African Development Bank Group

Working paper series

No 168 - January 2013

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Working Paper Series

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Correct citation: Simpasa, Anthony Musonda, (2013), Competition and market structure in the Zambian banking sector, Working Paper Series N° ***168*** African Development Bank, Tunis, Tunisia.

AFRICAN DEVELOPMENT BANK GROUP

Competition and Market Structure in the Zambian Banking Sector

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Working Paper No. 168
January 2013

Office of the Chief Economist

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Abstract

Studies on banking competition in developing countries, and especially in Africa, are sparse. This study evaluates the degree of competition in the Zambian banking sector in the wake of dynamic market shifts induced by entry of new foreign banks and privatisation of the state-owned bank. Using a detailed bank-level panel data set, we measure competition using the H-statistic and the time varying Lerner index. The estimation of Lerner index provides the first ever documented empirical evidence on the evolution of competition in the Zambian industry. This is important in assessing foreign influence on competitiveness. For the H-statistic, results show that Zambian banks earned their revenue under conditions of monopolistic competition. This finding is corroborated by the estimate of the Lerner index which suggests that the degree of competitiveness may not be as low as previously understood. The study shows that risk taking, revenue diversity and regulatory intensity are all important determinants of market power. Tight monetary policy is also found to strengthen the banks' exercise of market power. Generally, the findings lend support to previous research suggesting that increased foreign bank penetration and divestiture of state ownership in banking can heighten competitive pressures in the banking sector. Thus, the main policy lessons drawn from the analysis is that competitive conditions could be further enhanced by easing regulatory impediments and in the long-run, allowing more foreign bank participation could spur competitive conduct in the industry.

JEL Classifications: C33, D43, G21, L13
Key Words: Banking, competition, Lerner index, market power

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1. Introduction

Competition in the banking industy has been a subject of great scholarly inquiry and continues to occupy a large body of empirical research. From public policy perspective, competitiveness of the banking sector represents a socially optimal target, since it reduces the cost of financial intermediation and improves delivery of high quality services thereby enhancing social welfare. Banking competition also promotes economic growth by increasing firms' access to external financing (Beck, Demirgüç-Kunt, & Maksimovic, 2004; Pagano, 1993). However, Petersen and Ranjan (1995) show theoretically that banks wielding market power tend to lend to young firms whose credit record may be opaque, hence leading to high lending rates. In practice, Cetorelli and Gamberra (2001) argue that although concentrated banking systems offer growth opportunities for young firms, there is strong evidence of a general depressing effect on growth associated with banks' exercise of market power and this impacts all sectors and firms. Hence, competition in banking should be placed at the centre of any public policy agenda since it has the mechanism to respond to the dynamic changes in economic conditions, especially those that affect delivery of financial services.

Financial sector reforms initiated in 1992 in Zambia brought great anticipation that competition in the banking system would be enhanced, thus leading to reduced intermediation spreads and improved access to financial services. However, expectations have been at variance with practical observations. The banking system is highly concentrated, segmented and dominance by few large banks (de Luna Martinez, 2006; GRZ, 2004; Finmark Trust, 2006). This may be due to the inherent nature of banking systems in developing countries which undermine the efficacy of policy reforms in generating a 'critical level' of competitive pressure in the aftermath of deregulation as envisaged. However, concentration ratios as measures of competitiveness do not provide adequate and conclusive explanations of actual bank behaviour and may lead to wrong inferences on competitive conditions (Hausman & Sidak, 2007). Instead, banking competition should be assessed based on market contestability arising from presence or absence of entry barriers (Baumol, 1982).

Mwenda and Mutoti (2011) remedy this by measuring banking competition in the Zambian banking sector using the $H-$statistic. However, although this is an improvement over

concentartion ratios, the authors do not condition the competitive index on changes in market conditions brought about by entry of new foreign banks in recent years and privatisation of the Zambia national Commercial Bank (ZNCB) in 2007[2]. To evaluate foreign influence and privatisation effecs on competitive conduct of banks operating in Zambia, we estimate the H – statistic across two periods (pre-entry/pre-privatisation and post-entry/post-privatisaiton) and the time varying Lerner index and compare the results. Accordingly, our study reconciles the dilemma of inconsistencies between expectations of policy reforms and observed evidence on the conduct of Zambian banks.

The rest of the paper is organised as follows. Section two presents stylised facts on the Zambian banking sector while section three is a summary of the related empirical literature. Section four discusses the methodology and data issues and section five presents estimation results. Section six concludes the paper.

2. Stylized facts of the Zambian banking sector

After more than two decades of financial repression, financial liberalisation offered an opportunity for a revival of the Zambian banking industry. As part of the broader economic reform package, financial reforms were in recognition that a well-functioning and competitive financial system is critical to the country's overall economic development. Accordingly, major obstacles in the banking sector were eliminated, creating a platform for open bank entry into the sector in order to foster competition and infuse efficiency among financial intermediaries.

In 2004, the Government embarked on the Financial Sector Development Programme, a comprehensive strategy aimed at building and strengthening financial sector infrastructure to enable it support economic diversification and sustainable growth (GRZ, 2004). The FSDP blueprint concluded that dominance of foreign owned banks may be a possible source of

[2] The Government sold 49% of its 99.8% stake in ZNCB to Rabo Financial Institutions Development B.V (RFID), a subsidiary of the Dutch owned Rabobank, which also assumed management rights and representation at the board. Subsequently, RFID offloaded 3.41% to Lizara Investments Limited, a nominee of the Zambia National Farmers Union, while 1.32% was offered to employees through the Employee Share Ownership Programme without affecting its controlling rights in appointing management. In 2008, the ZNCB undertook an Initial Public Offering, which saw Government's stake diluted by 24.68%, reducing its stake to 25%. The long-term plan is for the State to completely divest its interests in the bank.

collusive behaviour. The implementation of the FSDP has helped address key bottlenecks in the financial system, including improving the governance of the banking sector, after crisis of the mid-1990s.

In 2006 there were 13 commercial banks. Out of these, seven were subsidiaries of foreign banks; one joint venture with majority foreign ownership, four domestic private banks and a public sector bank. As indicated above, ZNCB a public sector and the second largest bank by asset size, was privatised in 2007 although by regulatory definition, it is still majority owned by Zambians with 54.41% domestic interest. This case provides a unique feature of ownership, encompassing foreign financial equity stake, domestic private sector participation and public sector interest. Nonetheless, management rights reside with Rabobank, the single largest foreign shareholder[3]. From 2008, 6 more subsidiaries of foreign banks have been registered, bringing the total number of banks with foreign ownership to 14 and a total of 19 banks for the whole industry. The number of domestic private banks has remained unchanged (see Table 1).

