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# **Non-performing loans and Financial Development: New Evidence**

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# **Non-performing loans and Financial Development: New Evidence**

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**2019**

## **Abstract**

We investigate the influence of financial development on non-performing loans using a global sample. The findings reveal that two financial development proxies, foreign bank presence and financial intermediation, are positively associated with non-performing loans. Among the determinants of non-performing loans, bank efficiency, loan loss coverage ratio, competition and banking system stability are inversely associated with NPLs while NPLs are positively associated with banking crises and bank concentration. In the regional analysis, NPLs are negatively associated with regulatory capital and bank liquidity, implying that banking sectors with greater regulatory capital and liquidity experience fewer NPLs

JEL Classification Code: E44, G01, G21, G28, G32, F34, O16

Keywords: Non-performing loans; financial development; banking crisis; foreign banks; financial intermediation; credit risk

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## 1. Introduction

This study examines the influence of financial development on non-performing loans.

Non-performing loans (NPLs) are important because they reflect the credit quality of the loan portfolio of banks, and in aggregate terms, reflect the credit quality of the loan portfolio of the banking sector in a country. An understanding of the factors that influence the level of non-performing loans is crucial for the risk management function of banks and for national bank supervisors responsible for banking stability. The determinants of non-performing loans within and across countries is a major theme in the non-performing loan academic literature (Skarica, 2014; Louzis et al, 2012; Nkusu, 2011, etc). Also, the cyclical nature of bank lending and the incidence of abnormal loan losses arising from bank lending have been of interest to policy makers in recent years; yet academic and policy studies have not examined the role of financial (sector) development in exacerbating or reducing systemic losses in a financial system particularly losses arising from massive non-performing loans among lending institutions.

The level of financial development in a country is important because it can influence the severity of a financial or economic crisis and it can affect the domestic mobilisation of resources needed to tackle an existing crisis (Naude, 2009); hence, it is not surprising that financially developed countries recovered from the 2008 global financial crisis quicker than less financially developed countries (Naude, 2009). Prior to the 2008 financial crisis, aggregate non-performing loans for most countries were relatively low but increased significantly during and after the 2008 financial crisis<sup>1</sup>, compelling national banking supervisors to intervene to deal with the rising non-performing loan problem in their banking sectors. Despite the formulation of several national policy frameworks intended to mitigate rising non-performing loans such as the imposition of stringent capital requirements for banks (ECB, 2017), yet rising non-performing loans remain a major issue, which raises concern about the adequacy of existing policy solutions to mitigate rising non-performing loans. We argue that the level of financial development can provide some insight to improve our understanding of the persistence of non-performing loans.

Financial development is important for bank profitability and efficiency (Demirgüç-Kunt and Huizinga, 2000), and its importance has been highlighted by Demirgüç-Kunt and Huizinga (2000), Naceur and Omran (2011) and Ozili (2015). Moreover, in practice and in policy, non-performing loans arising from bank lending is an indicator of bank performance (BIS, 2017; Beck et al, 2015), and bank performance is also influenced by the level of financial sector development (Tecles and Tabak, 2010); therefore, it is important for policy makers to understand the role of financial development for the persistence of non-performing loans. A policy solution that takes into account the structure of the financial system and the level of financial development for banking sector performance can be effective (Demirgüç-Kunt and Huizinga, 2000). Yet, policy debates on non-performing loans have paid little attention to the role of financial development for nonperforming loans, an indicator of banking performance. In this paper, we look at the influence of financial development on aggregate non-performing loans.

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<sup>1</sup> See Appendix A1.

Given that the level of non-performing loan is an indicator of bank performance, i.e., the lower the better according to Beck et al (2015), we postulate that certain financial (sector) development characteristics can make it more probable for the banking sector to experience higher or fewer aggregate non-performing loans. Hence, we are interested in explaining the relationship between non-performing loans and financial development using country and regional data for non-performing loans. We employ two datasets: data for 96 countries and data for 6 regions of the world. Our measures of financial development are foreign bank presence (financial liberalisation), private credit by banks to GDP ratio (financial intermediation) and bank deposit to GDP ratio (size of banking sector). The findings reveal that non-performing loans are positively associated with financial development measured as (private credit by banks to GDP ratio, implying that banking sectors with greater financial development (via greater financial intermediation and foreign bank presence) experience higher non-performing loans.

This study contributes to the literature on the determinants of NPLs and macro-financial feedback in two ways. One, we focus on the relationship between non-performing loans and financial sector development, an issue that remain unexplored in the literature. Two, we use two datasets and combine regional graphical analysis and global empirical analysis to analyse the association between NPLs and financial development during the 2003 to 2014 period. Three, we introduce non-traditional banking sector determinants that potentially explain the behaviour of non-performing loans. From a policy standpoint, our analysis is of interest to policy makers for two reasons. First, our analysis on the relationship between aggregate non-performing loans and financial development is crucial for macro-prudential surveillance and can help policy makers in their evaluation of external factors beyond their control that influence the level of aggregate non-performing loans despite their micro-prudential policy efforts to reduce the size of NPLs. A thorough understanding of this relationship can provide some breakthrough to bank supervisors/regulators in their attempt to identify the causes of rising non-performing loans and how to reduce non-performing loans in the banking sector. Finally, our analysis is relevant for the stress testing of bank loan quality. National bank supervisors should take into account the level of financial sector development in their stress-test scenarios in order to gain robust stress test results that can improve their understanding of what gives rise to non-performing loans in the banking sector.

The remainder of the paper is organized as follows. Section 2 presents the conceptual framework and the literature review on non-performing loans. Section 3 presents a description of the dataset and the econometric methodology used to estimate the influence of financial development on non-performing loans. Section 4 discusses the results. Section 5 concludes.

## 2. Related Literature & Conceptual Framework

### 2.1. Related Literature

The literature on non-performing loans (NPLs) focus extensively on the macroeconomic and bank-level determinants of non-performing loans with little or no focus on the role of financial development for the persistence of non-performing loans. For instance, Nkusu (2011) investigate the determinants of non-performing loans across 26 developed countries over the 1998 to 2009 period and find that deteriorating macroeconomic conditions such as: economic growth and higher unemployment led to higher non-performing loans. Klein (2013), using country-level data, investigate 16 CESEE countries over the 1998 to 2011 period and find that aggregate NPLs are negatively associated with credit growth, unemployment, gross domestic product growth rate and inflation. Louzis et al (2012) investigate the determinants of non-performing loans (NPLs) in the Greek banking sector for each loan category: consumer loans, business loans and mortgages, and find that non-performing loans are significantly influenced by management quality, GDP, unemployment, interest rates and public debt. Skarica (2014), using country-level non-performing loans data, investigate the determinants of non-performing loans among 7 countries in the Central and Eastern European (CEE) region during the third-quarters of 2007 and 2012 and find that higher non-performing loans are significantly associated with economic slowdown, unemployment and inflation. Beck et al (2015) examine the macroeconomic determinants of non-performing loans (NPLs) across 91 countries and find that non-performing loans are significantly affected by real GDP growth, share prices, exchange rate and lending interest rate. Anastasiou et al (2016) focus on the Euro-area banking system during the 1990 to 2015 period and find that income tax and output gap significantly influence NPLs.

In the literature, GDP growth rate is often associated with NPLs because NPLs are lower during economic booms and are higher during recessionary periods (see, Skarica, 2014; Ozili, 2015; Beck et al, 2015; etc). Also, high unemployment levels are associated with high non-performing loans because high unemployment can affect borrowers' capacity to repay loans (Klein, 2013; Nkusu, 2011; Ozili, 2018). The effect of inflation on non-performing loans is inconclusive in the literature, with mixed evidence (see, Klein, 2013; Beck et al, 2015, etc.). Global risk-factors may also influence the persistence of non-performing loans. For instance, Espinoza and Prasad (2010) investigate 80 banks from the Gulf Cooperation Council (GCC) region and employ the VIX proxy to control for global financial volatility and risk aversion. They find that non-performing loans are positively correlated with greater global financial volatility, implying that non-performing loans increases with global risk.

Regarding bank-level determinants, Klein (2013) finds that capital adequacy measured as equity-to-asset ratio is negatively correlated with NPLs, implying that banks with relatively low capital have incentives to engage in risky lending behaviour which increases the incidence of non-performing loans. On the other hand, Boudriga et al (2009) investigate the cross-country determinants of nonperforming loans (NPLs) while controlling for the impact of banking supervision and institutional factors on credit risk exposure. They show that banking sectors with higher capital adequacy ratios and prudent loan loss provisioning report fewer non-performing loans. Ozili and Thankom (2018) show that European systemic banks, on average, have fewer NPLs than non-systemic banks because systemic banks have superior credit risk management systems to mitigate non-performing loans

compared to non-systemic banks. They also find a negative relationship between loan loss provisions and non-performing loans for both systemic and non-systemic banks in Europe. Additionally, Klein (2013) shows that profitable banks have fewer NPLs because lower NPLs leads to higher interest income which subsequently improves overall profitability. Ozili (2018) investigates the determinants of banking stability, using NPLs as a stability indicator. Using data for 48 African countries, the study finds that bank efficiency, bank concentration, foreign bank presence, unemployment rate and the size of the banking sector are significant predictors of aggregate NPLs; however, higher government effectiveness, high competition and strong legal systems reduced the persistence of non-performing loans in the post-financial crisis period.

The level of financial development in a country is important, and non-performing loan is an indicator of bank performance; therefore, some link between financial development and non-performing loans can be established. But, the literature that examine the relationship between firm/bank performance and financial development have not explored the role of financial development levels for the persistence of non-performing loans, hence, our understanding of how financial sector development affects non-performing loans is unclear in the literature. For instance, Naude (2009) demonstrate that the level of financial development is important because it can influence the severity of a financial or economic crisis and it can affect the domestic mobilisation of resources needed to tackle an existing crisis in a country. Demirgüç-Kunt and Huizinga (2000) and Naceur and Omran (2011) show that financial development is important for banking sector performance while Tecles and Tabak (2010) show that bank performance can be influenced by financial sector development. Moreover, because non-performing loans are also indicators of banking performance from a policy and regulatory standpoint (BIS, 2017), some studies attempt to link between non-performing loans and financial development.

One study, Tanaskovic and Jandric (2015) use private credit to GDP ratio to control for financial sector development in their study of the macroeconomic and institutional determinants of NPLs for some countries in Central, Eastern and South-Eastern Europe (CESEE) during the 2006 to 2013 period. They find that NPL is negatively correlated with GDP and financial sector development, and positively associated with foreign currency loans ratio and exchange rate. Other scholars argue that foreign bank presence reflects financial development through financial liberalisation and can have some impact on non-performing loans. Giannetti and Ongena (2009) show that foreign firms are more inclined to fund low-risk borrowers that have promising projects rather than fund unpromising projects belonging to high-risk and well-connected or state-owned firms, and lending to low-risk borrowers with promising projects will reduce the risk of non-performing loans thus improving the asset quality of the firm. However, Giannetti and Ongena (2009)'s study did not examine the case of non-performing loans. Following their reasoning, one would expect that countries whose banking sectors are dominated by greater foreign bank assets will experience fewer aggregate non-performing loans. Accordingly, we control for foreign bank presence in our analyses to test this claim. Another study, Demirguc-Kunt and Huizinga (2000) investigate the relationship between financial development and structure on bank performance using bank-level data for developed and developing countries during 1990-1997 period and show that greater financial sector development is associated with lower profitability for banks reflecting increased efficiency due to increased competition. However, Demirguc-Kunt and Huizinga (2000) did not examine the case of non-performing loans. In contrast, our study is different because we take a shift from the extant literature to

investigate more directly the relationship between non-performing loans and financial (sector) development while controlling for traditional and non-traditional determinants of non-performing loans.

