



WP/05/17

IMF Working Paper

Competition and Efficiency in Banking: Behavioral Evidence from Ghana

Thierry Buchs and Johan Mathisen

IMF Working Paper

African Department

Competition and Efficiency in Banking: Behavioral Evidence from Ghana

Prepared by Thierry Buchs and Johan Mathisen¹

Authorized for distribution by Samuel Itam

January 2005

Abstract

This Working Paper should not be reported as representing the views of the IMF.

The views expressed in this Working Paper are those of the author(s) and do not necessarily represent those of the IMF or IMF policy. Working Papers describe research in progress by the author(s) and are published to elicit comments and to further debate.

This paper assesses the degree of bank competition and discusses efficiency with regard to banks' financial intermediation in Ghana. By applying panel data to variables derived from a theoretical model, we find evidence for a noncompetitive market structure in the Ghanaian banking system, which may be hampering financial intermediation. We argue that the structure, as well as the other market characteristics, constitutes an indirect barrier to entry thereby shielding the large profits in the Ghanaian banking system.

JEL Classification Numbers: G21, D43

Keywords: Ghana, banking competition

Author(s) E-Mail Address: tbuchs@ifc.org; jmathisen@imf.org

¹ We would like thank Bank of Ghana staff, Hugh Bredenkamp, Jack Glen, participants at the Ghana at the Half Century conference in July 2004, Luca Ricci and Tom Walter for helpful comments and suggestions. At the time this paper was prepared, Johan Mathisen was an economist in the IMF's African Department and Thierry Buchs was a Senior Economist at the International Finance Corporation (IFC). Any remaining errors and omissions are our own.

Contents	Page
I. Introduction	3
II. Overview of the Ghanaian Banking System	4
A. Structure of Ghana's Banking Sector.....	4
B. Financial Performance of the Banking Sector.....	6
C. Possible Factors Explaining Bank Profitability and the Efficiency of Intermediation ..	10
III. Analytical Framework and Econometric Estimation.....	12
A. The Panzar and Rosse Analytical Framework.....	13
B. Description of the Data and Definitions of Variables	16
C. Estimation Results.....	17
D. Interpretation of the Coefficients	19
IV. Conclusions.....	21
References.....	23
Appendix.....	25
Figures	
1. Nominal Interest Rates, Government Debt, Real Growth of Private Sector Credit, Private Sector Credit, 1998-2003.....	5
2. Investment and (Gross) Lending of the Banking Sector (1996-2003).....	6
3. Savings, Investment and Loans Ratios Across Sub-Saharan Africa.....	12
Tables	
1. Structure of the Banking Sector.....	4
2. International Comparison of Selected Banking and Institutional Indicators	8
3. Financial Soundness Indicators for the Banking Sector, 1997–2003	9
4. Profitability Indicators	10
5. Panzar and Rosse's <i>H</i> -Statistics.....	14
6. <i>H</i> -Statistics Values for the Banking System in Ghana	17
7. Banking Sector Market Structure in Selected Countries	17
8. Regression Results	18
Appendix Table	
A1. Market Equilibrium Test Results.....	26

I. INTRODUCTION

Financial systems tend to evolve around a banking sector seeking to achieve economies of scale in order to offset the costs of collecting and processing information designed to reduce uncertainty, thereby facilitating a more efficient allocation of financial resources. In well-functioning economies, banks tend to act as quality controllers for capital seeking successful projects, ensuring higher returns and accelerating output growth. However, a competitive banking system is required to ensure that banks are effective forces for financial intermediation channeling savings into investment fostering higher economic growth.

This paper assesses the level of competition in the Ghanaian banking sector. At first sight, the very high profit ratios and high cost structure of Ghanaian banks could indicate a monopolistic banking structure. This is partly corroborated by the findings of this paper. By deriving variables from a theoretical model and using a 1998-2003 panel data set, we find evidence for a noncompetitive market structure in the Ghanaian banking system, possibly hampering financial intermediation. This paper argues that the structure, as well as the other market characteristics, constitutes an indirect barrier to entry thereby shielding the large profits in the Ghanaian banking system.

Besides the banking sector, the Ghanaian financial system also includes insurance companies, discount houses, finance houses, leasing companies, savings and loan associations, credit unions, and a stock exchange.² Thus, by narrowing the focus to the banking sector only, other potentially important participants of the Ghanaian financial system might have been overlooked. However, the banking system is by far the largest component of the financial system, and, according to the recent Financial Sector Stability Assessment (FSSA) update,³ many of these other financial institutions remain underdeveloped, even by sub-Saharan African standards. Moreover, this paper defines the banking sector to include only deposit-taking financial institutions; it excludes rural banks⁴ and the Bank of Ghana.

The remainder of the paper is organized as follows. Section II describes the main characteristics of the structure and features of the banking sector in Ghana, highlighting the main differences between Ghana and other sub-Saharan African countries. The banks' financial performance is then discussed, and certain possible explanatory factors for the performance are outlined. After a very brief literature survey, Section III presents the theoretical model, operationalizes it by deriving empirical variables, and describes the dataset. Then the overall results are presented and discussed, followed by an attempt to investigate the relationships between the factors of production, macroeconomic variables and revenue and profitability in the banking sector. Section IV summarizes the results and concludes.

² For a full description of the Ghanaian financial system, see "Ghana: Selected Issues," Section II in Bredenkamp and others (2003).

³ "Ghana: Financial Sector Stability Assessment Update," IMF Staff Country Report (396/03).

⁴ The rural banks account for only about 5 percent of banking system assets.

II. OVERVIEW OF THE GHANAIAN BANKING SYSTEM

A. Structure of Ghana's Banking Sector

The Ghanaian banking system is rather diverse. Of the 17 banks operating in Ghana, there were 9 commercial banks, 5 merchant banks, and 3 development banks (Table 1).⁵ The three largest commercial banks account for 55 percent of total assets of the banking sector, which is relatively moderate compared with other countries in the region. However, about 25 percent of total assets and 20 percent of deposits are held by a single state owned commercial bank (“bank 1”). The development banks and merchant banks, which focus on medium- and long-term financing and corporate banking, respectively, together share about 30 percent. The five small commercial banks operate on a much smaller scale. Foreign investors hold about 53 percent of the shares in eight commercial banks, which is below the sub-Saharan Africa average, and three banks are state-owned (Table 2). The banking penetration ratio, at one bank branch per 54,000 inhabitants, is relatively high, but formal banking reaches only 5 percent of the population and the coverage varies widely. This reflects the fact that 35 percent of bank branches are in the greater Accra region even though this region represents less than 13 percent of the country's population. About half of all bank branches in the interior belong to the dominant state owned bank.