Table 1: Ownership structure of banks operating in Zambia

No.	Name of Bank	Type of ownership (2006)	Type of ownership (2011)
1	Indo-Zambia Bank	Joint venture	Joint venture
2	First Alliance Bank	Domestic Bank	Domestic Bank
3	Cavmont Bank	Domestic Bank	Domestic Bank
4	Finance Bank	Domestic bank	Domestic bank
5	Investrust Bank	Domestic bank	Domestic bank
6	Zambia National Commercial Bank	Public Sector	Domestic bank – mixed ownership
7	Intermarket Bank	Subsidiary of a foreign bank	Subsidiary of a foreign bank
8	African Banking Corporation	Subsidiary of a foreign bank	Subsidiary of a foreign bank
9	Bank of China	Subsidiary of a foreign bank	Subsidiary of a foreign bank
10	Barclays Bank	Subsidiary of a foreign bank	Subsidiary of a foreign bank
11	Citibank	Subsidiary of a foreign bank	Subsidiary of a foreign bank
12	Stanbic Bank	Subsidiary of a foreign bank	Subsidiary of a foreign bank
13	Standard Chartered Bank	Subsidiary of a foreign bank	Subsidiary of a foreign bank
14	AB Bank	N/A	Foreign financial institutions
15	Access Bank	N/A	Subsidiary of a foreign bank
16	Ecobank	N/A	Subsidiary of a foreign bank
17	First National Bank	N/A	Subsidiary of a foreign bank
18.	International Commercial Bank	N/A	Subsidiary of a foreign banking group
19.	United Bank for Africa	N/A	Subsidiary of a foreign bank

Source: Bank of Zambia

[3] See ownership structure above

The increase in the number of banks has been accompanied by growth in nominal assets, accounting for more than 90% of total financial industry assets, which is ten times higher than other market participants. At the end of 2011, the banks' nominal asset size stood at K27.8 trillion (30% of GDP) which was about three times higher than the K10.7 trillion held in 2006 (27.7% of GDP). Traditional intermediation activities (loans and advances) account for the largest share of banks' assets.

Between 2006 and 2011, the share of loans in total assets increased to 43% from 36%, reflecting increased lending to the private sector on consolidation of macroeconomic gains. Over the same period, the share of liquid assets (cash and Treasury securities) fell to 35% from 42%, mainly due to divesture from Government securities as yield rates became less attractive. Historically, the low level of financial intermediation has been attributed to banks' purchase of Treasury securities which offer risk-adjusted positive premiums relative to the more risky bank loans. The banks' share of foreign assets has also declined in recent years, averaging about 16% between 2006 and 2011 against 28% from 1998 to 2002.

However, the Zambian banking system continues to exhibit a high level of concentration with few large banks dominating the financial landscape. Table 2 below shows the banks' market structure as depicted by the four firm concentration ratio ($CR4$) in three main components of the banks' balance sheet.

Table 2: Three bank concentration ratios, CR4 (%), end period 2002-2011

	Assets	Deposits	Loans
2002	70.5	74.9	74.1
2003	67.9	70.2	77.9
2004	70.7	73.8	77.7
2005	70.2	72.5	77.6
2006	64.0	66.9	74.7
2007	61.7	65.2	74.8
2008	67.3	67.2	75.7
2009	63.9	66.0	69.7
2010	62.9	65.8	70.9
2011	64.6	66.6	65.3
Average	66.4	68.9	73.8

Source: Author's own calculations based on BoZ data

For assets and deposits, the four largest banks accounted for an average of about two thirds between 2002 and 2011, while for the loans, the proportion was much higher. The high concentration in the loans market was driven by banks' expansion of their loan book in the wake of improved macroeconomic conditions. On the other hand, the dominance of the four largest banks in deposits and total assets has been diluted by increased market capture of smaller banks and new industry entrants, an indication of growing competitive intensity in this segment of the banking market. Between 2008 and 2011, the new foreign banks captured an average of 3% of the deposit market.

Profitability of Zambians banks has generally been buoyant, generated from earnings on loans, Treasury securities. Realised gains on foreign exchange transactions and fee income have also contributed significantly to banks' profits. Table 3 shows the banks' return on assets (ROA) and the net interest margin (NIM), both used to gauge profitability and intensity of competitive pressures.

Table 3: Bank profitability measures, by ownership category, 1998-2011

	Return on assets, ROA (percent)				Net interest margin, NIM (percent)			
	Foreign	**Domestic**	**Public**	**All banks**	**Foreign**	**Domestic**	**Public**	**All banks**
1998	4.80	0.85	2.75	3.89	5.47	2.29	0.39	3.86
1999	7.92	0.47	0.17	5.61	4.53	1.01	1.81	2.97
2000	9.99	3.12	4.32	8.16	6.72	4.17	1.66	5.74
2001	7.48	5.93	-7.16	4.7	5.65	4.81	1.82	5.35
2002	7.15	7.60	6.43	7.05	4.64	5.68	5.29	5.35
2003	5.65	6.27	0.93	4.76	2.85	5.80	0.09	3.70
2004	3.14	4.94	1.31	3.02	5.10	7.54	5.01	6.00
2005	6.52	6.99	3.15	6.00	5.25	7.71	9.15	6.70
2006	3.98	5.27	1.33	3.68	4.75	4.84	7.18	5.60
2007	2.68	3.63	..	2.83	7.07	7.26	..	7.10
2008	2.60	6.67	..	3.17	7.22	7.92	..	7.32
2009	1.37	6.10	..	1.99	8.20	7.94	..	8.16
2010	2.45	0.50	..	2.25	6.30	6.88	..	6.36
2011	3.30	0.11	..	3.40	6.33	3.95	..	6.10
Average	**4.93**	**4.17**	**1.47**	**4.32**	**5.72**	**5.56**	**3.60**	**5.74**

Note: .. means not applicable
Source: Author's own calculations from BoZ data

For both measures, there is no marked difference in the average level of profitability between subsidiaries of foreign banks and domestic private banks. Between 1998 and 2011, ROA averaged about 5% for foreign banks and 4% for local private banks, in line with the industry

average. Subsidiaries of foreign banks recorded a slump in profitability in 2009, at the same time their NIM fell to 6.3% from 8.2% the previous period. This performance reflects entry level 'subsidisation' and concomitant losses incurred by the three new foreign banks in 2008 and 2009, at a time when the whole industry also experienced a squeeze in earnings due to the global financial crisis.

