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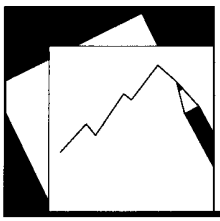

IMF Working Paper

Benchmarking Banking Sector Efficiency Across Regional Blocks in Sub-Saharan Africa: What Room for Policy?

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Abstract

This paper examines the determinants of net interest margins in four regional blocks in Sub-Saharan Africa and one comparator block in the Eastern Caribbean. Using bank-level data, we find that countries with a high level of operating costs, a high ratio of equity to total assets and high treasury bill interest rates have higher net interest margins. Moreover, high operating costs are associated with low measures of institutional quality and a small size of bank operations. We find support for the view that market structure is also partly responsible for high net interest margins in Sub-Saharan Africa. If interpreted causally, high operating costs and a high ratio of equity to total assets and, indirectly, institutional factors such as the rule of law, are the most important factors in accounting for high interest margins in the East African Community, relative to other regions.

JEL Classification Numbers: G14, G21, G28, E44, E52

Keywords: Financial intermediation efficiency, net interest margins, economies of scale, institutions.

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I. INTRODUCTION

Channeling funds from savers to investors is one of the key functions of financial intermediaries. One measure of the efficiency with which banks perform this function is the net interest margin (NIM), which is defined in this study as the value of a bank's net interest revenue as a share of its total assets.[2] Within Sub-Saharan Africa (SSA), NIMs are on average considerably higher than in most developed economies, raising the question of whether inefficiencies in the channeling of finance have been a constraint to growth. In recent years, certain countries, such as those in the East African Community (EAC), seem to have experienced a sustained downward trend in margins, whereas other regions have seen margins grow or fluctuate around a trend.

To the extent high NIMs are may be considered as a signal of inefficiency, understanding their determinants is a key priority for policymakers willing to increase the potential for growth linked to a more efficient financial system.[3] However, high margins can in principle arise for a multitude of reasons**.** Beck and Hesse (2009) document the various possible explanations and group them under four main hypotheses. According to the *risk-based hypothesis*, informational imperfections in the relationship between banks and borrowers generate costs. These costs may stem from the inability to ascertain the borrowers' creditworthiness, which can lead to adverse selection and the pricing of safer borrowers out of the market. At the same time, lack of information about a borrower's behavior may lead to moral hazard. In both of these cases, information asymmetries may lead banks to charge higher margins as compensation for risk. A second view, the *small financial system hypothesis*, identifies the cause of high NIMs with the fixed costs of providing financial services, such as those associated with setting up branches. The presence of fixed costs may make it difficult for small financial systems to take advantage of scale economies, requiring high margins to compensate for high average costs (Bottomley, 1963). The third view, the *market structure hypothesis*, seeks to explain high margins through imperfectly competitive banking behavior. High NIMs according to this view reflect high economic rents earned by banks in an environment of low competition. Finally, the *macroeconomic hypothesis* stresses the role of the exchange rate, interest rate, and real economy fluctuations. This view attempts to capture several possible causal mechanisms from macroeconomic factors to high NIMs: for instance, high domestic interest rates may reflect large macroeconomic risks, imposing additional costs on banks and, again, leading them to charge high NIMs as a result.

The four different hypotheses have very different policy implications. For instance, if the fixed costs of lending are the underlying cause of high margins, efforts to promote

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[2] A distinction must be made between net interest margins and the average banking spread—the difference between ex-ante contracted lending and deposit interest rates. It is possible for net interest margins to be low and *ex ante* spreads to be high, for instance if there is widespread default among borrowers. We leave the examination of the link between NIMs and *spreads* for further work, and hence about the extent to which the conclusions of this paper apply more generally.

[3] High net interest margins are also correlated with low financial depth, making NIMs a relevant indicator for the IMFs recent focus on financial deepening in developing countries.

competition among banks are unlikely to be fruitful. On the other hand, if large asymmetries of information between banks and borrowers create a high degree of risk in lending, stabilizing the macroeconomy will not eliminate the underlying risk driving high margins. Reducing information asymmetries through credit bureaus, or reducing the costs of such asymmetries through improved asset recovery in the face of default, would be more suitable strategies. Thus, it is critical to determine which of the hypothesis are supported by the data, and which drivers are the main determinants of NIMs.

By investigating the above-mentioned hypotheses together, this study seeks to assess their relative contribution to NIMs across several regional groupings. Our choice of explanatory variables is guided by each of the four hypotheses. We therefore include measures of lending risk, monopolistic rents, economies of scale and business-cycle movements as possible explanatory variables for NIMs. Additionally, our paper adopts a regional perspective. We attempt to explain the observed patterns of cross-sectional and time-series variation in NIMs among four regional groupings in SSA. These groupings share common institutional characteristics, in that they either involve a common currency and customs union, or state these as central goals.[4] The SSA regions investigated are the EAC, the West African Economic and Monetary Union (WAEMU), the Central African Economic and Monetary Community (CEMAC), as well as the South African Customs Union (SACU).[5] In addition to these SSA regional associations, we include the Eastern Caribbean Currency Union (ECCU) as a comparator, as it performs similarly according to key measures and enjoys similar institutional arrangements.[6]

The paper uncovers several important findings. First, we find strong evidence that bank operating costs and equity-to-capital ratios are both statistically and economically significant determinants of NIMs in all regions. Moreover, there is evidence that poor institutional quality indirectly influences NIMs through higher operating costs. This result is consistent with the view that poor regulatory quality and rule of law cause banks to engage in costly credit appraisals and monitoring, as suggested by Honohan and Beck (2007). Additionally, operating costs are strongly and inversely related to the size of the loan portfolio, suggesting that fixed costs to lending are non-trivial in our sample, creating scope for banks with larger loan portfolios to exploit economies of scale. Taken together, our results are consistent with

[4] Two out of the four, namely CEMAC and WAEMU, have formally adopted a currency union, whereas the EAC state a currency union as a long-term objective. SACU and WAEMU operate a customs union while the EAC and CEMAC have stated a customs union to be a long-term goal.

[5] The East African Community (EAC) consists of Burundi, Kenya, Rwanda, Tanzania and Uganda; the Economic and Monetary Community of Central Africa (CEMAC) consists of Cameroon, the Central African Republic (CAR), Equatorial Guinea, Republic of Congo and Gabon; the East Caribbean Currency Union (ECCU) consists of Antigua and Barbuda, Dominica, Grenada, St Kitts and Nevis, St Lucia and St Vincent and the Grenadines; the West African Economic and Monetary Union (WAEMU) consists of Benin, Burkina Faso, Cote d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo, and the Southern African Customs Union (SACU), consisting of Botswana, Lesotho, Namibia, South Africa and Swaziland.

[6] Specifically, ECCU operates a currency union, with a currency board and the members' currency pegged to the dollar at a fixed rate.

both the *risk-based* and *small financial system* views, namely that the small nature of the African financial systems and risk factors, amplified by the inefficiency of the judicial system, are key determinants of high margins.

The structure of the paper is organized as follows. Section II presents a brief review of the literature, provides a motivation for our choice of explanatory variables, and situates the contribution of our paper. Section III provides stylized facts regarding the evolution of NIMs and their various accounting components between 1997 and 2011 in the regions under study, suggesting some preliminary hypotheses for our econometric analysis. Section IV outlines our econometric strategy to test the relative importance of the four hypotheses outlined by Beck and Hesse (2009). Our estimation results are presented in Section V. Finally Section VI concludes with a discussion of policy recommendations and areas for future work.

II. LITERATURE REVIEW

A large body of empirical work has examined the determinants of NIMs in developed economies, with a smaller but growing literature examining NIMs in Emerging Markets (EMs) and Low Income Countries (LICs). However, only a few firm conclusions appear to emerge. There is some consensus on the role of macroeconomic and bank-specific variables in determining NIMs, but evidence is less clear cut for the role of institutions and the degree of bank competition. We provide a brief summary, focusing on findings regarding the role of macroeconomic, market-structure, institutional and bank-specific variables.

