

# Asset quality in a crisis period: An empirical examination of Ghanaian banks

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## Abstract

This paper examines the factors that account for the deterioration in the asset quality of Ghanaian banks during a period of financial crises using a unique dataset on 25 banks from 2005 to 2010. Based on system Generalized Method of Moments estimations, we find that the persistence of non-performing loans in addition to loan growth, bank market structure, bank size, inflation, real exchange rate and GDP growth are the significant determinants of banks asset quality in Ghana. The findings have implications for both bank management and regulators in emerging economies.

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## 1. Introduction

An efficient financial intermediation requires a stable banking system to channel surplus funds into savings for investments to promote rapid economic growth (King and Levine, 1993; Brown et al., 2009). This is done through the creation of loan assets by banks and other financial intermediaries. However, the creation of the loan assets exposes banks to the risk of defaults by borrowers as well as liquidity constraints. This does not only affect the bank profitability but also the stability of the banking system. Numerous empirical studies<sup>1</sup> have found high levels of non-performing loans to have preceded banking crises, as evidenced from the recent sub-prime mortgage crises. In many African countries, high levels of non-performing loans resulted in the banking crises from 1982 to 1989. For instance in Ghana, Kapur et al. (1991) and Daumont et al. (2004) documented evidence that about 41% of loans to private borrowers in Ghana were

non-performing and that seven (7) of the eleven (11) audited banks were declared bankrupt. The major source of loan defaults, as argued by Keeton (1979) and Stiglitz and Weiss (1981), are from information imbalances in credit markets. Due to information asymmetry, banks are more likely to adversely select high risk loan clients because they can afford the high loan price demanded by the banks. Additionally, the high loan rates may also induce ex-post behaviour by borrowers in investing in risky projects which increases probability of default.

Like in the other African countries which experienced banking crises in the 1980s, several reforms were undertaken to improve the stability of the financial system. However, financial stability risk within the Ghanaian banking industry is still high largely due to the continuous deterioration in the asset quality of the banking sector (IMF, 2011).<sup>2</sup> This current empirical investigation is motivated by this worrying trend and seeks to provide insights into the factors that contribute to the continuous deterioration in bank asset quality in Ghana. While several studies have examined the stability of banking systems in developed economies and developing Asian economies, empirical evidence for emerging African economies appear to be scant. In an early study on the fundamental drivers of loan losses, Keeton and Morris (1987) found that adverse macroeconomic environment leads to high increases in provisions for bad and doubtful debt. Meanwhile Keeton (1999) provided first evidence on the linkage

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<sup>1</sup> Demirgüç-Kunt (1989) and Demirgüç-Kunt and Detragiache (1998). Peer review under responsibility of Africagrowth Institute.



<sup>2</sup> See IMF Financial Stability Update Report on Ghana. The report further asserts that any slight deterioration in the quality of banking industry loans will lead to a collapse of the banking industry.

between credit growth and the resultant lower credit standards<sup>3</sup> which contributed to high loan defaults among US banks. Kalirai and Scheicher (2002) also concluded that the quality of bank loan assets was mainly influenced by macroeconomic factors such as nominal interest rate, production index, stock returns and business confidence. Bofondi and Ropele (2011) examined the effect of macroeconomic factors on banks' loan quality over a 20-year period in Italy. While the authors find household non-performing loans to vary directly with unemployment rate and nominal interest rate, growth in GDP and housing prices had an inverse relationship with the performance of loans granted to households over the study period. Using the vector autoregressive (VAR) methodology to perform a stress test of the banking system in Ghana, Amediku (2006) employed quarterly data from 1995 to 2005 to conclude that a deterioration in bank non-performing loans resulted from adverse output shock and rise in inflation.

Using a sample of commercial and savings banks in Spain from 1985 to 1997, Salas and Saurina (2002) examined the determinants of bank asset quality. The authors find credit expansion, bank size, efficiency, economic growth, portfolio composition, interest spread, equity and market structure as the significant determinants of problem loans. By employing both dynamic and static panel regression models, Pain (2003) identified both bank-specific and macroeconomic determinants of non-performing loans for major UK banks. The panel regression estimates indicated that GDP growth, real interest rates and lagged aggregate lending growth, and loan portfolio composition explained loan loss provisioning of the major United Kingdom banks studied. Louzis et al. (2012) examined both macroeconomic and bank-specific determinants of loan quality in the Greek banking sector to identify economic growth, unemployment rate, lending rates and public debt as the significant factors that explain variations in bank non-performing loans. The authors find that the type of bank loan significantly affects the performance of overall bank loan portfolio. Specifically, while the quality of consumer loans and business loans is greatly affected by lending rate fluctuations and real GDP growth respectively, mortgages were found to be least affected by macroeconomic developments.

Motivated by the economic and banking crises between the 1980s and mid-1990s in a large number of Sub-Saharan African countries, Fofack (2005) examined factors that caused the high non-performing loans for both the CFA and non-CFA<sup>4</sup> countries; identifying economic growth, depreciation in the exchange rate, real interest rate, net interest margins and interbank loans as the significant contributing factors of the banking crises. In a study into banking consolidation after the banking crises in Nigeria, Ezeoha (2011) provides evidence to suggest that consolidation of banking system leads to a deterioration in bank asset quality. While the author finds liquidity and equity capital to have worsened asset quality over the study period, profitability, unsecured credit, and credit expansion improved the performance of bank

loan portfolio. De Bock and Deymyanets (2012) assessed the linkages between banks' asset quality and macroeconomic factors in 25 emerging banking markets<sup>5</sup> from 2006 to 2010. The authors identified fall in exchange rate and worsening terms of trade as the correlates of bank asset quality. More recently, Klein (2013), in examining the causes of non-performing loans in Central, Eastern and South Eastern Europe (CESEE) from 1998 to 2011, found bank equity, profitability, excessive lending, unemployment, inflation and exchange rate as the factors that cause fluctuations in the performance of bank loan portfolios.

From the empirical literature, bank-specific determinants of asset quality appears to be scanty in many emerging markets with vast empirical studies on American, European and Asian banking systems.<sup>6</sup> The less stringent regulatory framework of banking systems in emerging markets makes it inappropriate for wholesale application of the findings from developed banking markets in such markets. While a number of studies<sup>7</sup> have examined various aspects of the Ghanaian banking industry, to the best of our knowledge, no study<sup>8</sup> has examined the bank level factors that explain the performance of bank loan portfolio. With Ghana having a bank dominated financial system<sup>9</sup> like many African and emerging economies, examining the factors that account for deterioration in bank asset quality would not only lead to banking system stability but also improve the soundness of the financial system in general. Also, the quality of banks assets not only has greater implications for bank management and supervisory authorities, but also poses great challenges to governments in the pursuit of stable economic environment to stimulate growth and enhance the welfare of its citizenry. Against this background, this study examines bank-specific determinants of asset quality in the Ghanaian banking industry using bank level data on 25 banks from 2005 to 2010. Unlike prior studies, this study makes use of a unique dataset to disaggregate non-performing loans into its different classes. This enables us to identify the source(s) of persistence. From our results, we find that non-performing loans account for 7.1% of banking industry assets, supporting what Caprio and Klingebiel (1996) describe as "a silent form of distress" in which a significant portion of the banking system is insolvent, but still remains open. Our empirical estimation from the system generalized method of moments (GMM) provides evidence in support of the persistence of non-performing loans in addition to loan growth, market concentration, size, income diversification, inflation, GDP growth and real exchange rates as the significant determinants of banks asset quality in Ghana

<sup>5</sup> Argentina, Brazil, Bulgaria, Chile, China, Colombia, Dominican Republic, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, Peru, Philippines, Poland, Romania, Russia, South Africa, Thailand, Turkey, Ukraine, Uruguay, and Venezuela.