Finally, we did not control separately for macroeconomic factors because we expect some causality and/or high correlation between financial development and macroeconomic indicators as indicated by Levine (1997), rather we deflated the financial development indicators by GDP, a macroeconomic indicator. To this end, our analyses in this paper can be viewed as attempt to examine the relationship between financial development and bank performance, taking non-performing loans as a measure of bank performance.

## 2.2. The Persistence of Non-Performing Loans

NPL is an indicator of banks' asset quality, and asset quality is an important indicator of the performance of the banking sector of a country amongst other performance indicators (ECB, 2017). In aggregate terms, the asset quality of a country's banking sector is determined by its aggregate non-performing loan measured as the ratio of impaired loans to gross loans (Beck et al, 2015); however, the definition of non-performing loans will differ across countries<sup>2</sup>. The level of non-performing loans is of serious concern to bank regulators/supervisors due to its role in the failure of several systemic and non-systemic financial institutions around the world particularly during the 2007 to 2008 financial crisis (BIS, 2017). Some studies have analysed the behaviour of NPLs in several regions.

### 2.2.1. Some Regional Evidence

Klein (2013) focused on NPLs in the Central, Eastern and South-Eastern Europe (CESEE) region and observed that the persistence of NPL was driven by macroeconomic factors to a greater extent than bank-level factors, such as GDP growth, unemployment, and inflation. In Africa, Ozili (2017b) show that the level of non-performing loan is a strong predictor of loan loss provision estimates for African banks. Makri et al (2014) focus on the Eurozone and find that both macroeconomic and bank factors equally explain the persistence of nonperforming loans in the Eurozone region. In the Asian region, Corsetti et al (2001) show that excessive non-performing loans arising from the Asian banking system worsen the Asian crises of the 1990s. In the Middle East and North Africa (MENA) region, Creane et al (2004) show that MENA countries experience fewer nonperforming loans in their banking sector but this progress was rapidly outperformed by the banking sector of developed countries. Ozili (2018) use non-performing loans as a stability indicator, when investigating the determinants of banking stability in Africa. The study finds that bank efficiency, banking concentration, foreign bank presence and institutional quality are predictors of NPLs in the African region.

### 2.2.2. Some Regional Statistics

Several banking analysts expect the level of non-performing loans to increase in subsequent years after the 2008 financial crisis. To confirm whether these expectations are true, we obtained some NPL data from the World Bank for different regions using the World Bank's regional classification. Figure 1 reports the trend in aggregate NPLs over time. A closer look at aggregate NPLs across regions in Figure 1 confirm that the post-2008 financial

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<sup>2</sup> see 2012 report on NPLs by the European Banking Coordination "Vienna" Initiative. Available at: <http://vienna-initiative.com/wp-content/uploads/2012/08/Full-Forum-Meeting-of-the-European-Bank-Coordination-Vienna-2.0-Initiative.pdf>

crisis era witnessed significant increase in aggregate NPLs in some regions. Also, there is some consensus among regulators for the need to address the nonperforming loans problem at the individual bank level. One attempt to reduce the level of aggregate non-performing loans in a country would involve minimising the level of non-performing loans for each individual bank in the country. More so, any microprudential policy designed to address NPLs in the financial sector, should also take account the level of financial sector development in the country. This is because certain financial development characteristics/structures in a country can increase or reduce the likelihood of non-performing loans. Figure 2 show some association between non-performing loans and financial sector development indicators. Also, Figure 2 to 7 show that aggregate NPLs are inversely associated with financial intermediation (private credit to GDP ratio) and the size of the banking sector (bank deposits to GDP ratio) for the World, SSA, MENA, LAC and EAP regions while a positive association is observed for the ECA region in the post-crisis period. For all regions, NPLs are inversely associated with return on equity (ROE) and return on assets (ROA). Subsequently, we empirically test this observed association to determine whether varying cross-country financial sector development indicators affect the level of aggregate non-performing loans.