- *Macroeconomic environment*: The dealership model of Ho and Saunders (1981) has influenced early work on NIMs whereby these rise with the variance of interest rates in the face of intermediation risks. This hypothesis was corroborated by Maudos and de Guevara (2004) who employed the dealership model and found that with macroeconomic variables in the form of interest-rate volatility played a significant role. Inflation and high treasury bill rates have also been found to be positively correlated with bank spreads (Hoonahan, 2003, Ahokpossi, 2012; Poghosyan, 2010).

- *Degree of bank competition:* Standard theory predicts more intense competition to yield lower spreads.[7] However, the empirical evidence has been mixed. One difficulty is that the proxies for market structure used in the literature are not always comparable, with market concentration indicators used by some of the authors appearing fragile. Nevertheless, Poghysan (2010) and Martinez-Peria and Moody (2004) find a significant effect of market concentration.

- *Bank specific factors*: Building on the dealership model of Ho and Sounders (1981), many studies have found a role of bank specific factors (Beck and Hesse, 2009; Poghysan, 2010; Gelos, 2009). Higher operating costs were found to be positively

[7] However, some recent papers have argued imperfect competition may encourage efficient lending (e.g. Petersen and Rajan, 1995), emphasizing the need for establishing the interplay between NIMs and market competition empirically.

associated with higher NIMs. Depending on their strategy, some banks may rely more on fee income which negatively affect NIMs. Higher non-performing loans could also lead to higher margins through higher risk premia. As Demirguc-Kunt, Laeven and Levine, (2004) have demonstrated, capitalization could affect funding costs and as a result NIMs.

- *Institutional setting*: Other studies have attempted to explore the role of institutions and found that they have a significant effect on NIMs (Demirguc-Kunt, Laeven and Levine, 2004; Poghosyan, 2012). An institutional setting that permits loan recovery and preservation of creditor rights through strong legal environment are expected to lower NIMs.

- *Findings for SSA:* The seminal work by Honohan and Beck (2007) provides a discussion of the challenges facing the banking sector in the region as a result of volatile macroeconomic environment and a small size of most financial systems. Beck and Hesse (2009) explored the four sets of hypotheses for high margins discussed above and find a role for macroeconomic variables. They find that faster GDP growth, rising inflation and increasing treasury bill rates to be associated with higher margins, whereas lower spreads are linked to better institutions and larger balance sheets. They also found strong evidence for risk-based approach and some evidence for macroeconomic views, but little evidence for the market structure view. For a large sample of banks in SSA, Ahokpossi (2012) finds an important role for lending risk, interest rate risk, bank equity and non-interest activity. Among macroeconomic variables, inflation appears to be statistically significant, with non-linear effects.

III. EVOLUTION OF NET INTEREST MARGINS (1997–2011)

In Figure 1, we summarize the cross-sectional and time-series patterns of NIMs in our sample of five regions, during 1997– 2011. We define NIMs for bank *i* in country *c* at time *t* as follows:

$$NIM_{ict} = \frac{TIR_{ict} - TIE_{ict}}{TA_{ict}} \quad (1)$$

where total interest revenue TIR_{ict}, total interest expense TIE_{ict} and total assets TA_{ict} are taken from the income statement of the bank for year *t*. We begin with a discussion of differences in levels of NIMs in the sample, and follow with a brief overview of trends.

The difference between interest received and interest paid by the bank goes towards personnel costs and other non-interest operating costs OC_{ict}, provisions for loan losses LLP_{ict}, as well as contributing to profits π_{ict}. All of these items are related by the accounting identity:

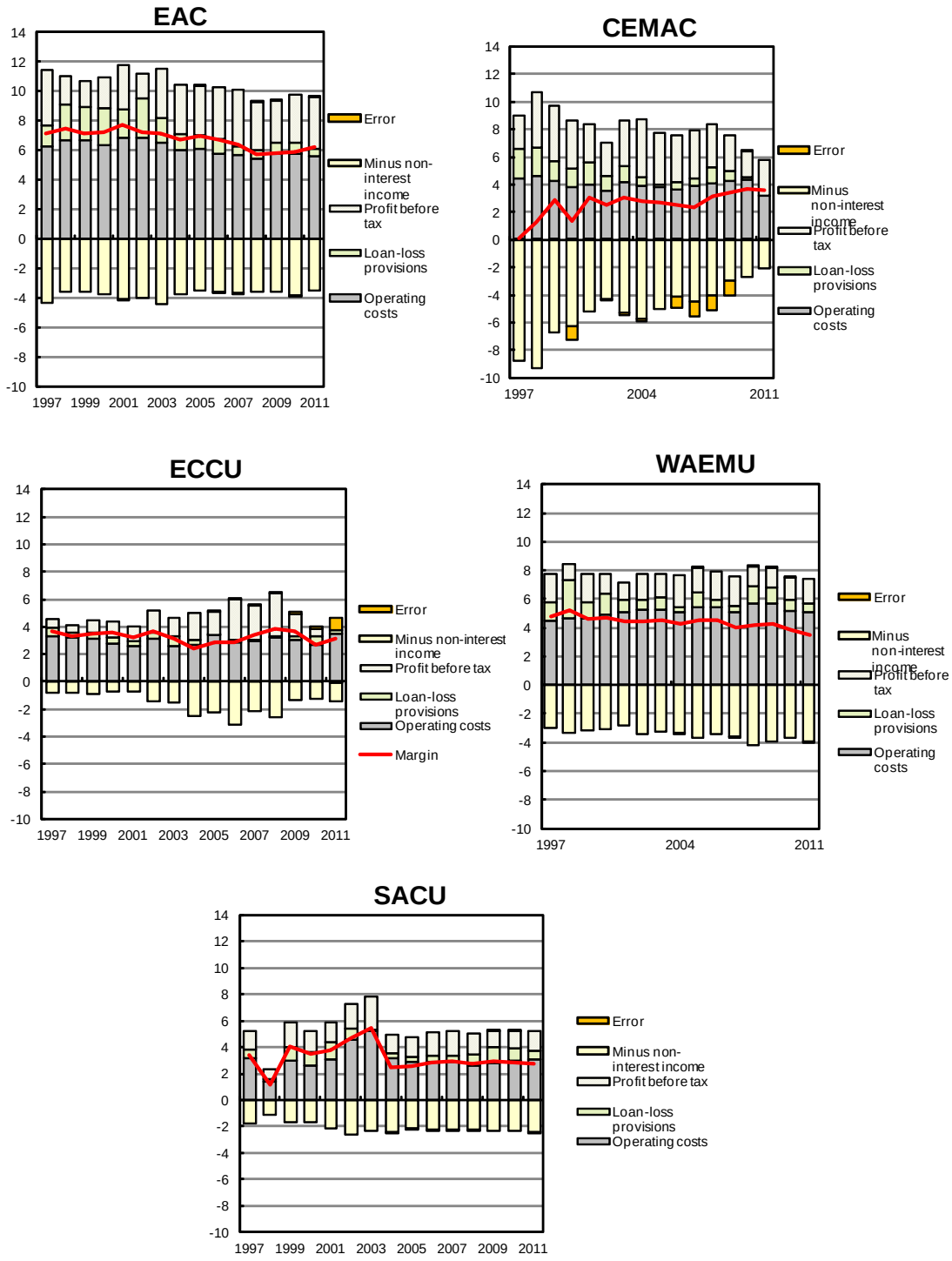
$$\pi_{ict} = TIR_{ict} - TIE_{ict} + NII_{ict} - OC_{ict} - LLP_{ict} \quad (2)$$

On dividing by total assets, and solving for $(TIR_{ict} - TIE_{ict})/TA_{ict}$, we can use (2) to express NIMs as the following five components profit before tax, loan-loss provisions, non-interest income, operating costs and an error term, all normalized by total assets[8]. Thus, in this section, we complement our account of the evolution of NIMs in the five regions with the evolution of their various components. Figure 1 examines the evolution of NIMs between 1997–2011 in the five regions under investigation and illustrates considerable heterogeneity. Throughout 1997–2011, the EAC had the highest margin levels of all the regions. On average, these were over 2 percentage points greater than in the next-highest region, WAEMU. By 2011, CEMAC, ECCU and WAEMU had similar levels of margins, although the regions faced considerable heterogeneity in 1997. By 2011 SACU had the lowest margins of all five regions at 2.72 percentage points, with the EAC still having the highest NIMs at above 6 percentage points. In ECCU, margins remained fairly constant over the period 1997-2011, but oscillating somewhat between 3.7 and 2.5 percentage points.

