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Abstract

Financial sector reform is generally considered good for the economy as it engenders financial innovation and promotes efficiency in the financial system, potentially leading to higher economic growth. However, recent global evidence has shown that deregulation of the banking industry can sometimes have the unintended effect of destabilizing the financial system, contributing to macroeconomic instability and, in some cases, reversal of the economic growth. A salient feature of structural financial sector reforms is enhanced competition in the banking industry, with the attendant stability-fragility trade-off. Compared to other economies, Sub-Sahara Africa (SSA) financial system is broadly bank-based and weakly contestable, therefore, any systemic bank failures would have serious contagious repercussions in these economies. Combining both micro and macro factors, we implement a duration bank distress prediction model on a sample of SSA countries to identify the main internal and external risk drivers of fragility (insolvency) to the banking industry in the aftermath of financial sector reforms. The results indicate that bank-specific, macroeconomic and institutional factors are important in predicting episodes of bank distress.

JEL Classification: G21, G28, O23, O55

Key Words: Financial sector, banks, competition, fragility, macroeconomic stability

1. Introduction

The banking industry plays an essential role in the economy in terms of resource mobilization and allocation and, is by far, the most important part of the financial system in developing economies, accounting for the bulk of the financial transactions and assets. In addition, banks have recently expanded in other activities such as securities markets, fund management, insurance, among others, blurring the distinction between banks and other financial markets. Accordingly, it is expected that through reforms (increased competition), banks can potentially be the main source of financial innovation and efficiency or, in a worst case scenario, as a source of systemic risk to the financial structure through contagion, thus engendering macroeconomic instability and diminished investment and growth. The latter phenomenon was aptly evidenced by the recent global financial crisis which had its origin in excessive risk-taking behavior through the use of leveraged asset-price derivatives by financial institutions, mostly banks. Notably, in developing countries, lack of well-developed domestic capital markets and access to international capital markets makes the banking sector ubiquitous and, therefore, any systemic bank failures would have serious contagious repercussions in such economies.

Differentiating healthy banks from troubled banks raises important policy issues of early banking distress warning surveillance systems, effectiveness of monetary policy, and macroprudential regulations to enhance liquidity and soundness of the financial system. Studies of bank insolvencies, with an aim of developing models of early warning system for individual banks, have in the recent past relied on bank-level data, occasionally augmented by macro data, (Cole & Gunther, 1998). The indicators developed from these studies are closely related to supervisory rating system of banks, with the most widely known rating system for banks being CAMELS system.[1] It is important to note, however, that systemic bank failures are typically complex and differ from one country to another based on economic, institutional and socio-political heterogeneity.

[1] CAMELS is an acronym for Capital adequacy (C), Asset quality (A), Management (M), Earnings (E), Liquidity (L) and Systemic risk (S).

Over the past three decades, many Sub-Saharan Africa (SSA) countries have liberalized their financial systems, restructuring a majority of the state-owned commercial banks, thereby creating conducive environment for increased foreign bank entry and allowing acquisition of foreign assets by domestic financial firms. Received evidence shows that in developing countries with transparent financial regimes where financial sector reforms have been implemented, competition in the banking industry has generally improved[2] compared to countries characterized by less transparent financial sector regimes (Ariss, 2010; Beck, Demirguc-Kunt, & Levine, 2009; Claessens & Laeven, 2004). For instance in the East African countries, studies have shown that financial sector reforms stimulated competitive pressures in the banking industry (Yildirim & Philippatos, 2007; Berger, Klapper, & Turk-Ariss, 2009; Mugume, 2007). The results are robust to entry of foreign banks and bank privatization (Čihák & Podpiera, 2005). However, this evidence is not uniform. Other studies on SSA have reported limited effects of reforms on competition (Saab & Vacher, 2007; Buchs & Mathisen, 2005), with liberalization in some cases leading to financial crises (Fowowe, 2013). Less established, though, is the evidence on the relationship between financial liberalization (competition) and stability/fragility in the banking industry in these economies, particularly in SSA countries. Previous studies on SSA have overly focused on the efficiency effects of bank industry liberalization in the economy and the determinants of banking competition and profitability.

The objective of this study is to assess the implication of financial sector reforms on banking stability-insolvency nexus in a sample of SSA countries by examining variables relevant in explaining and predicting banking stability/fragility. Specifically, we assess the extent to which financial liberalization undertaken by these countries either contributed to stability in the banking industry or led to incidences of fragility (bank distress). This work builds on previous research in five important ways. First, to the best of our knowledge, this is the first study that analyzes the implications of increased competition in the banking sector resulting from financial sector reforms on the stability/insolvency of the banking system in SSA, with most of the previous work having been undertaken on developed

[2] In their study, (Demirguc-Kunt & Detragiache, 2005) noted that in the absence of well-developed institutions and good prudential regulation and supervisions, financial liberalization can also engender financial instability since reforms might afford banks greater opportunities for taking risks.

economies. Second, this study explores the proposition that banking stability/insolvency in SSA is not only a function of the regulatory environment, but also of macroeconomic and institutional factors thereby embracing the recent view on the need for a macroprudential approach to banking stability and fragility issues. Third, by computing the contribution of each explanatory variable to the estimated likelihood of banking fragility, it is easy to identify the sources of fragility and thereby facilitate the development of an effective early banking distress warning surveillance systems and macroprudential regulations to enhance liquidity and soundness of the financial system in SSA where the financial system is overly bank-based.

Fourth, the study is relevant because the banking industry in SSA provides an interesting analysis for the competition-stability hypothesis in developing countries given dominance of banks in their financial system. Since domestic money and capital markets are still in infancy or non-existent for most of the SSA countries, from a policy perspective, this assessment is especially important because it focuses on structural, supervisory and regulatory banking issues in view of the continued emphasis on financial liberalization of the banking industry in order to foster competition, enhance efficiency of the financial system and improve financial access and inclusion. Finally, currently given there is no study on SSA analyzing competition-stability/fragility trade-off, we believe this study provides an initial and useful step towards quantifying this relationship, even with the seemingly inadequate indicators of stability-insolvency nexus in the banking industry in the region. By exploring both country-specific, micro-bank and macroeconomic factors, hopefully, this study will stimulate discussion on a future operational financial surveillance index (and timing) of bank fragility (insolvency) in the region, and the framework could also be applied to other developing countries with financial system of similar salient features. More importantly, the analysis provides a basis for further work using bank-level data for the most recent period, particularly in the context of the global financial crisis.

This study utilizes the duration model for bank distress (fragility) prediction before and after financial sector reforms. This approach is preferred to the previously used static probit/logit models because it corrects for bank distress period at risk and allows for time-varying covariates (explanatory variables).

From a practical perspective, this we find this approach appropriate as it uses all the information available to yield bank distress probability estimates for all the banks in the sample at each point in time, thereby avoiding selection bias inherent in probit/logit models. Further, this approach allows for prediction of both the likelihood and timing of bank distress which is important to regulatory authorities. That is, by determining the likelihood and timing, the regulatory authority can assess whether a particular bank, exhibiting the characteristics of a distressed bank, needs to be rescued or closed down based on the lead time to crisis. We acknowledge the limitation in full implementation of this model for all of the SSA countries due to unavailability of long period data for most of the countries and variables.

The rest of the paper is structured as follows. Section 2 gives an overview of the relevant literature, focusing largely on the relationship between financial system regulatory reforms, bank competition and stability (insolvency) interactions. Section 3 provides a descriptive analysis of the stylized facts of the banking industry in selected SSA countries. Methodology and data issues are discussed in Section 4, while Section 5 focuses on the empirical analysis and discussion of the results. Section 6 provides conclusion and policy recommendations.

2. An Overview of Financial Reforms and Banking Competition-Stability Nexus

The policy debate on the market structure of the banking industry has over the years focused on the economic efficiency, bank profitability and growth effects of the intermediation role of banks in the economy. Perhaps, more than any other industry, concentration in the banking industry has for a long time been encouraged based on the perceived benefits of this concentration on financial stability at the national, regional and global levels.[3] Early to mid-1980s witnessed consolidation among banks in most of developed countries' financial systems, raising concerns about the implication of bank concentration on

[3] It should also be noted that analyzing competition in the banking industry is more complicated than other industries because of the multiple products and other services offered by banks which differs between domestic banks (depending on size and liquidity) and between domestic and foreign banks. For details see, for example, Berger et al., (2007).

stability of the financial system (Claessens & Laeven, 2004). The seminal work by Keeley (1990) on the impact of competition on increased US bank failures in early 1980s stimulated debate on the relationship between banking competition and financial stability/insolvency.