<sup>6</sup> Keeton and Morris (1987), Keeton (1999), Gambera (2000) Rajan and Dhal (2003), Jimenez and Saurina (2006), Hoggarth et al. (2005) Bofondi and Ropele (2011) and Louzis et al. (2012).

<sup>7</sup> Buchs and Mathiesen (2008), Bawumia et al. (2005), Amediku (2006), Aboagye et al. (2008a), Aboagye et al. (2008b), Biekpe (2011), Saka et al. (2012), Aboagye (2012), Zangina and Bokpin (2012).

<sup>8</sup> Amediku (2006) examined the effect of macroeconomic factors on non-performing loans.

<sup>9</sup> In all, 75% of the assets of the financial sector are made up of bank assets.

<sup>3</sup> The relaxing of credit requirements.

<sup>4</sup> Did not include Ghanaian banks although the study period covered the banking crises in Ghana.

over the crises. Substandard and doubtful loans were found to persist on overall bank asset quality. The findings were robust to both ordinary least squares and difference method of moments (GMM) estimations.

The rest of the study is organized into the following: Section 2 focuses on the overview of the Ghanaian Banking industry. Section 3 gives the description of the data used and econometric specification. Section 4 discusses the results of the empirical estimation and Section 5 concludes the study.

## 2. Overview of banking in Ghana

In the 1980s, most public sector banks were declared insolvent with about 41% non-performing loans attributable to the private sector (Kapur et al., 1991, pp. 60–61). This period also witnessed numerous prudential banking reforms in Ghana and many developing economies; spearheaded by World Bank. Specifically in Ghana, such reforms included the passing of the *Banking Law, 1989* (P.N.D.C.L. 225), *Bank of Ghana Act, 2002*, Act 612, the *Banking Act, 2004a,b* (Act 673), and the *Banking Amendment Act 2007* (Act 783). The *Banking Law* (P.N.D.C.L. 225) was revised in 1989 under the Financial Sector Adjustment Programme (FINSAP I). Some of the new provisions in the Act included placing limits on risks exposure; capital adequacy ratio of 6%; setting uniform accounting standards and expansion of auditing scope and strengthening both on-site and off-site supervision of banks by the Bank of Ghana. The supervisory powers of the Bank of Ghana were enhanced with the revision of the *Bank of Ghana Law* (P.N.D.C.L. 291) in 1992. In 2002, the *Bank of Ghana Act 612* led to the establishment of the Banking Supervision Department responsible for the supervision and examination of all banking institutions in the country to strengthen the regulatory capacity of the Bank of Ghana. The supervision of the banking and credit system was to ensure adherence to prudential banking reforms by Ghanaian banks. The *Banking Law, 1989* (P.N.D.C.L. 225), was replaced by *Banking Act, 2004a,b* (Act 673) to promote an effective banking system. The regulations in the Act covered the licensing of banks, capital requirements, liquidity, ownership and control, restrictions on lending, supervision and control and accounts and auditing. A notable reform in the Act was the increase in the minimum capital adequacy ratio from 6% to 10%. The *Banking Amendment Act (2007)*, Act 738, replaced the *Banking Act (2004)* with an additional function of ensuring the soundness and stability of the financial system in Ghana and also the establishment of offshore banking and other offshore financial services such as insurance and leasing with a focus of positioning Ghana as the regional hub for financial activities in Africa and to attract diaspora investments. As evidenced from the aforementioned reforms, most of the regulations have sought to ensure adherence to best banking practices.

### 2.1. Stylized fact about Ghanaian banks

#### 2.1.1. Asset structure of Ghanaian banks

The asset structure of Ghanaian banks is mainly made up of loans and advances, assets held in foreign currencies,

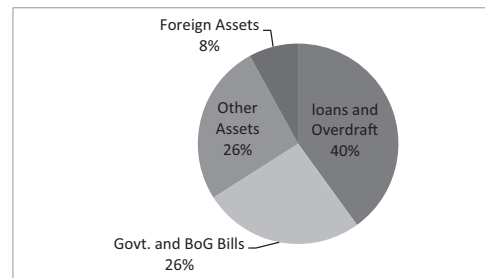


Fig. 2.1. Asset Structure of Banks (2010).

Source: International Monetary Fund (2011).

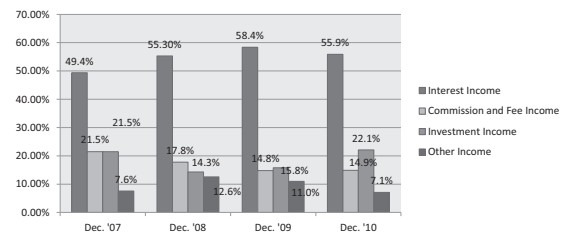


Fig. 2.2. Income Structure (2007–2010).

Source: Bank of Ghana (2011).

investments in government securities and other assets. From Fig. 2.1, banks loans and overdrafts accounted for 40.1% of total banking industry asset in 2010 compared to investments, government bills and securities of 26%. In all 8% of the banking industry assets are held in the form of foreign assets. The implications of the banking industry asset structure are that banks are exposed more to credit risk.

#### 2.1.2. Loan asset portfolio analysis

From Table 2.1, banking industry loans and advances expanded from 2005 to 2010. The gross loans granted by the industry was GH¢m 2519.70 in 2005. This figure almost doubled to GH¢m 4146.5 in 2006. The rising trend continued to 2010 at GH¢m 7994.70. The growth in banking sector lending to private enterprises also followed a similar trend: from 68% share of gross loans in 2006, above the period average of 66.95%. The period end figure of 72.8% shows the continuous reliance of the private sector on the banking industry for funding. While household share in gross loans exhibited little variations between the ranges of 13.7% in 2010 and 17.6% in 2008, credit to government and public institutions and public enterprises declined from 5.1% and 12%, respectively, in 2006 to 2.6% and 10.9%, respectively, in 2010. The high concentration of lending among private enterprises indicates that any adverse economic effects could affect the ability of firms to service bank debts and have severe consequences for banking operations.