Figure 1: Aggregate NPLs for all regions

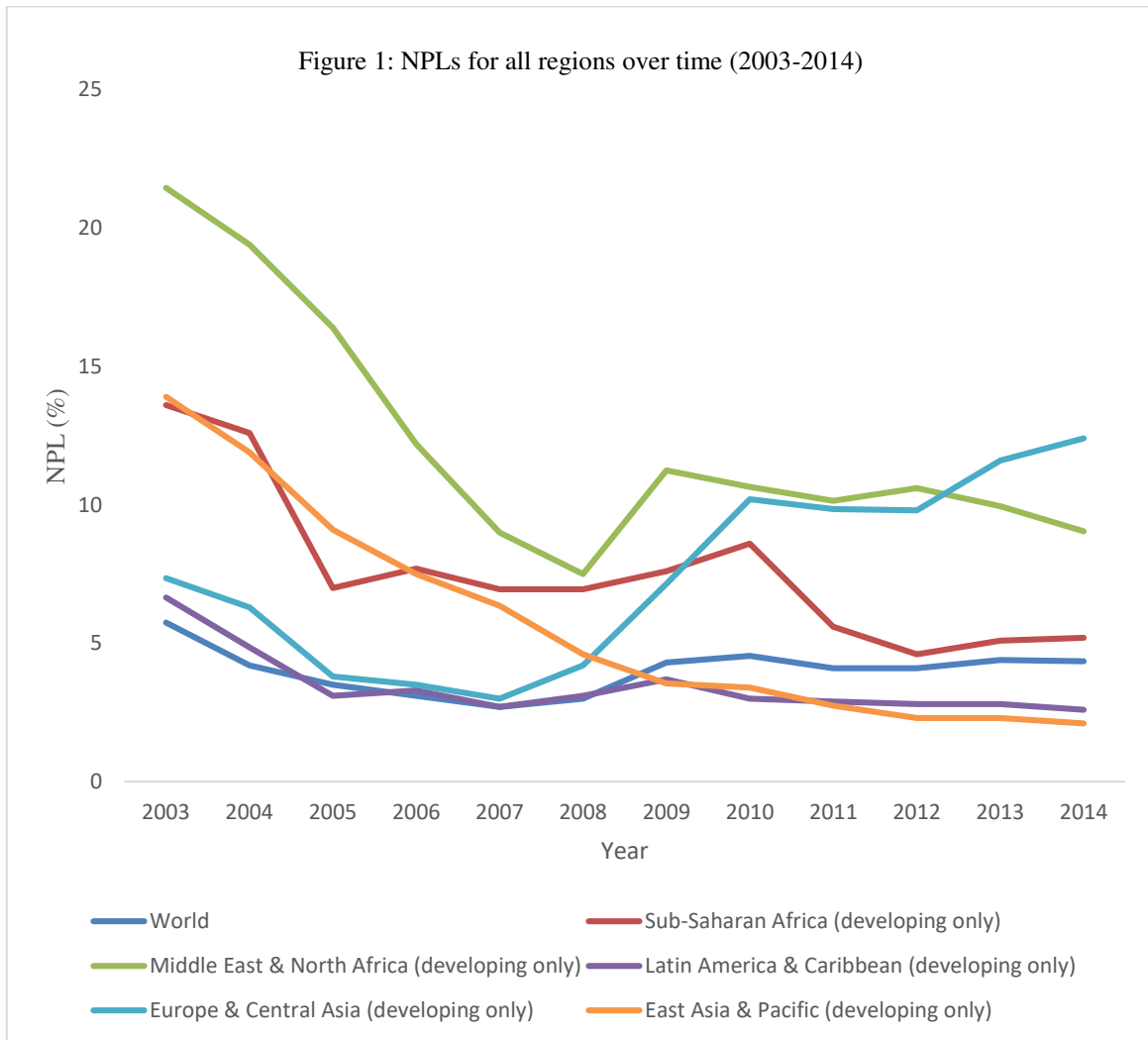


Figure 2: World Region

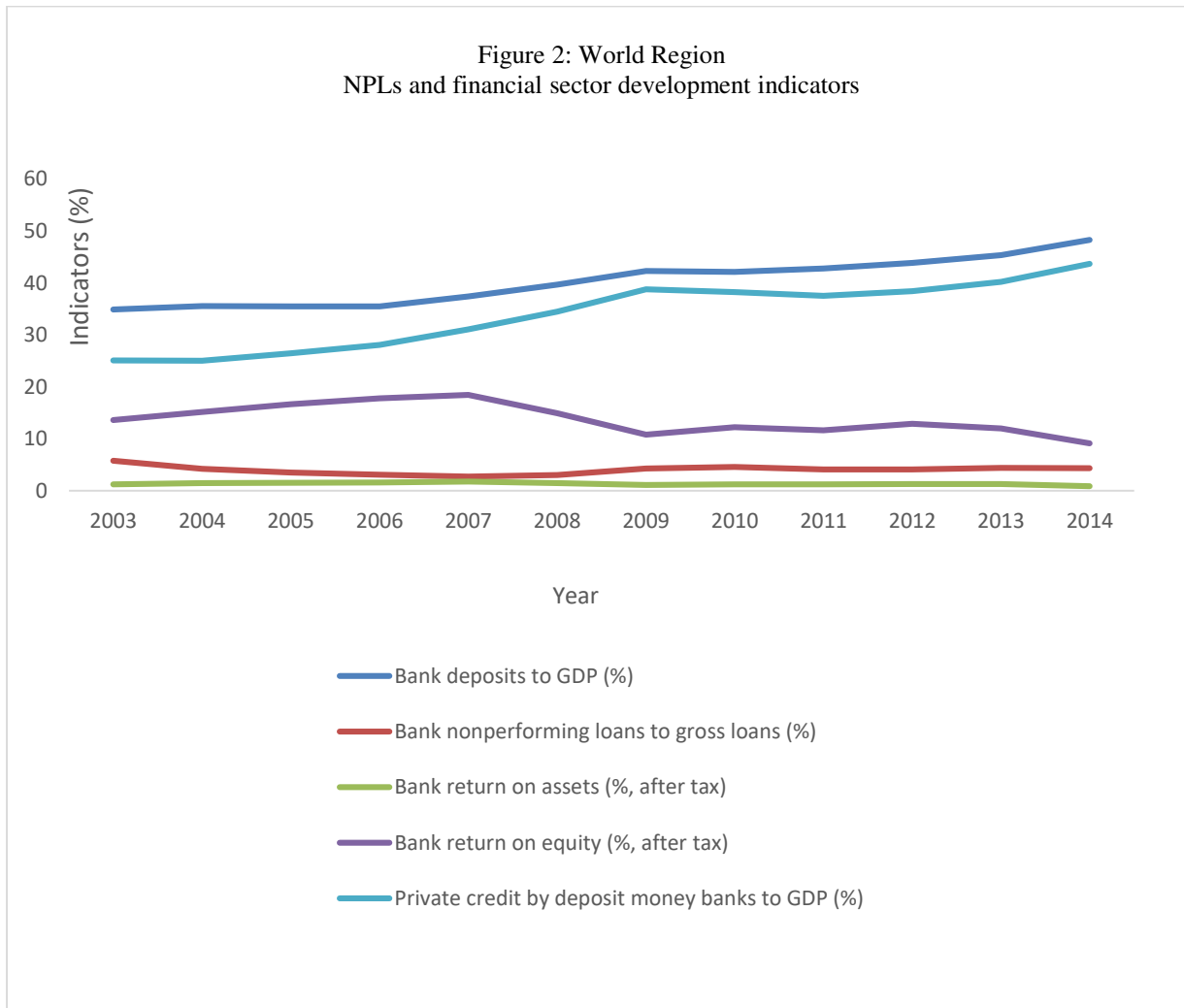


Figure 3: Sub-Saharan African Region

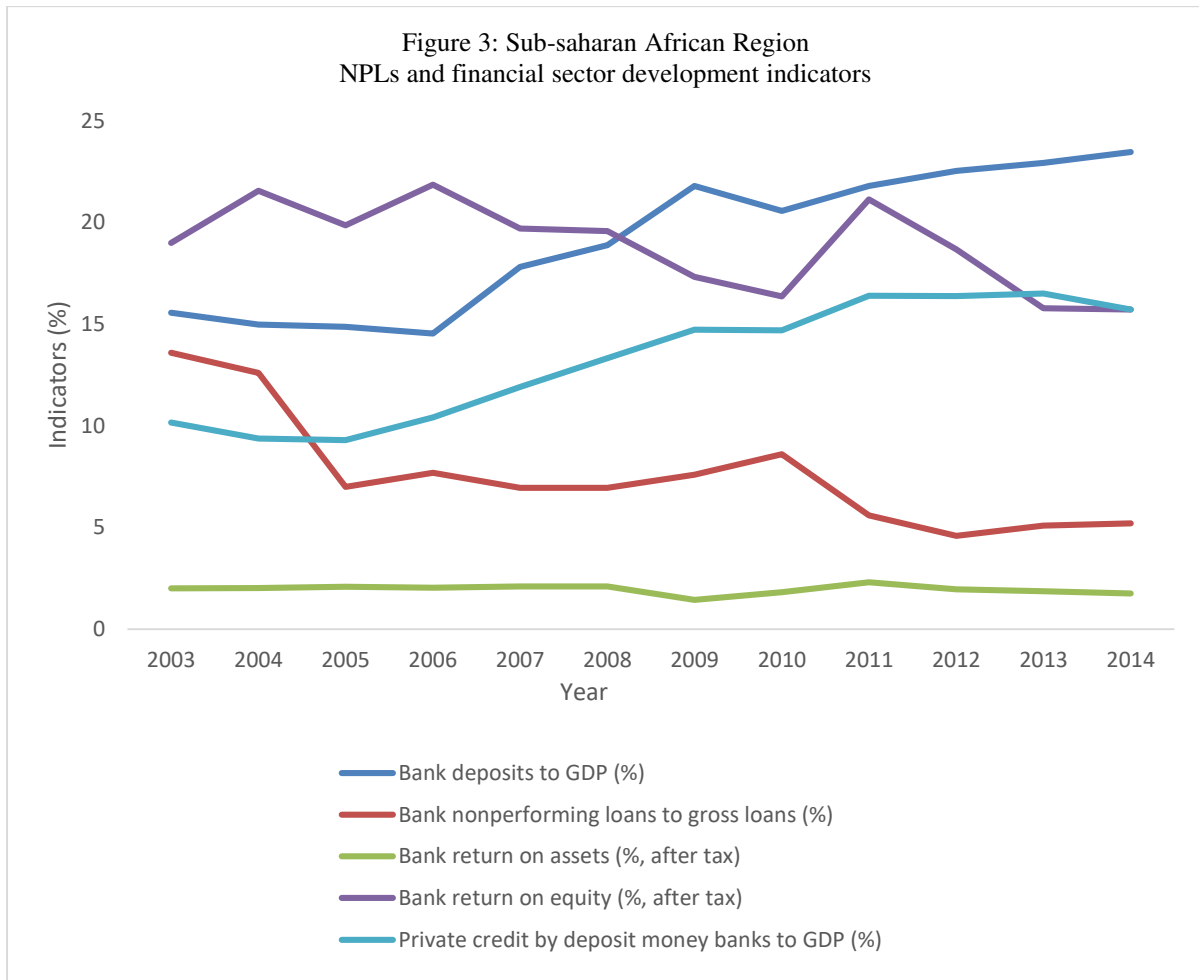


Figure 4: Middle East and North Africa (MENA) region

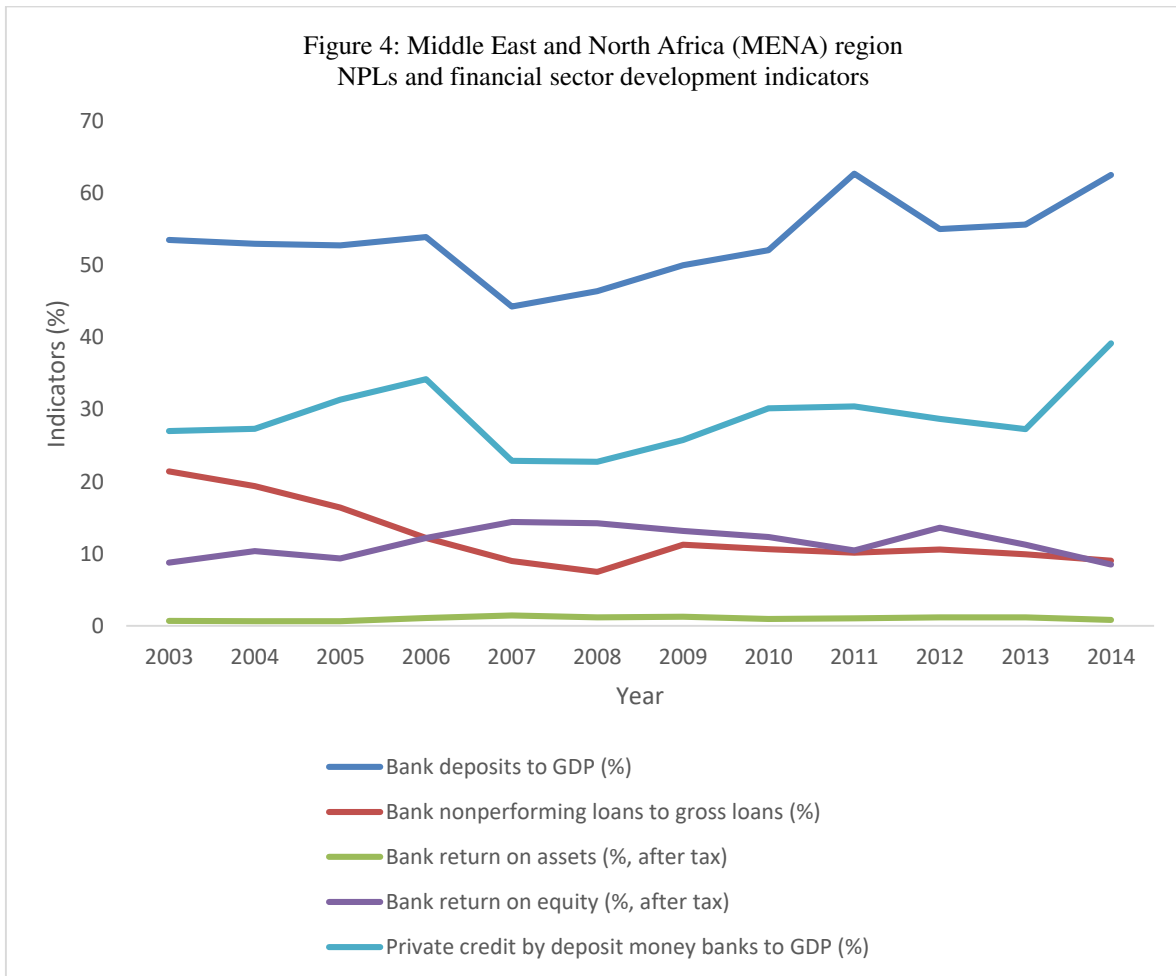


Figure 5: Latin America and Caribbean (LAC) region

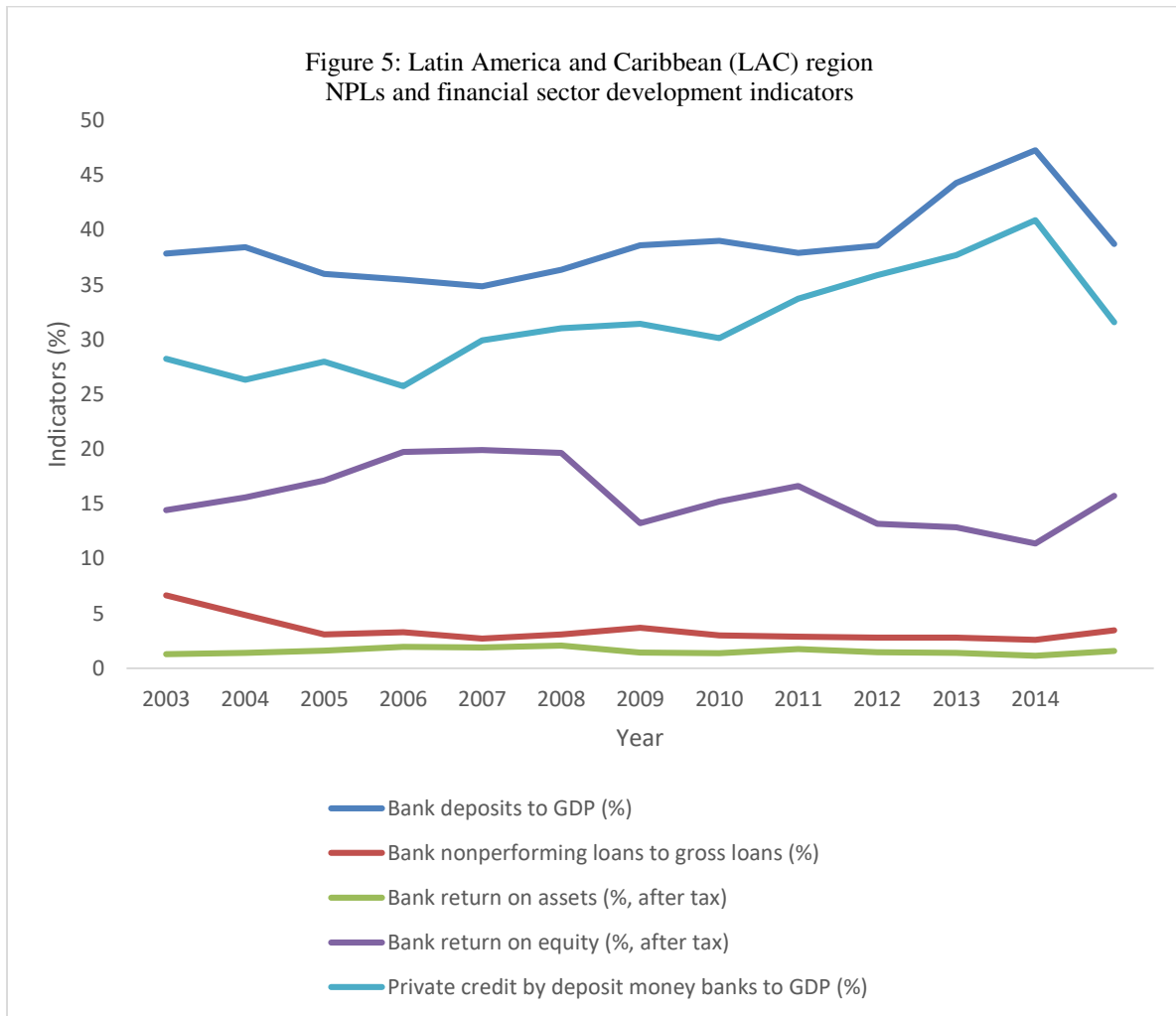


Figure 6: Europe & Central Asia (EAC) region

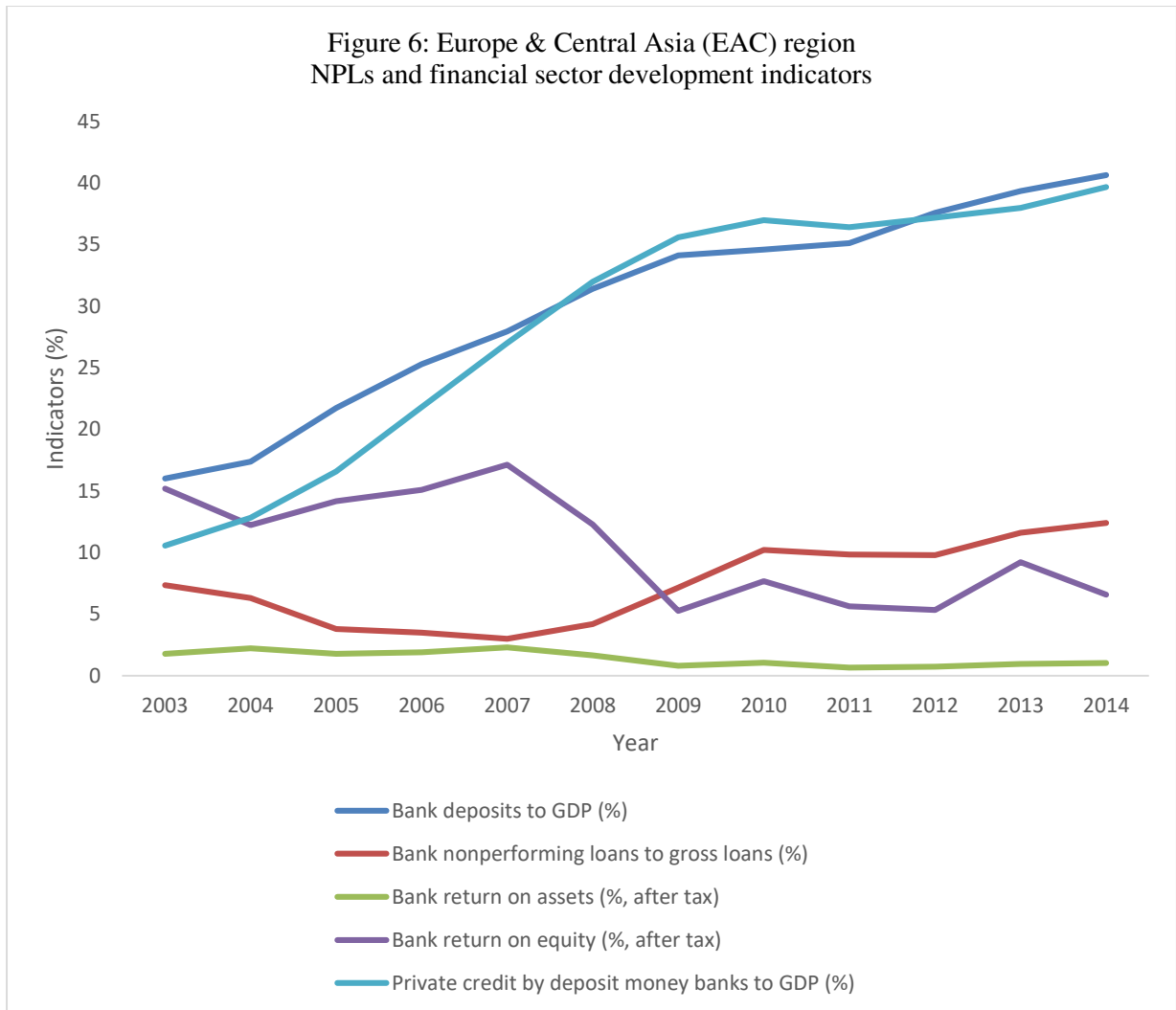
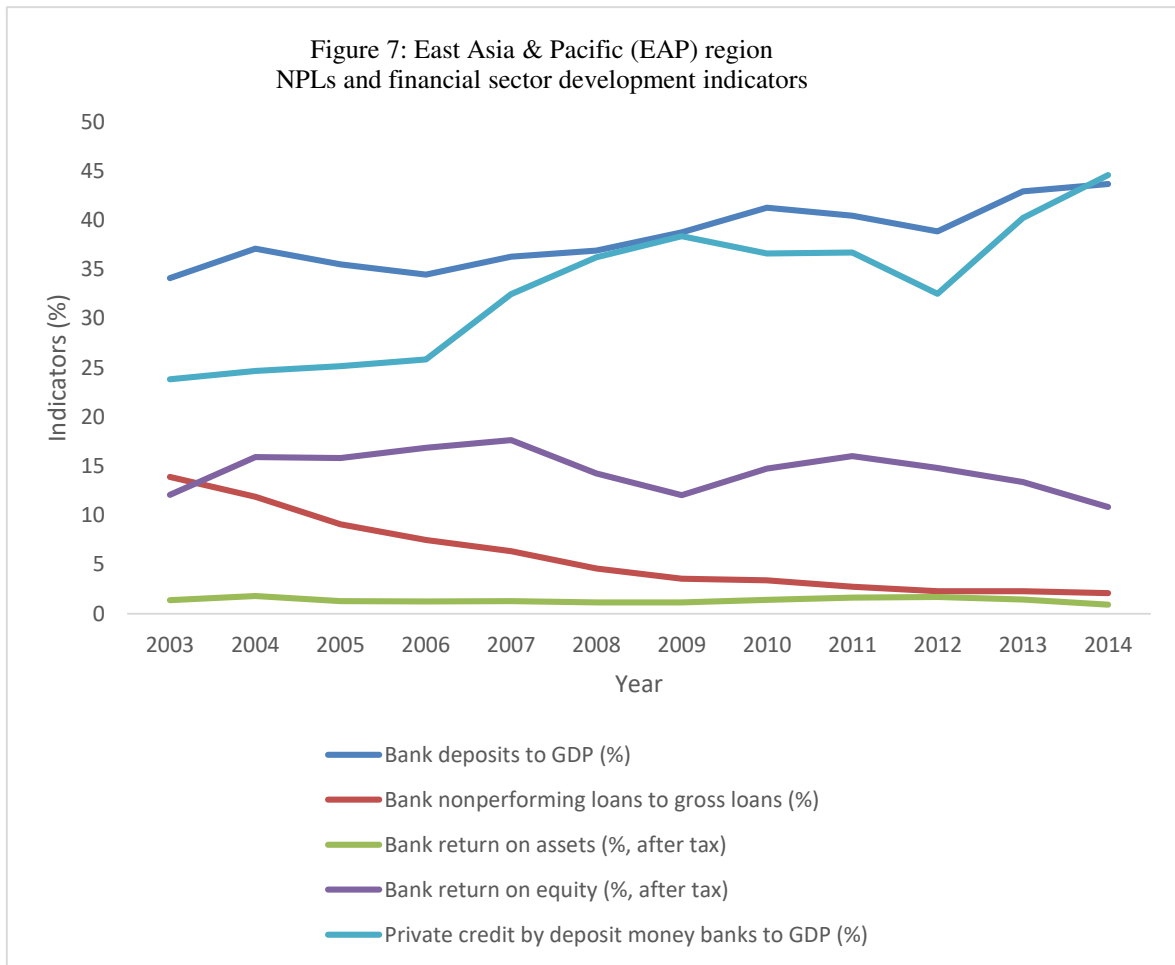


Figure 7: East Asia & Pacific (EAP) region



### 3. Data and Method

#### 3.1. Data

Data was obtained from the global financial development indicator in the World Bank database. As we are interested in the impact of financial development on aggregate non-performing loans from a cross country perspective, we use two datasets: (i) “cross-country panel data” that reflects a comprehensive global sample, and (ii) “regional panel data” to capture uniform characteristics across regions which might be ignored in cross-country analyses. By panel data, we mean pooled cross-section and time series aggregate data for countries. The country panel data consists of 134 countries over the 2003 to 2014 period. The regional panel data consist of data for six (6) regions over the 2003 to 2014 period and the regions<sup>3</sup> are: the World, Sub-Saharan Africa (developing countries only), Middle East and North Africa (developing countries only), Latin America and Caribbean (developing countries only), Europe and Central Asia (developing countries only) and East Asian and Pacific (developing countries only) regions. In the analyses, we separate the two datasets and undertake separate cross-country and regional analyses. Our justification for separating the two datasets is to avoid double counting from the first category so that no country is included twice in the analyses.