In a recent study, Beck et al., (2009) noted that over the 1980-2008 period, out of 105 countries sampled on bank concentration, 53% had three-firm concentration ratios above 0.9; 27% between 0.5 – 0.9 and only 20% below 0.5.[4] Further, over the same period, the largest global banks outstripped the importance of the overall financial sector, with the ratio of the top ten global bank's assets to world GDP increasing to 35% as the bank's annual assets growth rate of 9% outstripped the average world's GDP growth rate of 4%, indicating increased global banking concentration.[5] With deregulation of the financial systems across the globe (particularly in developed economies) in mid 1990s and early 2000 there was intense competition among banks and other non-bank financial institutions. This resulted in proliferation of contrasting studies that gravitated around the bipolar "competition-stability" and "competition-fragility" analysis, albeit with mixed findings.[6]

In reality, the relationship (trade-off) between bank *competition and financial stability* and *competition and fragility* is more complex, in part due to the intricacies and unique position that banks occupy in the economy, (Allen & Gale, 2004; Bikker & Haaf, 2002). The empirical literature on these relationships, mainly based on developed country context, has produced mixed results. Broadly, critics of financial deregulation that leads to intense competition in the banking industry assert that banks' aggressiveness undermines stability, largely due to increased risk-taking behavior associated with heightened competitive behavior among banks (Hoggarth, Milne, & Wood, 1998; Bolt & Tieman, 2004). On the other hand, Demirgüç-Kunt and Detragiache, (1998) go further and posit that the detrimental effect of financial sector liberalization on the fragility of the banking is weaker when the institutional

[4] Three-firm concentration ratio refers to share of the three-largest commercial banks in the economy, ranging from 0 – 1, with 0 indicating no concentration and therefore a more contestable market while 1 indicated the highest concentration by the three largest banks.

[5] In the US where the bulk of the academic research on banking market structure has been undertaken, for instance, the increase in the ratio of bank's assets to GDP was 15%.

[6] For a more comprehensive literature review on *competition-stability* and *competition-fragility* theses see, for example, Čihák et al., (2006) and Carletti and Hartmann (2002) and the references therein.

environment is strong.[7] Recent studies provide additional support for the argument that high concentration and banks' exercise of market power is good for bank stability (Bretschger, Kappel, & Werner, 2012; Ariss, 2010).

Using a model of risk-taking by banks with two periods and two states, Keeley (1990) shows that as competition increases in the banking market, risk-taking by banks also increases and becomes contagious. Allen and Gale (2000) corroborate this finding in a model of competition and risk-taking aimed at demonstrating the agency problem.[8] They pointed out that when firms are debt-financed (e.g. deposits for banks), managers acting in the interest of the shareholders have an incentive to take excessive risk since the manager's performance is adjudicated based on quarterly returns, with debt holders bearing the downside risk while the shareholders benefit from upside potential return. As a corollary, Hellman et al., (2000) noted that stiff competition leads to financial institutions making riskier investments in order to generate sufficient profits for shareholders or in order to maintain their market share, engendering financial stability as a result of bank-runs from contagion.

In a sample of 69 countries over 1980-1997 period, Beck et al., (2006) estimated how the likelihood of financial crises depended on various banking system, regulatory and country characteristics. They found no evidence that increased concentration led to greater banking sector fragility. However, they noted that stability was higher in countries where regulations preventing entry or wider banking activities were lower and institutional environment conducive to competition. Similarly, using a sample of 38 countries over 1980-2003, Cihak et al., (2006) estimated the Panzer-Rosse *H-Statistic* to depict competition in assessing the relationship between competition and stability. They used cross-sectional data on the occurrences of crises. Based on duration and logistic probabilistic model to predict occurrence of crises, they found that greater competition was associated with a lower risk of crisis, while higher

[7]Honohan (2000) contends that, whereas the government can impose financial repressions in the banking sector, the arguments advanced by the policy makers are that at least the financial system would be protected from some of the risks associated with financial liberalization such as removal of interest rate controls and restrictions on foreign entry, particularly where macroeconomic conditions are not stable, as is the case with some of the SSA countries.

[8] Similar findings are also in Allen and Gale (2004) who adopted a Cournot competition model in which banks choose the volume of deposit they want, subject to an upward slopping supply of funds schedule.

concentration per se does not increase the risk of crisis, but noted that more restrictive regulatory environment may contribute to a build-up of instability. The type of monetary policy regime has also been found to be a factor in banking crises. In their study, Boyd et al., (2004) reported that monopolistic banking systems tend to be vulnerable if inflation rate was below certain threshold and vice versa for competitive markets if inflation rate is above certain threshold.

However, proponents of financial deregulation and the resulting competition in the banking industry argue that it fosters stability as well although this is conditional on robust regulatory and supervisory regimes. In particular, Staikouras and Wood (2000); Allen and Gale (2004) and Schaeck et al., (2009) show that competition in banking industry is not detrimental to stability of the financial system. Thus, as Beck (2008) and Northcott (2004) have argued, any signs of instability can mainly be attributed to weak regulatory regimes, and tends to be a short-term phenomenon which can be remedied by strengthening regulatory systems. In the long-run, authorities should endeavor to promote competition among banks to lower intermediation costs and increase access to finance, necessary for economic growth (Beck, Demirgüç-Kunt, & Maksimovic, 2004; Pagano, 1993). Further, while acknowledging the resilience of large banks in a concentrated market, Beck et al., (2003) pointed out that systemic importance of large banks may induce "too-big-to-fail" mentality among the public and policy makers, with the implicit guarantee of survival leading to excessive risk-taking. Moreover, large banks may be opaque with weak internal control systems, thereby rendering them less effective. This phenomenon was evident during the Latin American and Asian financial crises in the 1990s and was the main trigger of the global financial crisis in 2008.

Lack of large dataset on the episodes of financial crisis and the level of bank concentration in developing countries, particularly SSA countries, has hampered research in understanding the competition-stability and competition-fragility nexus.[9] A majority of the studies on banking in SSA are focused on the effect of bank competition on cost-efficiency analysis, and the role of commercial banks in

[9] Appendix C provides timeline of the onset and end of the banking crises in a sample of SSA countries.

monetary policy transmission mechanism or economic development.[10] In their study, Caminal and Matutes (2002) find ambiguous evidence between market power and bank stability. The inconclusive evidence of the competitive effects of reforms probably reflects the process of financial liberalization undertaken by individual countries, and the strength of supportive institutions. In general, reforms are effective under conditions of good quality institutions, particularly preceding the reforms (Lensink, Meesters, & Naaborg, 2008).

Whereas financial repressions by the governments in SSA in pre-1990s tended to limit competition, the general argument by the authorities in these countries was that at least the banking system was protected from the risks posed by a liberalized financial sector, such as removal of controls on interest rates and relaxation of foreign entry restrictions.[11] This argument has especially been observed in economies with an unstable macroeconomic environment and therefore, arguing that liberalization would render interest rate volatile with severe repercussions on the financial sector and the real economy (particularly when real interest rates remain relatively high after liberalization). Further arguments against competition were that increased competition for market share following liberalization of foreign entry can result in narrower profit margins, contributing to excessive risk taking (unsound lending), resulting in in increased exposure to market and credit risks. However, while these might be valid arguments, the preceding discussion has established that there is no clear-cut relationship between competition-stability and competition-fragility, as this might vary depending on institutional and market conditions. We explore these aspects further below in the context of banking systems in SSA countries.

[10] For review see, for example, Davoodi et al., (2013); Sanya and Gaertner (2012); Buchs and Mathisen (2005); Čihák et al., (2006); Čihák and Podpiera (2005), among others.

[11] In their study, Bretschger et al., (2012) posit that in developing countries, excessive government involvement in the banking system can have two unintended effects. The degree to which the government uses the financial system to squeeze resources to support the budget directly or indirectly can expose banks to erosion of capital base. On the other hand, when the government becomes aware of the risk to viability of the financial system, it often provides opportunities for the banks to earn profits through high margins business via limiting competition (e.g. restriction on foreign banks entry, number of branch expansion, imposition of credit ceiling, etc) often at the expense of the customer.