Table 1. Structure of the Banking Sector*

	Ownership (Percent)		Total Assets (Bns of cedis)	As Percent of GDP	Number of Branches	Share of Total (Percent)		
	Ghanaian	Foreign				Total assets	Net lending	Deposits
Banking system			18,668	38.2	309	100.0	100.0	100.0
Commercial banks			13,055	26.7	229	69.3		
Bank 1	97	3	4,624	9.46	134	24.8	16.9	20.8
Bank 2	10	90	2,710	5.55	24	14.5	18.1	16.9
Bank 3	24	76	3,011	6.16	23	16.1	16.3	18.8
Bank 4	46	54	1,713	3.50	38	9.2	10.2	8.8
Bank 5	39	61	470	0.96	6	2.5	2.1	2.6
Bank 6	53	47	128	0.26	4	0.7	0.6	1.0
Bank 7	0	100	120	0.25	3	0.6	0.3	0.8
Bank 8	9	91	230	0.47	1	1.2	0.5	1.2
Bank 9	100	0	49	0.10	1	0.3	0.3	0.3
Merchant banks			2,875	5.9	18			
Bank 10	100	0	751	1.54	5	4.0	4.8	5.4
Bank 11	6	94	1,325	2.71	4	7.1	8.2	6.2
Bank 12	34	66	409	0.84	3	2.5	2.1	2.6
Bank 13	71	29	286	0.59	2	1.5	1.5	2.0
Bank 14	100	0	104	0.21	1	0.6	0.4	0.7
Development banks			2,738	5.6	62			
Bank 15	100	0	1,847	3.78	42	0.0	11.2	8.4
Bank 16	100	0	538	1.10	14	0.0	3.8	2.0
Bank 17	100	0	352	0.72	6	0.0	1.9	2.0

Sources: Bredenkamp and others (2003) and IMF Staff Country Report no. 396/03.

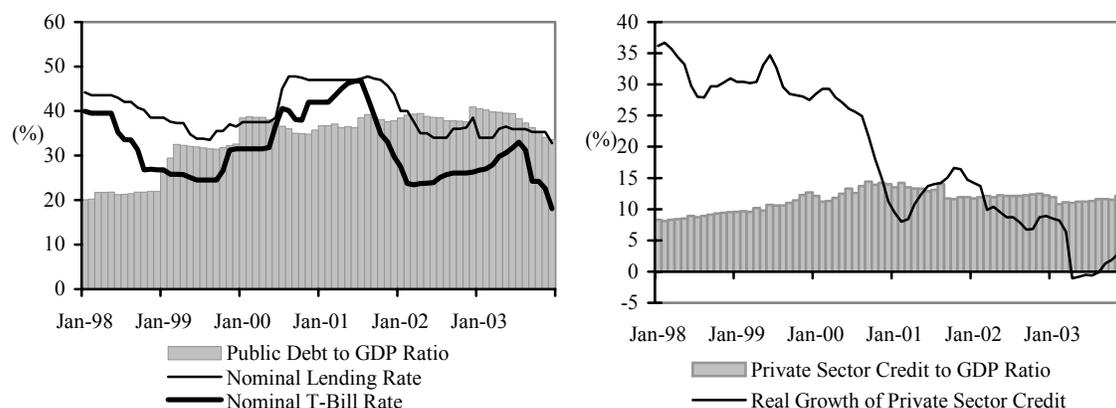
* As of December 2002. The housing bank established in 2003 has been excluded from this study.

⁵ Commercial banks engage in traditional banking business, with a focus on universal retail services. Merchant banks are fee-based banking institutions and mostly engage in corporate banking services. Development banks specialize in the provision of medium- and long-term finance.

As measured by the aggregated total-assets-to-GDP ratio, the banking sector grew rapidly between 1996 and 2000, reflecting partly financial deepening, as well as loose monetary conditions. After reaching 44 percent in 2000, the ratio dropped to 38 percent in 2001 and further to 31 percent at end-2003, reflecting tightened monetary conditions. The same trend characterized the share of commercial banks' foreign operations: the share of bank assets denominated in foreign currency reached 35 percent on 2000 and then declined to 30 percent in 2001, probably reflecting the increased stability of the cedi exchange rate.

Following the tightening of monetary policy in 2001, domestic credit to the private sector has remained at around 10 percent of GDP, which is low even by African standards (Table 2). This essentially reflects a typical crowding-out effect, as most of the banks' resources are absorbed by the public sector, either in the form of loans to state-owned enterprises or holdings of government securities. As shown in Figure 1, increasing government financing requirements led to very high real treasury bill yields, especially in periods of tight monetary policy, and by extension, to high lending rates. During 1998-2003, net loans averaged 34 percent of total assets (peaking at 43 percent in 2001), as banks preferred to invest their resources in liquid, low-risk assets, such as government securities, the latter constituting about 25 percent of total assets during the period.⁶

Figure 1. Nominal Interest Rates, Government Debt, Real Growth of Private Sector Credit, Private Sector Credit, 1998-2003