In the first dataset, aggregate NPL values for some countries are not reported in the World Bank database. Of the 134 countries, 38 countries do not have any reported data for non-performing loans and we exclude these countries from the sample. However, we include all countries with missing NPL data for some years and available NPL data for some years. This reduces the final country sample to 96 countries that have available data; implying that the data distribution is an unbalanced panel. See Appendix A3 for variable description. The summary of the descriptive statistics shows that the full country-sample NPL mean and World NPL mean are approximately the same in Panel A and B. Panel B shows that the level of financial development (PGDP and DGDP) is relatively low in Sub-Saharan Africa compared to other regions.

Panel A

Panel A: First-Sample Summary of Descriptive statistics													
	CI	LD	NII	CAR	NPL	LLC	DGDP	PGDP	CRISIS	BCON	ZSCORE	FOREIGN	LERNER
Mean	54.9	104.8	35.9	15.8	6.3	70.4	62.1	60.1	0.1	69.7	11.4	38.1	0.3
Median	54.9	89.4	34.6	15.1	3.7	60.2	47.8	47.2	0.0	69.3	9.4	27.0	0.3
Maximum	218.1	879.7	80.0	43.4	45.3	322.1	479.7	262.5	1.0	100.0	41.8	100.0	0.9
Minimum	0.0	17.7	0.0	1.8	0.1	0.0	6.10	2.0	0.0	23.4	-12.6	0.0	-1.6
Std. Dev.	14.9	77.3	12.3	4.6	6.6	42.7	57.4	47.6	0.3	18.8	8.0	32.1	0.1
Observations	1128	1108	1127	1005	994	924	1105	1117	864	1062	1131	796	921
Panel A reports the aggregate descriptive statistics from the country dataset for the 2003 to 2014 period. All ratios are expressed in percentages for expositional convenience.													

<sup>3</sup> We take the regional classifications as given in the World Bank database, to avoid any bias that would be introduced if we had classified the regions by ourselves.