The trends in NIMs have also been quite heterogeneous across the regions. There has been a sustained decline in margins in the EAC between 2001 and 2008. In this period, margins fell from a high of 7.7 percentage points in 2001 to 5.7 in 2008, before rising somewhat to 6.2 from 2009 to 2011. Figure 1 illustrates that declining operating costs and loan-loss provisions were associated to large extent with this trend. For instance, loan-loss provisions accounted for 2.7 percentage points of the margin in the EAC in 2002, but only 0.4 percentage points in 2011. In the same period, operating costs fell from 6.9 percentage points in the EAC to 5.7 percentage points. The WAEMU region also experienced a sustained decline in margins, from 5.2 in 1998 to 3.5 percentage points in 2011, but in contrast to the EAC this was not associated with a decline in operating costs. Rather, for WAEMU, this trend was associated with falling loan-loss provisions and rising non-interest income.

[8] Unlike in Randall (1998), reserves do not enter our decomposition. This is because we use a different definition of margins. As in Beck and Hesse (2009), we define them as net interest revenue over total assets. Randall, on the other hand, defines net interest margins as total interest revenue/interest-bearing assets minus total interest expense/funding. This generates an additional term when normalizing by total assets. The error term in Table 1 stems from the inclusion of non-standard expenses and income in the income statement in BankScope; however, it is negligible and we do not focus on it in the analysis.

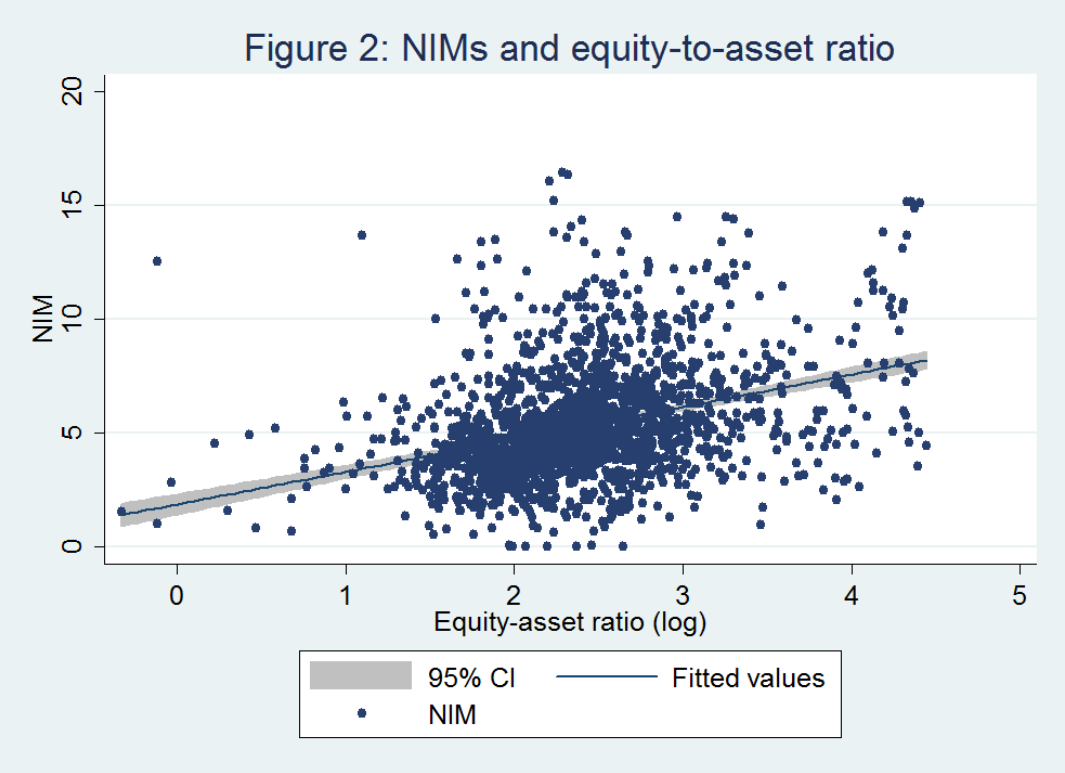
Figure 1. Evolution of Net Interest Margins Across Regions



Both CEMAC and SACU experienced considerable volatility in NIMs between 1997 and 2011. CEMAC initially had low NIMs (1.3 percentage points in 1998), coupled with very high levels of non-interest income (equivalent to 9.4 percentage points). This may be related to the structural differences due to the dominance of oil firms in the region, and the heavy

reliance of banks on lending to firms with government contracts. After a period of considerable volatility, margins rose to 3.6 percent in 2011. SACU similarly experienced considerable fluctuations in NIMs between 1997 and 2004, which coincided with large changes in operating costs. This volatility may be due to the considerable structural change in the South African banking sector comprising a number of mergers and acquisitions.

Among the variables in the decomposition, operating costs and loan-loss provisions seem to have been associated most closely with movements in NIMs across the regions. The data also seems to suggest that operating costs both move closely with margins and explain long-run differences**.** A decline in loan-loss provisions appears to have been associated with declines in margins in the EAC and WAEMU, but to have also been a trend present in all five regions. Over the whole period, operating costs were by far the largest contributor to margins in all regions except CEMAC, where it accounted for between 41 (SACU) and 46 percent (ECCU) of the margin on average.



A further variable which seems to be closely correlated with NIMs, but is not included in the decompositions above, is the ratio of equity to total assets. The relationship between NIMs and the log of the equity-to-asset ratio in repeated cross-sections in our sample is presented in Figure 2 above. The correlation presented here, with an R-squared of 0.125, presents a strong *prima-facie* case that equity may be important in explaining NIMs in our sample.

IV. EMPIRICAL STRATEGY

Building on the stylized facts derived from the data, we test the four hypotheses outlined in the introduction, using three alternative econometric estimation techniques: pooled OLS, the inclusion of unobserved (time constant) bank characteristics using fixed effects and serial dependence in NIMs using system GMM.

A. Econometric model

The following panel data specification encompasses three empirical models

$$y_{ict} = \alpha y_{ict-1} + \beta' \mathbf{x}_{ict} + \gamma' \mathbf{z}_{ct} + \mu_{ic} + \eta_t + \varepsilon_{ict} \quad (3)$$

where y_{ict} represents the bank net interest margin for bank *i*, country *c* and time *t*, $\mathbf{x}_{ict}$ denotes the vector of bank-specific explanatory variables described in section II., while $\mathbf{z}_{ct}$ is the vector of country-specific macroeconomic, institutional and market-structure variables. μ_{ic} is an unobserved time-constant bank-specific effect; η_t is the time-specific effect[9] and ε_{ict} is the error term capturing all other omitted factors. We iteratively expand our specification to include, sequentially, bank-specific, market-structure, macroeconomic and institutional variables.

Following Ho and Saunders (1981) model, we include operating costs, loan-loss provisions, non-interest income, liquid assets, equity and the size of the loan book as bank-level explanatory variables. For completeness, both the Lerner and HHI indices are used as measures of market structure, and their derivation is presented in Appendix I. Inflation, the exchange rate and GDP per capita are considered among the macroeconomic factors which may influence NIMs. Honohan and Beck (2007) also suggest that high wholesale interest rates, proxied by the treasury bill rate and central bank rate, reflect currency and other macroeconomic uncertainty, as well as the government demand for loanable funds. Institutional variables encompass a range of governance indicators, which we capture in our preferred specification by a composite index, explained further in Section B below.

