate the necessity to incorporate macroeconomic shocks in financial policy decision-making. The historical volatility in commodity prices and exchange rates can be built in modeling scenarios to stress test the ability of the banking systems to withstand adverse shocks.
- The study highlighted that each of the five SSA countries analysed presents unique features preventing a one-size-fits-all approach. As the focal SSA banking systems vary markedly in terms of size, composition, ownership and concentration, policy makers should refine an appropriate country-specific regulatory, legal and accounting environment for banks to facilitate economic prosperity. At the same time, policy mak-

ers need to be ready to enhance cross-border cooperation and surveillance.

In principle, risks are dynamic in nature and hard to spot. Hence, future research entails the collection of longer and more extensive datasets along with the use of alternative proxies for credit risk. Crises episodes have taught us to pay attention to hidden or misunderstood risks of low probability events where the economy can malfunction. Since European banks remain among the key providers of liquidity to Sub-Saharan African banks, the study of spill-over effects from European – also intra-regional – financial volatility perspective could enhance the present research.

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References

- Abedola, S.S., Yusoff, W.S.W., Dahalan, J., 2011. An ARDL approach to the determinants of non-performing loans in Islamic banking system in Malaysia. *Kuwait Chapter Arab. J. Bus. Manage. Rev.* 1 (2), 20–30.
- Aggarwal, R., Demirgüç-Kunt, A., Martínez Pería, M.S., 2006. Do Workers' Remittances Promote Financial Development? World Bank Policy Research Working Paper, 3957.
- Andrie, M., Berg, A., Morales, R.A., Portillo, R., Vlcek, J., 2013. Forecasting and Monetary Policy Analysis in Low-income Countries: Food and Non-food Inflation in Kenya. IMF Working Paper, 61.
- Aslund, A., 2012. Lessons from Reforms in Central and Eastern Europe in the Wake of the Global Financial Crisis. Peterson Institute for International Economics, Working Paper, 12–7.
- Balakrishnan, R., Danninger, S., Elekdag, S., Tytell, I., 2009. How Linkages Fuel the Fire: The Transmission of Financial Stress from Advanced to Emerging Economies. IMF, World Economic Outlook, April 2009.
- Beck, T., Martínez-Pería, 2010. Foreign bank participation and outreach: evidence from Mexico. *J. Financial Intermed.* 19 (1), 52–73.
- Beck, R., Jakubik, P., Piloju, A., 2015. Key determinants of non-performing loans: new evidence from a global sample. *Open Econ. Rev.* 26 (3), 525–550.
- Berger, A., DeYoung, R., 1997. Problem loans and cost efficiency in commercial banks. *J. Banking Finance* 21, 849–870.
- Bernanke, B.S., Gertler, M., 1989. Agency costs, net worth, and business fluctuations. *Am. Econ. Rev.* 79, 14–31.
- Bernanke, B.S., Gertler, M., Gilchrist, S., 1999. The financial accelerator in a quantitative business cycle framework. In: Taylor, J.B., Woodford, M. (Eds.), *Handbook of Macroeconomics*. Elsevier, Amsterdam.
- Castro, V., 2013. Macroeconomic determinants of the credit risk in the banking system: the case of the GIPSI. *Econ. Model.* 31, 672–683.
- Claessens, S., Kose, A., 2013. Financial Crises: Explanations, Types, and Implications. IMF Working Paper, 28.
- Claessens, S., Van Horen, N., 2014. Foreign banks: trends and impact. *J. Money Credit Banking* 46 (1), 296–326.
- Cull, R., Martínez-Pería, M.S., 2012. Bank Ownership and Lending Patterns During the 2008–2009 Financial Crisis. Evidence from Latin America and Eastern Europe. World Bank, Policy Research Working Paper, 6195.
- De Bock, R., Demyanets, A., 2012. Bank Asset Quality in Emerging Markets: Determinants and Spillovers. IMF Working Paper, No.71.
- De Haas, R., Korniyenko, Y., Loukoianova, E., Pivovarsky, A., 2012. Foreign Banks During the Vienna Initiatives: Turning Sinners into Saints? IMF Working Paper, 117.
- Delechat, C., Ramirez, G., Wagh, S., Wakeman-Linn, J., 2010. How global financial markets affect Sub-Saharan Africa. IMF Staff Pap. 57 (1).