#### 2.1.3. Composition of bank income

Fig. 2.2 depicts the composition of bank income from 2007 to 2010. Generally, the industry has high concentration of income in the form of interest income. In 2004, the share of interest income was 49.40% of total income compared to 21.50% for both commission and fee income and investment income. In 2008, while the share of interest income increased to 55.30%,

Table 2.1  
Banking sector loans (2006–2010).

	2006	2007	2008	2009	2010	Average
Gross loans (GH¢m)	2519.7	4146.5	5966.8	6920.8	7994.7	5493.73
<i>Distribution of gross loans by economic sector (In %)</i>						
Private enterprises	68.0	64	63.4	67.6	72.8	67.0
Household loans	14.9	17.5	17.6	15.5	13.7	15.8
Government and public institutions	5.1	4.7	5.3	2.5	2.6	4.0
Public enterprises	12	13.8	13.7	14.5	10.9	13.0

Source: Bank of Ghana, 2011

Table 2.2  
Profitability indicators (2006–2010).

	2006	2007	2008	2009	2010
Interest Margin to Total Assets	7.8%	6.4%	6.6%	6.9%	8.4%
Interest Margin to Total Income	51.8%	46.1%	41.3%	39.4%	50.1%
Return on Equity	39.6%	35.8%	30.1%	23.6%	28.6%
Return on Assets	3.3%	2.6%	2.5%	2.1%	2.7%

Source: Bank of Ghana (2011).

that of commission and fee income and investment income reduced to 17.8% and 14.30%, respectively. Another observation from Fig. 2.2 is that Ghanaian banks continue to rely on interest income as evidenced by the non-interest income share of total income being above 50% between 2008 and 2010. With this income structure, increases in non-performing loans would greatly affect bank profitability. Increasing income from non-interest generating activities would help mitigate their exposure to non-performing loans.

#### 2.1.4. Profitability Indicators

The banking sector's net interest margin grew to 8.4% in 2010 from 6.9% recorded in 2009. The industry's share of net interest income as share of total income grew from 39.4% in December 2009 to 50.10% in December 2010. Marginal increases were recorded for return on assets to 2.7% in December 2010 from 2.1% in 2009 while return on equity increased from 23.6% in 2009 to 28.6% in December 2010 (Table 2.2).

#### 2.1.5. Capital adequacy ratio

Bank equity capital depicts banks' ability to absorb losses on their books. The capital adequacy ratio of the industry was continuously above minimum regulatory requirement of 10% from 2007 to 2010. While a marginal decline of 13.80% was experienced in 2008 from 15.70% in 2007, the ratio increased from 18.2% and 19.1% in 2009 and 2010 respectively. With the current liberalized market and improving macroeconomic environment, the prospects of the sector's growth and development are high. Because of competition, innovation and efficiency in the industry are expected to deepen (BoG, 2011; Zangina and Bokpin, 2012). This might however, lead to more mergers and acquisitions since stronger asset base is needed to effectively compete and still maintain appreciable profit margins as well as meet the new capital requirement of GH¢m 60 million. These policies together with the downward revision in the prime

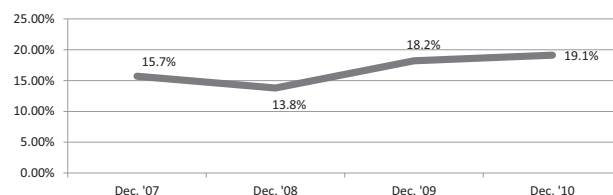


Fig. 2.3. Capital ratio (2007–2010).

Source: Bank of Ghana (2011).

rate and a stable macroeconomic environment are expected to position the industry for greater growth (Fig. 2.3).

### 3. Data description

This research considered 25 banks in Ghana covering the period<sup>10</sup> from 2005 to 2010 using annual bank data. The data were obtained from the Banking Supervision Department of the Bank of Ghana which serves as the regulatory body for Ghanaian banks and the Ghana Statistical Services for data on macroeconomic variables. The bank level data were extracted from the year-end income and balance sheet statements of the banks. Over the period, 26 banks had been registered to carry on banking business in Ghana. However, one bank was dropped because of insufficient data points over the six-year period. Unbalanced panel data were used for the analysis.

#### 3.1. Variable description

##### 3.1.1. Asset quality

Asset quality of bank loans refers to the timely manner with which borrowers are meeting their contractual obligations. In this study, we employ the ratio of non-performing loans to gross loans and advances as the indicator for asset quality. A higher ratio indicates lower bank asset quality. The asset quality (ASQ) for bank  $i$  at time  $t$  is given as;

$$ASQ_{i,t} = \frac{SSL_{i,t} + DL_{i,t} + LL_{i,t}}{GLA_{i,t}}$$

<sup>10</sup> The study period was influenced by data availability. The data allows for the decomposition of the non-performing into sub-standard, doubtful and loss loans categories. This enables the testing for the persistence of the each of the three classes of non-performing loans on asset quality.

where  $SSL_{i,t}$ ,  $DL_{i,t}$  and  $LL_{i,t}$  represent substandard loans,<sup>11</sup> doubtful loans<sup>12</sup> and loss loans<sup>13</sup> respectively, whereas  $GLA_{i,t}$  represents gross loans and advances for bank  $i$  at time  $t$ .

### 3.1.2. Banking structure

One of the major goals of the financial liberalization policies is to improve the competitiveness of financial markets in developing economies. This study therefore examines how the changing banking market structure has impacted on asset quality. The relationship between bank market structure and stability is explained by the competition-stability and competition-fragility hypotheses. According to the competition-stability hypothesis, competition-driven efficiency results in banks' stability and improves the soundness of the banking industry (Pain, 2003; Boyd et al., 2006; Boyd and De Nicoló, 2005; Beck et al., 2006; Turk-Ariss, 2010; Schaeck and Cihak, 2010b). However, the competition-fragility hypothesis posits that banks with market power (in a concentrated industry) earn higher profits to improve industry stability (Keeley, 1990; Bordo et al., 1995; Hoggarth et al., 2005). In line with Keeton and Morris (1987) and Pain (2003), this study employed the Herfindahl–Hirschman Index (HHI) to measure lending concentration among banks in the economy. The Herfindahl–Hirschman Index for loans and advances is given by;

$$HHI_L = \sum_{i=1}^N l_i^2$$

where  $HHI_L$  and  $l_i$  represent the Herfindahl–Hirschman Index for lending and the market share of loans for bank's  $i$  respectively. The market share is the ratio of each banks gross loans and advances to total industry loans and advances for each year studied. A higher HHI indicates concentration in lending among few banks in the industry.