3. Stylized Facts on the Banking Sector in Sub-Sahara Africa

The success of financial sector reforms is dependent on the speed, sequencing and the scope of reforms. Prior to the reforms, SSA countries were characterized by narrow financial systems, which were not equipped to sustain a comprehensive banking sector reform process over a short period. Most of the SSA countries exhibit heterogeneity in terms of characteristics of their financial systems in terms of the depth of their financial markets and sophistication of their financial markets. In general, the financial sector in SSA is underdeveloped on various dimensions of financial development such as depth and efficiency (Čihák *et al.,* 2012) with a dominance of banks, which, in comparison to other regions are relatively small but concentrated with a dominance of foreign-owned banks. Indeed Beck *et al*. (2011) estimated that an average bank has total assets of USD 220 million compared with the balance sheet of a non-African bank with an average of about out USD 1 billion in total assets.

Table 1: Characteristics of Financial System in Selected SSA Countries, 2008-2010

	Depth of financial institutions				Sophistication of financial markets
Country	Private credit/GDP (%)	Accounts per 1,000 people	Lending-deposit spread (%)	Commercial bank's weighted average Z-Score	Stock market turnover ratio (%)
Ethiopia	17.2	91.7	3.3	10.3	3.5
Ghana	14.0	298.8	5.0	15.4	5.9
Kenya	29.0	328.4	9.1	19.2	13.9
Malawi	11.7	102.4	21.5	18.9	2.1
Mauritius	80.8	823.4	11.0	23.5	10.1
Namibia	44.5	635.3	5.0	41.1	3.4
Nigeria	31.1	245.6	6.5	13.3	24.3
South Africa	75.8	882.9	3.4	27.1	69.9
Tanzania	14.4	126.6	17.3	19.9	6.7
Uganda	12.3	169.5	11.2	10.6	0.5
Zambia	11.8	153.7	13.7	7.6	14.8

Source: World Development Indicators and Čihák et al., (2012). Note: The countries were selected on the basis of availability of data on all metrics.

There are variations within SSA with South African banks being larger than other sub-Saharan banks. Foreign bank ownership is estimated to account for over 60 percent of overall banking system assets in

SSA which is comparable to Europe and Central Asia, but considerably higher than East Asia and Pacific, Latin America and Caribbean and Middle East and North Africa (Mlachila, Park, & Yaraba, 2013). Financial intermediation remains low in SSA. Indeed, as seen in Table 1, financial intermediation (as measured by the ratio of private sector credit to GDP) is higher in upper middle income countries, notably South Africa and Mauritius, but less in low-income countries (Malawi, Uganda, and Tanzania) and those that recently graduated into middle income status, such as Zambia and Ghana.

Further, countries that have had the lowest level of sophistication of the financial sector are also those with the lowest levels of efficiency as evidenced from the highest spreads particularly in Malawi and Tanzania. The high spread (and inefficiency) can in part be attributed to the oligopolistic nature of the market structure,[12] especially in middle income SSA countries; Kenya, Mauritius, Tanzania, Uganda and Zambia, (Mlachila, Park, & Yaraba, 2013). It should be noted that, the low spreads in Ethiopia reflects less of bank competition rather an indication of government intervention in the financial sector including regulating interest rates, at levels perceived to consistent with social goals of the country. The low degree of financial development in low-income SSA countries and frontier markets can also be seen in illiquidity in financial markets, with the stock market playing a minimal role as a source of alternative source of finance. This leaves banks as the most dominance players in the financial system, itself an indicator of financial underdevelopment. This is also reflected in a low level of financial penetration or outreach. In Zambia, for instance, only a third of the adult population has access to a bank account. Further, as Table 1 illustrates, the severity of financial exclusion is mostly manifested in the low number of bank accounts per 1,000 people, particularly in Ethiopia and Malawi. It is noteworthy however, that in some countries, such as Kenya, the proliferation of mobile banking e.g. M-PESA, which has revolutionized the banking sector has greatly fostered bank penetration and increased financial access (Ondiege, 2013). According to the IMF, M-PESA processes more transactions domestically daily than Western Union does globally

[12] A recent 2013 Central Bank of Kenya (CBK) report showed that the average spread of the top six banks in Kenya was 15.3% (lending rate of 19.7% and deposit rate of 4.4%) compared to 11% of the smaller banks, the high spread accounted for 40% of the profit margin of these large banks, http://www.centralbank.go.ke/index.php/monthly-economic-reviews-2

reaching more than 70 % of the country's adult population (IMF, 2011). Until recently, statistics were not captured in the conventional access rates.

Broadly, however, banks in these countries are generally stable, with the weighted Z-core in excess of 10, with the exception of Zambia, where it fell below 10. Recent regulatory changes requiring banks' to increase their capital base is likely to bring Zambian banks in line with regional peers in terms of strengthening stability and enhancing resilience. This notwithstanding, previous financial sector assessments, such as the financial sector assessment programs have given the Zambian financial sector, and banking system in particular, a clean bill of health, underpinning the country's commitment to reforms. This general health of the financial sector is consistent with the reform agenda in the 1980s and 1990s aimed at strengthening capital bases and risk management (Mlambo, Kasekende, & Murinde, 2012)which has resulted in marked decline in the incidence of systematic banking crises (Mlachila, Park, & Yaraba, 2013). Further, given the dominance of banks in SSA financial activities, countries that implemented rapid financial reforms suffered immense instability to their economies, (Kasekende, 2010).[13] For instance, in Zambia where financial liberalization was rapidly implemented under conditions of severe macroeconomic imbalances, liberalization of interest rates translated into steeply high nominal interest rates. This eroded the quality of existing loans, further intensifying banks' financial fragility (Brownbridge, 1996). As a result, over 1995 – 1998 period, more than six banks became insolvent and went out of business.

The proliferation of both local banks and subsidiaries of foreign banks after relaxation of entry requirements posed considerable regulation and supervisory challenges for supervisory authorities in a number of SSA countries, since many of these banks lacked managerial capacity and banking experience. In Nigeria, for instance, financial liberalization was undermined by persistent fiscal deficits which hampered the central bank's use of indirect instruments for monetary policy. This resulted in unstable interest and exchange rates, triggering illiquidity in the banking sector. Consequently, four banks were

[13] For an overview of cross-country liberalization and regulatory experiences in SSA, see for example, (Mlachila, Park, & Yaraba, 2013) and (Mlambo, Kasekende, & Murinde, 2012).

closed between 1994 and 1995 while 13 were taken over by the central bank as part of the restructuring exercise (Brownbridge, 1998). Generally, the spate of bank failures in SSA was also attributed to proliferation of non-performing loans in the early 1990s, many of which were as a result of insider borrowing (Fofack, 2005) but also due to instability in the macroeconomic environment during the period of financial liberalization.

In other countries, including Ethiopia and Ghana, reforms were gradual. The process took the form of restructuring of public sector banks to make them more financially viable before privatization. However, Worku (2011) has questioned the timing and sequencing of the reforms in Ethiopia and argues that the benefits of financial liberalization have been limited. The regulatory restriction of foreign bank entry has particularly been detrimental to the Ethiopian banking system, from the perspective of competitive conduct, and the policy should therefore be reconsidered. Financial distress in the banking sector was itself a precursor to the reforms in Cameroon, Senegal and Uganda and the reforms included improvements in operating procedures and strengthening of regulatory and supervisory framework (Fowowe, 2013). In Botswana, the level of bank distress was lower and the policy response took a mild and more targeted approach.

However, the pitfalls of financial liberalization are also numerous. As earlier noted, liberalization of interest rates and lower inflation has largely benefitted the banks since they charge higher lending rates, while savings rates have remained stagnant or even negative in real terms, thereby discouraging sufficient savings mobilization. Although lending rates have been declining in recent years, they nonetheless remain high and loan default rates are not uncommon in most sub-Saharan African countries. According to the World Bank data (World Bank, 2013) more than 10% on average of the SSA banks' loan portfolio relative to total assets is impaired. This has induced banks to engage in 'cream skimming' activities, resulting in accumulation of huge liquid and less risky assets at the expense of more credit to the private sector, particularly to small businesses. Indeed the banking systems in SSA have been characterized by significant excess liquidity reflecting the scarcity of what are deemed to be credit-worthy borrowers

(Mlachila, Park, & Yaraba, 2013). Not only has this starved the private sector of investment funds, but also complicates conduct of monetary policy, creating a gridlock in the interbank market (Saxegaard, 2006).