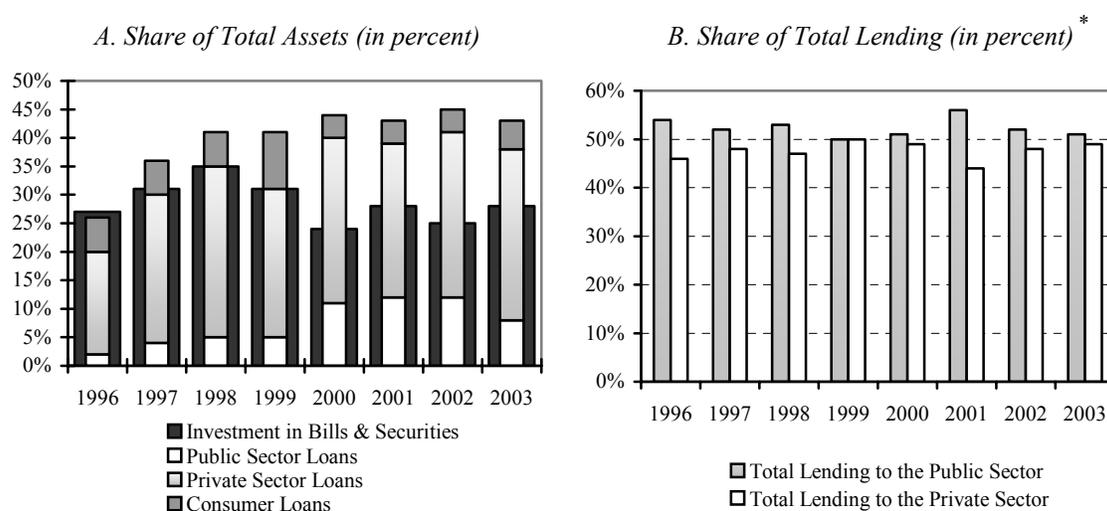


Source: Bank of Ghana

⁶ Apart from the financing constraints imposed by Ghana's large fiscal deficits, the banks' holdings of government securities is also sustained by high secondary reserve requirements that require banks to hold 35 percent of their deposit liabilities in such securities.

In addition, state-owned enterprises have attracted sizable amounts of lending from commercial banks recently, thereby exacerbating the crowding-out effect (Figure 2). As a result, during the last few years, bank lending to the public sector has typically absorbed more than half of total available resources. The residual resources available for lending to the private sector (about 35 percent of total assets in 2003) have been mainly channeled to the manufacturing sector (25 percent of credit to the private sector), commerce and finance (9 percent) and services (8.5 percent). The agriculture, forestry, and fishing sectors have received less than one-tenth of total bank credit although agriculture accounts for 36 percent of GDP. With the exception of the national oil refinery plant—which is the sector’s largest exposure⁷—no single borrower amounts to 10 percent of the financial sector’s total equity.

Figure 2. Investment and (Gross) Lending of the Banking Sector (1996-2003)



Source: Section II in Bredenkamp and others (2003), Bank of Ghana

* Total lending includes loans, overdrafts and investments.

B. Financial Performance of the Banking Sector

Financial performance indicators portray a mixed picture. On the one hand, the average capital adequacy ratio (CAR) was about 13.4 percent in 2002 and 9.3 percent at-end 2003, well above the minimum 6 percent required by law. There was, however, significant dispersion among banks, and two small commercial banks even failed to meet the minimum capital standard requirement,⁸ prompting intervention by bank supervisors.

⁷ Even though a large portion of TOR’s short-term debt was restructured into medium-term government bonds in 2001 and 2002, TOR exposure still exceeded 75 percent of GCB’s equity capital as of June 2003.

⁸ IMF Staff Country Report no. 396/03.

In addition, as a result of the negative macroeconomic developments in 1999-2000, the asset quality of the banks' loan portfolio appears to have deteriorated. Past-due/nonperforming loans soared from 16.2 percent in 2000 to an eight-year high of 28.6 percent of total loans in 2001 and 2002 before declining slightly to 24.4 percent in 2003 (Table 3). The overall impact of this sizable increase on the banking system has been partially softened by the relatively prudent lending of the two largest foreign-owned banks, however. The system is also characterized by high overhead costs. The five largest banks incur on average overhead costs of 7 percent to average assets, which is similar to the sector as a whole but substantially higher than the sub-Saharan African average of 5.7 percent. Note, however, that these costs are below those reported in Nigeria and Zambia (Table 2). The high costs could partly reflect substantial investments in banking infrastructure, notably in information and communication technologies, as telecommunication in particular suffers from interconnectivity problems.⁹ It could also reflect some marketing practices, such as the refusal to network the automated teller machines, which appears to have led to unduly high investments in such systems. However, one key element in the total overhead costs is the staff expenditure component (about 3.7 percent to average assets), which constitutes roughly half of total overhead costs. For example, the dominant state owned bank ("bank 1") has one of the highest staff costs (4.3 percent to average assets), while the other large commercial banks' average is 3 percent. This high ratio suggests both a low level of assets per employee and a relatively high average staff cost per employee.

On the other hand, profitability indicators indicate that, despite high overhead costs and sizable provisioning, Ghanaian banks' pretax returns on assets and equity are among the highest in sub-Saharan Africa (Table 2)—a situation that reflects very wide interest margins. On an adjusted basis, the return on assets (RoAA) was 6.1 percent in 2002, which is remarkable even by African standards, and the same applies to both net interest revenue and noninterest revenue which are, respectively, 10 percent and 6.4 percent of average assets. The decline in interest rates in 2002 reduced the banks' income from government securities and led to a slight narrowing of interest rate spreads, but the latter remain between 20 and 30 percent.

The combination of wide interest margins, sizable overhead costs, and an ample supply of relatively low-risk, high-return, government paper, has resulted in high costs of intermediation. Since the large interest margins also reflect the nonperforming loan problem, the poor quality of banks' loan portfolios is a major source of concern for the stability of the system. Most banks would indeed be vulnerable in the event of a major credit risk shock.¹⁰

⁹ For example, one of the larger, foreign owned banks has set up a direct satellite network to bypass the national telecommunications network altogether.

¹⁰ IMF Staff Country Report No. 396/03.

Table 2. International Comparison of Selected Banking and Institutional Indicators
(In percent, unless otherwise indicated)

	Ghana	Kenya	Mozambique	Nigeria	South Africa	Tanzania	Uganda	Zambia	SSA Average
Size of financial intermediaries									
Private credit to GDP	11.8	26.8	16.7	14.4	147.2	4.9	4.0	7.5	15.2
M2 to GDP	19.0	43.8	5.1	25.8	87.2	18.3	13.0	16.9	24.8
Currency to GDP	10.5	13.2	15.6	10.8	28.4	8.5	8.8	6.4	13.9
Banking industry									
Number of banks	17	53	10	51	60	29	15	16	..
Net interest margin	11.5	5.0	5.9	3.8	5.0	6.5	11.6	11.4	8.3
Overhead costs	7.3	3.7	4.5	7.4	3.7	6.7	4.6	11.2	5.7
Foreign bank share (assets)	53	4.8	98	11.0	0.6	58.7	89.0	66.6	..
Bank concentration (3 banks)	55.0	61.6	76.6	86.5	77	45.8	70.0	81.9	81.0
Nonperforming loans (share of total loans)	28.8	41.0	..	17.3	3.9	12.2	6.5	21.8	..
Capital markets									
Stock market capitalization (percent of GDP)	10.1	9.2	..	10.9	77.4	4.3	0.6	6.0	21.3
Contract enforcement									
Number of procedures	21	25	18	23	16	26	14	1	29
Duration (number of days)	90	255	540	730	99	207	127	188	334
Bankruptcy									
Time in years	..	4.6	..	1.6	2.0	3.0	2.0	3.7	3.5
Credit market									
Credit rights index (0 is weakest) ¹	1	1	3	1	2	3	1	2	2
Entry regulations									
Number of procedures	10	11	16	9	9	13	17	6	11
Duration (number of days)	84	61	153	44	38	35	36	40	72
Cost (percent of GNI per capita)	111	54	100	92	135	9	199	24	255