The global crisis had a more telling albeit lagged impact on domestic private banks. In 2010, the ROA for domestic banks fell sharply to half a percent from a high of 6% in 2009 and deteriorated further in 2011 to 0.1%. This was consistent with a fall in NIM, which declined to 7% in 2010 and 4% in 2011. On average, the only public sector bank had the lowest level of profit and interest margins. This may be due to a high proportion of non-performing loans and general profligacy associated with state owned institutions.

Commercial banks in Zambia have continued to show resilience, largely credited to the strong capital position. A majority of banks hold capital balances above the regulatory threshold, depicting the strength and stability of the Zambian banking sector. To boost the banks' capital position and strengthen their resilience, the authorities raised regulatory capital further and introduced a tiered structure in April 2012 (GRZ, 2012). The minimum capital requirement for local banks was raised to K104 billion (US$20 million) while the requirement for foreign banks was pegged at K520 billion (US$100 million). Prior to this revision, the minimum regulatory capital was uniform across all banks at K12 billion (about US$2 million). The authorities argue that the new capital requirement is expected to boost banks' lending to the private sector.

3. Review of selected empirical literature

The $H-$statistic proposed by Panzar and Rosse (1987) and the Lerner index (Lerner, 1934) have been widely employed in empirical models of banking competition and measures of market power. Other models developed by Lau (1982) and Iwata (1974), have received less empirical attention. The $H-$statistic, the sum of revenue elasticities with respect to input prices, measures the extent to which a change in factor input prices is reflected in the banks' equilibrium revenue. According to Panzar and Rosse (1987), market structure is determined by the magnitude and sign of the $H-$statistic. Table 4 summaries the interpretations of the $H-$statistic.

Table 4: Interpretation of the Panzar-Rosse H – statistic

Value of $\boldsymbol{H}$ - statistic	Market Structure Characterisation
$H \leq 0$	Monopoly or conjectural variations short-term oligopoly. In this case each bank operates independently as under monopoly profit maximising conditions and the H-statistic is a decreasing function of the perceived demand elasticity.
$0 < H < 1$	Monopolistic competition characterised by free entry equilibrium excess capacity. The H-statistic is an increasing function of the perceived demand elasticity.
$H = 1$	Perfect competition, or natural monopoly in a perfect contestable market, or sales maximising firm subject to break even constraint. It could imply free entry equilibrium with full (efficient) capacity utilisation.
Market equilibrium test	
$E = 0$	Equilibrium
$E \leq 0$	Disequilibrium

Source: Molyneux, et al. (1994) .

Early estimates of the $H-$statistic were predominantly for developed and emerging economies. These include Bikker and Haaf (2002) who showed unambiguously that monopolistic competition was the dominant market structure for the banking sector of the countries in the European Union (EU). This evidence is supported by Casu and Girardone (2006) also for a group of EU countries and Gelos and Roldos (2004) for a group of European and Latin American emerging countries.

In Africa, the evidence has been scanty. However, as bank level data have become readily available and the need to evaluate the efficacy of financial reforms become more imperative, the research gap in narrowing. Sanya and Gaertner (2012) provide latest evidence for the East African Community and show that competition in the four countries analysed was low. Chen (2009) provides evidence using a more comprehensive sample of SSA countries. The conclusion was that the degree of competitiveness varied across countries. In Ghana, Buchs and Mathisen (2005) note that financial reforms did not adequately foster banking competition while Hauner and Peiris (2008) find contrasting evidence for Uganda.

Despite receiving wide empirical application, the $H-$statistic has been criticised on three main fronts. Firstly, the validity of the index is subject to the assumption of long-run equilibrium being met. However, for emerging and developing economies, this assumption may not always hold. Secondly, in its purest form, the $H-$statistic ignores the dynamic nature of competitive pressures which may be induced by banks' responses to market developments. Some studies have attempted to remedy this by estimating the index on an annual basis, see for instance,

Yildirim and Philippatos (2007) for Central and Eastern European countries and, Yeyati and Micco (2007) for Latin America. Nonetheless, this assumes the researcher has a luxury of degrees of freedom and the equilibrium assumption being fully satisfied on an annual basis. The latter condition usually fails the test.

The third criticism is one of measurement. The index is derived from a structural revenue specification. However, there is no consensus on how revenues should be measured. In some studies, revenues are scaled by assets while other studies have derived the index without scaling revenues. Critics argue that scaling revenues yields a price and no longer represents a true revenue measure (Bikker, Spierdijk, & Finnie, 2006). Studies that do not use scaled revenues include assets as an additional explanatory variable to account for scale effects. However, the broad conclusion on the relevant market structure in the banking sector is invariant to how revenue variable is measured. Accordingly, there is no loss of generality in measuring competition using either scaled or unscaled revenue.

The Lerner index is a relative mark-up of price over marginal cost (Lerner, 1934) and measures the banks' exercise of market power. According to Coccorese (2009), the Lerner index is a true reflection of the banks' degree of market power because it represents the behavioural departure from monopoly and perfect competition. The index also recognises the need to endogenise market structure in testing the exercise of market power (Delis, Staikouras, & Varlagas, 2008). Angelini and Cetorelli (2003) assessed the behaviour of Italian regional banks and found that deregulation fostered a reduction in price-cost margins. However, Fernandez de Guevara et al, (2005) fail to find support of financial reforms on competitive conditions in the European Union. In Africa, Aboagye et al., (2008) observe that Ghanaian banks possess market power mainly on account of size, efficiency and the macroeconomic environment in which they operate.

Studies have shown that when banks are faced with a constant elasticity of demand for banking products and assuming there is no measurement error in the variables, there is a symmetrical relationship between the H-statistic and the Lerner index (Shaffer, 1983; Bikker & Haaf, 2002). As banks become more competitive (higher H-statistic), the narrower the relative price-cost mark-up (smaller Lerner index). A number of recent studies apply both approaches in measuring

banking competition, one serving as robustness check to the other, see for instance, Sanya and Gaertner (2012), Kammoun and Ammar (2012) and Anzoategui, et al. (2010). In general, the two approaches offer plausible explanations of banking competitive performance (Cetorelli, 1999) and reinforce the understanding that perfect competition and monopoly are neither plausible practical outcomes of market conduct in the banking industry (Cetorelli, 2001).