Pooled OLS, which comprises our initial specification, is both unbiased and efficient if the bank-specific effects are zero for all *i* and all *t*, and $\alpha = 0$. However, in the presence of bank fixed effects, such as time-constant differences in managerial quality, OLS is inappropriate. Even if the bank fixed effects are uncorrelated with the regressors, the estimator will be inefficient; if such correlation does exist, the OLS estimates will be biased. Fixed effects is the appropriate estimation technique if unobserved bank characteristics are both present and

[9] All of our models are estimated with the full set of time fixed effects, which capture common shocks to (common trends in) the net interest margins for all banks in all regions. Also, all of our specifications use robust standard errors.

correlated with the other control variables, and the assumption of strict exogeneity holds.[10] As will be seen in the next section, we do find that unobserved bank characteristics matter. Nevertheless, we believe it is important to include our pooled OLS results. Firstly, fixed effects have limited power to identify the effects of variables which are persistent over time, as the demeaning operation reduces variation, resulting in a loss of precision. This is particularly problematic for our measures of institutions, which are very persistent over time.[11] Moreover, in the presence of measurement error and persistent independent variables, fixed effects can result in considerable attenuation bias (Deaton, 1995).

If both bank fixed effects are non-zero and are correlated with the regressors, and $\alpha \neq 0$, i.e. the true model has a lagged dependent variable, Nickell (1981) demonstrates that the strict exogeneity assumption fails and, consequently, fixed effects is biased. In our case, we cannot determine *a priori* that banks might smooth NIMs over time, for instance due to reasons similar to those often cited to explain standard price persistence. If this is the case, it is either appropriate to circumvent the bias either by using the difference GMM estimator proposed by Arellano and Bond (1991), or the system GMM estimator proposed by Arellano and Bover (1995) and Blundell and Bond (1998). In this paper, we will opt for the system GMM estimator, as it resolves some of the small-sample biases and imprecision of the difference GMM estimator without very strong assumptions (Baltagi, 2005). This estimation technique is appropriate under the assumption that there is no correlation between the differences of the variables and the bank-specific effects.

We remain agnostic about whether fixed effects or system GMM is the appropriate estimation technique in our context. As discussed by Angrist and Pischke (2009), while the dynamic panel GMM model does not nest the fixed effects model, or vice versa, the two have a useful bounding property on the causal effects of interest.[12] In our results section, we will consider the two estimation techniques to give bounds on the likely magnitude of the parameters of interest.

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[10] In the context of our model, the assumption of strict exogeneity amounts to the independent variables being uncorrelated with the error terms in all periods, i.e. $E[(\mathbf{x}'_{ict}, \mathbf{z}'_{ct})' e_{ics}] = \mathbf{0}$ for all $t,s = 1,2,\ldots,T$. As discussed in the text, the assumption fails if the lagged dependent variable features among the regressors.

[11] For this reason, when we regress operating costs on institutional variables, the size of operations and various controls to test the hypothesis that economies of scale and institutions impact net interest margins through the operating cost channel, we will resort purely to pooled OLS methods.

[12] In particular, if the dynamic specification is correct, but we mistakenly use fixed effects, estimates of a positive effect will be too large. On the other hand, if the fixed effects specification is correct, but we mistakenly estimate an equation with the lagged dependent variable, estimates of a positive effect will tend to be too small.

B. Data

In order to exploit the variation in the data as far as possible, we chose to keep the analysis at the level of individual banks. All bank-specific data were obtained from the BankScope database supplied by Bureau Van Dijk. Table 1 provides a summary of all variables and their sources. Macroeconomic variables were sourced from the World Economic Outlook of the International Monetary Fund. The World Bank's World Governance Indicators (WGI) outlined in Kaufman et al. (2005) was the source of information on institutions.

Table 1: Variable Definitions And Sources

Variable	Measure	Source
Bank-specific Variables		
Net interest margin	Ratio of total interest revenues net of total interest expenses to total assets	BankScope
Operating costs	Ratio of total operating expenses to total assets (log)	BankScope
Equity	Ratio of total equity to total assets (log)	BankScope
Loan-loss provisions	Ratio of loan loss provisions to total assets (log)	BankScope
Liquidit assets	Ratio of liquid assets to total assets	BankScope
Size of operations	Logarithm of total loans	BankScope
Non-interest income	Ratio of non-interest income to total assets	BankScope
Market competition		
Lerner Index	See Appendix I for definition	Author calculations
HHI (Deposits)	See Appendix I for definition	BankScope
HHI (Assets)	See Appendix I for definition	BankScope
Governance		
WGI Voice and Accountability	See Kaufman et al. (2011) for definition	Kaufman et al. (2011)
WGI Political Stability	See Kaufman et al. (2011) for definition	Kaufman et al. (2011)
WGI Government Effectiveness	See Kaufman et al. (2011) for definition	Kaufman et al. (2011)
WGI Regulatory Quality	See Kaufman et al. (2011) for definition	Kaufman et al. (2011)
WGI Rule of Law	See Kaufman et al. (2011) for definition	Kaufman et al. (2011)
WGI Control of Corruption	See Kaufman et al. (2011) for definition	Kaufman et al. (2011)
WGI Composite	Synthetic measure based on first principal component of governance indicators	Author calculations
Macroeconomic		
GDP per capita	GDP per capita in USD	World Economic Outlook
Exchange rate	% change in USD exchange rate	World Economic Outlook
Inflation	% change in CPI	World Economic Outlook
Treasury Bill	Interest rate on 3-month Treasury Bill paper*	World Economic Outlook

Notes: (*) Central bank discount rates used where Treasury Bill rates not available.

Our original sample of banks for the five regions in BankScope consisted of 400 banks in 30 countries over the period 1997-2011. However, we eliminated microfinance institutions and holding companies for other banks in the sample, and all banks which had fewer than four consecutive yearly observations.[13] We also eliminated outliers by removing all banks in the top and bottom percentiles of the distributions of bank-specific variables, with the exception of the size of the loan book. This yielded a final sample of 213 banks, as the basis for an unbalanced panel.

[13] The presumption being that microfinance institutions do not necessarily follow the same model of behavior as commercial banks. MFIs were identified using the Microfinance Information exchange database, found on http://www.themix.org/. The Stanford Bank in Antigua and Barbuda was also dropped, as it altered the results for ECCU significantly given its large balance sheet and the non-standard nature of operations.

We perform a number of transformations to the variables. Operating costs, equity-to-asset ratios, loans and the loan loss provisions are all entered in logs. As the six measures of institutions in the WGI are highly collinear, a summary index of institutions using principal components analysis was constructed, with weights derived from the first principal component.

V. RESULTS

In this section, we present our estimates of the various hypothesized determinants of net interest margins for banks in the five regional groupings during 1997–2011. In Table 2 column (i), the coefficients on operating costs, equity, loan size and loan-impairment charges were positive and statistically significant. The coefficient on non-interest activity was negative, as expected, and statistically significant at the one percent level. Among bank-specific variables, we only did not find the ratio of liquid to total assets to be statistically significant. In the more general specifications in columns (ii) and (iii), we observe that the bank specific variables are robust to controlling for market structure. Aside from the coefficient on operating costs, which falls by about 24 percent in magnitude, the coefficients remain very similar.

Our market competition measure proxied by the Lerner index (column (ii)) is significant at the five percent level. Once we control for macroeconomic variables (column (iii)), the statistical significance of the Lerner Index rises to one percent. The coefficient also rises by over 50 percent, suggesting downward omitted-variable bias in column (ii). Again, we observe that the sign and significance of the coefficients on bank-specific variables are robust to the inclusion of macroeconomic variables. Of the macroeconomic variables, short-term interest rates and inflation are significant with a positive sign at the two and one percent levels respectively, while exchange rate depreciation is significant with a negative sign at the one percent level (i.e. exchange rate depreciation lowers NIMs), giving some *prima facie* support regarding the *macroeconomic* view. The result that depreciation is associated with lower margins runs somewhat counter to our expectations but, as illustrated later, this result is not robust to controlling for fixed effects and serial correlation. Perhaps surprisingly, GDP per capita is not significant at any level.

Although the results are robust after controlling for institutional variables, (columns (iv) to (x)) institutions are not statistically significant. As indicated earlier, there is a high degree of collinearity among the various measures of institutions. Despite considering separately the effect of alternative measures of institutions, including a synthetic measure based on principal components analysis (column (x)), none of these yield results that are statistically significant.