- Delgado, J., Saurina, J., 2004. Credit Risk and Loan Loss Provisions. An Analysis with Macroeconomic Variables. Banco de Espana Working Paper, No. 12.
- Demirgüç-Kunt, A., Detragiache, E., 1998. The determinants of banking crises in developing and developed countries. IMF Staff Pap. 45, 81–109.
- Demirgüç-Kunt, A., Laeven, L., Levine, R., 2004. Regulations, market structure, institutions, and the cost of financial intermediation. J. Money Credit Banking 36 (3), 593–622.
- Dickey, D.A., Fuller, W.A., 1979. Distribution of the estimators for autoregressive time series with a unit root. J. Am. Stat. Assoc. 74 (366).
- EIB, 2013. Banking in Sub-Saharan Africa: Challenges and Opportunities.
- Engle, R., Granger, C., 1987. Co-integration and error correction: representation, estimation and testing. Econometrica 55, 251–276.
- Espinoza, R., Prasad, A., 2010. Nonperforming Loans in the GCC Banking System and their Macroeconomic Effects. IMF Working Paper, 224.
- Flamini, V., McDonald, C., Schumacher, L., 2009. The Determinants of Commercial Bank Profitability in Sub-Saharan Africa. IMF Working Paper, 15.
- Fofack, H., 2005. Nonperforming Loans in Sub-Sahara Africa. Causal Analysis and Macroeconomic Implication. World Bank Policy Research Paper, 3769.
- Ghosh, A., 2015. Banking-industry specific and regional economic determinants of non-performing loans: evidence from US states. J. Financial Stab. 20, 93–104.
- Greenidge, K., Grosvenor, T., 2009. Forecasting Non-performing Loans in Barbados. Bank of Barbados Working Paper.
- Harris, R., Sollis, R., 2003. Applied Time Series Modeling and Forecasting. John Wiley and Sons, Chichester.
- Havrylychuk, O., 2010. A Macroeconomic Credit Risk Model for Stress Testing the South African Banking Sector. South African Reserve Bank, Working Paper 10/02.
- IMF (2012) Global Financial Stability Report.
- IMF (2013) Kenya, Country Report No. 13/107.
- Johansen, S., 1991. Estimation and hypothesis testing of cointegration vectors in gaussian vector autoregressive models. Econometrica 59, 1551–1580.
- Johansen, S., 1995. Likelihood-Based Inference in Cointegrated Vector Autoregressive Models. Oxford University Press, Oxford.
- Johansen, S., Juselius, K., 1990. Maximum likelihood estimation and inference on cointegration—with applications to the demand for money. Oxf. Bull. Econ. Stat. 52, 169–210.
- Kalirai, H., Scheicher, M., 2002. Macroeconomic stress testing: preliminary evidence for Austria. Austrian Central Bank (OeNB). Financial Stab. Rep. 3, 58–74.
- Kangogo, N.J., Asienga, I.C., 2014. Factors affecting non-performance of personal loans in banking industry: case study of tier one banks in Kenya. Conference Proceedings, 4th Annual Conference Kabarak University, 2014.
- Kasekende, L., Brixova, Z., Ndikumana, L., 2010. Africa: Africa's counter-cyclical policy responses to the crisis. J. Global. Dev. 1 (1).
- Keeton, W.R., Morris, C.S., 1987. Why Do Banks' Loan Losses Differ, Economic Review. Federal Reserve Bank of Kansas City, pp. 3–21.
- Kiyotaki, N., Moore, J., 1997. Credit cycles. J. Political Econ. 105, 211–248.
- Kavkler, A., Festić, M., 2010. The trade deficit and banking sector results in Romania and Bulgaria. Econ. Interferences 12 (27), 199–213.
- Klein, N., 2013. Non-performing Loans in CESEE: Determinants and Impact on Macroeconomic Performance. IMF Working Paper, 72.
- Kwaitkowski, D., Phillips, P.C.B., Schmidt Shin, P.Y., 1992. Testing the null hypothesis of stationarity against the alternative of a unit root. J. Econom. 54, 159–178.
- Llewellyn, D.T., 2002. An analysis of the causes of recent banking crises. Eur. J. Finance 8, 152–175.
- Louzis, D., Vouldis, A., Metaxas, V., 2012. Macroeconomic and bank-specific determinants of non-performing loans in Greece: a comparative study of mortgage, business and consumer loan portfolios. J. Banking Finance 36 (4), 1012–1027.
- Mallick, H., Agarwal, S., 2007. Impact of real interest rates on real output growth in India: a long-run analysis in a liberalized financial regime. Singap. Econ. Rev. 52 (2), 215–231.