4. Methodology and data

Empirical model-PR model

The primary interest of this study is to assess the state of competition in the Zambian banking sector in the context of broader macroeconomic and institutional setting. This exercise is implemented using both the Panzar-Rosse (PR) methodology and the more dynamic Lerner index. Both approaches have sound theoretical foundations and empirical appeal. The analysis enables us to compare our results with those obtained from previous studies, especially in developing countries.

The PR methodology allows for bank specific differences in the reduced form revenue function and knowledge of bank output and prices is not required. The empirical PR model is given by Equation 1 below:

$$\begin{aligned}\ln\left(REV_{it}\right) = {} & \beta_0 + \beta_L \ln\left(w_{Lit}\right) + \beta_F \ln\left(w_{Fit}\right) + \beta_K \ln\left(w_{Kit}\right) + \beta_{RISK} \ln\left(RISK_{it}\right) \\ & + \beta_{CR} \ln\left(CAPRATIO_{it}\right) + \beta_{NII} \ln\left(OI_{it}\right) + \beta_{BR} \ln\left(BRANCH_{it}\right) \\ & + \beta_{INFL} \ln\left(INFL_t\right) + \beta_{TBR} \ln\left(TBR_t\right) + \varepsilon\end{aligned} \tag{1}$$

where subscripts i and t denote bank i at time t and REV is banks' composite revenue, scaled by total assets to control for scale effects; w_L, w_F and w_K denote, respectively, unit price of labour, approximated by expenses on salaries and other staff compensations, divided by total assets; unit price of funds (interest expenses divided by total purchased funds); unit price of capital (all other expenses divided by fixed and other assets). From Equation (1), $H = \beta_L + \beta_K + \beta_F$, the sum of the revenue elasticities with respect to input factor prices.

Explanatory variables are given by bank specific factors and indicators of macroeconomic conditions to capture the environment under which banks operate. $RISK$ is the ratio of non-performing loans to gross loans; $CAPRATIO$ is the ratio of capital-to-risk weighted assets, capturing regulatory burden and $BRANCH$ is the number of bank branches, capturing the effect of bank network density on revenue performance. To capture macroeconomic conditions, we include volatility in the rate of inflation $(INFL)$ to control for macroeconomic uncertainty while the 91-day Treasury bill rate (TBR) is included to capture stance of monetary policy on the banks' behaviour[4]. Including the 91-day yield rate is consistent with Sanya and Gaertner (2012) who used it as the main instrument of open market operations in East African Community countries to delineate liquidity preference on banks' behaviour. Finally, ε represents a disturbance term.

Testing for long-run equilibrium

The validity of the PR methodology rests on satisfying the assumption of long-run equilibrium. Equilibrium is established by replacing REV in Equation (1) with ROA. According to Shaffer (1983), rates of return should be equalised across banks and must not be correlated with input prices in order for long-run equilibrium to hold. In this case, the equilibrium condition is given by $E = \beta_L + \beta_K + \beta_F = 0$, where E now denotes equilibrium. Since ROA can potentially take on negative values, it is adjusted by a factor of one before taking logarithmic transformation.

As noted above, the assumption of long-run equilibrium may be difficult to sustain in transition and developing countries where banking sectors are still undergoing structural transformation (Mktrtchyan, 2005; Northcott, 2004). However, Buchs & Mathisen (2005) posit that given the internal logic of the PR model, it is best to think of long-run equilibrium as reflecting the banks' ability to adjust to shocks. This is true of the Zambian banking system which has consistently exhibited resilience since the end of the banking crisis in the mid-1990s which saw closure of

[4] During the estimation period, the central banks used the 91-day Treasury bill rate to set the policy rate with a mark-up of 2 percentage points while commercial banks have used it as a benchmark in setting lending rates (BoZ, 2010).

nearly a dozen distressed banks. Nonetheless, long-run equilibrium must be empirically tested rather than imposed arbitrarily.

Empirical model of the Lerner index

The empirical strategy for estimating the Lerner index is adapted from Fernandez de Guevara and Maudos (2007) and Aboagye, et al. (2008) as applied to Ghanaian banks. Thus, in line with these studies, we estimate a generalised translog cost function given by Equation (2) below:

$$\begin{aligned}\ln TC_{it} &= \beta_0 + \beta_y \ln Y_{it} + \frac{1}{2}\beta_{yy}\left(\ln Y_{it}\right)^2 + \beta_{wl}\ln w_{Lit} + \beta_{wf}\ln w_{Fit} + \beta_{wk}\ln w_{Kit} \\ &+ \beta_{wll}\left(\ln w_{Lit}\right)^2 + \beta_{wff}\left(\ln w_{Fit}\right)^2 + \beta_{wkk}\left(\ln w_{Kit}\right)^2 + \beta_{wlwf}\ln w_{Lit}\ln w_{Fit} \\ &+ \beta_{wlwk}\ln w_{Lit}\ln w_{Kit} + \beta_{wkwf}\ln w_{Fit}\ln w_{Kit} + \sum_{j=wl,wf,wk}\delta_{yj}\ln Y_{it}\ln w_{jit} \\ &+ \theta_{risk}\ln RISK + \zeta, \\ i &= 1,...,N;\ t = 1,...,T\end{aligned} \tag{2}$$

TC_{it} denotes total operating costs (interest expenses plus non-interest expenses), output is measured by total assets (Y_{it}), input factor prices are as defined above while ζ is a composite disturbance error term obeying all classical assumptions.

The cost function imbeds symmetry and homogeneity conditions with the unit price of funds as the numeraire. To gain efficiency, the cost function is estimated jointly with input cost share equations using Zellner's (1962) two-step iterated seemingly unrelated regression estimation (ISURE) procedure. Since input shares sum to 1, the equation for the funding cost share is dropped leaving equations for labour and capital cost shares. Partially differentiating Equation (2) with respect to Y_{it} yields bank level marginal cost $\left(mc_{it}\right)$:

$$mc_{it} = \frac{\partial \ln TC_{it}}{\partial \ln Y_{it}} = \frac{TC_{it}}{Y_{it}}\left(\beta_y + \beta_{yy}\ln Y_{it} + \sum_{j=L,K}\delta_{yj}\ln w_{jit}\right) \tag{3}$$

Bank level marginal cost $\left(p_{it}\right)$ and corresponding output price, measured as total income divided by total bank assets $\left(p_{it}\right)$, are in turn used to calculate the bank-specific time varying Lerner

index $LI_{it} = \frac{p_{it} - mc_{it}}{p_{it}}$. Averaging (mc_{it}) and (p_{it}) across all banks yields the industry wide marginal cost (MC_t) and market price (P_t) which are used to generate the industry wide Lerner index, given by $LI_t = \frac{P_t - MC_t}{P_t}$.