Further, the majority of banks in SSA countries tend to be risk-averse and elect to invest in relatively more attractive government treasury securities. In Zambia, for instance, investment in government securities has averaged about 20% of total assets since 2005, earnings banks up to a third of total interest income. In Uganda, the proportion of treasury bills as a share of the total assets exceeded that of loans between 2002 and 2003. In general, reliance of the banking system on government securities has been a hindrance to effective financial development and deepening of the capital and money markets mainly because banks purchase and hold these securities to maturity without the need for trading them in the secondary market. Ikhide (1998) observed that, in terms of institutional setting, a robust secondary market meant to foster active participation could not thrive in Nigeria due to the dominance of the primary market for government securities. Consequently, the economic impact of bank lending in SSA has been limited as firms with opaque credit record are rationed out of the credit market. The failure to foster development of alternative sources of financing presents another shortcoming of financial reforms in a majority of the SSSA countries. In particular, with the exception of South Africa, the capital market is severely underdeveloped in a most of the SSA countries. In 2011, the average value of the stock market relative to GDP was 42%. However, if we exclude South Africa, the figure falls by about half to 23%.

In terms of performance and conduct, there are cross-country variations in SSA. Table 2 presents selected average banking structure and financial performance indicators in SSA as a whole, while Table 3 replicates the same disaggregated information for a selected group of SSA countries. From Tables 2 and 3, we observe that between 1998 and 2002, the three largest banks accounted for more than 80% share of the market with this declining to 73% over the period 2008-2011. Although this represents a reduction from the early reform period, it still reflects the dominance of few commercial banks in financial system. Nigeria recorded the largest increase in banking concentration during 2008-2011 relative to the early reform period. The share of assets held by three large banks rose to 57% from 49%, following banking

consolidation through an increase in minimum capital requirements in the wake of systemic financial weaknesses, which prompted regulatory action by the central bank. The affected banks accounted for about a third of Nigeria's banking system assets (Mlachila, Park, & Yaraba, 2013). In Table 2, there is an indication of significant participation of the government in the financial (banking) sector, through issuance of government securities in the primary market as would be evident from low loan-deposit ratios averaging 70 percent. This has reinforced, the lower level of financial intermediation compared to other developing regions of the world with the limited access to finance, reflecting low income levels, small absolute size and financial infrastructure weaknesses (Mlachila, Park, & Yaraba, 2013).

Table 2: Bank Performance Indicators of SSA Countries, (period average, %)

	1998-2002	2003-2007	2008-2011
Bank assets to GDP	18.27	21.10	26.22
Bank private sector credit to GDP (FinDev)	13.85	16.29	20.48
Bank deposits to GDP	17.73	21.07	26.72
Bank credit to deposits	73.59	70.12	70.91
Bank overhead costs to total assets	5.85	6.35	5.53
Net interest margin (NIM)	7.65	7.24	6.35
Bank concentration ratio, CR3	84.39	77.01	73.06
Return on assets, (ROA)	2.37	4.49	1.95
Return on equity (ROE)	21.26	23.29	16.96
Bank cost to income ratio (CIR)	56.84	56.80	58.33
Bank Z-Score	13.76	13.96	14.91
Non-performing loans to gross loans (NPLs)	..	10.59	7.42

Source: Authors' computations based on data from Demirgüç-Kunt, et al., (2012); World Development Indicators, 2013 (Online Version)
Notes: ..= not available

Bank efficiency also exhibits mixed performance across all countries. However, the evidence shows persistently high net interest margins (NIM), largely reflecting limited competition in the banking industry. But this is not just unique to SSA because since the global financial crisis, banks in most countries have also recorded a decline in NIM. The average NIM for SSA fell to 6.4% over 2008 - 2011 period from above 7% for the period preceding the crisis (2003-2007) but this figure remained relatively higher than the average for East Asia and Pacific countries of 3.7%, 5.6% for Latin America and Caribbean, and the global average of 4.4%. The high interest margins in SSA is largely attributed to high levels of bank concentration and cost inefficiency (Bawumia, Belnye, & Ofori, 2005; Beck & Hesse,

2009; Ahokpossi, 2013) as well as dominance of few large (foreign) banks. Recent empirical studies have observed that the banking sector in many SSA countries is oligopolistic and dominated by large foreign banks, even after the reforms (Mugume, 2007; Hauner & Peiris, 2008; Simpasa, 2011; 2013). Paradoxically, the largest decline in NIM between 2003-2007 and 2008-2011 periods was recorded in SSA countries with relatively less developed financial systems and low degree of financial sophistication. For example in Burundi, the NIM fell by 4.1% points to 6.0% while in Guinea, the reduction was more than 8 % points to 4.6%. Incidentally, both countries had some of the lowest traditional measures of financial development.

Although bank concentration is still relatively high in SSA, there is little to suggest that this has an impact on bank returns. Broadly, banks operating in a concentrated industry tend to enjoy monopoly rents, however, as data in Tables 3 and 4 shows, the return on assets (ROA) more than doubled in the mid-2000s, a period in which bank concentration also declined. The fall in ROA during the global financial crisis coincides with the decrease in the level of concentration. However, given the inherent structure of the banking system in SSA, the fall in profitability may be a manifestation of the effect of the financial crisis rather than the increase in competitive conduct.

Subsequent to the reforms, the banking systems in most countries in SSA have become progressively more stable and relatively resilient to external shocks.[14] As a measure of insolvency risk, the Z-score has fallen by a margin of 1 percentage point during the post crisis period compared with earlier years. However, for a number of countries, the immediate impact of the global financial crisis was to heighten banks' fragility, although this was soon overcome by regulatory intervention and strengthening of banks' own internal governance structures and management vigilance.

[14] This is notable from the fact that none of the largest banks in SSA received any government funding (recapitalization), compared to over 60% of the largest banks (commercial and investment) in the US and EU. On of the arguments advanced for this divergence in experience is that most them were not involved in the sophisticated and highly leveraged lending, lower exposure to the real estate market, decreased lending to the government and the relatively low share of foreign lending in SSA loan portfolio (also given that most of them have fewer subsidiaries outside their countries).

Evidence shows that banks with less shareholder influence within the corporate governance structure tend to be less risky relative to those characterized by comparative shareholder power (Laeven & Levine, 2009). For instance in Nigeria, central bank action led to bank consolidation after escalation in loan losses threatened systemic financial stability. This notwithstanding, Nigerian banks have remained financially distressed, as evidenced by the sharp fall in the Z-score from a high of 4.7% in 2007 to -4.5% in 2009. However, in South Africa, despite the country's financial integration into the global financial landscape and exposure to the euro zone crisis, the banking system remains solidly stable with adequate capitalization and relatively buoyant liquidity (SARB, 2013). Equally, the banking systems in Kenya and Uganda have also shown strong resilience, largely fostered by increases in equity capital buffers and low volatility of asset returns. Thus, the severity of insolvency risk in individual country banking systems reflects differences in regulatory response, other bank-level structural and institutional underpinnings, and exposure to external shocks.

Table 3: Bank Performance Indicators of Selected SSA Countries, (period average, %)