- Masih, M., Hamdan, B., 2008. The impact of monetary policy on deposit and lending rates in industrial and developing countries: an application of ARDL approach. J. Int. Finance Econ. 8 (3), 114–122.
- Mawili, G.M., 2013. The impact of macroeconomic factors on non-performing loans in the Kenyan banking industry. In: Proceedings of the 1st Annual Research Conference, Jomo Kenyatta University, 12–13 September 2013.
- Mecagni, M., Corrales, J.S., Dridi, J., Garcia-Verdu, R., Imam, P., Matz, J., Macario, C., Maino, R., Mu, Y., Moheput, A., Narita, F., Pani, M., Rosales, M., Weber, S., Yehoue, E., 2015. Dollarization in Sub-Saharan Africa Experience and Lessons. IMF.
- Melander, O., Malika, P., Segoviano, M., Vamvakidis, A., 2011. Dancing spreads: market assessment of contagion from the crisis in the euro periphery based on distress dependence analysis. Int. Adv. Econ. Res. 17 (3), 347–363.
- Nkusu, M., 2011. Nonperforming Loans and Macroeconomic Vulnerabilities in Advanced Economies. IMF Working Paper, 161.
- Nikolaidou, E., Vogiazas, S.D., 2013. Credit risk modelling in the romanian banking system: evidence from an ARDL model. In: Karasavoglou, A., Polychronidou, P. (Eds.), Contributions to Economics: Balkan and Eastern European Countries in the Midst of the Global Economic Crisis. Springer.
- Nikolaidou, E., Vogiazas, S.D., 2014. Credit risk determinants for the bulgarian banking system. Int. Adv. Econ. Res. 20 (1), 87–102.
- Odhiambo, N.M., 2010. Finance-investment-growth nexus in South Africa: an ARDL bounds testing procedure. Econ. Change Restruct. 43 (3), 205–219.
- Peek, J., Rosengren, E., Kasirye, F., 1999. The poor performance of foreign bank subsidiaries: were the problems acquired or created? J. Banking Finance 23 (2–4), 579–604.
- Perron, P., 1989. The great crash, the oil price shock, and the unit root hypothesis. Econometrica 57, 1361–1401.
- Perron, P., 1997. Further evidence on breaking trend functions in macroeconomic variables. J. Econ. 80, 355–385.
- Pesaran, M.H., Smith, R.P., 1998. Structural analysis of cointegrating VARs. J. Econ. Surv. 12, 471–505.
- Pesaran, M.H., Shin, Y., 1999. An autoregressive distributed lag modelling approach to cointegration analysis. In: Strom, S., Holly, A., Diamond, P. (Eds.), Econometrics and Economic Theory in the 20th Century: The Ragner Frisch Centennial Symposium. Cambridge University Press, Cambridge.
- Pesaran, M.H., Shin, Y., Smith, R.P., 2001. Bounds testing approaches to the analysis of level relationships. J. Appl. Econ. 16, 289–326.
- Phillips, P.C., Perron, P., 1988. Testing for a unit root in time series regression. Biometrika 75, 335–346.
- Popov, A., Udell, G., 2010. Cross-border Banking and the International Transmission of Financial Distress During the Crisis of 2007–2008. European Central Bank Working Paper, 1203.
- Podpiera, J., Weill, L., 2008. Bad luck or bad management? Emerging banking market experience. J. Financial Stab. 4 (2), 135–148.
- Rinaldi, L., Sanchis-Arellano, A., 2006. Household Debt Sustainability: What Explains Household Non-performing Loans? An Empirical Analysis. ECB Working Paper, 570.
- Shrestha, M.B., Chowdhury, K., 2005. ARDL Modelling Approach to Testing the Financial Liberalisation Hypothesis. University of Wollongong Working Paper, pp. 5–15.
- Warue, B.N., 2013. The effects of bank specific and macroeconomic factors on nonperforming loans in commercial banks in Kenya: a comparative panel data analysis. Adv. Manage. Appl. Econ. 3 (2), 135–164.
- Washington, G.K., 2014. Effects of macroeconomic variables on credit risk in the Kenyan banking system. Int. J. Bus. Commer. 3 (9), 1–26.
- Waweru, N.M., Kalani, V.M., 2009. Commercial banking crises in Kenya: causes and remedies. Afr. J. Account. Econ. Finance Banking Res. 4 (4), 12–33.
- Zeman, J., Jurca, P., 2008. Macro Stress Testing of the Slovakian Banking Sector. National Bank of Slovakia Working Paper, 1/2008.
- Zivot, E., Andrews, K., 1992. Further evidence on the great crash, the oil price shock, and the unit root hypothesis. J. Bus. Econ. Stat. 10 (10), 251–270.