LI_t is a counterpart of the $H-$statistic but shows evolution over time. Under perfect competition, $P_t = MC_t$, and hence $LI_t = 0$. A larger deviation of price from marginal cost depicts increasing monopolistic conduct with the Lerner index approaching unit. A $LI_t = 1$ signifies complete exercise of market power. Like the $H-$statistic, LI_t is bounded between 0 and 1with intermediate values denoting monopolistic competition. However, it is not uncommon for Lerner index to take on negative values. According to Solis and Maudo (2008), this denotes 'super competition' and may occur when banks price below marginal cost such as the case of initial subsidization noted above.

To complete the exercise, we relate the estimates of the bank level Lerner index to bank-specific and environmental factors (regulatory and macroeconomic variables) in order to evaluate factors that drive market power in the Zambian banking sector. This is important for regulatory authorities that rely on defective measures of market power. Equation (6) specifies the relationship between the estimated bank level Lerner index and potential correlates.

$$\ln(LI_{it}) = \alpha_o + \alpha_1 \ln(RISK_{it}) + \alpha_2 \ln(INEFF_{it}) + \alpha_3 \ln(CAPRATIO_{it}) + \alpha_4 \ln(OI_{it}) + \alpha_5 \ln(TBR_t) + v_t \quad (4).$$

The variables are as previously defined. In addition, we add a measure of cost inefficiency $(INEFF)$ to capture the potential effect of inefficiency on market power[5]. Cost inefficiency in

[5] Cost inefficiency scores are generated from a stochastic cost frontier equation in line with Simpasa (2010). Results of the stochastic cost frontier estimation are available from the author on request.

banking is often associated with high mark-ups because banks tend to mask their operating inefficiency through high spreads, the cost of which is borne by customers.

Sample and data

Quarterly unbalanced panel observations from 1998-2011 for 18 chartered commercial banks in Zambia are used to estimate the $H-$statistic and LI_{it}. Only one bank which began operations in 2011 is excluded from the analysis due to insufficient data points.

As it is well known, there are different panel econometric approaches used in estimating models of banking competition. However, out of the competing panel data methods, the choice is mainly between fixed and random effects models to describe the 'best' statistical approach. Panel estimation provides flexibility in modelling differences in behaviour across individual sample units. In contrast, pooled regression is less common in studies of this nature due to potentially strong firm and temporary effects, which may arise from heterogeneity of banks. In pooled analysis, heterogeneity is assumed away and this could have significant implications on results (Arellano, 2003).

In order to ascertain the 'best' panel data estimation approach between fixed and random effects, we are guided by results of the Hausman specification test. Further, in line with Hoechle (2007) and Green (2003) all regression equations are estimated with robust standard errors in order to correct for groupwise heteroscedasticity and cross-sectional correlation in panels. The data are gleaned from the banks' balance sheet and profit/loss accounts and fortnightly statistics provided by the Bank of Zambia, the regulatory institution for commercial banks. The bank level data are proprietary and not in the public domain while macroeconomic statistics are readily available. Table 5 gives a summary of descriptive statistics on variables used in regression analysis.

Table 5: Descriptive summary statistics of variables used in regression analysis

Variable Symbol	Variable Name	Mean	Std Dev.	Min	Max
ASSETS	Total assets	668,959.6	939,086.5	3,966.00	4,771,918.00
TC	Total operating costs	19,747.7	26,463.5	180.90	185,220.80
BRANCH	Number of bank branches	13	16	1	59
RISK	Non-performing loans/Total loans	0.11	0.15	0.00	1.30
REV	Total revenue/total assets	0.06	0.06	-0.00	1.50
w_L	Unit price of labour (Staff costs/Total Assets)	0.02	0.01	0.00	0.20
w_F	Unit price of funds (Interests expenses/Purchased funds)	0.02	0.03	0.00	0.70
w_K	Unit price of physical capital (All other expenses/Fixed and all other assets)	0.23	0.87	2.60	22.20
INFL	Inflation Volatility (3-month standard deviation of inflation)	1.85	1.29	0.10	5.90
TBR	91-day Treasury bill rate (% per annum)	20.41	13.73	2.20	52.60
OI	Other income/Total assets	0.02	0.02	-0.07	0.50
LI	Lerner index (Price-Marginal cost)/Price	0.20	0.02	-6.00	2.10
INEFF	Cost inefficiency score	0.18	0.11	0.00	0.50
CAPRATIO	Total regulatory capital/risk-weighted assets	0.16	0.24	0.11	6.10
LABSHARE	Labour input share	0.36	0.11	-0.06	0.82
KAPSHARE	Capital input share	0.38	0.16	-1.24	1.00
ROA	Return on assets	0.01	0.02	-0.01	0.20

Note: Total costs and total assets are expressed in millions of current Zambian Kwacha (K' million).

Source: Bank of Zambia (BoZ) and own calculations

5. Empirical results

5.1. $H-$Statistic results from fixed effects panel estimation

First round of evidence on competitive conduct in the Zambian banking sector is assessed by the estimate of the $H-$statistic. The benchmark model is applied on a full sample period for all banks. In the test for long-run equilibrium carried out for the full sample, $E=-0.02$ with $(p-value=0.92)$. Accordingly, we fail to reject the null hypothesis of long-run equilibrium implying that over the sample period the Panzar-Rosse estimation procedure can be used to measure banking competition in Zambia. Furthermore, the Hausman test for panel estimation

justifies the fixed effects model over random effects specification. Table 6 summarises empirical results of fixed effects estimated benchmark model.