Sources: IMF, *International Finance Statistics*; BankScope; World Bank, *World Development Indicators*; Doing Business Indicators Database; and Table 2, "Tanzania: Financial System Stability Assessment," IMF Staff Country Report No 03/241. Washington DC: IMF (2003). Banking statistics and capital market indicators are for 2001. All institutional indicators are for 2003.

1/ The index is based on four powers of secured lenders in liquidation and reorganization. A minimum score of 0 represents weak creditor rights and the maximum score of four represents strong creditor rights. For a description of the methodology, see <http://rru.worldbank.org/DoingBusiness/Methodology/CreditMarkets.aspx>

Table 3. Financial Soundness Indicators for the Banking Sector, 1997–2003
(In percent, at year's end, unless otherwise indicated)

	1997	1998	1999	2000	2001	2002	2003
Capital Adequacy							
Regulatory capital to risk-weighted assets 1/	15.2	11.1	11.5	11.6	14.7	13.4	9.3
Percentage of banks greater or equal to 10 percent	87.5	75.0	60.0	62.5	64.7	52.9	66.7
Percentage of banks below 10 and above 6 percent minimum	6.3	12.5	40.0	37.5	35.3	35.3	27.8
Percentage of banks below 6 percent minimum	6.3	12.5	0.0	0.0	0.0	11.8	5.6
Capital (net worth) to assets	13.4	12.2	12.2	11.9	13.1	12.6	12.5
Asset quality							
Foreign exchange loans to total loans 5/	25.6	28.5	33.4	35.3	34.1	33.8	...
Past-due loans to gross loans	24.6	18.9	20.1	16.2	28.0	28.6	24.4
Nonperforming loans	21.6	17.2	12.8	11.9	19.6	22.7	18.3
Watch-listed loans	3.0	1.7	7.3	4.3	8.4	5.9	6.0
Provision as percent of past-due loans	78.0	89.4	67.2	58.6	46.4	63.6	64.4
Earnings and profitability							
Net profit (before tax)/net income	51.5	39.2	61.2	52.4	45.9	43.4	39.2
Return on assets 2/	8.0	8.6	8.5	9.7	8.7	6.8	6.4
Return on equity 3/	39.9	48.9	48.8	65.7	49.7	36.9	54.0
Expense/income	44.0	42.2	44.3	38.2	40.2	47.3	36.0
Interest rate spread (deposit money banks)							
Lending rates minus demand deposit rates	37.0	33.8	32.5	30.5	30.5	30.5	23.3
Lending rates minus saving deposit rates	16.3	22.0	23.5	29.3	29.5	25.5	23.0
Liquidity							
Actual reserve ratio (as percent of total deposits)	60.1	64.8	61.8	49.9	62.4	66.0	66.1
Excess reserve ratio 4/	17.1	21.8	18.8	5.9	18.4	22.0	22.1
Loan/deposit	42.2	48.7	59.0	64.0	63.9	50.1	56.1
Foreign exchange liabilities/total liabilities 5/	24.9	21.1	29.7	36.2	27.0	27.4	...
Sensitivity to market risk							
Net foreign exchange assets (liabilities) to shareholders' funds 5/	62.9	48.1	(7.6)	(9.4)	22.9	24.3	...

Source: IMF Staff Country Report No. 396/03 and Bank of Ghana.

1. The method for calculating CAR is different from that of Basel CAR and is likely to be more conservative than the Basel method.
2. The ratio of net profit before tax to two-year annual average assets.
3. The ratio of net profit after tax to two-year annual average shareholders' funds.
4. The actual reserve ratio in excess of the minimum requirement ratio.
5. No comparable estimate available for 2003 as commercial banks' foreign assets and liabilities were reclassified.

Table 4. Profitability Indicators
(In percent of average assets)

	Net interest	Noninterest income	Overhead	Provisions	RoAA	RoAE	RoAA	Deflated RoAE
Ghana 1/	10.0	6.4	7.0	2.2	6.1	36.9	5.3	22.3
Bank 1 1/	12.2	4.4	6.4	3.2	6.0	46.1	5.3	31.5
Bank 2 1/	10.8	6.7	6.2	0.5	9.7	64.3	8.4	49.6
Bank 3 1/	10.7	6.1	7.4	0.2	7.3	53.8	6.3	39.1
Median								
CFA franc zone 2/	4.6	0.6	4.8	1.0	1.8	17.7	1.8	15.0
Large SSA economies 2/	5.9	2.5	5.4	1.2	1.4	16.3	1.3	10.5
Small SSA economies 2/	5.9	1.2	4.6	0.6	2.8	30.1	2.6	20.2
SSA 2/	5.7	1.2	4.8	0.8	1.9	27.9	1.9	15.0

Sources: IMF, *International Financial Statistics*; banks' financial statements, and authors' estimates.

1/ 2002.

2/ 1998-2001 averages.

C. Possible Factors Explaining Bank Profitability and the Efficiency of Intermediation

At least three factors may have prevented further financial deepening in Ghana so far, and which may be relevant for the interpretation of both profitability and efficiency indicators of the banking system. The first factor is macroeconomic policies, as macroeconomic stability is essential to the development of the financial sector. This is relevant because Ghana's macroeconomic policies over the last decade have been characterized by periodic slippages in financial discipline, leading to volatile and generally high inflation, large exchange rate swings, and negative real interest rates for extended periods. The most recent example of macroeconomic imbalances includes the severe terms of trade shock of 1999-2000, which, combined with fiscal slippages, resulted in inflationary pressures, a 15 percent exchange rate depreciation, and the buildup of a sizable domestic government debt. It is intuitive to assume that the high degree of uncertainty associated with Ghana's unstable macroeconomic environment has negatively affected both the size and the quality of financial intermediation.