A. Pooled OLS

Table 2: Determinants Of Net Interest Margins (pooled OLS)

Net interest margin	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
Operating costs/assets (log)	3.054***	2.331***	2.250***	2.239***	2.235***	2.244	2.244***	2.234***	2.241***	2.242***
	[8.701]	[9.005]	[9.068]	[8.964]	[8.956]	8.957	[9.020]	[8.980]	[8.946]	[8.979]
Equity/assets (log)	1.354***	1.501***	1.310***	1.295***	1.274***	.289**	1.291***	1.293***	1.306***	1.290***
	[5.313]	[6.215]	[6.309]	[6.333]	[5.885]	6.309	[6.417]	[6.334]	[6.237]	[6.232]
Loans (log)	0.164**	0.183**	0.225***	0.227***	0.223***	.223**	0.226***	0.226***	0.229***	0.225***
	[2.008]	[2.195]	[2.964]	[2.980]	[2.939]	2.942	[3.001]	[2.941]	[2.966]	[2.960]
Liquid/total assets	0.0123**	-0.00053	-0.00613	-0.00564	-0.00528	-0	-0.00554	-0.00547	-0.00492	-0.00552
	[2.007]	[-0.0941]	[-1.060]	[-0.972]	[-0.903]	-0.948	[-0.949]	[-0.943]	[-0.865]	[-0.954]
Loan impairment charge/assets (log)	0.252***	0.263***	0.241***	0.243***	0.241***	.246**	0.244***	0.249***	0.250***	0.244***
	[3.420]	[3.657]	[3.436]	[3.634]	[3.579]	3.632	[3.598]	[3.693]	[3.669]	[3.601]
Non-interest activity/assets	-0.424***	-0.321***	-0.281***	-0.292***	-0.289***	).287**	-0.288***	-0.284***	-0.287***	-0.288***
	[-6.332]	[-5.869]	[-5.380]	[-5.596]	[-5.555]	-5.475	[-5.463]	[-5.429]	[-5.483]	[-5.498]
Lerner Index		0.562**	1.230***	1.131***	1.199***	.229**	1.193***	1.242***	1.268***	1.197***
		[2.076]	[3.867]	[3.371]	[3.827]	3.620	[3.632]	[3.756]	[3.713]	[3.546]
Inflation			0.0350**	0.0350**	0.0307*	.0341'	0.0348**	0.0364**	0.0362**	0.0347**
			[2.174]	[2.120]	[1.870]	2.081	[2.156]	[2.212]	[2.223]	[2.107]
T-Bill rate			0.125***	0.120***	0.122***	.121**	0.122***	0.122***	0.122***	0.122***
			[4.952]	[4.486]	[4.655]	4.729	[4.732]	[4.737]	[4.761]	[4.707]
USD exchange rate (% change)			-0.0164**	-0.0149**	-0.0147**	.0149	-0.0150**	-0.0143**	-0.0139**	-0.0149**
			[-2.558]	[-2.307]	[-2.300]	-2.265	[-2.253]	[-2.167]	[-2.076]	[-2.277]
GDP per capita (log)			2.81E-05	3.52E-05	4.53E-05	0	2.74E-05	2.93E-06	-4.1E-06	2.59E-05
			[0.648]	[0.813]	[1.051]	0.378	[0.587]	[0.0625]	[-0.0869]	[0.566]
WGI Voice and Accountability				-0.115						
				[-0.739]						
WGI Political Stability					-0.11					
					[-0.779]					
WGI Government Effectiveness						0.07				
						[0.294]				
WGI Regulatory Quality							-0.0169			
							[-0.0592]			
WGI Rule of Law								0.175		
								[0.725]		
WGI Control of Corruption									0.197	
									[0.812]	
WGI Composite										-0.00048
										[-0.00439]
Constant	-2.076**	-1.272	-3.020***	-2.920***	-2.872***	.845**	-2.921***	-2.787***	-2.845***	-2.907***
	[-2.528]	[-1.546]	[-3.585]	[-3.494]	[-3.353]	-3.552	[-3.686]	[-3.504]	[-3.519]	[-3.615]
Observations	1524	1400	1399	1320	1320	1320	1320	1320	1320	1320
R-squared	0.417	0.419	0.474	0.467	0.467	0.47	0.466	0.467	0.467	0.466
No. of banks	213	210	210	209	209	209	209	209	209	209

Notes: We use standard errors which are robust to rabitrary heteroskedasticity and clustering at the bank level. Year dummies are included in all regressions. t-statistics are presented in brackets. The levels of significance are denoted as follows: *** p<0.01, ** p<0.05, * p<0.1

As this result runs counter to those of Demirguc-Kunt et al., (2004) who find a direct effect, we investigate the possibility that institutions may impact NIMs indirectly through operating costs. The role of institutions is therefore explored through an auxiliary pooled OLS regression (Table 3) with operating costs as the dependent variable, and the size of loans, non-performing loans, the Lerner Index and World Governance Indicators as controls. The inclusion of the Lerner Index permits the testing of the hypothesis that uncompetitive markets have higher levels of operating costs relative to competitive markets. The results suggest that operating costs decline with all five different measures of institutions by Kaufman et al., with levels of significance between one and 10 percent. In our preferred

specification (viii), with the composite measure of institutions, institutions are statistically significant at the one percent level with a coefficient of -0.09. This is suggestive of the importance of institutional factors for the costs of intermediation.

Of the five measures of institutions, Voice and Accountability, Rule of Law and Control of Corruption measures result in the lowest standard errors, suggesting the strongest relevance for operating costs. Our preferred measure—the composite index of governance variables—is also highly statistically significant. The results are consistent with anecdotal evidence that the poor institutional climate in which SSA banks operate causes them to engage in costly monitoring or screening which, in turn, leads to higher NIMs.[14] The inclusion of the size of the loan book facilitates the testing of the hypothesis that average operating costs per asset decline with an increase in the size of loans (e.g. due to fixed costs of intermediation), thus allowing us to test the *small financial system* hypothesis. In line with the *small financial system* view, operating costs are negatively associated with a larger loan portfolio, with a coefficient around -0.06.

Table 3: Determinants Of Operating Costs (pooled OLS)

Operating costs (log)	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
Size of operations (log)	-0.0584*** [-2.704]	-0.0661*** [-3.269]	-0.0636*** [-3.101]	-0.0651*** [-3.049]	-0.0640*** [-3.065]	-0.0642*** [-3.097]	-0.0609*** [-2.942]
Non-performing Loans (log)	0.0198 [1.044]	0.0184 [0.951]	0.0152 [0.779]	0.019 [0.978]	0.0143 [0.752]	0.0115 [0.608]	0.0142 [0.741]
Lerner Index	0.0522 [0.478]	0.0662 [0.549]	-0.0579 [-0.483]	0.0359 [0.312]	0.0394 [0.346]	0.00961 [0.0855]	-0.0199 [-0.169]
WGI Voice and Accountability	-0.151*** [-3.030]						
WGI Political Stability		-0.114*** [-2.815]					
WGI Government Effectiveness			-0.219*** [-3.470]				
WGI Regulatory Quality				-0.162* [-1.722]			
WGI Rule of Law					-0.159*** [-2.617]		
WGI Control of Corruption						-0.155*** [-2.932]	
WGI Composite							-0.0917*** [-3.555]
Constant	1.775*** [14.60]	1.801*** [15.50]	1.759*** [14.54]	1.812*** [14.81]	1.768*** [14.12]	1.782*** [14.54]	1.749*** [14.38]
R -squared	0.148	0.145	0.147	0.125	0.138	0.141	0.153
Observations	1011	965	965	965	965	965	965
Number of banks	170	170	170	170	170	170	170

Notes: Robust t-statistics in brackets. *** p<0.01, ** p<0.05, * p<0.1

[14] Our results corroborate the findings of Demirguc-Kunt, Laeven and Levine (2004), who also find governance to be important for bank operating costs.