## Panel B

Panel B: Second-Sample Summary of Descriptive statistics (Regional)										
	CI	LD	NII	CAR	NPL	LLC	DGDP	PGDP	ZSCORE	LERNER
Regions	mean	mean	mean	mean	mean	mean	mean	mean	mean	mean
SSA	58.44	69.49	43.86	16.19	7.63	52.1	19.145	15.72	7.77	0.29
MENA	47.36	38.70	31.15	13.95	12.3	65.27	53.51	28.93	19.50	0.32
LAC	61.98	87.46	30.05	15.22	3.46	121.43	38.72	31.59	13.61	0.25
ECA	56.58	108.10	36.44	19.68	7.43	61.82	30.10	28.72	6.31	0.27
EAP	48.13	82.05	30.14	15.69	5.81	52.19	38.36	33.10	9.89	0.32
World	55.04	83.89	36.35	15.34	4.00	64.77	40.28	33.93	9.82	0.28

Panel B reports the aggregate descriptive statistics from the regional dataset for the 2003 to 2014 period. All ratios are expressed in percentages for expositional convenience. SSA = Sub-Saharan African. MENA = Middle East and North Africa. LAC = Latin America and Caribbean. ECA = Europe and Central Asia. EAP = East Asian and Pacific. All regional data for 2003 to 2014 is available from Global Financial Development indicators at World Bank Database.

### 3.2. Methodology

To investigate the impact of financial development on non-performing loans, we use a modified version of the models of Ozili (2015), Beck et al (2015), Louzis et al (2012) and Anastasiou et al (2016) who together investigate some internal and external NPL determinants. Similarly, in our model specification, NPL is estimated as a function of internal and external determinants while controlling for financial development which is the variable of interest. The models are expressed as:

$$\begin{aligned}
 NPL = & \beta_0 + \beta_1 CI + \beta_2 LD + \beta_3 NII + \beta_4 CAR + \beta_5 LLC + \beta_6 DGDP + \beta_7 PGDP + \beta_8 CRISIS \\
 & + \beta_9 BCON + \beta_{10} STABILITY + \beta_{11} FOREIGN + \beta_{12} LERNER \\
 & + e
 \end{aligned}
 \tag{Equation (1)}$$

$$\begin{aligned}
 NPL = & \beta_0 + \beta_1 CI + \beta_2 LD + \beta_3 NII + \beta_4 CAR + \beta_5 LLC + \beta_6 DGDP + \beta_7 PGDP + \beta_8 CRISIS \\
 & + \beta_9 BCON + \beta_{10} STABILITY + \beta_{11} FOREIGN + \beta_{12} LERNER + \beta_{13} PGDP * LD \\
 & + \beta_{14} CI * STABILITY + \beta_{15} DGDP * BCON \\
 & + e
 \end{aligned}
 \tag{Equation (2)}$$

For the country dataset, the model in Equation (1) and (2) estimate the impact of financial development on non-performing loans after controlling for bank-level determinants and the financial structure of the banking sector across countries.

For the regional dataset, data for banking crisis, foreign bank presence and bank concentration are not available for each region; therefore, we adjust the model which is re-specified below in Equation (3) as:

$$\begin{aligned}
 NPL = & \beta_0 + \beta_1 CI + \beta_2 LD + \beta_3 NII + \beta_4 CAR + \beta_5 LLC + \beta_6 DGDP + \beta_7 PGDP \\
 & + \beta_8 STABILITY + \beta_9 LERNER + \beta_{10} PGDP * LD + \beta_{11} CI * STABILITY \\
 & + e
 \end{aligned}
 \tag{Equation (3)}$$

We control for five determinants that potentially influence the level of non-performing loans at bank-level. The first determinant is cost to income ratio (CI) which reflects bank efficiency. Lin and Zhang (2009) use this variable to capture bank efficiency as a measure of bank performance. Efficient banks tend to report fewer non-performing loans compared to inefficient banks, thus improving bank performance (Lin and Zhang, 2009;

Louzis et al, 2012; Karim et al, 2010); accordingly, we expect that countries with efficient banking sectors should have fewer aggregate non-performing loans; thus, we expect a positive association between NPL and CI. The second determinant is loan to deposit ratio (LD), measuring bank liquidity (Van den End, 2016). A too high LD ratio indicates that banks have liquidity problems, and liquidity difficulties of banks are often positively correlated with non-performing loans. Therefore, we expect that banking sectors with liquidity problems should have higher non-performing loans; hence, a positive association between aggregate NPL and banking sector liquidity is expected. Another determinant is non-interest income to total income (NII) ratio (see, Smith et al, 2003; DeYoung and Rice, 2004; Ozili, 2017c). Banks that have significant exposure in non-interest source of income should have fewer non-performing loans, thus improving bank performance because they rely less on interest income associated with bank lending. Similarly, at country-level we expect that banking sectors with higher NII ratio should have fewer non-performing loans. We therefore expect a negative relationship between NPL and NII. The fourth determinant is regulatory capital (CAR). Bank capital ratio is an important determinant of bank performance (Boudriga et al, 2009; Klein, 2013; Ozili, 2017a). Compared to Boudriga et al (2009) and Klein (2013), we use risk-adjusted capital ratio and expect that banks with higher regulatory capital should have fewer non-performing loans because banks' risk-adjusted capital should limit banks from risky lending that would otherwise lead to higher non-performing loans and reduced profitability (Ozili, 2017a). Following Ozili (2017a), we also expect that banking sectors with higher regulatory capital ratios should have fewer non-performing loans, implying a negative relationship between NPL and CAR. Loan loss coverage ratio (LLC) measured as loan loss provisions to non-performing loans, is another determinant of non-performing loans, according to Caporale et al (2015). A high LLC ratio indicates that bank provisions are sufficient to protect banks from losses arising from rising non-performing loans (Ozili and Outa, 2017); therefore, banks with higher coverage ratios should be able to mitigate problems arising from losses associated with non-performing loans, hence, we expect a negative relationship between NPL and LLC.

Next, we incorporate three financial (sector) development indicators into the model: (i) size of banking sector (DGDP) measured as bank deposit to GDP ratio (Demirguc-Kunt and Huizinga, 2000); (ii) extent of financial intermediation (PGDP) measured as private credit by domestic banks to GDP ratio (Demirguc-Kunt and Huizinga, 2000; Cihak et al, 2012) and (iii) foreign bank presence (FOREIGN) reflecting financial development via financial liberalization measured as the ratio of foreign bank assets to total banking assets in the domestic country (Hermes and Lensink, 2004; Giannetti and Ongena, 2009). Foreign bank presence can mitigate connected-lending problems and improve capital allocation by channelling funds to high quality borrowers who are able to repay, thereby reducing the risk of non-performing loans (Giannetti and Ongena, 2009); therefore, we expect a negative relationship between NPL and FOREIGN.

Next, we incorporate four financial structure indicators into the model: banking competitiveness, bank stability, banking concentration and banking crisis indicators. Banking competitiveness is measured by the Lerner index. Banks in highly competitive environments will take deliberate steps to minimise risks including non-performing loans in order to gain a favourable risk management perception from investors and regulators, compared to rival banks (Boyd and De Nicolo, 2005; Jimenez et al, 2013). Following this reasoning, countries with a more competitive banking sector should experience fewer non-performing loans. On the other hand, excessive competition can compel banks to engage in risky lending practices such as reducing their loan screening

procedures and using lax lending criteria which in turn would increase the likelihood of generating higher non-performing loans (Manove et al, 2001; Bolt and Tieman, 2004). Given the two competing arguments, we do not have a definite prediction for the association between competition and non-performing loans. Banking stability is commonly measured by the z-score index in the literature, defined as the ratio of the return on assets plus the capital ratio divided by the standard deviation of the return on assets (Laeven and Levine, 2009; Foos et al, 2009; Demirgüç-Kunt and Huizinga, 2010; Ozili,2018). Higher Z-score values indicate increased banking stability and we expect that stable banking sectors should have fewer non-performing loans, implying a negative relationship between NPL and the STABILITY variable. Also, we control for banking concentration, but we do not have a definite prediction for this variable. We also control for banking crises and expect countries to have higher non-performing loans when they experience major financial/economic crises.

The correlation matrix in Panel C shows that multicollinearity is not an issue in the analyses. Finally, the model is estimated using the panel OLS regression<sup>4</sup> with country and year fixed effects applied.

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<sup>4</sup> We also estimate the model using dynamic panel GMM regression and find results that are not statistically meaningful for the analysis; therefore, we exclude the results from the main analysis and base our inference from the fixed effect OLS regression results. The GMM regression is shown in Appendix A2.

Panel C: Pearson Correlation Matrix

Correlation	CI	LD	NII	CAR	NPL	LLC	DGDP	PGDP	CRISIS	BCON	STABILITY	FOREIGN	LERNER
CI	1.000												
LD	-0.068 0.162	1.000											
NII	0.330*** 0.000	-0.109** 0.025	1.000										
CAR	0.081* 0.097	-0.178*** 0.000	0.119** 0.013	1.000									
NPL	0.0212 0.662	-0.142*** 0.003	0.072 0.140	0.176*** 0.000	1.000								
LLC	0.057 0.234	-0.021 0.666	0.029 0.548	0.042 0.394	-0.175*** 0.000	1.000							
DGDP	-0.239*** 0.000	-0.171*** 0.000	-0.041 0.395	-0.173*** 0.000	-0.190*** 0.000	-0.186*** 0.000	1.000						
PGDP	-0.218*** 0.000	0.374*** 0.000	-0.077 0.115	-0.361*** 0.000	-0.244*** 0.000	-0.174*** 0.000	0.618*** 0.000	1.000					
CRISIS	0.081* 0.095	0.140*** 0.004	0.038 0.432	-0.159*** 0.001	0.034 0.483	-0.187*** 0.000	0.226*** 0.000	0.4046*** 0.000	1.000				
BCON	-0.042 0.385	0.019 0.690	0.113** 0.019	0.008 0.874	-0.031 0.518	-0.074 0.129	0.061 0.209	0.281*** 0.000	0.109** 0.024	1.000			
STABILITY	-0.126** 0.009	-0.059 0.221	-0.107** 0.026	0.051 0.294	-0.112** 0.021	0.054 0.266	0.325*** 0.000	0.149*** 0.002	-0.088* 0.068	0.092* 0.057	1.000		
FOREIGN	0.119** 0.014	-0.212*** 0.000	0.007 0.884	0.144*** 0.003	0.073 0.130	-0.131*** 0.007	-0.066 0.173	-0.319*** 0.000	-0.153*** 0.002	-0.018 0.704	-0.212*** 0.000	1.000	
LERNER	-0.427*** 0.000	-0.128*** 0.008	-0.196*** 0.000	0.264*** 0.000	-0.033 0.502	0.109** 0.023	0.042 0.391	-0.091* 0.061	-0.313*** 0.000	0.002 0.965	0.179*** 0.000	0.012 0.805	1.000

T-statistics are reported in parenthesis. \*\*\*, \*\*, \* represent 1%, 5% and 10% significance levels

## 4. Empirical Results

Section 4.1 presents the regression results for the cross-country analyses while section 4.2 presents the regional results.