### 3.1.3. Loan growth

The effect of loan growth on asset quality depends on whether the growth is influenced by supply shift, which arises out of banks' willingness to lend or demand forces from borrowers demand for credit. Keeton (1999) argues that when loan growth is driven by banks' willingness to lend, lending increases either through the reduction in lending rates or lowering credit requirements for new loans. This would increase the likelihood that borrowers may default on their loans, hence affecting the quality of bank loans.<sup>14</sup> However, if the growth is from the demand side, the pull factors will drive loan rates upwards and lead to tightening of credit conditions, ensuring greater scrutiny of loan applicants to reduce the possibility of adverse selection, and hence lower the probability of future loan defaults – hence, a positive credit growth–asset quality relationship. The growth of bank lending is given by  $LG_{i,t} = \frac{LOAN_{i,t} - LOAN_{i,t-1}}{LOAN_{i,t-1}}$  where  $LG_{i,t}$ ,

$LOAN_{i,t}$  and  $LOAN_{i,t-1}$  represent the growth of loans for bank  $i$  at time  $t$ , loans and advances for bank  $i$  at time  $t$  and loans and advances for bank  $i$  at time  $t - 1$ .

### 3.1.4. Bank size (SIZE)

Bank size is proxied as the natural logarithm of total bank assets. While large banks are assumed to have better risk management techniques, which ensure proper screening of loan applicants and lower default rate, it is also argued that as banks become too large, monitoring and evaluation become difficult as they take on increased risk. Empirical evidence on the relationship between asset quality and bank size however remain mixed. In line with Biekpe (2011) who suggests that the economies of scale enjoyed by larger Ghanaian banks enable them to benefit from reduced risk, this study expects a negative relationship between bank size and non-performing loans.

### 3.1.5. Interest spread (NITI)

Bank intermediation spread, measured as the ratio of net interest income to total income, is used to capture the impact of cost of bank lending on asset quality. A higher spread indicates higher lending rates and intermediation cost by banks, ceteris paribus. Reduction in interest expense could also account for high spread. As found in other studies,<sup>15</sup> an increase in the spread increases the loan interest payments, which increase the likelihood of loan defaults. In addition, riskier borrowers would be adversely selected since they could afford the high cost of borrowing. Fofack (2005) found a negative but insignificant relationship between variable and non-performing loans in a study in Sub-Saharan CFA and non-CFA countries. The widening spread in the banking industry provides strong support to test whether higher lending rates lead to adverse selection and moral hazards in the Ghanaian credit market.

### 3.1.6. Income diversification (INCDIV)

Diversification of a bank's income source reduces the bank's dependence on interest income from loan repayments, hence the reduction in the bank credit risk from lending. Banking regulations by Bank of Ghana provide limit on the risk exposures banks are allowed to undertake by placing a limit on their lending activities which has focused attention on non-interest generating activities. In this study, bank income diversification is proxied as the ratio of non-interest income to total income (INCDIV).<sup>16</sup> This measure reflects banks' reliance on non-interest generating activities besides the traditional lending businesses. Although a negative relationship is expected, Stiroh (2004a) argues that any diversification benefits would depend on the correlation between non-interest income and net interest income. This we conclude could be the source of an income diversification having a positive relationship with bank non-performing loans.

<sup>11</sup> 25% of this class of non-performing loan is written off.

<sup>12</sup> 50% of this class of non-performing loan is written off.

<sup>13</sup> 100% is this class of non-performing loan is written off.

<sup>14</sup> Salas and Saurina (2002), Jimenez and Saurina (2006) and Keeton (1999).

<sup>15</sup> Salas and Saurina (2002) and Louzis et al. (2012).

<sup>16</sup> Louzis et al. (2012) also employed the same measure of income diversification.

### 3.1.7. Macroeconomic determinants

Macroeconomic conditions affect the ability of borrowers to service bank debt. The cash flow of households and firms is normally tied to economic cycles. Hence in times of adverse macroeconomic shocks, indebted households and firms are more likely to default. Prior literature provides evidence of significant relationship between asset quality and several macroeconomic variables such as GDP growth, real interest rates, inflation rate, real exchange rate, unemployment rate and money supply. In this study, we employ GDP growth rate, inflation rate and real exchange rate due to the inter-relationship among macroeconomic variables. For instance while economic growth is likely to be reflected in low unemployment rate and higher per capita GDP, real interest rate and money supply will in turn influence the average price level (inflation rate) in the economy. While economic growth is expected to have a negative impact on non-performing loans, inflation should have a positive relationship. The explanation provided for the negative relationship between GDP growth and non-performing loans as found in several empirical studies<sup>17</sup> is that growth in real GDP also results in increases in disposable income, resulting in a high demand for goods and services produced by firms. The increased sales would in turn improve the debt servicing capacity of the firms and other owners of productive resources. On the impact of inflation on bank non-performing loans, studies by Fofack (2005), Babouček and Jančar (2005), Rinaldi and Sanchis-Arellano (2006) have found that a rising level of inflation which characterizes uncertain business conditions worsens the performance of bank loan portfolio, hence a positive (negative) relationship between inflation and non-performing loans (asset quality). We consider the effect of portfolio flows on bank asset quality by examining the impact of real exchange rate fluctuations during the crises period on asset quality. Several authors<sup>18</sup> have emphasized that “a weakening local currency makes it harder to serve foreign currency debt or exacerbate weaknesses in the banking system”. The reason being the existence of vulnerabilities associated with an overvalued currency in a highly dollarized or lightly regulated financial system. In this regard, it is argued by De Bock and Deymyanets (2012) that “debt denominated in foreign currency is harder to serve when the exchange rate weakens vis-à-vis the foreign currency and that, banks do not always completely hedge the exchange rate risk that arises from currency mismatches on their balance sheet”, consistent with Céspedes et al. (2004) and Burnside et al. (2001). It is further argued that, even if they would, banks might be exposed to credit risk on loans to firms that have borrowed in foreign currency and did not hedge. Though these channels appear to be in contrast with older models such as the Mundell-Fleming or sticky-price open economy models, where the financial sector is not modelled explicitly, they do overwhelmingly suggest that the use of the “exchange rate” as a transmission mechanism is adequate in capturing the

effect of “portfolio flows”. More so, since the effect of “capital inflows” on “macroeconomic developments” was not the focus of our paper, we deemed the use of the “exchange rate” in our asset quality model as an appropriate instrument.

### 3.2. Empirical model

From the empirical literature reviewed, dynamic panel model formulations were employed in examining the determinants of bank asset quality. The models were adopted from Salas and Saurina (2002), Pain (2003) and Louzis et al. (2012).

$$ASQ_{i,t} = \alpha_i + \beta_1 ASQ_{i,t-1} + \beta_2 HHI_t + \beta_3 LG_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 NITI_{i,t} + \beta_6 INCDIV_{i,t} + \beta_7 GDP_t + \beta_8 INF_t + \beta_9 RER_t + \varepsilon_{i,t} \quad (1)$$