Table 4: Determinants of Operating Costs Regression - Additional Controls (pooled OLS)

Operating costs (log)	(i)	(ii)	(iii)	(iv)	(v)
WGI Composite	-0.0917***	-0.100***	-0.0794***	-0.0842***	-0.0692*
	[-3.555]	[-3.803]	[-3.055]	[-2.685]	[-1.851]
Size of operations (log)	-0.0609***	-0.0187	-0.0331	-0.0589***	-0.0588***
	[-2.942]	[-0.718]	[-1.107]	[-2.810]	[-2.830]
Non-performing Loans (log)	0.0142	0.00542	0.000197	0.0137	0.0142
	[0.741]	[0.251]	[0.00819]	[0.709]	[0.741]
Lerner Index	-0.0199	-0.0873	-0.263	-0.0423	-0.0488
	[-0.169]	[-0.728]	[-1.413]	[-0.337]	[-0.372]
Secondary Enrollment		-0.00181			
		[-1.103]			
Tertiary Enrollment			-0.00985*		
			[-1.929]		
Infrastructure				-0.019	
				[-0.541]	
GDP per capita (log)					-1.82E-05
					[-0.909]
Constant	1.749***	1.641***	1.724***	1.668***	1.793***
	[14.38]	[10.11]	[10.36]	[8.930]	[13.61]
R-squared	0.153	0.139	0.098	0.154	0.157
Observations	952	575	423	952	952
Number of banks	170	117	131	170	170

Notes: Robust t-statistics in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table 4 tests the robustness of the above findings to omitted variables. In so doing, country-specific variables which might also tend to reduce operating costs, but which may be correlated with our measure of institutions, such as enrollment rates in secondary education (column (ii)) and enrollment rates in tertiary education (column (iii)) are explored. The underlying hypothesis is that low rates of enrollment will impose higher labor costs for banks, which anecdotally seem to recruit workers with higher levels of skills. Additionally, a measure of infrastructure (column (iv)), proxied by the number of telephone lines per capita in a given year is included.[15] Finally, as a general proxy of potential omitted variables we include GDP per capita in column (v).

[15] Our measures of secondary and tertiary enrollment, as well as infrastructure measures, are sourced from the World Bank's World Development Indicators database.

Our estimate of the impact of institutions on operating costs remains significant at the one percent level after including additional controls. Furthermore, the size of the coefficient does not change drastically from our original specification (column (i)). Only if we include GDP per capita, which is highly collinear with institutions, do we find that the coefficient estimate falls from -0.09 to -0.07. Despite the likely effect of inflating standard errors due to including GDP per capita, which is itself insignificant, the measure of institutions remains significant at the 10 percent level. Among our controls, only tertiary educational enrollment seems to be a statistically significant determinant of operating costs, with a negative sign and 10 percent significance level. The size of the loan book remains significant except in two specifications (columns (ii) and (iii)). In contrast to Gelos (2009), we find no evidence that lack of competition, as measured by the Lerner Index, causes banks to incur higher operating costs.

Our results suggest that better institutions reduce the need for financial intermediaries to engage in costly monitoring and costly recovery of assets in case of default. Conversely, countries with lower measures of institutional quality are interpreted as presenting banks with an environment of high asymmetries of information and related costs. In this sense, we see the results presented in Tables 4 and 5 as supporting the *risk-based* view of why we observe high NIMs. Their quantitative implications are explored in more depth in the section below (Table 9).

B. Fixed Effects and System GMM

Although our pooled OLS results provide a first pass of the potential factors driving NIMs, the Breusch-Pagan Lagrange Multiplier test indicates that hypothesis that bank-specific effects are present cannot be rejected (the Chi-squared test statistic is very large). Furthermore, the Hausman test indicates that the hypothesis that bank-specific effects are correlated with other regressors cannot be rejected in our preferred specification (iii), making pooled OLS estimation biased for reasons explained in section III. Thus, the fixed effects specification is the appropriate representation of the data generating process.[16]

The results of our fixed-effects regressions are presented in columns (i)-(iii) of Table 5. They are similar in magnitude to those derived from pooled OLS. An examination of each column of the table suggests that the sign and significance of each of the bank-specific variables is preserved under fixed effects. Among macroeconomic variables, the coefficient on short-term interest rates also appears to maintain size, sign and significance. The inclusion of fixed effects does, however, have the effect of eliminating the significance of inflation and exchange rate depreciation, while also making GDP per capita significant at the 10 percent level. Finally, we observe that, the Lerner Index is statistically significant with a positive sign, but only if we include the full set of macroeconomic controls.[17]

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[16] If the Hausman test did reject the null hypothesis, the correct specification would be random effects, which assumes that the unobserved characteristics are uncorrelated with the regressors.

[17] This result that might be accounted for by the regression in column (ii) being mis-specified. Specifically, the presence of omitted variables will bias the estimated coefficient, while also reduce the variance of the explanatory variables, inflating the standard errors.

The results from the GMM dynamic panel estimator, which allows us to take into account the possible persistence in NIMs, are presented in columns (iv) to (vi) of Table 5. In addition to controlling for persistence in NIMs, we also attempt to employ the system GMM method to control for the possible endogeneity of bank-specific variables and market structure. Accordingly, our strategy is to instrument the entire set of bank-specific variables with internal instruments (lags). The only exception are operating costs, which we assume to be exogenous once other bank-specific, market structure, institutional and macroeconomic variables have been controlled for.

Under the GMM specification, of the bank specific variables only operating costs and equity remain statistically significant. The size of loans, the loan impairment charge and non-interest income, while significant under Pooled OLS and fixed effects, are no longer significant under system GMM (with the exception of non-interest income in column (iv) which is significant at the 10 percent level). This suggests that the earlier significance of these variables may have been driven by simultaneity considerations. The lagged margin is significant at the one percent level, and the estimate of α ranges from 0.39 to 0.44, demonstrating non-trivial persistence. While the short-term rate is still statistically significant at the one percent level, GDP per capita loses its statistical significance.

As under fixed-effects, the Lerner Index is only significant in the full specification including macroeconomic variables, albeit with a somewhat smaller coefficient. In Table 6, we investigate the robustness of this result to alternative measure of market structure, namely the Herfindahl index (HHI) for assets and deposits. We find that HHI by assets is insignificant and has the wrong sign, while HHI by deposits has the right sign and a similar magnitude to the Lerner Index, but is statistically insignificant. Although the Lerner Index measure of market structure seems to more accurately capture the degree of market competition, the lack of robustness of the result to alternative measures— together with the challenges surrounding measures of market structure— suggests the need for caution in interpreting this result as supporting the *market structure* view outlined by Beck and Hesse (2009).

Table 5: Determinants Of Net Interest Margins (fixed effects and system GMM)

	Fixed effects			System GMM		
Net interest margin	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Lagged net margin	-	-	-	0.390***	0.442***	0.391***
				[3.296]	[5.439]	[4.915]
Operating costs/assets (log)	1.820***	1.701***	1.655***	2.323***	1.326***	1.582***
	[5.817]	[6.120]	[6.005]	[3.773]	[3.809]	[3.730]
Equity/assets (log)	1.236***	1.245***	1.217***	0.626	1.431***	0.985***
	[7.299]	[6.928]	[7.047]	[1.532]	[3.742]	[2.858]
Loans (log)	0.483***	0.544***	0.449***	0.339	-0.209	0.145
	[3.044]	[3.729]	[3.158]	[1.120]	[-1.551]	[0.973]
Liquid/total assets	0.00474	0.000394	0.0000927	-0.00501	-0.00515	-0.0121
	[0.908]	[0.0844]	[0.0187]	[-0.636]	[-0.528]	[-1.357]
Loan impairment charge/assets (log)	0.247***	0.263***	0.265***	-0.0303	0.112	0.056
	[5.341]	[5.611]	[5.676]	[-0.249]	[1.332]	[0.740]
Non-interest activity/assets	-0.329***	-0.270***	-0.274***	-0.263*	-0.225	-0.221
	[-4.752]	[-4.403]	[-4.581]	[-1.674]	[-1.581]	[-1.468]
Lerner Index		0.502	1.174***		-0.23	0.785**
		[1.510]	[3.101]		[-0.745]	[2.083]
Inflation			-0.00695			-0.00198
			[-0.650]			[-0.142]
T-Bill rate			0.0701***			0.0929***
			[2.765]			[4.751]
USD exchange rate (% change)			-0.00684			-0.00566
			[-1.250]			[-0.948]
GDP per capita (log)			-0.000241*			-0.0000188
			[-1.961]			[-0.481]
Constant	-1.066	-1.174	-1.294	-3.069	-0.518	-2.192**
	[-1.045]	[-1.265]	[-1.313]	[-1.524]	[-0.462]	[-2.057]
R -squared	0.258	0.246	0.268			
Observations	1524	1400	1399	1314	1208	1208
Number of banks	213	210	210	212	209	209
Hausman test p-value	[0.0046]	[0.1408]	[0.0368]			
No. of instruments				99	118	118
Hansen test p-value				0.579	0.267	0.294
A-B AR(1) test p-value				0.000976	0.0000221	0.0000833
A-B AR(2) test p-value				0.39	0.441	0.655