### 4.1. Cross-country Results

Column 1 of Table 1 reports the regression result. CI coefficient is negative and significant, indicating that NPLs are inversely related to bank efficiency. This implies that countries that have efficient banking systems experience higher non-performing loans, and this result do not support the finding of Louzis et al (2012). LD and NII coefficients are negative but insignificant. LLC coefficient is negative and significant, indicating an inverse relationship between NPL and banks' loan loss coverage ratio. This implies that banks in countries with higher loan loss coverage ratio experience fewer non-performing loans because they are better protected against losses arising from problem loans. This finding is consistent with the ideas of Ozili and Outa (2017). This finding is also relevant for the ongoing debate about which loan loss ratios serve as a better safety net to absorb losses, given two possible alternatives: the choice of loan loss coverage ratio or loan loss provision ratio. Our finding suggest that coverage ratios might be more sufficient than loan loss provisions since NPLs are directly included in the denominator of the computation of the loan loss coverage ratio.

PGDP coefficient is positively significant and indicates that NPL has a positive relationship with the extent of financial intermediation. This implies that banking sectors with greater financial intermediation activities experience higher non-performing loans. This can be attributed to the lowering of loan screening standards and the use of lax lending criteria by banks to increase lending during good economic times, which also increases the likelihood of rising non-performing loans when unexpected events occur that affect the ability of borrowers to repay (Ozili, 2015). CRISIS coefficient is positively significant as expected and implies that countries that experience major banking crises have high non-performing loans. BCON coefficient is positively significant and implies that countries with concentrated banking systems experience higher non-performing loans. Ozili (2018) also find a positive and significant relationship between nonperforming loans and bank concentration. STABILITY coefficient is negatively significant as expected; and implies that non-performing loans are lower in countries that have a more stable banking sector.

LERNER coefficient is negatively significant and indicates that countries with competitive banking systems experience fewer non-performing loans. This finding supports Boyd and De Nicolo (2005) and Jimenez et al (2013) who argue that banks in competitive environments can take deliberate steps to minimise risks including non-performing loans to gain a favourable risk management perception from investors and regulators, compared to rival banks. FOREIGN coefficient is positively significant and indicates that higher NPLs are associated with banking sectors with greater foreign bank assets, which of course, implies that countries with greater foreign bank presence have higher non-performing loans. The findings do not support Ozili (2018) who find negative relationship between foreign bank presence and non-performing loans. CAR coefficient reports a positive sign but is statistically insignificant.

Table 1: Non-performing loans and Financial Development: Cross Country Analysis						
	(1)	(2)	(3)	(4)	(5)	(6)
	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)
c	9.074** (2.55)	-0.807 (-0.42)	-0.473 (-0.17)	8.438** (2.15)	11.543*** (3.22)	6.901* (1.79)
CI	-0.105*** (-4.64)	0.037** (1.94)		-0.104*** (-4.58)	-0.169*** (-5.95)	-0.101*** (-4.42)
LD	-0.010 (-0.88)	0.023** (2.47)		-0.005 (-0.26)	-0.011 (-0.97)	-0.013 (-1.10)
NII	-0.024 (-1.02)	0.045** (2.51)		-0.024 (-1.03)	-0.042* (-1.77)	-0.026 (-1.08)
CAR	0.107 (1.55)	0.214*** (3.57)		0.112 (1.60)	0.152** (2.22)	0.108 (1.57)
LLC	-0.022*** (-3.26)	-0.030*** (-5.49)		-0.022*** (-3.19)	-0.022*** (-3.37)	-0.021*** (-3.16)
DGDP	-0.009 (-0.36)		0.006 (0.32)	-0.011 (-0.42)	-0.014 (-0.54)	0.024 (0.69)
PGDP	0.068** (2.17)		0.064*** (2.89)	0.076** (2.02)	0.077** (2.50)	0.077** (2.42)
CRISIS	1.569** (2.12)		1.794*** (2.86)	1.651** (2.15)	1.209* (1.65)	1.567** (2.12)
BCON	0.058** (2.39)		0.059** (2.53)	0.058** (2.37)	0.055** (2.29)	0.102*** (2.62)
STABILITY	-0.223** (-2.42)		-0.159** (-2.03)	-0.225** (-2.43)	-0.716*** (-4.38)	-0.231** (-2.51)
FOREIGN	0.059** (2.47)		0.038* (1.63)	0.059** (2.42)	0.068*** (2.86)	0.062** (2.56)
LERNER	-12.351*** (-5.29)		-0.568*** (-4.59)	-12.294*** (-5.25)	-10.726*** (-4.59)	-12.458*** (-5.34)
LD*PGDP				-0.0001 (-0.39)		
CI*STABILITY					0.009*** (3.63)	
BCON*DGDP						-0.001 (-1.44)
Country Fixed Effect?	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect?	Yes	Yes	Yes	Yes	Yes	Yes
R <sup>2</sup>	82.40	65.19	80.91	82.41	83.08	82.51
Adjusted R <sup>2</sup>	77.37	60.09	76.17	77.32	78.18	77.45
F-statistic	16.39	12.786	17.09	16.18	16.95	16.29
Observations	424	862	464	424	424	424

Column (1)-(6) report regression result for 96 countries for the 2003 to 2014 period and the countries included in the analysis are reported in Appendix A1. T-statistics are reported in parenthesis. \*\*\*, \*\*, \* represent 1%, 5% and 10% significance levels. Regression includes country and year fixed effects. Standard errors are not clustered. CI = cost to income ratio, representing bank efficiency. LD = bank loan to bank deposit ratio, representing banking sector liquidity. NII = Non-interest income to total income ratio, representing bank profit from non-loan sources. CAR = ratio of regulatory capital to risk-weight assets, representing regulatory capital. LLC = loan loss coverage measured as loan loss provisions to non-performing loan ratio, represents the ability of bank provisions to protect banks from losses arising from rising non-performing. DGDP = bank deposit to GDP ratio, representing the size of the banking sector. PGDP = private credit by banks to GDP ratio, representing the extent of financial Intermediation. CRISIS = dummy variable that takes the value 1 for countries that had experienced a major banking crisis, and 0 otherwise. BCON = banking concentration. STABILITY = Z-score indicator. FOREIGN = foreign bank assets to total banking asset, representing foreign bank presence. LERNER = banking competitiveness.

## 4.2. Further Tests

### 4.2.1. Sensitivity Analysis

Next, we separately regress NPL on its bank-level determinants only. Column 2 of Table 1 reports the results. All the bank-level variables are significant while LLC coefficient remains negatively significant, which is consistent with the earlier findings in Column 1. Also, we separately regress NPL on each financial development and financial structure indicators and exclude the bank-level determinants, and the result is reported in Column 3 of Table 1. We observe that PGDP and FOREIGN remain positively significant, confirming the earlier result in Column 1. Also, CRISIS, BCON, STABILITY and LERNER coefficients are all significant except DGDP, confirming the earlier results in Column 1.

(Insert Table 1)

### 4.2.2. Interaction Analysis

From hindsight, we expect some complementarity among some variables, hence, the need for some interaction analyses. First, we expect countries with highly-liquid banking sectors to have greater financial intermediation activities and thus should have little or no need for government funding or bail-out funds. We therefore check whether non-performing loans are significantly fewer or higher in countries whose banking sectors are liquid and have greater financial intermediation. To do this, we interact the NPL variable with both the loan to deposit ratio (the liquidity indicator) and the private credit by banks to GDP ratio (the financial intermediation indicator). Column 4 of Table 1 reports the result. LD\*PGDP coefficient is insignificant to draw any meaningful inference.

Next, we expect that countries that have efficient banking sectors and greater stability should have fewer non-performing loans. We test for this complementarity by interacting the NPL variable with bank efficiency ratio (CI) and the stability indicator. Column 5 of Table 1 reports the result. CI\*STABILITY coefficient is surprisingly positive and significant, contrary to our expectation. This suggest that non-performing loans are positively associated with efficient and stable banking sectors. This finding may hold true if there are government guarantees on loans issued by banks to high risk sectors of a country, and banks would rely on the government to buy-up any losses arising from their lending to high risk sectors.

Further, we test for potential complementarity between banking sector concentration and the size of the banking sector. This is because a large banking sector in several countries is often dominated by few large banks, hence, greater concentration. We test whether this complementarity has any significant impact on non-performing loans. We interact NPL with the banking concentration (BCON) and banking sector size (DGDP) indicators. Column 6 of Table 1 reports the result. BCON\*DGDP coefficient is statistically insignificant, hence, no meaningful inference can be drawn.

(Insert Table 1)

### 4.3. Regional Results

Next, we introduce the second dataset into the analysis. A look at the regional dataset show that data for banking crisis, foreign bank presence, and banking sector concentration variables are not available, hence, the model is re-specified in Equation 3 in Section 3.2. Column 1 of Table 2 reports the regression result. LD coefficient is negatively significant and indicates that NPLs are inversely associated with bank liquidity, implying that banking sectors with higher liquidity have fewer non-performing. CAR coefficient is also negatively significant indicating an inverse association between NPLs and regulatory capital, implying that banks in countries with higher regulatory capital ratios experience fewer non-performing loans. The coefficient of the remaining variables is insignificant while LD\*PGDP and CI\*STABILITY coefficients are also insignificant in column 2 and 3 of Table 2. Overall, the regional results indicate that liquidity risk and bank regulatory capital are significant determinants of nonperforming loans. However, the regional results only highlight average characteristics that are similar across all regions. Also, differences in business and risk dynamics in each country/region may influence the interpretation of the regional results.

	Pooled Regional Regression		
	(1)	(2)	(3)
	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)
c	37.127*** (3.61)	38.254*** (3.67)	41.312*** (2.68)
CI	-0.171 (-1.58)	-0.174 (-1.60)	-0.249 (-1.04)
LD	-0.126** (-2.38)	-0.201* (-1.88)	-0.127** (-2.36)
NII	-0.102 (-0.63)	-0.055 (-0.31)	-0.095 (-0.57)
CAR	-0.786*** (-2.79)	-0.667** (-2.09)	-0.784*** (-2.76)
LLC	-0.047 (-1.13)	-0.054 (-1.32)	-0.048 (-1.15)
DGDP	0.214 (1.34)	0.243 (1.48)	0.207 (1.28)
PGDP	0.144 (1.01)	-0.078 (-0.25)	0.150 (1.04)
STABILITY	-0.121 (-0.58)	-0.065 (-0.29)	-0.454 (-0.49)
LERNER	-4.236 (-0.45)	-3.875 (-0.41)	-5.622 (-0.55)
LD*PGDP		0.003 (0.80)	
CI*STABILITY			0.007 (0.37)
Country Fixed Effect?	Yes	Yes	Yes
Year Fixed Effect?	Yes	Yes	Yes
R <sup>2</sup>	88.71	88.91	88.75
Adjusted R <sup>2</sup>	80.97	80.77	80.48
F-statistic	11.457	10.91	10.733



Observations	60	60	60
Column (1)-(3) report regional regression result for 5 major regions of the world for the 2003 to 2014 period and the regions included in the analysis are reported in Appendix A1 namely Sub-Saharan Africa (developing countries only); Middle East and North Africa (developing countries only); Latin America and Caribbean (developing countries only); Europe and Central Asia (developing countries only); East Asian and Pacific (developing countries only). T-statistics are reported in parenthesis. ***, **, * represent 1%, 5% and 10% significance levels. Regression includes country and year fixed effects. Standard errors are not clustered. CI = cost to income ratio, representing bank efficiency. LD = bank loan to bank deposit ratio, representing banking sector liquidity. NII = Non-interest income to total income ratio, representing bank profit from non-loan sources. CAR = ratio of regulatory capital to risk-weight assets, representing regulatory capital. LLC = loan loss coverage measured as loan loss provisions to non-performing loan ratio, represents the ability of bank provisions to protect banks from losses arising from rising non-performing. DGDP = bank deposit to GDP ratio, representing the size of the banking sector. PGDP = private credit by banks to GDP ratio, representing the extent of financial intermediation. STABILITY = Z-score indicator. LERNER = banking competitiveness.			