By taking advantage of our unique dataset which disaggregates the banks' non-performing loans into three classes,<sup>19</sup> this study attempts to identify the source of persistence. This is done by employing the lagged values of the three classes of non-performing loans in place of the aggregate lagged value of non-performing loans to form Eqs. (2)–(4):

$$ASQ_{i,t} = \alpha_i + \beta_1 SLR_{i,t-1} + \beta_2 HHI_t + \beta_3 LG_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 NITI_{i,t} + \beta_6 INCDIV_{i,t} + \beta_7 GDP_t + \beta_8 INF_t + \beta_9 RER_t + \varepsilon_{i,t} \quad (2)$$

$$ASQ_{i,t} = \alpha_i + \beta_1 DLR_{i,t-1} + \beta_2 HHI_t + \beta_3 LG_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 NITI_{i,t} + \beta_6 INCDIV_{i,t} + \beta_7 GDP_t + \beta_8 INF_t + \beta_9 RER_t + \varepsilon_{i,t} \quad (3)$$

$$ASQ_{i,t} = \alpha_i + \beta_1 LLR_{i,t-1} + \beta_2 HHI_t + \beta_3 LG_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 NITI_{i,t} + \beta_6 INCDIV_{i,t} + \beta_7 GDP_t + \beta_8 INF_t + \beta_9 RER_t + \varepsilon_{i,t} \quad (4)$$

$ASQ_{i,t}$  is the ratio of non-performing loans to gross loans and advances for bank  $i$  at time  $t$ ;  $ASQ_{i,t-1}$ ,  $SLR_{i,t-1}$ ,  $DLR_{i,t-1}$  and  $LLR_{i,t-1}$  are the lags of overall asset quality, substandard loan ratio, doubtful loan ratio and loss loan ration respectively for bank  $i$  at time  $t - 1$ .  $HHI_t$  is a proxy for lending concentration (diversification) at time  $t$  in the industry,  $LG_{i,t}$  represents growth of loans and advances for bank  $i$  at time  $t$ ,  $SIZE_{i,t}$  is the size of bank  $i$  at time  $t$ ,  $NITI_{i,t}$  is the ratio of net interest income to total income for bank  $i$  at time  $t$ ,  $INCDIV_{i,t}$  is the ratio of non-interest income to total income for bank  $i$  in time  $t$ ,  $GDP_t$  is the annual

<sup>17</sup> Salas and Saurina (2002), Rajan and Dhal (2003) Fofack (2005) and Jimenez and Saurina (2006).

<sup>18</sup> Dornbusch et al. (1995), Eichengreen and Hausman (1998), Calvo and Reinhart (2002), Céspedes et al. (2004), Magud et al. (2011), Kamil (2012).

<sup>19</sup> Substandard loans which are loans remaining outstanding for a period of between 3 and 6 months, doubtful loans for a period of between 60 days and 180 days and loss loans which remains outstanding after 1 year.

GDP growth rate  $i$  at time  $t$ ,  $INF_t$  is the annual inflation rate in time  $t$  and  $RER_t$  is the annual real exchange rate in year  $t$ .  $\varepsilon_{i,t}$  is the time variant error term for bank  $i$  at time  $t$ , while  $\alpha_i$  is the time-invariant firm specific unobserved effect.

### 3.2.1. Estimation procedure

The dynamic panel data employed are modelled as below:

$$y_{i,t} = \beta_1 y_{i,t-1} + \beta_2 BS_{i,t} + \beta_3 MEF_{i,t} + \varepsilon_{i,t}$$

$$\varepsilon_{i,t} = \alpha_i + \mu_t + e_{i,t}$$

where  $y_{i,t}$  is the non-performing loans ratio for bank  $i$  in year  $t$ . This is explained by its lag  $y_{i,t-1}$ , bank-specific factors ( $BS_{i,t}$ ) and macroeconomic factors ( $MEF_{i,t}$ ). The error term  $\varepsilon_{i,t}$  is made up of the unobserved bank-specific effect  $\alpha_i$ ;  $\mu_t$ , time-specific fixed effect and  $e_{i,t}$ , the bank-specific time variant effect. The structure of the model gives rise to autocorrelations as well as correlation between the bank fixed effects and the error. This problem of endogeneity is corrected using the difference generalized method of moments (GMM) of [Arellano and Bond \(1991\)](#) which uses the first difference of the explanatory variables to deal with the fixed effects and their lagged values as instruments. However, in small sample data with small number of time periods as employed in this study, the difference GMM has been found to have low predictive ability.<sup>20</sup> This study therefore employed system GMM<sup>21</sup> of [Arellano and Bover \(1995\)](#) and [Blundell and Bond \(1998\)](#) to deal with the concerns of the difference GMM. Following [Roodman \(2009\)](#), the lagged values of the bank specific variables were treated as endogenous, while the macroeconomic factors were dealt with as being exogenous. Since this reduces the number of observations and the power of regression estimates, we employed the [Arellano and Bover \(1995\)](#) forward orthogonalization procedure and collapsing method of [Holtz-Eakin et al. \(1988\)](#) to limit the number of instruments. To test the assumptions of instruments' validity and no first order autocorrelation, the Hansen  $J$  test of over-identifying restrictions of [Arellano and Bond \(1991\)](#) was used to test the moment conditions of the estimation procedure ([Liu and Hsu, 2006](#)). For robustness analysis, the ordinary least squares panel corrected standard errors (OLS-PCSE) estimation of [Beck and Katz \(1995\)](#) was employed for re-estimation of the model. The OLS-PCSE employs a sandwich type estimator of the covariance matrix which is robust to the presence of non-spherical errors. The Breusch-Pagan/Cook-Weisberg Lagrange Multiplier post-estimation was used to test for heteroskedasticity, while the [Wooldridge \(2002\)](#) test of no first order autocorrelation was also employed. The results provided strong justification for the use of [Beck and Katz \(1995\)](#) panel-corrected standard errors estimation method since evidence was provided for non-sphericity of the error terms for the static model.

<sup>20</sup> See [Blundell and Bond \(1998\)](#) and [Alonso-Borrego and Arellano \(1999\)](#) for arguments against the difference GMM.

<sup>21</sup> The system GMM estimations were carried out using the `xtabond2` command in STATA 12.

Table 4.1  
Composition of non-performing loans.

YEARS	SLR	DLR	LLR	ASQ	L/NPL	Stress ratio
2005	0.036	0.04	0.076	0.152	0.454	0.057
2006	0.016	0.027	0.062	0.105	0.602	0.070
2007	0.019	0.027	0.033	0.079	0.457	0.067
2008	0.022	0.019	0.038	0.078	0.44	0.048
2009	0.034	0.047	0.063	0.144	0.42	0.071
2010	0.032	0.026	0.081	0.138	0.486	0.114
Average	0.026	0.031	0.059	0.116	0.476	0.071

Source: Computations from Research Data, 2005–2010.

SLR, substandard loan ratio; DLR, doubtful loan ratio; LLR, loss loan ratio; ASQ, non-performing loans ratio; L/NPL, loss loans to non-performing loans; Stress Ratio, ratio of non-performing loans to total assets.

## 4. Results

### 4.1. Trend analysis of asset quality

The asset quality (non-performing loans) of banks, classified into substandard loans, doubtful loans and loss loans, was examined over the six (6) year period of the study. [Table 4.1](#) below details the trend of the three (3) classifications of non-performing loans (asset quality) in the banking industry.