Notes: For fixed effects, robust t-statistics in brackets. *** p<0.01, ** p<0.05, * p<0.1. For system GMM, Windmijer (2005) robust two-step statistics reported in brackets.

Table 6: Role Of Alternative Measures Of Market Structure (system GMM)

	System GMM		
Net interest margin	(i)	(ii)	(iii)
Lagged net margin	0.391***	0.445***	0.434***
	[4.915]	[3.804]	[3.795]
Operating costs/assets (log)	1.582***	1.459***	1.489***
	[3.730]	[3.174]	[3.175]
Equity/assets (log)	0.985***	0.775**	1.041***
	[2.858]	[2.361]	[2.945]
Loans (log)	0.145	0.0637	0.0352
	[0.973]	[0.284]	[0.168]
Liquid/total assets	-0.0121	-0.00199	-0.00577
	[-1.357]	[-0.209]	[-0.663]
Loan impairment charge/assets (log)	0.056	-0.0861	-0.0538
	[0.740]	[-0.847]	[-0.445]
Non-interest activity/assets	-0.221	-0.0783	-0.0686
	[-1.468]	[-0.485]	[-0.425]
Inflation	-0.00198	-0.0182	-0.0134
	[-0.142]	[-1.257]	[-0.922]
T-Bill rate	0.0929***	0.0668***	0.0816***
	[4.751]	[4.135]	[4.503]
USD exchange rate (% change)	-0.00566	-0.00923	-0.0068
	[-0.948]	[-1.418]	[-0.940]
GDP per capita (log)	-0.0000188	-0.00000511	-6.38e-05*
	[-0.481]	[-0.109]	[-1.702]
Lerner Index	0.785**		
	[2.083]		
HHI (assets)		-2.265	
		[-1.343]	
HHI (deposits)			0.99
			[1.146]
Constant	-2.192**	-1.222	-2.222
	[-2.057]	[-0.761]	[-1.451]
Observations	1208	1295	1284
Number of banks	209	210	210
No. of instruments	118	118	118
Hansen test p-value	0.294	0.354	0.163
A-B AR(1) test p-value	0.0000833	0.000635	0.000549
A-B AR(2) test p-value	0.655	0.526	0.403

Notes: For fixed effects, robust t-statistics in brackets. *** p<0.01, ** p<0.05, * p<0.1. For system GMM, Windmijer (2005) robust two-step statistics reported in brackets.

The validity of the system GMM procedure was verified through the Windmijer correction and Hansen *J* test. The Windmijer (2005) correction was used in order to overcome the downward bias that may arise from the two-step standard errors on estimated coefficients in small samples. In addition, as documented by Anderson and Sorensen (1996) and Bowsher (2002), a large instrument count in the system GMM weakens the power of the Hansen *J*-test in testing for instrument validity. This issue is nontrivial, as in system GMM the instrument grows quadratically in *T*, opening up the possibility of over fitting. To guard against this possibility, we apply the 'collapse' procedure recommended by Roodman (2009), which has the effect of making the instrument count invariant in *T*. The AR-2 test and the Hansen *J* test, reported at the bottom of each column, indicate that the over identifying restrictions implied by the GMM procedure are not rejected.

Table 7: Economic Significance Of Net Interest Margin Determinants For the Whole Sample.

	Coefficient estimates					Effect of 1 s.d. on margins		
Net interest margin	POLS	FE	GMM	Mean	S.D.	POLS	FE	GMM
Operating costs/assets (log)	2.250***	1.655***	1.582***	1.56	0.47	1.05	0.77	1.21
Equity/assets (log)	1.310***	1.217***	0.985***	2.42	0.61	0.80	0.74	0.98
Loans (log)	0.225***	0.449***	0.145	4.53	1.59	0.36	0.71	0.38
Liquid/total assets	-0.00613	0.0000927	-0.0121	27.90	16.02	-0.10	0.00	-0.32
Loan impairment charge/assets (log)	0.241***	0.265***	0.056	-0.46	1.18	0.28	0.31	0.11
Non-interest activity/assets	-0.281***	-0.274***	-0.221	3.17	2.01	-0.56	-0.55	-0.73
Lerner Index	1.230***	1.174***	0.785**	-0.06	0.48	0.59	0.57	0.62
Inflation	0.0350**	-0.00695	-0.00198	5.84	4.42	0.15	-0.03	-0.01
T-Bill rate	0.125***	0.0701***	0.0929***	8.21	4.06	0.51	0.28	0.62
USD exchange rate (% change)	-0.0164**	-0.00684	-0.00566	-2.04	9.57	-0.16	-0.07	-0.09
log GDP per capita (USD)	0.0000281	-0.000241*	-0.0000188	1811.03	2611.66	0.07	-0.63	-0.08

Notes: The economic impat of net interest margins was found by multiplying the standard deviation of each explanatory variable by the respective coefficient estimate. For system GMM, the table shows the permanent effect, calculated as beta/(1-alpha).

The economic significance of the regression results can be readily inferred from Tables 7 and 8. Table 7 shows the effect on NIMs of a one standard deviation change in one of the explanatory variables using our baseline specification – including bank-specific, market structure and macroeconomic variables, but excluding institutional factors (again, this corresponds to regressions (iii) in Table 3, and regressions (iii) and (vi) in Table 6). Parameter estimates from Pooled OLS, fixed effects and system GMM are considered. For system GMM, the long-run effect of a change in each variable, calculated as $\beta_k/[1-0.391]$, where 0.391 is the estimated value of the coefficient on the lagged dependent variable. Both operating costs and equity tend to dominate the effect of other variables. A one standard deviation increase in operating costs, amounting to a rise in the log of operating costs-to-assets of 0.47, is associated with an increase in NIMs between 0.77 (fixed effects estimate) and 1.21 percentage points (system GMM estimate). A one standard deviation increase in equity, equivalent to an increase in the log of the equity/asset ratio of 0.61, is associated with a rise in net interest margins by between 0.74 (fixed effects estimate) and 0.98 (system GMM estimate). While the economic impact of a one standard deviation increase in the t-Bill rate and Lerner Index are also non-trivial, they are lower than for either of the two bank-specific variables. If interpreted causally, the effect of a one standard deviation change in T-Bill rates of 4.06 percentage points raises net interest margins by 0.62 percentage points in the long run, according to our system GMM estimates. A one standard-deviation increase in the Lerner Index raises NIMs by the same amount, i.e. 0.62 percentage points.

Table 8: Economic Significance Of Operating Cost Determinants (indirect impact on NIMs)

Operating costs (log)	POLS	Mean	S.D.	Indirect impact on margins
Loans (log)	-0.0609***	4.53	1.59	-0.25
Non-performing Loans (log)	0.0142	1.67	1.38	0.05
Lerner Index	0.0199	-0.06	0.48	-0.02
WGI Composite	-0.0917***	-0.93	1.38	-0.33

Notes: The effect of each variable on operating costs was calculated using the POLS result in Table 4, column (vii). Subsequently, the indirect impact on net interest margins was calculated using the GMM results in column (vi) in Table 6. The table shows the permanent effect, calculated as beta/(1-alpha).