This assumption is supported by the low level of overall savings and investment. As shown in Figures 3 and 4, Ghana compared rather poorly to other African countries¹¹ on average in recent years; however, low bank intermediation seems to coexist with a wide range of savings ratios, thereby suggesting that other elements may also be at play. Another piece of evidence is the short time horizon in the overall financial sector. Long-term savings are virtually inexistent, as one-third of all bank deposits are demand deposits and terms for bank

¹¹ In Ghana, the savings-to-GDP ratio was 15.9 percent on average between 1996 and 2002, while the (private) investment ratio was 10.6 percent between 1996 and 2001.

loans hardly extend beyond one year. In addition, Treasury bills—which were until recently also used for open market operations—carry almost exclusively short-term maturities (three to six months).¹² Together with the high returns offered, this situation has exacerbated the crowding-out effect on private sector lending.

A second possible factor is the risky lending environment prevailing in Ghana, as reflected in the high level of past-due/nonperforming loans. This is largely due to the significant losses of some state-owned companies, but also reflects the lack of any central credit information system and the lack of cooperation among banks in sharing customer information. Some institutional factors may also affect the environment in which financial institutions operate. For instance, as shown in Table 2, the enforcement of creditors' rights is weak compared with the sub-Saharan African average. It is important to note that, although nonperforming loans have some substantial provisioning implications, provisioning standards are lower in Ghana than in most African countries.¹³ Depending on loan classification practices (and potential rollover of debt), this may suggest that the asset quality of banks' loan portfolio is somewhat overestimated, which may act as a further disincentive to engage in financial intermediation.

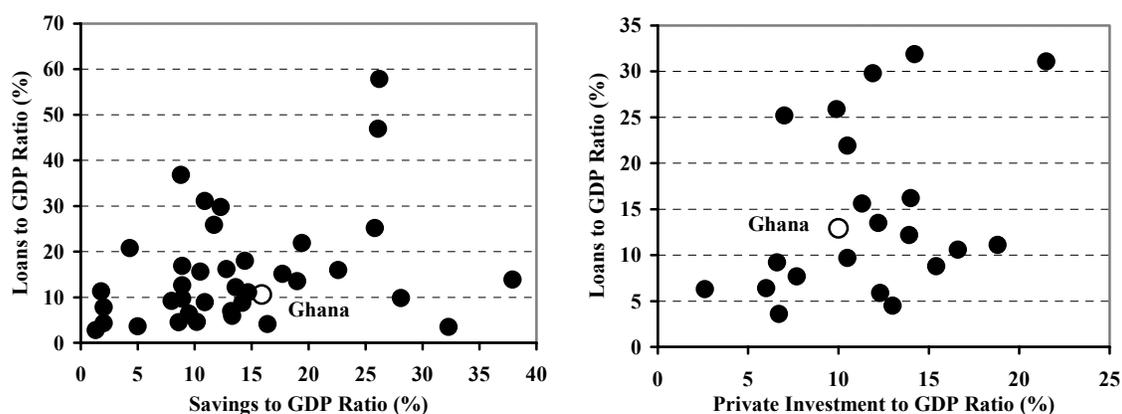
A third factor that may account for low and inefficient financial intermediation in Ghana is the presence of an uncompetitive market structure. Interestingly, there is no one-to-one relationship between concentration and competition. On the one hand, monopolistic or oligopolistic behavior tends to result in higher intermediation costs and diseconomies of management than under a competitive structure; thus, noncompetitive behavior is consistent with the presence of wide interest rate margins and spreads, which tend to deter potential depositors, as well as potential borrowers, and result in low lending ratios. On the other hand, market size may offer the possibility of exploiting economies of scale (from overhead in administrative operations and information gathering), as well as economies of scope (in combining different product lines for instance).¹⁴ What really matters for the net effect on competition is the level of contestability in the market: the threat of potential competition—or lack thereof—can substantially affect competitiveness conditions, regardless of market concentration.

¹² However, three-year inflation-indexed bonds were introduced in late 2001 along with secondary reserve requirements that require banks to hold 20 percent of their deposits base in such bonds.

¹³ In Ghana, nonperforming loans are defined based on a minimum of 180 days in arrears; loans are classified as “substandard” when they are in arrears for 90 to 180 days, as “doubtful” when they are in arrears for 180 to 540 days, and as “loss-making” when arrears exceed 540 days. Full provisioning is required for loss making, whereas substandard loans required a 50 percent provisioning.

¹⁴ See Vives (2001).

Figure 3. Savings, Investment and Loans Ratios Across Sub-Saharan Africa (1996-2002, average)*



Sources: World Development Indicators database; and IFC Private Investment Trends database.

* Savings refer to gross national savings. Loans are to the private sector only. The definition of “private investment” is not uniform across sub-Saharan Africa, and public enterprise investment is often reported as “private investment.”

In the case of Ghana, there are several reasons to question the extent to which banks actually compete. Although bank concentration appears to be moderate by regional standards, the dominant state owned bank (“bank 1”) enjoys a substantial market power, with 20 percent of total deposits and 44 percent of total branches—a situation that may influence price setting among banks and distort competition. Another potential piece of evidence is the fact that the dominant state owned bank invariably records the widest interest margin among commercial banks (12.2 percent in 2002; see Table 4).

However, beyond anecdotal evidence, more analysis is needed to draw some firm conclusions about the nature of the market structure in Ghana and the extent to which it offers a plausible explanation of the sector’s profitability. Therefore, the next section introduces a basic analytical framework to assess the nature of competitive conditions.