Generally, the asset quality (non-performing loans/gross loans) was above 10% except in 2007 and 2008. From [Table 4.1](#) above, 11.6% of loans and advances granted over the period were non-performing compared to 18.5% in Nigeria after their banking consolidation ([Ezeoha, 2011](#)). On the classes of the bank asset quality, loss loans ratio (ratio of loss loans to gross loans) consistently accounted for higher portions of the bank's loans with an average of 0.059 out of the asset quality (non-performing loans ratio) average of 0.116 and accounted for an average of 47.6% of non-performing loans. This indicates that 47.6% of the industry's non-performing loans were written off as losses over the period. Also, the 2005 recorded the highest write-off of non-performing loans with a ratio of 0.602. It must be noted that though loss loans are about half of overall non-performing loans, the combination of both substandard and doubtful loans ensures the persistence of non-performing loans. This is because loss loans are written-off and are replaced by substandard and doubtful loans.

[Daumont et al. \(2004\)](#) (citing [Caprio and Klingebiel, 1996](#)) defined systemic banking crisis whereby non-performing loans are at least between 5 and 10% of total assets and thus likely to be sufficient to wipe out most or all of the banking system's capital. On this basis, the stress ratio was computed as the ratio of non-performing loans to total industry assets. On the stress ratios, the ratio of non-performing loans to total industry assets was above 5% in all periods except 2008 which had a stress ratio of 0.048, with the highest ratio of 0.114 recorded in 2010. The average for the study period of 0.071 indicates that 7.1% of banking assets are made up of non-performing loans. This result indicates that the banking industry suffers from what [Caprio and Klingebiel \(1996\)](#) describe as "silent form of distress" in which a significant portion of the banking system is insolvent, but still remains open. This supports the report by [IMF \(2011\)](#) of a fragile

Table 4.2  
Descriptive statistics.

	Mean	Std. Dev.	Min	Max	SWILK	N
ASQ	0.116	0.119	0.000	0.704	6.951***	133
SLR	0.027	0.032	0.000	0.145	7.143***	135
DLR	0.032	0.041	0.000	0.289	7.711***	134
LLR	0.060	0.080	0.000	0.544	7.994***	137
HHI	0.083	0.011	0.060	0.090	5.189***	141
LG	7.964	0.697	5.700	9.150	4.882***	140
SIZE	19.290	1.192	16.200	21.448	3.249***	141
NITI	0.608	0.137	0.292	0.873	1.261	141
INCDIV	0.389	0.116	0.123	0.708	-0.13	141
GDP	0.065	0.011	0.050	0.080	3.403***	140
INF	0.135	0.031	0.090	0.180	-0.96	141
RER	0.118	0.198	-0.090	0.373	6.294***	141

Source: Computations from Research Data, 2012.

ASQ, non-performing loans ratio; SLR, substandard loan ratio; DLR, doubtful loan ratio; LLR, loss loan ratio; HHI, Herfindahl–Hirschman Index for lending; LG, loan growth; SIZE, bank size, NITI, Net interest income/Total Income; INCDIV, Non-Interest Income/Total Income; GDP, gross domestic product growth; INF, inflation; RER, real exchange rate.

\*\*\* Significance levels of 1%.

banking industry where “even a moderate deterioration in asset quality of banks would have led to insolvency of several banks”, and with total industry assets forming about 75% of the assets of the financial services industry (IMF, 2011), foreclosure of banks will destabilize the financial system.

#### 4.2. Descriptive statistics

The descriptive results represented in Table 4.2 depicts an average asset quality of Ghanaian banks, measured as the ratio of non-performing loans to total loans for the period from 2005 to 2010 of 11.6%. The average growth in bank size was 19.29. The measure of concentration, the Hirschman–Herfindahl Index (HHI) of loan concentration which measures the concentration of lending among banks for loan customers as 0.083, indicates that lending is diversified within the banking industry, hence a competitive banking industry. The average credit growth of 7.964% indicates a slower rate of credit extension within the industry over the period. The mean for interest rate spread of 0.608 indicates that 60.8% of the industry’s total income comes from intermediation activities, while the mean return on non-intermediation activities was 38.9% of operating income. The average GDP, inflation and real exchange rates for the six-year period are 6.5%, 13.5% and 11.8% respectively. The Shapiro–Wilk (SWILK) statistics indicates that all the variables except interest spread, income diversification and inflation are not normally distributed at 1%.

Table 4.3 shows the correlation matrix for the variables in the regression model defined in the previous section. According to Kennedy (2008), correlation coefficients of below 0.70 indicate that weaker relationships exist among the independent variables, hence the avoidance of any potential multicollinearity problems in the regression estimates.

#### 4.3. Determinants of bank asset quality

The Hansen *J* and Arellano–Bond test results for the validity and robustness of the systems Generalized Method of Moments (GMM) estimator respectively provide ample evidence of the reliability of the estimated coefficients in all models. The Hansen *J* statistics tests the null hypothesis that the over-identifying restrictions are valid. The test results for the models do not reject the null hypothesis of valid instruments (because prob  $> \chi^2$  are all greater than 0.05). A consistent GMM estimator, according to Arellano and Bond (1991), must not exhibit second-order autocorrelation. Although all the models exhibit first order autocorrelation, the null hypotheses of no second order autocorrelation could not be rejected. Due to the unbalanced panel nature of the data, the total observations dropped to 84 for 22 banks from the 25 bank data analyzed.

The lag of asset quality was found to have a positive relationship with non-performing loans at a 1% significance level to indicate the negative impact of worsening loan portfolio of Ghanaian banks. Although loan write-offs in each class of non-performing are expected to reduce current levels of non-performing loans, the poor loan portfolio ensures that more performing loans graduate to non-performing status with time in proportions greater than the amount of loan write-offs. Their coefficient of 0.337 indicates that 1% increase in the lag of non-performing loans ratio leads to deterioration in asset quality of 33.7%. These results attest the persistence effect of non-performing loans. On the source of the persistence, the lags of substandard ( $SLR_{t-1}$ ) and doubtful ( $DLR_{t-1}$ ) loans exhibit significant positive relationship with non-performing loans, whereas the negative relationship between loss loan ( $LLR_{t-1}$ ) and non-performing loans was insignificant. This makes current levels of non-performing loans an important factor in controlling the future quality of bank’s assets. Pain (2003) and Dash and Kabra (2010) found evidence of positive persistence of non-performing loans. This result is, however, contrary to that of Louzis et al. (2012) who found that increases in previous non-performing loss reduce current levels of non-performing loans due to huge write-offs among Greek banks.