#### 4.4. Regions: Graphical Analysis

This section discusses the trend results for each region in the graphical analyses from 2.2.2. We focus the discussion only on the variables of interest: non-performing loans and financial development.

##### 4.4.1. Aggregate NPL across all region

Figure 1 shows that, prior to the global financial crisis, aggregate non-performing loans declined in all regions: the MENA, SSA, LAC, ECA, EAP and the World. After the crisis, nonperforming loans rose and remained at high levels until 2014 particularly in the European and Central Asian (ECA) region while the Middle East and North African (MENA) region also experienced substantial non-performing loans with a decline towards 2014. The observed rise in NPL in European banking (and in Asia) resonates with the European Central Bank's most recent attempt to develop a methodology for the resolution of nonperforming loans (see ECB, 2017).

(Insert Figure 1)

##### 4.4.2. NPL and Financial Development

Figure 2 show that aggregate non-performing loans in the World region was low before the crisis but increased slightly during the crisis and remained stable afterwards up until 2014 while the level of financial development (proxy as private credit to GDP ratio) increased persistently before, during and after the crisis. This trend suggests a positive association between NPL and financial development in the post crisis period. National bank supervisors in this region should monitor these trends, act on it and take into account the business dynamics and risks that are peculiar to each region and country.

(Insert Figure 2)

For the sub-Saharan African region, figure 3 shows that aggregate non-performing loans declined before the crisis and further declined towards the end of 2014 while the level of financial development (proxy as private credit to GDP ratio) increased during and after the crisis. This trend indicates a negative association between NPL and financial development in the post crisis period. National bank supervisors in this region should monitor these trends and act on it and should take into account the business dynamics and risks that are peculiar to each country in Africa.

(Insert Figure 3)

For the Middle East and North Africa region, figure 4 shows that aggregate non-performing loans declined before the crisis and remained relatively stable until 2014 while the level of financial development (proxy as private credit to GDP ratio) increased before the crisis, declined during the crisis and subsequently increased after the crisis. The pre-crisis trend indicates a negative association between NPL and financial development. National bank supervisors in this region should monitor these trends and act on it and should take into account the business dynamics and risks that are peculiar to MENA countries.

(Insert Figure 4)

In the Latin America and Caribbean region, figure 5 show that aggregate non-performing loans remained relatively stable from 2003 to 2013 but increased in 2014 while the level of financial development (proxy as private credit to GDP ratio) increased during and after the crisis up until 2013 but decline in 2014. National bank supervisors in this region should monitor these trends and act on it and should take into account the business dynamics and risks that are peculiar to each country in the Latin America and Caribbean region.

(Insert Figure 5)

For the Europe and Central Asian region, figure 6 shows that aggregate non-performing loans declined before the crisis and increased persistently until 2014 while the level of financial development (proxy as private credit to GDP ratio) increased persistently before, during and after the crisis. The trend indicates a positive association between NPL and financial development in the post-crisis period. National bank supervisors in this region should monitor these trends and act on it and should take into account the business dynamics and risks that are peculiar to each country in this region.

(Insert Figure 6)

For the East Asia and Pacific region, figure 7 shows that aggregate non-performing loans declined persistently from 2003 through 2014 while the level of financial development (proxy as private credit to GDP ratio) increased after the crisis and experienced a sharp drop in 2012 and then increased subsequently, suggesting a negative association between NPL and financial development. National bank supervisors in this region should monitor these trends and act on it and should take into account the business dynamics and risks that are peculiar to each country in this region.

(Insert Figure 7)

#### 4.5. Additional Test

We also estimate the model using dynamic panel GMM regression and find results that are not statistically meaningful for the analysis; therefore, we exclude the results from the main analysis and base our inference from the fixed effect OLS regression results. The GMM regression result is reported in Appendix A2

(Insert Table A2)

## 5. Conclusion

The purpose of the study is to investigate the influence of financial development on non-performing loans. In the cross-country analysis, we find that two financial development proxies: foreign bank presence and financial intermediation are positively associated with non-performing loans, which imply that non-performing loans increases with greater financial development that take the form of greater foreign bank presence and greater financial intermediation. This could be due to weak supervision of the lending standards of all banks and non-bank financial institutions actively involved in the financial intermediation process. Weak supervision encourages financial institutions to engage in lax lending standards which subsequently gives rise to non-performing loans particularly when unexpected events sets in that affect borrowers' ability to repay bank loans. Among the determinants of non-performing loans, bank efficiency, loan loss coverage ratio, competition and banking system stability are inversely associated with NPLs while NPLs are positively associated with banking crises and bank concentration. For the regional analyses, the graphical analysis shows that NPLs are negatively related to financial development while the empirical analysis does not show any significant relationship although NPLs are observed to be significantly associated with regulatory capital ratios and bank liquidity, implying that banking sectors with greater regulatory capital and liquidity experience fewer NPLs. Finally, national bank regulators/supervisor should not only take into account the role that financial development structures play in influencing aggregate non-performing loans but should also ensure that thorough supervision of the lending practices of banks is in place as well as the active monitoring of the financial intermediation process in the country.

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## Appendix

A1: Non-performing loans (Trend)													
S/N	Country	Pre-Financial Crisis					Crisis	Post-Financial Crisis					
S/N	Country	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1	Algeria							21.1	18.3	14.4	11.7	10.6	9.2
2	Argentina	17.7	10.7	5.2	3.4	2.7	3.1	3.5	2.1	1.4	1.7	1.7	2
3	Australia	0.3	0.2	0.6	0.6	0.6	1.3	2	2.1	2	1.8	1.5	1.1
4	Austria	3	2.7	2.6	2.7	2.2	1.9	2.3	2.8	2.7	2.8	2.9	3.5
5	Bahrain						2.3	3.9	5.1	4.9	5.8	5.6	4.6
6	Bangladesh	22.1	17.5							5.8	9.7	8.6	9.4
7	Belarus	3.7	2.8	3.1	2.8	1.9	1.7	4.2	3.5	4.2	5.5	4.4	4.4
8	Belgium	2.6	2.3	2	1.7	1.4	1.7	3.1	2.8	3.3	3.8	4.3	4.4
9	Bolivia	16.7	14	11.3	8.7	5.6	4.3	3.5	2.2	1.7	1.5	1.5	1.5
10	Bosnia and Herzegovina	8.4	6.1	5.3	4	3	3.1	5.9	11.4	11.8	13.5	15.1	14
11	Botswana										2.6	3.6	4.1
12	Brazil	4.1	2.9	3.5	3.5	3	3.1	4.2	3.1	3.5	3.4	2.9	2.9
13	Bulgaria	3.2	2	2.2	2.2	2.1	2.4	6.4	11.9	15	16.6	16.9	16.7
14	Burundi								9.4	7.4	8.2	9.9	10.9
15	Cameroon								10.1	11.4	11.6	10.3	9.7
16	Canada	1.2	0.7	0.5	0.4	0.4	0.8	1.3	1.2	0.8	0.7	0.6	0.5
17	Chile	1.6	1.2	0.9	0.7	0.8	1	2.9	2.7	2.3	2.2	2.1	2.1
18	China	20.4	13.2	8.6	7.1	6.2	2.4	1.6	1.1	1	1	1	1.2
19	Colombia	6.8	3.3	2.7	2.7	3.2	3.9	4	2.9	2.5	2.8	2.8	2.9
20	Congo, Rep.								1	1.1	1.5	1.2	2.5
21	Costa Rica	1.7	2	1.4	1.4	1.2	1.5	2.1	1.9	1.8	1.7	1.7	1.6
22	Croatia	8.9	7.5	6.2	5.2	4.8	4.9	7.7	11.1	12.3	13.8	15.4	16.7
23	Cyprus						3.6	4.5	5.8	10	18.4	38.6	44.9
24	Czech Republic	4.9	4	3.9	3.6	2.4	2.8	4.6	5.4	5.2	5.2	5.2	5.6
25	Denmark	0.8	0.7	0.2		0.6	1.2	3.3	4.1	3.7	6	4.6	4.4
26	Djibouti							9.3	8.3	9.4	11.4	14.5	18
27	East Asia & Pacific (developing only)	13.9	11.9	9.1	7.5	6.35	4.6	3.55	3.4	2.75	2.3	2.3	2.1
28	Egypt, Arab Rep.	24.2	23.6	26.5	18.2	19.3	14.8	13.4	13.6	10.9	9.8	9.3	8.9
29	Europe & Central Asia (developing only)	7.35	6.3	3.8	3.5	3	4.2	7.15	10.2	9.85	9.8	11.6	12.4
30	Finland	0.5	0.4	0.3	0.2	0.3	0.4	0.6	0.6	0.5	0.5		
31	France	4.8	4.2	3.5	3	2.7	2.8	4	3.8	4.3	4.3	4.5	4.2
32	Gabon	13.9	16	14.1	10.7	7.6	8.5	7.2	9.9	4.4	3.4	3.5	
33	Georgia	2.4	2	3.8	0.8	0.8	4.1	6.3	5.9	4.5	3.7	3	3
34	Germany	5.2	4.9	4.1	3.4	2.7	2.9	3.3	3.2	3	2.9	2.7	2.3
35	Ghana	18.3	16.3	13	7.9	6.4	7.7	16.2	17.6	14.1	13.2	12	11.3
36	Greece	7	7	6.3	5.4	4.6	4.7	7	9.1	14.4	23.3	31.9	33.8