III. ANALYTICAL FRAMEWORK AND ECONOMETRIC ESTIMATION

The concept of market *contestability* has spanned a large theoretical and empirical literature covering many industries. The basic idea of market contestability is that, on the one hand, there are several sets of conditions that can yield competitive outcomes, with a competitive outcome possible even in concentrated systems. On the other hand, collusive actions can be sustained even in the presence of many firms. The most commonly used models for testing for the degree of competition are Bresnahan (1989) and Panzar and Rosse (1987). The Bresnahan model uses the condition of general market equilibrium and rests on the idea that profit-maximizing firms in equilibrium will choose prices and quantities such that marginal costs equal their (perceived) marginal revenue, which coincides with the demand price under perfect competition, or with the industry’s marginal revenue under collusion. The model generally uses industry aggregates (although firm-specific data is possible) and permits

estimation of a measure of the degree of competition. The Panzar and Rosse model takes a slightly different route and investigates the extent to which a change in factor input prices is reflected in (equilibrium) revenues earned by a specific bank in the context of a Chamberlinian equilibrium model. Like the previous model, the Panzar and Rosse approach leads to an estimate of the degree of competition. The advantage of the latter is that it uses bank-level data, allows for bank-specific differences in the production function, and permits an analysis of the differences between types of banks in terms of size and ownership.

A. The Panzar and Rosse Analytical Framework

Consider the following structural demand and cost relationship facing a particular firm i :

$$R_i = R_i(y_i, n, z_i) \quad (1)$$

$$C_i = C_i(y_i, p_i, x_i), \quad (2)$$

where R = total revenue
 C = total costs
 y = output
 n = number of firms
 z = exogenous variable affecting revenue
 p = input prices and
 \underline{x} = other exogenous variables, with
 all variables are expressed in logarithms,

Profits are defined as $\pi_i = R_i(y_i, n, z_i) - C_i(y_i, p_i, x_i)$, implying that the firm maximizes its profits where marginal revenue equals marginal costs (equation 3). This means that in equilibrium, the zero profit constraint holds at the market level as well:

$$\frac{\partial R_i}{\partial R_i(y_i, n, z_i)} - \frac{\partial C_i}{\partial C_i(y_i, p_i, x_i)} = 0. \quad (3)$$

Profit-maximizing output is defined as equation (4), with an asterisk (*) representing equilibrium values. Substituting (4) into (1), and assuming that n is endogenously determined in the model, yields equation (5), which is the reduced-form of the revenue function.

$$y_i^* = y_i^*(z_i, p_i, x_i) \quad (4)$$

$$R_i^* = R_i^*(y_i^*(z_i, p_i, x_i), n^*, z_i) \equiv R^*(z_i, p_i). \quad (5)$$

Note that market power is measured by the extent to which a change in factor input prices (∂p_i) is reflected in the equilibrium revenue (∂R_i^*) earned by firm i . Panzar and Rosse then define a measure of competition H as the sum of the elasticities of equation (5) with respect to input prices, with i denoting a particular firm.

$$H = \sum_i \frac{\partial R_i^*}{\partial p_i} \frac{p_i}{R_i^*}. \quad (6)$$

According to Panzar and Rosse, it is not just the sign of the H -statistic that matters, but its magnitude as well. Under a monopolistic structure, an increase in input prices P will increase marginal cost, thus reducing equilibrium output y^* and revenue, thereby implying that the H -statistic value be less or equal to zero. In contrast, in a perfectly competitive setting in the long-run, an increase in input prices P will increase marginal cost as well as average costs by the same proportion, without—under certain assumptions—changing the equilibrium output of banks. As inefficient banks are forced to exit the market, the increased demand faced by the remaining firms leads to an increase in output prices and revenues in the same proportion as costs, thereby implying a value of the H -statistic equal to unity. In the case of monopolistic competition, described as the most plausible characterization of banks' interactions by Bikker and Haff (2002b) p.6, under certain assumptions an increase in input prices P will lead to a less than proportional increase in revenues, as the demand for banking facing individual banks is inelastic. In this case, the H -Statistic will lie between 0 and 1. The main discriminatory powers of the H -statistics, as discussed in the literature, are summarized in Table 5.

Table 5. Panzar and Rosse's H -Statistics

Values of H	Implied Market Structure
$H \leq 0$	Monopoly Colluding oligopoly, conjectural variations of oligopoly
$0 < H < 1$	Monopolistic competition
$H = 1$	Perfect competition Natural monopoly in a perfectly contestable market

Note that the model is subject to a several assumptions:

- banks are operating in (long-run) equilibrium;
- the performance of the banks is influenced by other participants' actions (except in the case of a purely monopolistic structure);
- the cost structure is homogeneous and the production function is a standard Cobb-Douglas function with a constant return to scale; and
- the price elasticity of demand is greater than unity.

However, the definition of equilibrium is not very clear in the Panzar and Rosse model. Given the internal logic of the model, it is best to think of equilibrium as a steady-state, reflecting adjustments to shocks. As noted by Gelos and Roldos (2002), other crucial assumptions are necessary to apply this analytical framework to the banking sector: first, banks are generally assumed to behave as single-product firms, using labor, capital and intermediated funds as inputs; second, input prices are assumed not to be linked to higher quality services, as the opposite might imply higher revenues, thereby biasing the value of the H -statistic.

The Panzar and Rosse approach has been extensively used to analyze the nature of competition in mature banking systems, initially in North America¹⁵ and subsequently in

¹⁵ On the U.S. banking system, see Shaffer (1989) and on Canada, see Nathan and Neave (1989).

various European countries and Japan.¹⁶ More recently, the approach has also been applied to emerging markets' banking systems¹⁷ or in the context of large cross-country studies.¹⁸ However, there is no published study that we are aware of that examines the case of African countries, except for Claessens and Leaven (2003), who do include Nigeria and South Africa in their sample of 50 countries.

In the empirical analysis, let us operationalize equation (5) as follows:

$$\text{Log}R_{it} = \lambda + \sum_{j=1}^j \mu_j \log P_{it}^j + \rho \log Y_{it} + \sum_{k=1}^k \sigma_n \log Z_{it}^k + \varepsilon_{it} , \quad (7)$$

with $j=3$ inputs, so that P_{it}^j is a three-dimensional vector of factors prices. Y_{it} is a scale variable, Z_{it}^n is a vector of exogenous and bank-specific variables that may shift the revenue schedule (business mix), λ is a constant term and ε_{it} is the stochastic error term.

For the dependent variable R , Various authors (Molyneux (1994), Bikker and Groeneveld (1998), Claessens and Laeven (2003), Levy Yeyati and Micco (2003)) use the ratio of interest revenue (or alternatively total revenue) to total balance sheets, but as noted by Vesala (1995), such a specification provides a price equation. Following Gelos and Roldos (2002), we prefer to estimate two reduced-form revenue equations, one for scaled total revenue, and one for unscaled total revenue. We also use both total revenue and interest revenue as the dependent variable to compare results.