	1998-2002						2003-2007						2008-2011					
	NIM	CR3	ROA	ROE	CIR	Z-Score	NIM	CR3	ROA	ROE	CIR	Z-Score	NIM	CR3	ROA	ROE	CIR	Z-Score
Angola	4.3	92.8	1.0	10.1	57.2	8.7	6.6	80.4	2.7	26.5	46.4	10.4	6.3	69.5	3.3	33.8	41.0	10.9
Benin	4.2	86.2	1.4	17.4	62.0	15.8	4.8	85.0	0.6	6.4	68.1	16.8	4.2	86.7	1.2	13.6	63.4	16.7
Botswana	6.6	95.1	3.7	48.6	49.5	16.4	6.5	79.5	3.9	60.2	45.5	14.6	5.6	73.0	2.9	46.2	46.7	14.1
Burkina Faso	5.0	77.8	1.9	21.0	62.1	9.2	6.3	59.3	1.2	14.1	61.0	8.6	4.4	62.9	0.5	5.9	60.8	7.3
Burundi	9.8	89.7	2.9	24.2	47.3	19.5	10.1	98.6	2.0	17.9	67.4	16.5	6.0	91.7	3.0	26.9	61.4	19.0
Cameroon	3.7	74.8	1.8	24.3	44.6	17.1	4.6	59.0	1.4	17.5	39.9	18.5	4.2	67.2	1.0	13.9	62.8	15.2
Cote d'Ivoire	5.6	79.6	0.9	10.5	62.8	18.0	5.2	66.8	1.0	9.5	68.7	22.6	4.4	74.4	1.5	15.6	68.8	20.5
Ethiopia	2.7	90.8	0.9	10.4	47.7	8.2	3.8	90.0	2.4	26.0	38.0	9.8	4.9	85.2	3.3	35.8	31.8	10.1
Gabon	6.8	100.0	2.8	17.4	46.1	17.9	4.3	98.1	2.4	16.9	42.1	15.9	4.8	96.6	1.2	10.0	64.3	11.1
Ghana	12.6	100.0	5.1	60.7	41.4	6.5	13.5	89.1	5.2	48.8	52.0	7.9	9.9	47.2	2.1	17.4	61.7	7.1
Guinea	7.7	..	2.0	21.3	85.3	5.2	13.0	..	5.0	43.2	53.8	7.6	4.6	..	1.3	23.4	66.5	3.2
Kenya	7.2	62.2	0.9	8.2	61.2	9.5	8.2	53.2	2.6	20.5	59.0	12.7	7.8	43.7	3.3	22.7	55.1	14.6
Mali	5.9	83.6	0.9	7.6	67.7	21.0	6.2	75.8	0.9	7.3	62.7	18.4	4.6	66.6	1.3	12.8	64.6	14.8
Mauritius	3.7	88.0	3.2	16.4	20.4	31.0	3.6	75.8	2.7	14.3	39.2	27.8	2.9	50.1	2.0	14.6	51.0	18.8
Nigeria	8.8	29.9	2.6	26.4	61.9	3.3	7.3	49.1	2.6	18.1	63.6	4.5	6.4	57.4	-1.6	-64.4	80.0	1.1
South Africa	3.9	85.6	1.5	7.4	55.7	30.1	5.3	87.8	1.3	22.4	62.5	10.1	2.9	78.2	1.0	16.4	54.9	9.0
Uganda	10.4	64.6	3.8	43.2	50.7	13.2	11.7	65.5	3.6	37.9	55.3	14.0	9.5	56.1	3.4	24.4	59.3	18.6
Zambia	5.0	64.6	-0.1	-0.5	82.3	11.8	7.1	57.5	1.4	12.9	73.0	12.0	9.5	59.2	1.5	14.8	65.3	11.4
Av for above sample	**6.3**	**80.3**	**2.1**	**20.8**	**55.9**	**14.6**	**7.1**	**74.7**	**2.4**	**23.4**	**55.5**	**13.8**	**5.7**	**68.6**	**1.8**	**15.8**	**58.9**	**12.4**
Mean for SSA	**7.7**	**84.4**	**2.4**	**21.3**	**56.8**	**13.8**	**7.2**	**77.0**	**4.5**	**23.3**	**56.8**	**14.0**	**6.3**	**73.1**	**2.0**	**17.0**	**58.3**	**14.9**

Source: Authors' computations based on data from Demirgüç-Kunt, et al., (2012); World Development Indicators, 2013 (Online Version)
Notes: ..= not available

Table 4: Correlation Coefficients

	NIM	CR3	ROA	ROE	CIR	Z-Score	FinDev
NIM	1.00	0.05	0.42	0.23	-0.03	-0.14	-0.28
CR3	0.05	1.00	0.18	0.13	-0.13	0.01	-0.11
ROA	0.42	0.18	1.00	0.60	-0.41	0.05	-0.07
ROE	0.23	0.13	0.60	1.00	-0.32	0.00	-0.14
CIR	-0.03	-0.13	-0.41	-0.32	1.00	-0.22	0.21
Z-Score	-0.15	0.01	0.04	0.00	-0.22	1.00	0.21
FinDev	-0.29	-0.11	-0.07	-0.08	-0.13	0.21	1.00

Source: Authors' computations based on data from Demirgüç-Kunt, et al., (2012)

Whether the probability of bankruptcy or insolvency risk is a factor of competitive conduct or other factors is a matter of ongoing empirical debate. Table 4 shows the correlation among different financial and banking performance indicators, we note that, the relationship between insolvency risk and concentration is not adduced by the data. A correlation between the Z-score and the concentration ratio is 1%. The absence of a robust relationship may suggest that banking competition does not engender fragility. However, given the limitations of concentration ratios as measures of competition, this relationship must be interpreted with caution.

The discussion above indicates that financial reforms are critical to strengthen banks' resilience to shocks, and fostering financial stability. As a result, fewer banks have experienced financial difficulties despite increased exposure to international markets than was previously the case. Notably, a high level of concentration does not fully capture the degree of contestability in the banking system, and may thus not be a good measure of competition. The analysis also shows cross-country variations, with progress especially lacking in countries where reforms have not been deep enough, or institutions are still weak.

4. Methodology and Data

Studies on banking crises/fragility prediction have extensively used the probit/logit framework (Demirgüç-Kunt & Detragiache, 1998; Beck, Demiguc-Kunt, & Levine, Bank concentration, competition and crises: First rsults, 2006), among others. However, the disadvantage of this approach is that it is static, thereby, not able to capture dynamics of banking distress in terms of timing and likelihood of a crisis over time. In addition, these models are not able to separate the determinants of likelihood of bank failure and timing of banking distress, which is particularly important to policy makers since these two phenomenon are driven by different factors. For instance, information about the types of factors that influence timing of banking distress could be important in designing regulatory closure rules and gain insight into the process of financial deterioration in order to halt bank failures.

To overcome these shortcomings of the probit/logit model, our study implements duration model with time-varying covariates.[15] This approach provides the conditional probability of observing banking distress at period *t*, assuming no such bank distress has occurred in the economy until period *t*. The main advantages of using the duration model compared to the conventional probit/logit approach is that the duration model recognizes that the probability of a bank becoming distressed may vary over time depending on bank-specific, country-specific and macroeconomic conditions. Further, duration model does not require strong distributional assumptions associated with probit/logit models. Finally, duration model is important in allowing a distinction to be made between failing and surviving firms. This is imperative to regulatory

[15] Another term for duration analysis is survival analysis. These terms will be used interchangeably throughout the remaining sections. This approach has been used in many finance-related studies in predicting firm bankruptcies, share prices, dividends, etc (Shamway, 2001; Theodossiou, 1993; Wheellock & Wilson, 2000). Compared to the time-varying covariate approach adopted in this study, the models used in the finance literature use constant covariates from beginning of the measurement period t_0 to the time of the measurement $T = t_i$. This approach limits application using macroeconomic variables since they do not remain constant over time.

authorities given the high regulatory costs associated with bank insolvencies and closure. Using this model it is therefore possible for regulators to seek to rehabilitate banks identified as having sufficient lead time for corrective measures and enforcement actions, while those banks with the shortest expected survival time (duration) could be targeted for immediate closure.

The principal tenets behind duration analysis are the survivor function ($S(t)$) and hazard function ($h(t)$), (Theodossiou, 1993; Kieffer, 1988). Survival time analysis permits us to determine the factors that explain the duration of a given state. The variable of interest in these models is the time it takes a system to change from one state to another (duration), and such change is associated with an event (e.g. bank failure or success), which indicates the ending of an event the "next period" whose duration we model, (Cleves, William, & Roberto, 2004; Whalen, 1991). This random variable (duration) takes a positive value, T, whose probability distribution can be characterized by any of the three functions:

(a) Distribution Function: $F(t) = \text{Prob}(T \leq t)$ (1)

(b) Density Function = $f(t) = \frac{dF(t)}{dt} = \frac{-dS(t)}{dt}$ (2)

(c) Survival Function: $S(t) = \text{Prob}(T \geq t)$ (3)

The density function (2) is the the time to failure, while survival function (3) is the probability that the random variable duration, T, equals or exceeds the value t. Note that, the survival function (3) can be expressed as one minus the cumulative distribution function (1), that is, $1 - F(t)$. We can therefore formulate the conditional probability of leaving the state of being a non-distressed banking system within the time interval t until $t + h$, given the survival time as;

$P\{t \leq T[t(t+h)]|T \geq t\}$ (4)

A hazard function can be derived from the probability in (4) as follows;

$$h(t) = \lim_{\Delta t \to 0} \frac{P\{t \leq T[t(t+h)] | T \geq t\}}{\Delta t} = \frac{f(t)}{S(t)} \qquad (5)$$

The hazard function in (5) is the instantaneous rate of leaving the state of no-distress per unit of period at *t*. Note that equation (5) is just a ratio of functions (2) and (3).