37	Grenada						3.46	5.9	7.6	9.4	11.8	13.8	14.6
38	Guatemala	6.5	7.1	2.4	2.3	1.6	2.2	2.7	2.1	1.6	1.3	1.2	1.3
39	Honduras				4	3.1	4.3	4.7	3.7	2.9	3.3	3.4	3.3
40	Hong Kong SAR, China	3.9	2.3	1.4	1.1	0.8	1.2	1.6	0.8	0.7	0.6	0.5	0.5
41	Hungary	2.6	1.8	2.3	2.6	2.3	3	8.2	10	13.7	16	16.8	15.6
42	Iceland	2.1	0.9	1.1	0.8			14.1	18.3	11.6	6.3	4.3	
43	India	8.8	7.2	5.2	3.5	2.7	2.4	2.2	2.4	2.7	3.4	4	4.3
44	Indonesia	6.8	4.5	7.6	6.1	4	3.2	3.3	2.5	2.1	1.8	1.7	2.1
45	Ireland	0.9	0.8	0.7	0.7	0.8	1.9	9.8	13	16.1	25	25.7	20.7
46	Israel	2.6	2.5	2.3	2	1.5	1.5	1.4	3.1	3.4	3.5	2.9	2.2
47	Italy	6.7	6.6	5.3	6.6	5.8	6.3	9.4	10	11.7	13.7	16.5	17.3
48	Japan	5.2	2.9	1.8	1.8	1.5	2.4	2.4	2.5	2.4	2.4	2.3	1.9
49	Jordan	15.5	10.3	6.6	4.3	4.1	4.2	6.7	8.2	8.5	7.7	7	5.6
50	Kenya	34.9	29.3			10.6	8.8	8	6.3	4.4	4.6	5	5.5
51	Korea, Rep.	2.6	1.9	1.2	0.8	0.7	0.6	0.6	0.6	0.5	0.6	0.6	0.6
52	Latin America & Caribbean (developing only)	6.65	4.85	3.1	3.3	2.7	3.1	3.7	3	2.9	2.8	2.8	2.6
53	Lebanon		17.7	16.4	13.5	10.1	7.5	6	4.3	3.8	3.8	4	4
54	Lesotho		1	3	3	3	1.8	3	3	2.1	2.5	3.7	
55	Luxembourg	0.5	0.3	0.2	0.1	0.4	0.6	0.7	0.2	0.4	0.1	0.2	
56	Macedonia	22.4	17	15	11.2	7.5	6.7	8.9	9	9.5	10.1	10.9	10.8
57	Malaysia	13.9	11.7	9.4	8.5	6.5	4.8	3.6	3.4	2.7	2	1.8	1.6
58	Malta		6.5	7.4	5.9	5.9	5.5	5.8	7	7.1	7.8	8.9	9
59	Mauritania								45.3	39.2	25.7	20.4	
60	Mauritius				3	2.5	2	3.3	2.8	2.8	3.6	4.2	4.9
61	Mexico	3.2	2.5	1.5	1.8	2.3	3	2.8	2	2.1	2.4	3.2	3
62	Middle East & North Africa (developing only)	21.45	19.4	16.4	12.2	9	7.5	11.25	10.65	10.15	10.6	9.95	9.05
63	Morocco	18.7	19.4	15.7	10.9	7.9	6	5.5	4.8	4.8	5	5.9	6.9
64	Mozambique	14.4	5.9	3.5	3.1	2.6	1.9	1.8	1.9	2.6	3.2	2.3	3.3
65	Namibia	3.9	2.4	2.3	2.6	2.8	3.1	2.7	2	1.5	1.3	1.3	1.5
66	Netherlands	2	1.5				1.7	3.2	2.8	2.7	3.1	3.2	3.1
67	New Zealand					0.3	0.9	1.7	2.1	1.7	1.4	1	0.9
68	Nigeria	20.5	21.6		9.3	9.5	6.3	37.3	20.1	5.8	3.7	3.4	3
69	Norway	1.6	1	0.7	0.6	0.5	0.7	1.3	1.5	1.7	1.5	1.3	1.1
70	Paraguay	20.6	10.8	6.5	3.3	1.3	1.1	1.6	1.3	1.7	2.1	2	1.8
71	Peru	14.8	9.5	6.3	4.1	2.7	2.2	2.7	3	2.9	3.2	3.5	4
72	Philippines	16.1	14.4	10	7.5	5.8	4.6	3.5	3.4	2.6	2.2	2.4	2
73	Poland	21.2	14.9	11	7.4	5.2	2.8	4.3	4.9	4.7	5.2	5	4.8
74	Portugal	2.4	2	1.5		2.8	3.6	4.8	5.2	7.5	9.8	10.6	11.9
75	Qatar						1.2	1.7	2	1.7	1.7	1.9	1.7
76	Romania	8.3	8.1	1.4	1.8	2.6	2.7	7.9	11.9	14.3	18.2	21.9	13.9



77	Rwanda	33	31	29	25	16.9	12.6	13.1	11.3	8.2	6	7	5.2
78	Senegal	13.3	12.6	11.9	16.8	18.6	17.4	18.7	20.2	16.2	18.4	19.1	20.3
79	Seychelles				4.4	2.3	2	3.8	5.5	8.1	9	9.2	8
80	Sierra Leone	7.4	16.5	26.8	26.9	25.6	17.9	10.6	15.6	15.1	14.7	22.4	33.4
81	Singapore	6.7	5	3.8	2.8	1.5	1.4	2	1.4	1.1	1	0.9	0.8
82	Slovenia	3.7	3	2.5			4.2	5.8	8.2	11.8	15.2	13.3	11.7
83	South Africa	2.4	1.8	1.8	1.1	1.4	3.9	5.9	5.8	4.7	4	3.6	3.2
84	Spain	1	0.8	0.8	0.7	0.9	2.8	4.1	4.7	6	7.5	9.4	8.5
85	Sri Lanka									3.8	3.6	5.6	4.2
86	Sub-Saharan Africa	13.6	12.6	7	7.7	6.95	6.95	7.6	8.6	5.6	4.6	5.1	5.2
87	Swaziland	2	7.2	7	7.7	7.5	7.6	8.6	7.8	7.5	9.7	6.8	6.9
88	Sweden	1.9	1.1	0.8	0.8	0.1	0.5	0.8	0.8	0.7	0.7	0.6	1.2
89	Switzerland	1.3	0.9	0.5	0.3	0.3	0.9	1.1	0.9	0.8	0.8	0.8	0.7
90	Tanzania								7.8	5.4	6.4	5.1	6.6
91	Thailand	13.5	11.9	9.1	8.1	7.9	5.7	5.2	3.9	2.9	2.4	2.3	2.3
92	Tunisia	24.2	23.6	20.9				13.2	13	13.3	14.9	15.2	15.8
93	Turkey	11.5	6.5	5	3.9	3.3	3.4	5	3.5	2.6	2.7	2.6	2.7
94	Uganda	7.2	2.2	2.3	2.9	4.1	2.2	4.2	2.1	2.2	4.2	5.6	4.1
95	Ukraine	28.3	30	5.6	4	3	3.9	13.7	15.3	14.7	16.5	12.9	19
96	United Arab Emirates	14.3	12.5	8.3	6.4	2.6	2.3	4.3	5.6	7.2	8.4	7.3	6.5
97	United Kingdom	2.5	1.9	1	0.9	0.9	1.6	3.5	4	4	3.6	3.1	1.8
98	United States	1.1	0.8	0.7	0.8	1.4	3	5	4.4	3.8	3.3	2.5	1.9
99	Uruguay	14.3	4.7	5.6	3.7	1.1	1	3.8	2.4	1.5	1.3	1.3	
100	Vietnam						2.2	1.8	2.1	2.8	3.4		
101	World	5.75	4.2	3.5	3.1	2.7	3	4.3	4.55	4.1	4.1	4.4	4.35
102	Yemen, Rep.						18	13.9	17.7	21.2	25.5	21.7	24.7
103	Zambia								14.8	10.4	8.1	7	

A2: Non-performing loans and Financial Development						
We also estimate the model using dynamic panel GMM regression and find results that are not statistically meaningful for the analysis; therefore, we exclude the results from the main analysis and base our inference from the fixed effect OLS regression results. The GMM regression is shown in Appendix A2						
Pooled Country-Sample GMM Result						
	(1)	(2)	(3)	(4)	(5)	(6)
	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)
NPLt-1	0.589*** (8.89)	0.582*** (7.635)	0.518*** (-11.51)	0.655*** (8.21)	0.596*** (8.78)	0.614*** (8.90)
CI	-0.062 (-1.17)	0.005 (1.08)		-0.075 (-1.44)	-0.045 (-0.51)	-0.055 (-1.06)
LD	0.045 (0.95)	0.046*** (7.74)		0.144 (1.51)	0.059 (1.08)	0.067 (1.09)
NII	-0.017 (-0.16)	0.059*** (6.21)		-0.059 (-0.55)	-0.005 (-0.05)	-0.063 (-0.54)
CAR	0.064 (0.42)	0.153*** (7.75)		0.096 (0.60)	0.084 (0.37)	0.115 (0.63)
LLC	0.037 (1.56)	-0.038*** (-8.03)		0.020 (0.74)	0.035 (1.47)	0.036 (1.47)
DGDP	-0.096 (-0.72)		-0.247*** (-3.79)	-0.082 (-0.63)	-0.081 (-0.57)	-0.012 (-0.06)
PGDP	0.200 (1.41)		0.319*** (3.93)	0.291* (1.86)	0.178 (1.16)	0.139 (0.81)
CRISIS	-2.085 (-0.76)		-1.601 (-0.84)	-1.173 (-0.40)	-1.608 (-0.58)	-1.853 (-0.65)
BCON	0.225*** (3.38)		0.182*** (4.35)	0.249*** (3.64)	0.219*** (2.98)	0.352* (1.87)
STABILITY	0.032 (0.11)		-0.494*** (-3.33)	0.072 (0.26)	0.130 (0.34)	0.068 (0.23)
FOREIGN	-0.141 (-1.38)		-0.113* (-1.69)	-0.081 (-0.74)	-0.171 (-1.54)	-0.108 (-0.95)
LERNER	-30.77*** (-5.92)		-25.59*** (-7.29)	-31.89*** (-5.92)	-30.91*** (-5.78)	-34.83*** (-4.25)
LD*PGDP				-0.001 (-1.20)		
CI*STABILITY					-0.003 (-0.37)	
BCON*DGDP						-0.002 (-0.73)
Country Fixed Effect?	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect?	Yes	Yes	Yes	Yes	Yes	Yes
J-statistic	12.71	50.44	20.95	11.34	12.86	12.65
P(J-statistic)	0.625	0.416	0.399	0.658	0.538	0.554
Observations	332	683	364	332	332	332
Column (1)-(6) report regression result for 96 countries for the 2003 to 2014 period and the countries included in the analysis are reported in Appendix A1. T-statistics are reported in parenthesis. ***, **, * represent 1%, 5% and 10% significance levels. GMM first-difference regression. Regression includes country first-difference and year fixed effects. Standard errors are not clustered.						

## A3: Data description and source

Indicator	Indicator Name	Source
BCON	Bank concentration	Global financial development indicator archived in World Bank database.
CI	Bank cost to income ratio, measuring efficiency.	Global financial development indicator archived in World Bank database.
LD	Bank credit to bank deposits ratio, measuring banking sector liquidity.	Global financial development indicator archived in World Bank database.
DGDP	Bank deposits to GDP ratio, measuring size of banking sector	Global financial development indicator archived in World Bank database.
NPL	Bank nonperforming loans to gross loans ratio	Global financial development indicator archived in World Bank database.
NII	Bank noninterest income to total income ratio, measuring bank profitability from non-loan sources	Global financial development indicator archived in World Bank database.
CAR	Bank regulatory capital to risk-weighted assets ratio, measuring bank capital regulation	Global financial development indicator archived in World Bank database.
CRISIS	Banking crisis dummy (1=banking crisis, 0=none)	Global financial development indicator archived in World Bank database.
FOREIGN	Foreign bank assets among total bank assets ratio, measuring financial liberalisation	Global financial development indicator archived in World Bank database.
LERNER	Lerner index, measuring competition	Global financial development indicator archived in World Bank database.
LLC	Provisions to nonperforming loans ratio, measuring loan loss coverage ratio	Global financial development indicator archived in World Bank database.
PGDP	Private credit by deposit money banks to GDP ratio, measuring extent of financial intermediation	Global financial development indicator archived in World Bank database.
STABILITY	Bank Z-score, measuring banking stability	Global financial development indicator archived in World Bank database.