H is estimated for the whole sample t , and the H -statistic test is defined as (8):

$$H_t = \sum_{j=1}^j \mu_j = 0 . \quad (8)$$

As noted previously, one of the crucial hypotheses of the Panzar and Rosse model is that the banking sector is assumed to be in equilibrium. As the H -statistics depend on industry-specific characteristics, cross-country comparisons may be misleading. In practice, researchers have usually overcome this problem by focusing on and testing for the change in H over time, or by formally testing the equilibrium hypothesis, even if the definition of what constitutes equilibrium in the banking sector remains elusive.¹⁹ Notwithstanding this

¹⁶ On European countries, see Molyneux et al. (1994) (France, Germany, Italy, Spain, United Kingdom), Vesala (1995) (Finland), Coccorese (2002) (Italy), De Brandt and Davis (2000) (France, Germany, Italy), Rime (1999) (Switzerland), Hondroyannis et al. (1999) (Greece), Bikker and Groeneveld (1998) (15 EU countries), Hempell (2002) (Germany), and Maudos and Perez (2002) (Spain). On Japan, see Molyneux et al. (1996).

¹⁷ See Gelos and Roldos (2002) (Central Europe and Latin America), Belaisch (2003) (Brazil), Yildirim and Philippatos (2002) (Central and Eastern Europe), Levi Yeyati and Micco (2003) (Latin America), and Zambrano Sequin (2003) (Venezuela).

¹⁸ See, for example, Claessens and Leaven (2003) (50 countries) and Bikker and Haff (2002a) (OECD countries).

¹⁹ See Shaffer (1982), Molyneux et al. (1996), and Claessens and Laeven (2003).

reservation, and following the existing literature, we report the results of the equilibrium tests, as well as the simple methodology used in Appendix 1. The results appear to indicate that the Ghanaian banking system was in equilibrium during the period under investigation.

B. Description of the Data and Definitions of Variables

Annual individual bank balance sheets and income statements from 20 banks in operation during (part of) 1998-2003 have been used to construct the data set. For econometric estimations, banks that closed (4) or commenced operations (2) during the period have been dropped, along with one small bank due to data unavailability, leaving 65 observations for each explanatory variable. Moreover, given that the data used in this estimation concern institutions operating in the same field of business within the same country, a common effect specification was chosen for the estimates presented in this paper. Fixed-effect and random effect models were, however, also estimated yielding similar results.²⁰ Finally, panel regressions were run on pooled cross-sections for each year, as well as over the whole sample period to pick up the time-series components of the data.²¹

The variables are defined as follows (all in natural logs):

$$UPL = \frac{\text{Personnel Expenses}}{\text{Total Loans \& Deposits}}$$

$$UPF = \frac{\text{Interest Expenses}}{\text{Total Deposits}}$$

$$UPC = \frac{\text{Other Expenses}}{\text{Fixed Assets}}$$

TA = Total assets (scale variable)

$$\text{Risk component 1 (RC1): } \frac{\text{Past Due Loans}}{\text{Total Loans}}$$

$$\text{Risk component 2 (RC2): } \frac{\text{Total Loans}}{\text{Total Assets}}$$

In addition, we have included a dummy variable ($dum1$) for public ownership (=1) and another ($dum2$) for foreign ownership (=1). Finally, the treasury bill rate in nominal ($NTBR$) and real ($RBTR$) terms has been included, as well as inflation ($INFL$).

²⁰ In fixed effect models, differences between the various members of the pooled dataset are captured by a constant intercept specific to each member. In random effect models, these differences are assumed to be random and estimated with the error term in the regression.

²¹ However, the time series is insufficient to test for stationarity in the summed residuals.

C. Estimation Results

As regards market structure, the results (Table 6) suggest that the Ghanaian banking sector is characterized by monopolistic competition according to the Panzar and Rosse classification. Irrespective of model specification, the *H*-statistic consistently lies between 0 and 1, with a value of 0.56 on average. Note that there seems to be some volatility in the *H*-statistics, especially in the scaled regressions, as shown in Table 6 below. This is not unusual, as evidenced by other recent studies using the same methodology with different specifications.²² However, the unscaled specification appears to display more stable results, and allowed to better assessing the crucial role of the scale variable.

Table 6. *H*-Statistics Values for the Banking System in Ghana*

	All Specifications	Unscaled Specifications	Scaled Specifications
Average <i>H</i> -statistic	0.555	0.627	0.482
Median <i>H</i> -statistic	0.569	0.626	0.481
Standard deviation	0.092	0.038	0.064

* The *H*-statistics are computed at the 5 percent significance level.

The market structure identified in Ghana—monopolistic competition—and score appears to be similar to that of comparable countries in the region (Table 7). Although cross-country comparison results should be treated with caution, it appears that Ghana’s market structure is only slightly less competitive that of Nigeria and Kenya, even though the Nigerian banking sector operates with much narrower interest margins and less foreign penetration than Ghana’s (Table 2). Note also that the market structure of South Africa is believed to be significantly more competitive, including by international standards.

Table 7. Banking Sector Market Structure in Selected Countries

Country	Period	<i>H</i> -statistic	Nb of banks	Nb of observations
Ghana	1998-2003	0.56	13	65
Sub-Saharan Africa				
Kenya	1994-2001	0.58	34	106
Nigeria	1994-2001	0.67	42	186
South Africa	1994-2001	0.85	45	186
North America (median)	1994-2001	0.67	3 countries covered	
South America (median)	1994-2001	0.73	12 countries covered	
East Asia (median)	1994-2001	0.67	6 countries covered	
South Asia (median)	1994-2001	0.53	3 countries covered	
Western Europe (median)	1994-2001	0.67	14 countries covered	
Eastern Europe (median)	1994-2001	0.68	7 countries covered	

Sources: Authors’ calculations (Ghana); and Claessens and Laeven (2003), Table 2.

²² See Gelos and Roldos (2002), and Yildirim and Philippatos (2002).