When introducing explanatory variables, the effect of the regressors is to multiply the hazard function, *h*(*t*), itself by a scale factor. It should be noted that interpretation of the explanatory variables depends on the specification, and the signs of the coefficients indicates the direction of this effect on the conditional probability, (Cole & Gunther, 1998; Theodossiou, 1993). The econometric proportional hazards is specified as;

$$h(t, X(t), \beta) = \lim_{\Delta t \to 0} \frac{P\{t \leq T[t(t+h)] | T \geq t, X(t), \beta\}}{\Delta t} = h_0(t) \exp(\beta' X_t) \qquad (6)$$

Where X_t denotes the time varying covariates (explanatory variables), while β is a vector of parameters to be estimated, $h_0(t)$ is the baseline hazard function which determines the shape of (6) with respect to time. This can be any complicated function as long as $h_0(t) \geq 0$. Finally, $\exp(\beta' X_t)$ provides a convenient interpretation of the coefficients due to its non-negativity. We estimate (6) using the maximum likelihood estimation technique;

$$f(t|\alpha, \beta, X) = \prod_{i=1}^{M} h_0(t_i|\alpha)^{\delta_i} \exp((\beta^T X)^{\delta_i} S_0(t_i|\alpha)^{\exp(\beta^T X)} \qquad (7)$$

If $\delta_i = 1$, bank *i* is right censored and 0 otherwise, for *i* = 1, ……M. The total number of banks in the sample is denoted as M. Model (7) can be modified (e.g. split-population) to allow for the

possibility that the sample of the banks can be split between failures and survivors, to facilitate inference about the separate effects of a given variable on the failure and timing of bank distress.

Data

This study is based on dataset of a sample of 16 SSA countries over 1995 – 2010 period.[16] We excluded countries for which we did not have sufficient observations for the explanatory variables and some for which we thought were outliers (e.g. Zimbabwe, Somalia, Central African Republic, etc), while others were deemed either to have small banking industry (dominated by state-owned banks) or with financial sector that is not fully liberalized. The countries chosen in the study sample account for over 70% of the SSA banking market share, therefore, it is prudent to surmise that the sample is fairly representative for the purpose of our analysis. Due to large number of missing entries, balance sheet and income statements of sample of 662 banks were selected from BankScope. This may potentially lead to under-recording of distress episodes in some of the countries. Coverage of SSA's banks is high in terms of total assets, about 85%. This confirms the fact that SSA financial sector is dominated by banks (i.e. bank-based financial system).

Banks are classified as distressed (fragile) based on the data from BankScope and national authorities. Most of the literature on banking distress defines bank failure when the financial

[16] We used bank-level data available from BankScope and other information was obtained from the International Financial Statistics (IFS) and World Development Indicators (WDI) databases as discussed in the appendix. One of the shortcomings of using BankScope data is that the complete data exists for a few SSA countries and with relatively shorter period of time. Further, some of the SSA are characterized by informal economy, lacking widespread banking services. Nevertheless, we still feel confident that because of representative share of the banks in our data, we are able to test the implication of financial sector reforms on bank competition-stability/fragility hypothesis based on a host of bank-specific, country-specific banking, macroeconomic, and institutional factors. Appendix A provides a list of the sample of the SSA countries. Information on all the variables and data sources used in the analysis is provided in Appendix B.

institution either received external support or was directly closed; bank failure was identified as one of the following categories (Gonzalez-Hermosillo, 1996):

(a) Financial institution was recapitalized by either the central bank (liquidity injection) or strategic investor.

(b) Financial institution was acquired by another financial institution.

(c) Financial institution's operations or license was temporary suspended by the regulatory authority.

(d) Regulatory authority closed the financial institution.

This categorization is intended as broader concept of bank fragility rather than the more restrictive *de jure* failure (i.e. shut down).[17] Since our sample period is 1995- 2010, a bank's duration is determined by the number of spans it remains in the sampled dataset. Hence, the minimum duration is $t = 1$ if the banking crisis was experienced in the first span and maximum duration is $t = 15$ if the crisis occurred in 2010 or if the economy never recorded episodes of bank distress.[18] Banks established in 1995 or one year thereafter are excluded from the sample. Further, means of the financial ratios are used to assess characteristics of distressed versus non-distressed banks to determine whether the distressed financial institutions were similar ex-ante to non-distressed banks. To assess risk of bank distress, we use bank's financial ratios, (Boyd, De Nicolo, & Loukoianova, 2009; Whalen, 1991; Wheellock & Wilson, 2000). Financial ratios extensively used in the literature are those related to CAMEL-rating system (capital adequacy,

[17] It is important to note that one limitation of this approach is the inclusion of banks which were merged for strategic reason, and not due to distress. Sensitivity test was performed but due to fewer bank mergers for strategic reason in SSA countries, the results were not significant.

18 For countries which did not experience episodes of bank distress, the duration data is right censored – the studied event (bank distress) has not occurred during 1995 – 2010.

asset quality, earnings and liquidity)[19]. This is because the probability of bank fragility is a function of these ratios, with the ratios positively related to the risk of bank distress. Banking aggregate variables are also used as a proxy for contagion effects. It is important to note that, the financial ratios should be construed as fundamental bank attributes that provide information about the symptoms rather than the cause of bank fragility. Of the 662 banks selected in our sample, 59 failed, 26 were merged while 577 survived. During the 1995 – 2010 period, the average duration of the whole sample was about 6 years, while the average duration of the banks that failed was 2 years (hence the rationale of including banks established after 2 years in the sample).

We follow the literature in using proxies for CAMEL-rating system, (Cihak, Demirguc-Kunt, Feyen, & Levine, 2012). Capital adequacy (CAP) is measured by the ratio of equity capital and loan loss reserves to gross assets. Asset quality (ASQ) is measured by loan asset ratio, management (MAGT) is proxied by trading income ratio, earnings (EARN) by cost-income ratio while provisions to loans ratio is used a proxy of liquidity (LIQ). These ratios are expected to be positively related to the likelihood of survival. Some studies have used equity investments to asset ratio as a proxy of systemic risk, however, due to lack of sufficient data we were not able to use this variable in our analysis.

Financial sector reform is captured by splitting the sample between *ex-ante* and *ex-post* financial reform regime. We acknowledge that it is not possible to put an exact timing on when financial reforms were initiated. However, based on evidence from the literature and country authorities, we delineate periods of significant financial liberalization which started in mid 1990s

[19] Most of the banks in SSA have inadequate information on CAMEL variables, therefore we used proxies as discussed in appendix B.

for most of the countries as evidenced by initial period of the adoption of structural adjustment programs (SAPs) as stipulated by the IMF and World Bank, capital account liberalization, privatization of state owned banks and foreign banks entry (and share) in domestic market. Banks are also categorized as to whether they have significant state involvement, foreign ownership or domestic private ownership. This is because, local banks with significant foreign holding have lower probability of bank distress. Similar scenario holds for state-owned banks, albeit to a lesser extent since the government can allow the heavily undercapitalized banks to go under. Thus we expect the survival function of foreign owned subsidiaries to have a survival function that is significantly higher, followed by state-owned banks and last by domestic private banks. That is, *ceteris paribus*, at every moment of the crisis, it is probable to have a domestic private bank failure, than state-owned and foreign owned subsidiaries, in that order. Further, we observe that the survival function of foreign owned subsidiary banks decreases slower than state-owned and domestic private. Intuitively, this points to the importance of lessening restrictions to foreign owned banks subsidiaries and allowing competition in the economy as a way of enhancing stability in the banking industry.

To model competitive conditions in the banking industry, we use the *H*-Statistic developed by (Panzer & Rosse, 1987).[20] This statistic measures the percentage change in a bank's revenues caused by a one percentage change in all of the bank's factor input prices and categorizes the market

[20] Other measures used in assessing bank competition are three-firm concentration ratio, which refers to share of the three-largest commercial banks in the economy, ranging from 0 – 1, with 0 indicating no concentration and therefore a more contestable market while 1 indicated the highest concentration by the three largest banks. However, the drawback of this method is that there might be additional large banks in the economy (this has led to computation of four-firm and five-firm concentration ratios). Some studies also use the five-firm concentration ratio with similar interpretation. The other measure is Herfindahl-Hirschman index (HHI) which has been shown to be an ambiguous indicator, therefore not widely used in banking competition, (Berger, Klapper, & Turk-Ariss, Bank Competition and Financial Stability, 2009). Even though it is superior to the two approaches, the shortcoming of the H-Static is that the interpretation of the statistic is only valid if the banking market condition is in equilibrium, which is not always the case.

conditions in the banking industry between competitive, monopolistically competitive and monopolistic market conditions. Thus, for $H \leq 0$ indicates monopoly, while $0 < H < 1$ indicates monopolistic competition and perfect competition if $H = 1$.

Macroeconomic and institutional variables are also incorporated in the explanatory variables. This is because macroeconomic shocks such as interest rates volatility, excessive credit growth, inflation, terms of trade shocks, budget deficits, exchange rate volatility, among others, have adverse impact the viability of financial institutions and in particular, stability of the banking industry. Similarly, institutional factors such as ease of doing business, bureaucracy in licensing and regulation, legal origin, corruption, civil conflict, rule of law, economic freedom, have important implications on performance and stability of banks in the economy.