The regression estimates also show that banking market concentration, proxied by the HHI for loans, negatively influences the non-performing loans of banks at a 1% significance level in models 1, 3 and 4 and 5% in model 2. This implies that an asset quality improves in a concentrated bank market. A concentrated banking industry indicates that most of the industry’s lending is concentrated among few banks, enabling them to have access to more information on borrowers. This mitigates the problem of adverse selection and moral hazard leading to low loan default rate. According to Petersen and Rajan (1995), banks with monopolistic power tend to be located closer to their clients and thus benefit from reduced monitoring cost and improved efficiency. As observed in Table 2.1, majority of loans are advanced to private businesses which are normally located in commercial centres as these banks (See Aboagye, 2012). This explains the negative impact of competition of non-performing loans. This finding supports the competition-fragility hypothesis. In line with expectations, loan growth (LG) exhibits positive and

Table 4.3  
Pearson correlation matrix.

	1	2	3	4	5	6	7	8
1.HHI	1.000							
2.LG	-0.291***	1.000						
3.SIZE	-0.365***	0.487***	1.000					
4.NITI	-0.039	0.008	0.004	1.000				
5.INCDIV	0.121	0.124	0.130	-0.675***	1			
6.GDP	-0.384***	0.133	0.173**	0.059	0.034	1.000		
7.INF	0.570***	-0.011	-0.046	-0.165*	0.245***	-0.118	1.000	
8.RER	-0.564***	0.392***	0.428***	-0.108	0.057	0.276***	0.052	1.000

HHI, Herfindahl–Hirschman Index for lending; LG, loan growth; SIZE, bank size; NITI, net interest income/total income; INCDIV, non-interest income/total income; GDP, gross domestic product growth; INF, inflation; RER, real exchange rate.

\* Significance levels of 10%.

\*\* Significance levels of 5%.

\*\*\* Significance levels of 1%.

Table 4.4  
Systems GMM estimations.

Dependent variable: asset quality				
	Model 1	Model 2	Model 3	Model 4
Constant	0.417 (4.39)***	0.546 (2.72)**	0.627 (4.12)***	0.491 (3.14)***
ASQ <sub>t-1</sub>	0.337 (3.29)***			
SLR <sub>t-1</sub>		0.709 (3.66)***		
DLR <sub>t-1</sub>			0.615(2.4)**	
LLR <sub>t-1</sub>				-0.058 (0.41)
HHI	-3.271 (-4.9)***	-4.814 (-6.22)**	-4.494 (-4.72)***	-2.871 (-3.36)***
LG	0.003 (2.34)**	0.001 (1.74)*	0.003 (3.06)***	0.002 (1.57)
SIZE	-0.047 (-4.73)***	-0.072 (-7.93)***	-0.061 (-6.23)***	-0.051 (-3.31)***
NITI	0.111 (1.73)*	0.219 (5.98)***	0.112 (1.82)*	0.106 (1.46)
INCDIV	-0.043 (-1.21)	-0.097 (-2.91)***	-0.016 (-0.38)	-0.021 (-0.46)
GDP	-1.006 (-2.68)**	-1.206 (-6.33)***	-0.800 (-3.23)***	-0.665 (-2.24)**
INF	1.098 (5.92)***	1.029 (5.37)***	1.079 (6.75)***	0.963 (7.38)***
RER	0.016 (1.73)*	0.014 (2.06)*	0.015 (1.47)	0.023 (2.65)**
AR(1): <i>p</i> -values	0.02**	0.059*	0.037**	0.050*
AR(2): <i>p</i> -values	0.822	0.84	0.264	0.490
Hansen <i>J</i>	12.36	12.38	12.18	16.64
Prob >χ <sup>2</sup>	0.778	0.776	0.789	0.479
Banks	22	22	22	22
Observations	84	84	84	84

Source: Results of Data Analysis in STATA 12.

ASQ, non-performing loans ratio; SLR, substandard loan ratio; DLR, doubtful loan ratio; LLR, loss loan ratio; HHI, Herfindahl–Hirschman Index for lending; LG, loan growth; SIZE, bank size; NITI, net interest income/total income; INCDIV, non-interest income/total income; GDP, gross domestic product growth; INF, inflation; RER, real exchange rate. AR(1) and AR(2) are first and second order correlation tests. Hansen *J* is the test for overidentifying restrictions. *z*-Statistics are in parentheses.

\* Significance levels of 10%.

\*\* Significance levels of 5%.

\*\*\* Significance levels of 1%.

significant relationship with the non-performing loans of banks at level of 5% in model 1, 10% in model 2 and 1% in model 3. This relationship is insignificant in model 4. This result implies that universal banks continuously extend relatively higher levels of credit experience deterioration in the quality of their loan assets. This result is consistent with other international evidence,<sup>22</sup> which suggests an adverse effect of credit growth on non-performing loans.

Bank size exhibited significant negative relationship with non-performing loans to indicate that larger Ghanaian banks have lower non-performing loans. Consistent across all estimations, the relationship is significant at 1%. This supports the assertion that large banks have the capacity to better manage their loan portfolio associated with high risk. This result is consistent with the findings of studies<sup>23</sup> that argue that larger banks have better risk management practices compared to smaller banks.

<sup>22</sup> Keeton (1999), Salas and Saurina (2002) and Jimenez and Saurina (2006).

<sup>23</sup> Rajan and Dhal (2003), Salas and Saurina (2002).

Table 4.5  
OLS and Difference GMM Estimations.

	OLS-PCSE		DIFFERENCE GMM	
	Coef.	z	Coef.	z
Constant	0.719	2.56**	2.716	3.92***
$ASQ_{it-1}$			0.259	2.82***
HHI	-2.883	-2.92***	-3.907	-3.55***
LG	0.004	2.14**	0.005	2.13**
SIZE	-0.034	-3.14***	-0.091	-3.4***
NITI	0.126	1.52	0.018	0.15
INCDIV	-0.013	-0.16	-0.175	-1.11
GDP	-1.100	-2.18**	-1.047	-1.74*
INF	0.884	2.98***	0.892	2.83***
RER	0.024	1.12	-0.058	-2.55**
R-squared	0.2952			
Wald $\chi^2$ (8)	23.17***			
BP-CW Hetttest: <i>p</i> -value	0.000***			
WD AR (1) test: <i>p</i> -value	0.3253			
AR(1): <i>p</i> -value			0.036**	
AR(2): <i>p</i> -value			0.7611	
Sargan: <i>p</i> -value			0.462	
Banks	24		22	
Observations	109		82	

Source: Results of Data Analysis in STATA 12.

ASQ, non-performing loans ratio; SL, substandard loan ratio; DL, doubtful loan ratio; LL, loss loan ratio; HHI, Herfindahl–Hirschman Index for lending; LG, loan growth; SIZE, bank size; NITI, net interest income/total income; INCDIV, non-interest income/total income; GDP, gross domestic growth; INF, inflation; RER, real exchange rate. BP-CW Hetttest is the test for heteroskedasticity. WD AR (1) is the Wooldridge test of autocorrelation. AR(1) and AR(2) are the first and second order correlation tests. Hansen *J* is the test for overidentifying restrictions.

\* Significance levels of 10%.

\*\* Significance levels of 5%.

\*\*\* Significance levels of 1%.