In Table 8, the economic significance of the determinants of operating costs, through their final impact on NIMs is considered. A one standard deviation in the log of the size of the loan book reduces NIMs, through lowering operating costs, by 0.25 percentage points. A one standard deviation improvement in our synthetic indicator of institutions, roughly equivalent to the difference between Burundi and South Africa in 2011, for instance, has an even greater impact, with NIMs predicted to fall by 0.33 percentage points.

Table 9: Regional Comparison Using 2011 Values and System GMM Estimates

Net interest margin	EAC	CEMAC	ECCU	WAEMU	SACU
Operating costs/assets (log)	2.37	1.45	1.31	2.08	1.84
Equity/assets (log)	1.90	1.33	1.64	1.47	2.17
T-Bill rate	1.48	0.61	0.90	0.65	0.97
Lerner Index	0.15	0.19	-0.27	0.18	-0.14
Implied net interest margin	5.75	3.39	3.84	4.20	4.98
True net interest margin	6.19	4.16	2.84	3.67	4.93
Error	0.44	0.64	-1.17	-0.70	-0.24

Notes: The 'contribution' of each explanatory variable for the region was calculated as follows. Firstly, we obtained the values of each bank-specific explanatory variable for a region as an arithmetic average of all the banks in that region. Secondly, this value was multiplied by the system GMM coefficient estimate for that variable. The table shows the permanent effect, calculated as beta/(1-alpha).

The results in Table 9 reinforce earlier conclusions (Table 8) from a regional perspective, by calculating the contribution to the average NIMs in each region implied by our system GMM regression estimates, using values for 2011[18]. We observe that, together, operating costs and equity/assets explain the vast proportion of the predicted NIMs in every region. For instance, in the EAC, operating costs account for 2.4 percentage points, equity/assets 1.9 percentage

[18] The average NIM and value of explanatory variable is computed as an arithmetic average of the bank variables.

points and short-term interest rates 1.5 percentage points respectively of NIMs, yielding an implied net interest margin at 5.8, in comparison to the actual margin in 2011 of 6.2.

VI. CONCLUDING REMARKS

The main finding of our study is that operating costs and equity-to-capital ratios are both statistically and economically significant determinants of NIMs in the SSA and the Eastern Caribbean. Additionally, operating costs are strongly and inversely related to the size of bank loan portfolios, suggesting that fixed costs to lending are significant, and that there is scope for large banks to exploit economies of scale. We also find evidence for a statistically significant, but quantitatively less strong, role of treasury bill rates on NIMs. The importance of the treasury bill rate supports the idea that banks respond to an increase in the cost of capital by increasing the spread between borrowing and lending rates, consistently with the predictions of Bernanke, Gertler and Gilchrist (1999) and Kiyotaki and Moore (1997).

The results suggest considerable evidence for the *risk-based* and *small-financial system* views. This is based on the significance of operating costs, specifically in the role of institutions and economies of scale. In addition, there is some evidence for the role of the *macroeconomic hypothesis*, based on the significance of the short-term interest rate, and some evidence for the *market-structure* view reflecting the significance of the Lerner index. Nonetheless, the lower economic significance of these variables in explaining NIMs suggests that the *macroeconomic* and *market-structure* hypotheses are less important in the regions under study.

A further contribution of this paper is the finding that institutional factors may indirectly contribute to higher operating costs. This underscores the impact of gaps in regulatory quality and the application of the rule of law on higher costs of credit appraisal, monitoring and asset recovery. The results are therefore consistent with anecdotal evidence that the poor institutional climate could result in banks engaging in costly monitoring or screening activities which, in turn, leads to higher margins.

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Appendix I
Measuring Market Competition

We examine three different measures of competition in the banking sector as a check for robustness: the Herfindahl-Hirschman Index (HHI) by assets, the HHI by deposits and the Lerner Index. This section clarifies our computation of these measures. The Lerner Index li_{ict} for bank *i* is a direct measure of pricing behavior by banks, and captures the markup in prices. It is defined as the difference between prices p_{ict} and marginal costs mc_{ict}, measured as a ratio of prices:

$$li_{ict} = \frac{p_{ict} - mc_{ict}}{p_{ict}}$$

The Lerner Index for a market is a weighted sum of Lerner Indices for particular banks, and is defined as

$$li_{ct} = \sum_{i \in c} w_{ict} li_{ict}$$

where *i* indexes banks, *c* indexes countries, *t* indexes time and w_{ict} is the weight of bank *i* in country *c* in year *t*. The weight represents the fraction of the total assets in country *c* of the assets of bank *i* in year *t*. The marginal cost component of the index is calculated by taking the derivative with respect to assets of the following translog regression for total costs

$$\begin{aligned} \ln c_{it} &= \alpha_1 + \alpha_1 \ln q_{it} + \frac{1}{2}\alpha_2 (\ln q_{it})^2 + \\ &+ \frac{1}{2}\sum_{j=1}^{3}\sum_{k=1}^{3}\beta_{jk} \ln w_{jkt} \ln w_{kit} + \frac{1}{2}\sum_{j=1}^{3}\beta_{jk} \ln q_{it} \ln w_{jit} + \\ &+ \ln equity_{ict} + \ln lend_{ict} + u_{it} \end{aligned} \qquad (0.1)$$

where c_{it} denote total bank costs, q_{it} denote total bank assets. $\{w_{it}\}_{i=1}^{3}$ denote, respectively, the ratio of personnel costs over total assets, the ratio of non-personnel operating costs over total assets, and interest expenses over total funding, $equity_{ict}$ is the ratio of equity to total assets, while $lend_{ict}$ denotes the ratio of net total lending to total assets. The price component p_{ict} is calculated as the ratio of total bank income to total bank assets.

Our other measure of market structure, the HHI, is perhaps the most widely used measure of competition. It is based on market shares, and is defined as

$$HHI_{ct} = \sum_{i \in c} s_{ict}^2 \qquad (0.2)$$

where s_{ict} is the market share of firm *i* in country *c*, where market share is either of deposits or of assets, depending on the measure of concentration used.

Appendix II

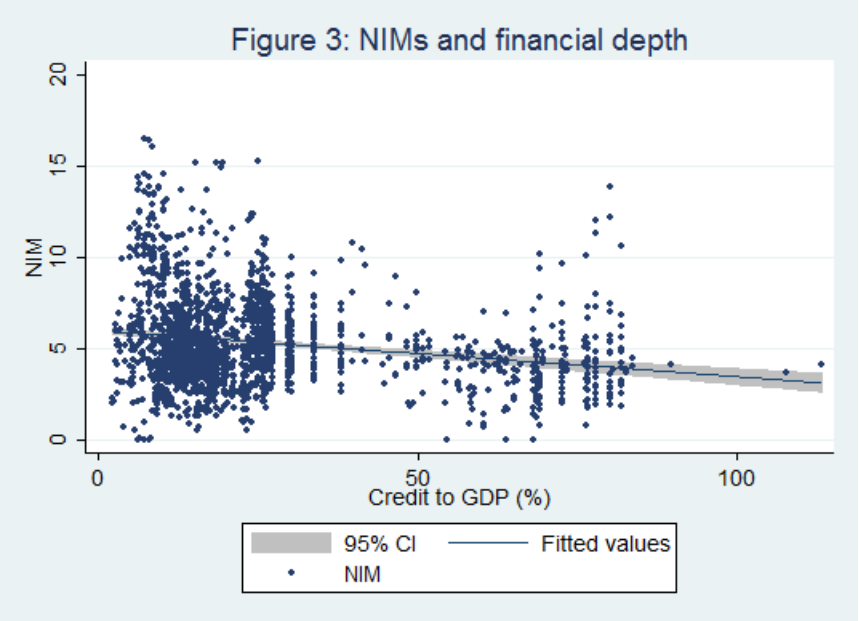
Figure 3: NIMs and financial depth
NIM
0
5
10
15
20
0
50
100
Credit to GDP (%)
95% CI
Fitted values
NIM