Table 6: Fixed effects panel estimation of PR model

Dependent variable: $\ln(REV)$			
Independent Variables	Coefficient	t-statistic	p-value
Intercept	-1.123	-1.610	0.000***
Input prices			
$\ln(w_L)$	0.184	4.360	0.000***
$\ln(w_F)$	0.188	9.350	0.000***
$\ln(w_K)$	0.088	3.560	0.000***
Bank-specific and regulatory factors			
ln(*Risk*)	-0.021	-2.450	0.015**
ln(*Capratio*)	-0.076	-2.700	0.007***
ln(*OI*)	0.213	5.800	0.000***
ln(*Branch*)	0.176	6.280	0.000**
Macroeconomics variables			
ln(*INFL*)	0.014	1.900	0.057*
ln(*TBR*)	0.104	2.429	0.015**
$H-$statistic		0.461	
Null: H=0 (p-value) Monopoly		0.000***	
Null: H=1 (p-value) Perfect Competition		0.000***	
Market Structure : Monopolistic competition			
Diagnostics			
Hausman test (p-value):		0.000***	
σ_u		0.273	
σ_ε		0.158	
ρ		0.750	
R^2		0.607	
No. of Obs.		641	
F-statistic (p-value)		0.000***	

Significance level: * p<0.10, ** p<0.05, *** p<0.01
Source: Author's own estimates based on BoZ data

The estimated value of the $H-$statistic is 0.46 and is statistically significant from both zero and one at the 1 % level. The null hypotheses of both monopoly and perfect competition are therefore decidedly rejected. The intuition of this finding is that over the study period, Zambian banks earned their revenue under conditions of monopolistic competition. This finding is further reinforced by the signs and significance of all three input factor prices. Intuitively, the results

suggest that factor prices are important for Zambian banks in the pricing of bank products and services. By magnitude, labour and funding unit costs contribute the most to the value of the $H-$statistic. All tests and diagnostic statistics also lend credence to goodness of fit and robustness of the model.

Furthermore, bank-specific factors are evidently robust, corroborating our prior expectations. The parameter estimate for the *RISK* variable is of the expected negative sign and statistically significant at 5 % level. This means that credit risk has impeded Zambian banks' revenue performance and undermined their ability to offer services to the market at competitive prices. The negative and significant coefficient on *CAPRATIO* suggests that a large capital buffer aimed at maintaining banks' solvency imposes opportunity costs on banks' revenue performance.

The estimated coefficients on *BRANCH* and *OI* have plausible signs and are highly significant. For *BRANCH* , this implies that more geographically diversified banks have a higher propensity to raise revenue than those with a smaller branch network. Although operating an extensive branch network attracts costs, on balance, proximity to customers is more beneficial to commercial banks. Similarly, income diversification generated from non-traditional intermediation activities such as fee based services is seen to boost overall revenue position. This is shown by the significance of the coefficient on *OI* which captures the effect of non-interest income.

For macroeconomic variables, the 91-day Treasury bill rate (TBR) is of the expected sign and has a statistically significant effect on banks' revenues. For this variable, it means that tight monetary policy aimed at liquidity withdrawals through open market operations strengthens the banks' revenue performance by bolstering holdings of risk-free Treasury securities. Macroeconomic instability, denoted by inflation volatility, appears not to have had a dampening effect on the banks' revenue performance. This finding appears counterintuitive. However, it should be noted that for the sample period, inflation averaged about 17% with average standard deviation of 2, implying less volatile inflation outcomes. Furthermore, even under high inflationary conditions, banks tend to devise measures to protect revenues from erosion by

adjusting interest rates and fees charged to their customers. Under these conditions, the positive coefficient on $INFL$ may be justified.

5.2. Random effects estimation results

The Hausman specification tests for panel data ruled out the random effects model. Nonetheless, in assessing the robustness of the PR model under different panel data statistical methods, we present the results of a random effects model. For the purpose of brevity, we only consider the estimate of the $H-$statistic. The random effects model yielded a $H-$statistic of 0.45, which is not significantly different from that derived using a fixed effects specification. The coefficients on input prices also carry correct signs and statistical significance. Thus, for the Zambian banking sector, the full sample $H-$statistic estimate may be invariant to the choice of panel data estimation approach.

5.3. Evolution of competition from PR model

In order to assess the evolution of the $H-$statistic over time and capture the potential impact of foreign bank entry on competitive conditions, the sample was divided into 2 periods with privatisation of the state owned bank and increased foreign bank entry as the cut-off dates. Privatisation of the state owned bank was conducted in 2007 and the new wave of foreign bank entry began in the second quarter of 2008. These changes present for potential for increased contestability in the banking industry. We therefore assess these dynamic market shifts on the competitiveness of Zambian banking sector. The pre-entry period is configured as 1998-2007 and the post-entry is between 2008 and 2011. Attempts to estimate the yearly $H-$statistic yielded implausible results. Panel data model specification tests and tests for long-run equilibrium were in many cases unstable. This instability may be due to the small sample size. Accordingly, results from this exercise are not reported. Table 7 summarises the findings from sub-sample regressions.

Table 7: Sub-sample H-statistic estimates

Dependent variable: Log of Total Revenue/Total Assets (TREVASST)			
	H-statistic	Pre-entry (1998-2007)	Post-entry (2008-2011)
		0.48	**0.33**
Hypothesis Tests for Different Market Structures			
Monopoly (H=0)	*p-value*	0.35	0.35
Perfect Competition (H=1)	*p-value*	0.000***	0.000***

Significance level: *** 1 %, ** 5 % and * 10 %
Source: Own estimates based on BoZ data

The estimate of the $H-$statistic for the pre-entry period was more than one and half times higher than the estimate for the post-entry period. However, in both periods, the test statistic rejects monopoly and perfect competition in favour of monopolistic competition. Nonetheless, the small size of the post-entry competition index may imply that entry of new market players has not diminished the dominance of few large banks. In fact, the results indicate that the market has become less competitive. Yeyati and Micco (2007) find similar results for Latin American countries. These short-term effects of foreign bank entry on competitiveness of the banking sector are amplified by the low level of financial sector development and the quality of institutions. For the Zambian banking sector, a possible explanation for this could be that since the post-entry period coincided with the global financial crisis, banks were forced to cut unit costs in order to survive or as hypothesized above, it reflects entry-level subsidisation.

5.4. Ownership structure and degree of bank competition

Results from sub-sample regressions show that foreign bank penetration of the order seen since 2008 has not yielded tangible competitive benefits. This possibly explains the broader dominance of incumbent large foreign banks. To gain further insight on the role of foreign ownership on bank competition, we conduct regressions on sub-samples of foreign banks and domestic private banks. The $H-$statistic for domestic banks was estimated at 0.37 for the fixed effects regression and 0.42 for the random effects model. For foreign banks, these estimates are 0.50 and 0.48 for the respective panel data specifications. The intra-bank group regression results suggest that foreign banks experience stronger competitive pressures than do their domestic counterparts. Nonetheless, the broad conclusion of monopolistic competition as defining the market structure for the Zambian banking sector remains decisive.