5. Empirical Results

Our main results are presented in Table 5. 1. It should be noted that interpretation of the signs of the coefficient is important.[21] A positive sign indicates longer lead time to crisis; therefore, a suggestion that the variable is an increasing functions of bank stability, and vice versa.[22] Based on the bank specific variables, we find that capital adequacy, earnings and liquidity provide good early warning predictors of bank stability/distress. However, while all three variables perform well in all the three sample period, we earnings variable is insignificant in post-reform period, indicating lower banking stability predictive capacity. This could also be attributed to decline in profits after liberalization due to increase in the number of domestic private banks and entry of

[21] Our results are qualitatively comparable to studies that have used sample of countries from East Asia and Latin America and Caribbean (LAC) although with different methodology (probit/logit), (Berger, Klapper, & Turk-Ariss, 2009; Gonzalez-Hermosillo, 1996; Demirguc-Kunt & Detragiache, 1998).

[22] On the other hand, a positive sign in a logit model would be an indication of greater probability of experiencing banking fragility episodes.

foreign affiliated banks. On the other hand, we note that asset quality and management variables are not significant across the three sample periods, indicating poor predictors of bank stability/distress The management variable exhibits negative sign in full sample and post-reform periods. This possibly could be because a lower trading income ratio (proxy for management) is less of a sign of banking stability than a sign of high volatile trading income. Therefore, management variable is more of profitability indicator rather than predictor of banking distress.[23]

In the second part of Table 5.1, we include bank aggregate variables (affecting all the banks in the economy) to proxy for bank contagion effects. Except for bank Z-score, H-Statistic, restriction on entry of foreign bank (proxies for increased competition in the domestic economy) and bank dummies (state-owned and foreign-owned) all the other variables are not good predictor of banking distress. This can be attributed to less established financial sector in SSA, with shallow capital markets and inter-bank borrowing and lending. The H-Static is positive and significant in the post-reform period implying that time to bank distress (lead time) increases as the degree of competition among the banks increase. This finding is corroborates the findings in other literature that competition among banks does not contributed to increased bank vulnerability, on the contrary, competition enhances banking stability, (Ariss, 2010). Similarly, entry of foreign bank is significant for both the full sample and post-reform period. This can be attributed to foreign banks buying into the equity of domestic banks after financial sector reforms. This observation corroborates (Wheellock & Wilson, 2000) findings on US banks that showed banks on verge of distress were more likely to be taken over. For SSA economies, entry of foreign banks presents an opportunity to invest in domestic banks (take-over).

[23] Several studies have shown this to be a relevant factor in advanced economies than developing countries, (Bretschger, Kappel, & Werner, 2012).

Table 5.1: Duration Model Results

Indicators	Full Sample	Pre-reform	Post-reform
Baseline hazard	1.043**	1.159**	1.702*
	(2.471)	(3.060)	(5.272)
Bank Specific			
CAP	12.051***	13.066**	12.872**
	(5.784)	(2.381)	(2.906)
ASQ	1.259	2.380	2.191
	(0.723)	(0.942)	(0.264)
MAGT	-1.167	4.096	-0.261
	(-0.792)	(0.975)	(-0.538)
EARN	2.902***	2.206***	3.070***
	(4.618)	(5.276)	(4.773)
LIQ	9.548**	5.232**	3.046
	(2.156)	(3.284)	(1.042)
Bank Aggregate			
FOREN	0.224	0.034	0.673
	(0.309)	(0.047)	(0.264)
NATOW	1.281	1.746	1.470**
	(0.512)	(0.505)	(2.173)
FOROW	-0.615	0.008	1.319**
	(-0.194)	(0.015)	(2.284)
BANKZ	1.016**	0.419	0.182
	(2.193)	(0.135)	(0.274)
BANKFRED	0.517	0.711	0.928
	(0.156)	(0.318)	(1.062)
H-STAT	1.206**	0.629	1.278**
	(2.343)	(0.704)	(2.452)
FOREST	2.084**	-0.481	1.101**
	(2.003)	(-0.206)	(2.365)
Macroeconomic			
RGDPG	1.460***	1.312***	0.961**
	(5.026)	(5.297)	(2.518)
INFL	-0.166**	0.224	-1.914**
	(-2.409)	(1.041)	(-3.208)
M2RES	0.042	0.136	1.271
	(1.412)	(0.273)	(0.328)
INTER	-2.610**	-1.426	-1.061***
	(-2.201)	(-1.472)	(-5.287)
PRIVGDP	-0.781**	1.047	-1.197**
	(-2.201)	(1.510)	(-2.426)
TOTCHAN	0.372	0.191	1.301
	(0.210)	(1.153)	(1.014)
FISCDEF	1.301	0.571	1.418
	(0.278)	(0.672)	(0.519)
EXVOL	1.401**	0.297	2.629**
	(2.635)	(0.432)	(2.815)

Note: Variables are defined in Appendix B. The t-values are in parenthesis with *, ** and *** indicates significance at the 10%, 5% and 1% levels, respectively.

Table 5.1: Duration Model Results Contd…

Indicators	Full Sample	Pre-reform	Post-reform
Institutional			
CONTRA	1.842**	1.134**	2.872***
	(2.314)	(2.109)	(5.381)
ECONFRED	2.071**	2.337	2.276**
	(1.849)	(0.274)	(2.761)
ACTREST	0.206	-0.217	1.428***
	(1.360)	(-0.205)	(7.874)
LEGOR_FRE	0.364	0.302	0.037
	(0.264)	(0.514)	(0.246)
LEGPR_OTHER	-0.297	-0.067	-0.015
	(-1.478)	(-0.810)	(-0.1392)
RELIG_MUS	0.212	0.516	0.006
	(0.166)	(0.922)	(0.193)
RELIG_OTHER	1.307	1.326	0.781
	(0.290)	(0.217)	(0.101)

Note: Variables are defined in Appendix B. The t-values are in parenthesis with *, ** and *** indicates significance at the 10%, 5% and 1% levels, respectively.

For the bank dummies, State and foreign-owned banks' dummies are significant. This follows from our earlier proposition that foreign-owned banks are less likely to experience banking distress since they can easily be recapitalized from their parent bank. Similarly, for strategic reasons, state-owned banks (e.g. development banks, agricultural banks) are more likely to be recapitalized by the government compared to private-owned banks.[24]

The third and fourth sections of Table 5.1 capture the effect of macroeconomic shocks and institutional factors on bank distress prediction. This is because the literature has shown that these variables are important in explaining how the environment in which banks operate affect their performance and viability, (Cihak, Demirguc-Kunt, Feyen, & Levine, 2012; Bretschger, Kappel, & Werner, 2012; Claessens & Laeven, 2004).

[24] The government sold major stakes in the previously state-owned banks. From the available evidence it is not possible to determine whether this was because the banks were distressed or this was because of financial sector reforms.

From the macroeconomic and structural factors section, we find that all the variables have the expected signs, albeit some are not significant. Real GDP growth is significant for both the full sample and post-reform sample periods. A rise in real GDP growth is a good indicator of banking stability. A booming economy, increases lending and profits leading to more bank. Conversely, declining real GDP growth is an early warning of bank distress due to slowed economic activities, unemployment and increase in non-performing loans on the bank's portfolio. On the other hand, private credit to GDP ratio, exchange rate depreciation, inflation and interest rate increase have the expected negative signs and are significant. The ratio of private lending to GDP increases over period ahead of banking distress. This implies that those banks that experiences episodes of excessive lending (credit growth) faster than the other banks are more likely to be at risk of distress. In recent times, this was evident during the global financial crisis which was precipitated by excessive lending by the banks in advanced economies to mortgages. Similarly, increase in inflation has the potential to trigger banking distress due to its impact on real interest rates – credit risk. Increase in interest volatility has the same impact on banking distress as an increase in interest rates contributes to both credit and market risk for the banks. Currency depreciation seems to increase bank distress in the full sample and post-reform periods. This is because, with advent of capital account reforms and relaxation of exchange control rules, domestic banks are able to borrow in foreign currency. Depreciation of the domestic currency is therefore likely to leave these banks with huge liabilities, especially if accompanied by slow-down in economic activities.

Finally, from the last section of Table 5.1, we find that all only contract enforcement, economic freedom index and activity restrictions are significant with the expected signs. These results conform to the literature on the role of institutions in the economy. We observe that

contract enforcement and lower activity restrictions have higher significance in the post reform era compared to the full sample and pre-reform periods.