We assert this relationship to result from economies of scale enjoyed by larger Ghanaian banks which enable them to benefit from reduced risk (Biekpe, 2011). Cost of bank lending captured by the net interest spread exhibited significant positive relationship with non-performing loans at significance levels of 10% in models 1 and 3 and 1% in model 2. The intuitive explanation for this relationship lies in the high intermediation spread within the Ghanaian banking industry. This exacerbates the moral hazard and adverse selection problem in the Ghanaian credit market. This has made bank borrowing very costly, hence affecting borrower's ability to repay bank loans. In line with expectations, bank income diversification which stabilizes the income of banks was found to be negatively related to bank non-performing loans in all estimations. This implies that branching into non-interest generating activities reduces the overall risk of default associated with financial intermediation, hence lower levels of non-performing loans. However, the relationship was only significant in model 2 at 1%.

Consistent with previous studies,<sup>24</sup> we find a negative significant relationship between non-performing loans and gross domestic product growth rate (GDP rate) in all estimations. This indicates that in a booming economy where economic activities

are brisk, bank borrowers are able to generate enough returns which enable them to service their loan commitments. This indicates that the asset quality of banks is less likely to deteriorate during periods of high economic growth. In the words of Laeven and Majnoni (2003), 'bankers on average create too little provisions in good times'. This relationship is significant at 5% in models 1 and 4 and 1% in models 2 and 3. The coefficients of GDP rate indicate that a percentage growth in economy will improve the asset quality (decrease in non-performing loans) of banks by 1.006%, 1.201%, 0.800% and 0.665% in models 1, 2, 3 and 4, respectively.

The positive relationship between non-performing loans and inflation rate conforms to the findings of Fofack (2005)<sup>25</sup> and several other studies<sup>26</sup> but contrary to that of Shu (2002). This implies that rising inflation leads to deterioration in the quality bank loan portfolio. Theoretically, increasing levels of inflation erode the purchasing power of consumers, restricting the amounts of goods and services they consume. This impacts on loan customers who cannot easily turnover their goods to generate enough returns to service the loans. Therefore in

<sup>24</sup> The Salas and Saurina (2002), Rajan and Dhal (2003), Fofack (2005) and Jimenez and Saurina (2006).

<sup>25</sup> For both CFA and non-CFA Sub-Saharan African countries. The sample excluded Ghana.

<sup>26</sup> Babouček and Jančar (2005), Rinaldi and Sanchis-Arellano (2006) and Klein (2013).

periods of high inflationary pressures, the asset quality of banks is more likely to deteriorate. These relationships exhibit significance levels of 1% in all estimations. Real exchange rate was also found to have a positive relationship with non-performing loans. This implies that a depreciation in the local currency leads to the decline in the quality of banking industry loan assets. This result is consistent with that of Fofack (2005) and Klein (2013). With most of the banking industry credit allocated for commerce and finance to fund export-oriented firms, the depreciation of the currency limits the ability to earn enough profits to cover bank credit repayment terms. The increased prices make it difficult to ensure high turnover for goods and services.

#### 4.4. Robustness test

On examining the robustness of system GMM estimations, in Table 4.4, the basic model (Eq. (1)) was re-estimated using the ordinary least squares panel-corrected standard errors (OLS-PCSE)<sup>27</sup> of Beck and Katz (1995) and the difference GMM of Arellano and Bond (1991). The diagnostics of the OLS indicate the presence of heteroskedasticity but no serial correlation. The results presented in Table 4.5 are generally consistent with the results in model 1. In OLS estimation, all the significant variables in the systems GMM estimation maintained their significance with the exception of income diversification (INCDIV) and real exchange rate; however, in the difference GMM results, only income diversification was insignificant. Additional robustness tests<sup>28</sup> using different measures of competition (HHI for deposits and assets) are consistent with these estimations.

## 5. Conclusion and policy implications

To enhance the stability of financial markets, studies have sought to examine the factors that affect the quality of bank loan portfolio mainly in developed economies. With little evidence on such factors in bank dominated financial markets in emerging economies, this study examined both bank level and macroeconomic determinants of bank asset quality in an emerging Ghanaian banking market with high levels of non-performing loans. This would provide regulatory authorities and bank management in Ghana and other emerging economies with the appropriate indicators to inform policy decisions in improving the performance of banking system loan portfolio. A panel data model on 25 Ghanaian banks from 2005 to 2010 was estimated using the two-step system and difference GMM estimation of Arellano and Bover (1995) as well as the ordinary least squares panel-corrected standard errors of Beck and Katz (1995) to identify the determinants of non-performing loans.

Descriptive statistics of the non-performing loans over the study indicate that significant portions of banking industry assets are locked up in non-performing loans. From our empirical estimations, we find evidence of a positive persistence effect of non-performing loans. This arises because of continuous deterioration in the performance of the banks' loan portfolio. Market concentration, bank size and income diversification were found to have a positive impact on bank asset quality, while bank interest spread and credit growth impact negatively on performance of bank loan portfolio. The empirical models outlined in this study also support the view that the macroeconomic environment is an important factor in explaining bank non-performing loans. Specifically, the results show that inflation rate and exchange rate depreciation negatively impacts bank asset quality. However, growth in the real economy translates into improvements in the asset quality of banking industry. The results show that the impact of growth in real GDP, real exchange rate and inflation on asset quality is instantaneous.

In this study, we provided first evidence of bank characteristics that explains bank loan performance in an emerging banking market in addition to the widely known macroeconomic factors. The findings of the study have implications for the regulation and management of banks in Ghana and other emerging economies. First, the identification of the bank specific determinants of bank asset quality would provide the basis for some form of managerial supervision by regulatory authorities since the management has control over such factors. Most importantly, efforts at improving the competitiveness of the banking industry should be backed by the development of an information depository to collate data for the monitoring of borrower repayment behaviour. Since monitoring borrower behaviour is found to be easy and less costly in concentrated market, the strengthening of the recently established credit bureau would address any information imbalances which may arise in competitive markets. For bank management, the factors identified in this study would help inform policy decisions in improving credit appraisal mechanisms to improve the quality of bank loan portfolios. We also advocate for an effective risk management mechanism by banks to detect early signs of borrower default.

This study identifies the following gaps for further studies. To better understand the channels for the fluctuations in non-performing, we propose that further studies should be undertaken to examine how different loan categories (i.e. loans to household, private enterprises, public enterprises and government institutions) affect bank asset quality. Due to the critical role of governance in bank management and the ownership stake by governments in some major banks in Ghana, we advise further studies on the effect of ownership structure and other corporate governance indicators on the bank asset quality. Future studies could test for the existence of the non-linear relationship between competition and non-performing as discovered by Martinez-Miera and Repullo (2010). This would enable regulators to identify the threshold effects of competition policy. Lastly, this study could also be replicated in other emerging banking markets to provide tools for ensuring the soundness of financial systems.

<sup>27</sup> According to Beck and Katz (1995), the PCSE makes the OLS efficient when the non-sphericity (i.e. serial correlation or heteroskedasticity) of the error terms is accounted for.

<sup>28</sup> Unreported but available on request.

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