5.5. Lerner index measure of market power

Results of the $H-$statistic offer some insights into the nature of competition in the Zambian banking industry. However, as estimates from sub-sample regressions demonstrate, the $H-$statistic may not provide a useful gauge on the evolution of competition in the banking sector. Therefore, the time varying Lerner index provides an improvement over the static $H-$statistic. Estimating the Lerner index requires knowledge of the banks' marginal cost and bank output. Marginal cost is calculated from results of estimating Equation (2) and applying Equation (3). The price of bank output is given by the ratio of total revenue to total assets. Table 8 below provides results of estimating Equation 2.

Table 8: Empirical results of the iterated cost function

	Coefficient	Parameter	Standard error	t-statistic	p-value
Intercept	β_0	1.107	0.170	6.46	0.000***
ln*(w_L)*	β_{wl}	0.605	0.045	13.36	0.000***
ln*(w_K)*	β_{wk}	0.145	0.035	4.14	0.000***
ln*(tass)*	β_y	0.978	0.028	35.48	0.000***
*1/2 (*ln*(tass))*^{2}	β_{yy}	-0.003	0.002	-1.08	0.282
*1/2 (*ln*(w_L)*^{2}	δ_{wll}	0.012	0.010	12.14	0.000***
*1/2 (*ln*(w_K))*^{2}	δ_{wkk}	0.004	0.002	5.65	0.000***
ln*(w_L)*ln*(w_K)*	δ_{wlwk}	-0.034	0.005	-6.56	0.000***
ln*(w_L)*ln*(tass)*	δ_{wly}	0.005	0.003	1.53	0.126
ln*(w_K)*ln*(tass)*	δ_{wky}	0.004	0.003	1.44	0.151
ln*(Risk)*	θ_{risk}	0.022	0.004	5.17	0.000***

Diagnostics

Equation	Obs.	Parameters	RMSE	R^2	p-value
Cost Function	655	10	0.161	0.993	0.000***
LABSHARE	655	4	0.051	0.757	0.000***
KAPSHARE	655	4	0.084	0.378	0.000***

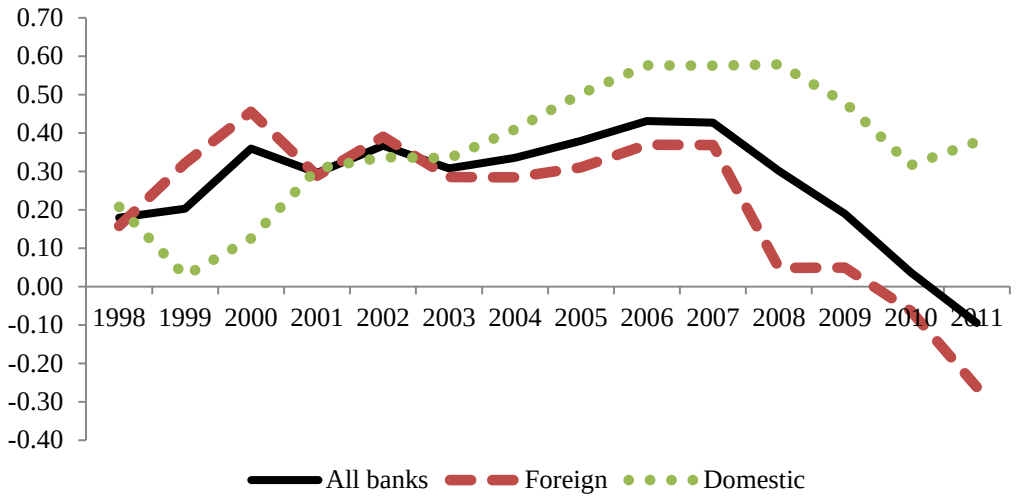
Significance level: * p<0.10, ** p<0.05, *** p<0.01
Source: Author's own computations based on BoZ data

The joint estimation of the cost function and the two input share equations yields reasonable parameters, with the normalised input prices and scale effect variables all carrying expected signs and statistically significance at 1%. As a control variable for undesirable effects of non-performing loans on banks' cost performance, *RISK* is also of the expected sign and statistically significant. Differentiating the above equation with respect to output yields marginal cost which, together with the calculated price, is used to derive the Lerner index.

5.6. Characterising the Lerner index and its evolution

Estimates of the Lerner index for all banks and by ownership category are depicted in Figure 1. The estimates show an upward trend in the Lerner index for both categories of bank ownership (domestic versus foreign).

Figure 1: Evolution of the Lerner index by bank ownership



Source: Author's own computations based on BoZ data

The net effect of the decline in price and marginal cost on the Lerner index depends on which one falls faster. For domestic banks, the price of output fell at a slower pace than the reduction in marginal cost, translating into a higher Lerner index, especially from 2003. In contrast, for foreign banks, the reduction in marginal cost exceeded the fall in output price, causing the Lerner index to fall rapidly, even falling below zero in 2010 and 2011, depicting some evidence of 'super competition' as banks emerged from the global financial crisis and needed to regain their market share.

The dominance of foreign banks is reflected in the evolution of the industry wide Lerner index. Due to the greater weight of foreign banks in the sample, the evolution in industry wide Lerner index mirrors the movement in the Lerner index for this bank group. For the full sample period, the average Lerner index stood at 0.27. The index was higher during the pre-entry period

between 1998 and 2007 at 0.33 relative to the post-2008 period, when it reached 0.11; three times lower than the previous period. The low value of the index for the latter period largely reflects new banks' below marginal cost pricing to gain foothold in the sector.

Since the average value of the Lerner index is close to zero for all sample periods, this suggests that competitive pressures in the Zambian banking sector may be stronger than actually thought, particularly among foreign owned banks. This finding is inconsistent with the estimate of the $H-$statistic which showed the degree of competition in the post-entry period to be lower than the pre-entry period. However, both estimates broadly converge on the prediction of monopolistic competition as the relevant market structure in the Zambian banking sector.

A notable observation in the evolution of the Lerner index is that until 2002, domestic private banks exhibited a relatively higher degree of competitiveness than their foreign counterparts. During this period, the Lerner index for domestic banks was lower, but rising, depicting increasing market power. This is not highly surprising given the intensity of competition among domestic private banks from mid to late 1990s, which as noted by Brownbridge (1998), was especially high on the deposit side. In contrast, there appears to be a high level of competition among foreign banks with the Lerner index falling sharply from 2007. These results resonate with those obtained with intra-bank group estimations of the $H-$statistic.

As macroeconomic conditions improved, interest rates fell. The composite weighted average Treasury bill yield rate declined to 9.0% in April 2006 from 17% a year earlier while the banks' weighted average lending base rate fell to 23.2 % in 2006 from 28.2% in 2005 and declined further to 18.9% in 2007. The fall in interest rates affected earnings, pushing banks to reduce costs, in order to maintain profitability.