Overall, the results in Table 5.1, with the exception of a few variables, most of our results conform to findings from previous studies. We find that, majority bank-specific and macroeconomic factors are very important predictors of bank distress. Higher degree of vulnerability was exhibited in the post-reform period compared to pre-reform, pointing to the importance of prudent corporate governance in the banking industry and macroeconomic stability as key to stability in the banking industry in a liberalized economy. Further, we find institutional factors also play an important role, in particular, enforcement of contracts, economic freedom and lessening of restrictions on economic activities. In terms of timing of the likelihood of banking distress, we found that the role of some of the variables as predictors of banking distress change a lot depending on how close a bank was close to a distress period.[25] These changes are attributed to endogeneity of the bank-specific variables which respond to macroeconomic changes.

Model Prediction Capacity

In the preceding section, we found that most of the variables are good predictors of banking distress episodes. However, a model is considered to be good depending on its prediction capacity. In this section we explore prediction capacity of the model following (Whalen, 1991). According to this approach, for each period, t, it is possible to obtain duration estimated probability $S(t|X)$ using functions (1) – (3) that show relationship between hazard and

[25] Due to space constraint, these findings are not reported here but are available from the authors upon request.

survival distributions in Section 4 of this study based on Cox's proportional hazard model, (Cox, 1972).

$$\hat{S}(t|X) = \hat{S}_0(t)^{\exp^{(\hat{\beta}' X)}} \qquad (8)$$

With $\hat{S}_0(t) = exp\left\{-\int_0^t \hat{h}_0(u)du\right\}$

Where h_0 (…) is the estimated baseline hazard function in (7), while $\hat{\beta}$ are the estimated coefficients. According to (Whalen, 1991), Using (8) for any period *t**, it is possible find the probability that a bank had survived until that period given its financial (bank-specific) characteristics, bank aggregate, macroeconomic and institutional variables (X). Then the probability that a bank had survived until that period is predicted, if the estimated probability of doing so is higher to a pre-established cut value *S**. This is repeated bank by bank, and then the survivorship predictions are compared to the observed ones. It is important to note that, based on this analysis, there are two types of errors that can be committed; Type I (predicting that a bank will survive until time *t** when it did not) and Type II (predicting that a bank will not survive until time *t** when it did).

Table 5.2: Model Predictive Power

	Predicted Values		
	0	1	**Total**
2 years predictions			
0	23	6	29
1	18	615	633
Total	41	621	662

Table 5.2 presents the prediction values. Predictions were made taking three reference periods: 2 years, 5 years and 9 years, corresponding to periods just after financial reforms and when most of the SSA experienced bank distress episodes. The columns correspond to predicted values and the rows to observed values. For instance, for the 2 years period prediction, 23 banks failed within 2 years of the sample period (1997) and the model predicted correctly. On the other hand, 6 banks are classified in the survivor group, while they failed in the first 2 years. Further, 18 banks were incorrectly classified in the bank distress group but they survived. Finally, 615 that survived more than 2 years were correctly classified. Similar exercise was carried out for 5^{th} and 9^{th} year and the findings were qualitatively similar. Overall, the model's prediction capacity is good given that close to 87% were correctly classified, with little variation in prediction capacity over time.

6. Conclusion and Policy Recommendations

Using duration model, this study explored the relationship between financial liberalization, banking competition and banking stability/fragility by empirically assessing the importance of bank-specific, macroeconomic and institutional factors in uncovering this relationship. Specifically, the study examined the proposition that increased competition in the banking sector resulting from financial liberalization enhances financial stability. The results indicate that CAMEL-type bank-specific factors are good predictors of which banks are more likely to experience banking distress. Further, delineation of the sample to capture financial liberalization period, which permit competition in the banking industry, presented interesting findings with regards entry of foreign banks, easing of restrictions and economic freedom all of which contributed to enhanced competition in the banking industry. Compared to pre-reform regime, increased competition in the post regime period corresponded with increased lead time to bank distress episodes. However, it is worth noting that, the stability of the banking system in a liberalized and competitive economy is contingent on government pursuing sound macroeconomic policies and enhancing effectiveness of institutions to allow the banking sector to thrive.

From a policy perspective, two key issues stand out from this study. First, there is lack of widely available financial surveillance indicators in SSA due to a dearth of comparative bank-level and macroeconomic data across the countries. Some of the SSA countries lacked important data or had incomplete data on some of the important variables. Therefore, greater attention is needed to develop effective indicators that can be used in early bank distress warning system. We believe this study will provide a fertile ground for effective future research in this area. Second, compared to other regions, the pace and scope of financial liberalization in SSA has

been uneven and sporadic. This makes it hard to develop metrics on assessing the effectiveness of financial liberalization in promoting banking competition and stability in SSA countries.

Appendix A: Sample of SSA Countries in the Study

Botswana	South Africa
Cote d'Ivore	Tanzania
Cameroon	Uganda
Ethiopia	Zambia
Ghana	
Kenya	
Madagascar	
Malawi	
Mauritius	
Mozambique	
Nigeria	
Senegal	

Appendix B: Data Description and Sources

Variable	Definition	Description	Source
	Bank Specific Variables		
CAP	Capital adequacy	Equity-to-asset ratio	BankScope
ASQ	Asset quality	Loan asset ratio	BankScope
MAGT	Management	Trading income ratio	BankScope
EARN	Earnings	Cost-income ratio	BankScope
LIQ	Liquidity	Provisions to loans ratio	BankScope
	Bank Aggregate Variables		
FOREN	Foreign bank entry	A dummy set to 1 the year foreign banks initially permitted into the economy and 0 elsewhere.	GFDR
NATOW	National banks	Share of government-owned banks in total banks.	GFDR
FOROW	Foreign banks	Share of foreign owned banks in total bank (with 50% foreign ownership).	GFDR
PRIVBANK	Private domestic banks	1- (share of foreign + share of public domestic)	Own
BANKZ	Bank Z-Score	Z-score is estimated as ROA+equity/assets)/sd(ROA); sd(ROA) is the standard deviation of ROA. Higher values indicate higher bank stability and less overall bank risk.	GFDR
BANKFRED	Financial (banking) freedom index	Index ranging from 1 – 5 with higher values indicating fewer restrictions. It measures the level of government involvement in the financial sector.	Heritage Foundation
H-STAT	Panzer-Rose H-statistic	Ranges between 0 – 1, with 1 = competition, 0 = monopoly and in between monopolistic competition and oligopoly market structure	Own
MBANK	Mean bank size	Log of average of total banking assets divided by the number of banks.	GFDR
FOREST	Restrictions on entry of foreign banks	Index ranging from 1-4 with lower values indicating less restrictions	GFDR
	Macroeconomic and Structural Indicators		
RGDPG	GDP growth	Real GDP growth	WDI
EXVOL	Exchange rate volatility	Standard deviation of changes in exchange rate (depreciation).	IFS
PRIVGDP	Private credit/GDP	Credit to the private sector share of GDP. This is used as a proxy of credit growth in the economy.	GFDR
M2RES	M2/Reserves	Ratio of M2 to Reserves. This is used as a proxy of vulnerability of a run on a country's currency.	IFS

INFL	Inflation	Average inflation rate.	
INTER	Real interest rate	Nominal interest rate minus inflation rate.	IFS
TOTCHAN	Terms of trade change	Changes in terms of trade.	IFS
FISCDEF	Fiscal surplus (deficit)/GDP	Fiscal surplus (deficit) as share of GDP (%)	IFS
	Institutional variables		
CONTRA	Contracts enforcement	Log of the number of days it takes to enforce contracts.	WB-DBR
ECONFRED	Economic freedom index	Index ranging from 1 – 5 with higher values indicating fewer restrictions.	Heritage Foundation
ACTREST	Activity restrictions	Proxy for regulatory regime, it is an index and takes on the values 1 – 4, with higher values indicating greater restrictions on banking activities and ownership.	DBR
LEGOR	Legal origin	Three dummy variables, 1 = British; 2 = French; 3 = Others. British legal origin is the base group.	WDI
RELIG	Religion	Three dummy variables capturing over 50% population's religion 1 = Christians; 2 = Muslims; 3 = other. Christianity is the base group.	

Notes

The crisis periods are defined in Appendix C, denoting the years in which each country experienced systemic banking crisis.
GFDR = Global financial Development Report, World Bank.
IFS = International Financial Statistics, International Monetary Fund
WDI = World Bank-World Development Indicators, World Bank.
DBR = World Bank –Doing Business Report, World Bank.

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