Benchmarking Zambia against regional peers (Table 9), estimates of the Lerner index show Zambia ahead of East African countries. Although the period of estimation is different, the results are instructive. In 2001 and 2008, Zambia ranked above countries of the EAC, except Kenya, which shows the highest degree of contestability in the region. For the period as a whole, competitiveness in the Zambian banking industry intensified further, as depicted by lower Lerner

index, induced largely by rapid entry of new foreign banks and the associated entry-level below marginal cost pricing.

Table 9: Comparative Lerner indices - Zambia and EAC Countries

	Zambia[a]	**East African Community (EAC)[b]**			
		Kenya	Rwanda	Tanzania	Uganda
2001	**0.30**	0.28	0.36	0.34	0.39
2008	**0.30**	0.29	0.41	0.37	0.36
2011	**-0.10**	..	..	..	..
Period average	**0.27**	**0.29**	**0.37**	**0.32**	**0.36**

.. not applicable

Source: a\Author's own computations based on BoZ data

b\Sanya & Gaertner (2012)

5.7. Determinants of market power in the Zambian banking sector

In order to explore the determinants of market power in the Zambian banking sector, we exploit the rich data set and relate the bank level estimate of the Lerner index to bank-specific factors and other variables. Equation 6 was estimated by fixed effects, drawing from inferences of the Hausman specification test, valid at 10%. The regression results for the determinants of competition are summarised in Table 10.

Table 10: Determinants of market power in the Zambian banking sector

	Coefficient	Parameter	t-statistic	p-value
Intercept	α_0	-5.95	-4.31	0.000***
ln*(RISK)*	α_1	-0.06	-2.09	0.04***
ln*(INEFF)*	α_2	-0.60	-1.77	0.08*
ln*(CAPRATIO)*	α_3	0.43	5.13	0.000***
ln*(OI)*	α_4	0.40	4.22	0.000***
ln*(TBR)*	α_5	0.09	1.60	0.11
σ_u		1.80		
σ_ε		0.60		
ρ		0.90		
No. of Obs.		537		
Hausman test		16.14		
p-value		0.08*		

Significance level: *** 1 percent, ** 5 percent and * 10 percent

Source: Author's own calculations based on BoZ data

The results show that all coefficients for bank-specific variables are statistically significant, except the parameter on the measure of cost inefficiency, which is weakly significant at 10%

level[6]. The sign of the coefficient is also inconsistent with prior expectations. The negative coefficient on *RISK* is rather small. At first glance, this finding appears counterintuitive. A majority of banks (largely foreign owned) with a low proportion of non-performing loans have employed robust screening techniques due to risk aversion. Therefore, the negative parameter estimate on the risk variable must be viewed in the banks' context of risk aversion.

The effect of regulatory capital $(CAPRATIO)$ is positive and statistically significant at 1 % level, as expected, implying that well capitalised banks tend to exercise greater market power by virtue of their strength and reputation. This also implies that stability and competition may not be consistent outcomes for the Zambian banking sector[7].

Revenue diversity shows up in higher mark-ups, as banks with a high proportion of non-traditional revenues use this as an entry barrier. The estimated parameter on OI is positive and significant suggesting that including a measure of non-interest revenue in the regression of determinants of competition helps address the importance of non-intermediated sources of income in the Zambian banking sector. Monetary policy stance has a weak impact on market power. Thus, the increase in Treasury bills holdings by commercial banks strengthens their exercise of market power. Since Treasury bills are issued by the Government, this also highlights the indirect effect of public sector behaviour on the banks' conduct.

6. Conclusion and policy implications

The paper has addressed an important subject of competition and market structure in the commercial banking sector for an emerging economy. Using a unique and detailed bank-level data set, the study extends previous research by estimating the Panzar-Rosse $H-$statistic from a reduced revenue regression for the full sample and sub-samples, taking into account market dynamics induced by accelerated foreign bank entry and the privatisation of the state-owned bank. Further analysis of market developments and their impact on competitiveness is

[6] The efficiency result is invariant to the choice of the measure of cost efficiency. Experiments with the cost-income ratio and net interest margins as alternative measures broadly yield similar results. We retain the model based measure because it is more reflective of cost efficiency performance.

[7] It is worth noting that the relationship between capital requirements and bank stability is a subject of continuing debate, with no conclusive evidence on the direction of causality (Rochet, 1992).

undertaken by estimating a time varying Lerner index which assesses the evolution of banking competition over time and the factors driving it. These competitive indices offer a practical perspective on the understanding of banking competition in Zambia and its policy implications. The broad conclusion from the analysis is that over the sample period, Zambian banks exhibited elements of monopolistic competitive behaviour. Specifically, the $H-$statistic estimated from the composite revenue equation was found to be positive and statistically different from zero and unit. For the Lerner index, the results provide deeper insights on the evolution of competitive conduct of Zambian banks. Over the period of analysis, the Lerner index declined, underpinning the growing intensity of competition, particular in post-entry period. This suggests that the degree of competition may be higher than previously understood. Of particular note, estimates of the Lerner index indicate that increased foreign bank presence may have heightened competition as new banks priced their products below marginal cost, the 'initial subsidisation' effect used to capture the market.

On the determinants of the Lerner index, the study finds that banks' risk averseness, revenue diversity and regulatory intensity are all important factors in influencing exercise of market power. Tight monetary policy is also found to strengthen the banks' exercise of market power. Generally, the findings lend support to previous research findings, particularly in developing countries and have implications in the design of antitrust and regulatory policy in the banking sector.

As the initial attempt at quantifying the competitive conduct of Zambian banks and how it has evolved overtime, the study offers important policy insights for the Zambian banking sector. In particular, the estimate of the time varying Lerner index offers a more illuminating perspective to the analysis of competitive behaviour of banks operating in Zambia than the more static the $H-$ statistic. In this regard, the study corroborates previous research in other countries which note the important effect of foreign bank penetration in stimulating competition in the banking industry.

Thus, in the long-run, maintaining an open policy for foreign bank entry could play a crucial role in fostering competitiveness in the Zambian banking sector particularly in view of the recent regulatory reforms on capital requirements which favour domestic banks. In this regard, the

study extends the frontier of knowledge in emerging economies and in sub-Saharan Africa in particular where such evidence is currently limited. Most importantly, the study underscores the fact that competitive conduct of banks operating in developing countries may not be significantly different from that exhibited in more mature economies.

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