Table 8. Regression Results*

	Total Revenue (TR)		Total interest revenue (TIR)		Total Revenue (TR/TA)		Total interest revenue (TIR/TA)	
C	0.238	-0.171	-1.085**	-1.395**	0.483	0.172	0.014	-0.253
t-statistic	0.634	-0.436	-2.763	-3.305	1.908	0.653	0.048	-0.822
UPL	0.254**	0.253	0.293**	0.293**	0.243**	0.239**	0.233**	0.234**
t-statistic	4.265	4.274**	4.676	4.601	4.179	4.109	3.499	3.433
UPF	0.235**	0.248	0.361**	0.373**	0.195**	0.196**	0.189**	0.199**
t-statistic	3.850	4.117**	5.633	5.778	4.668	4.730	3.930	4.094
UPC	0.108**	0.091**	0.056	0.045	0.108**	0.093**	0.057	0.050
t-statistic	3.658	2.969	1.798	1.382	3.670	3.041	1.676	1.390
TA	1.025**	1.033**	1.112**	1.116**
t-statistic	36.909	36.511	38.156	36.717
RC1	0.011	0.013	0.003	-0.001	0.012	0.011	0.006	-0.005
t-statistic	0.650	0.683	0.190	-0.045	0.684	0.575	0.319	-0.203
RC2	0.318**	0.294**	-0.012	-0.026	0.352**	0.341**	0.147	0.141
t-statistic	4.234	3.864	-0.155	-0.320	5.468	5.283	1.990	1.869
DUM1	-0.090	-0.094	-0.225**	-0.221**	-0.078	-0.076	-0.181**	-0.169**
t-statistic	-1.277	-1.327	-3.027	-2.895	-1.128	-1.088	-2.273	-2.081
DUM2	0.100**	0.100**	0.075	0.076	0.108**	0.111**	0.115**	0.117**
t-statistic	2.177	2.208	1.553	1.551	2.415	2.487	2.246	2.237
RTBR	...	0.104**	...	0.091**	...	0.103**	...	0.099**
t-statistic	...	3.326	...	2.726	...	3.283	...	2.703
NTBR	0.348**	...	0.395**	...	0.368**	...	0.490**	...
t-statistic	3.511	...	3.797	...	3.818	...	4.439	...
INFL	...	0.192**	...	0.235**	...	0.215**	...	0.311**
t-statistic	...	2.759	...	3.149	...	3.229	...	3.984

(**) Statistically significant at the 5 percent level

Memorandum items:								
R-squared	0.988	0.988	0.986	0.986	0.691	0.698	0.634	0.627
Adjusted R-squared	0.986	0.986	0.982	0.983	0.647	0.648	0.582	0.566
S.E. of regression	0.145	0.144	0.158	0.156	0.145	0.144	0.166	0.169
F-statistic	486.9	444.9	317.9	327.7	15.657	14.115	12.126	10.277
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mean dependent var.	11.7	11.7	11.2	11.2	-1.611	-1.611	-1.956	-1.956
S.D. dependent var.	1.208	1.208	1.196	1.196	0.244	0.244	0.256	0.256
Sum squared resid.	1.157	1.119	1.055	1.024	1.173	1.147	1.541	1.570
Durbin-Watson stat.	1.864	1.850	1.097	1.311	1.883	1.874	1.464	1.447
Market structure Wald test								
Ho: $H=0$ (Monopolistic)	Rejected							
Ho: $H=1$ (Perf. competition)	Rejected							
Ho: $0 < H < 1$ (Mon. competition)	Not Rejected							
H-statistic	0.597	0.592	0.654	0.666	0.546	0.528	0.422	0.433

Source: Authors' calculations.

* Market structure tests at the 5 percent level.

D. Interpretation of the Coefficients

In interpreting the coefficients in Table 8, the following results should be underscored:

- The unit price of labor (*UPL*) is significant in all specifications and with similar positive coefficients. This result appears to confirm that personnel costs are as important as overhead costs, which are notoriously high in Ghana, as discussed in Section II. It is also worth noting that the elasticity of this variable does not depend on whether the dominant state owned bank (“bank 1”) is excluded from the dataset, despite the larger size of these costs for that bank (Table 4).
- The unit cost of funds (*UPF*) is significant in all specifications and greater than zero. Moreover, as expected the cost of capital has a higher impact on interest revenue than other revenue. The elasticities of the scaled specifications of the model are much lower, giving further support to a presence of economies of scale as the relative interest expense depends on asset size. This variable should also capture the market interest rate, as a point of reference for deposit rates.
- The unit cost of fixed assets (*UPC*) is positively correlated with total revenue, but not related to total interest revenue. The positive relationship could reflect Ghana’s reliance upon a very high level of private transfers, many of which are associated with costs exacerbated by the lack of a reliable telecommunications network. It could also be due to investment costs (e.g., in ATMs, as were incurred in Ghana during the period) for which revenues are also fee based. This positive relationship may also reflect the fact that such costs are more relevant for merchant banks that rely more heavily on commission and fees as a source of income than for other types of banks with larger branch networks. The lack of correlation with interest revenue might further indicate a lack of competition between banks, perhaps because of the high costs of exiting a relationship with a bank (e.g., through closure fees) or other measures that hamper the effectiveness of e.g., marketing campaigns or other efforts by banks to attract this type of business.²³
- The scale variable (*TA*) is strongly significant and positive in all models, which implies that size is a major determinant for total as well as interest revenue. All things being equal, the larger the bank, the higher the revenues, confirming the results of earlier studies (Bossone and Lee, 2002). This denotes a strong economies of scale effect, which not only indicates that the profitability structure of the banking sector in Ghana is skewed toward the larger banks, but also implies that small banks have a definite disadvantage in the system. This could indicate scope for greater consolidation in the sector in the future, especially if government securities were to evaporate as a relative high-yield, risk-free source of income for the banks.

²³ See <http://www.bog.gov.gh/notices/notice03/chgintrates0603.htm>.

- The risk variables (*RC1* and *RC2*) require some careful interpretation. The past-due loan ratio does not appear to be significant, and its coefficient is positive at times, which would seem to be counterintuitive. However, this could well reflect the definition problem of past-due loans in Ghana, as discussed in section II. The loan ratio coefficient is also positive, but it is significant only for total revenues and not for interest revenue, which is interesting. Given the overexposure of the banking system to financially weak, state-owned enterprises, the non-relevance of the loan ratio for interest revenue is certainly plausible. As regards its contribution to total revenue, this could well reflect the fact that the loan recipients are paying a sizable share of commissions and fees.
- The dummy for state-ownership (*DUM1*) is consistently negative and statistically significant in all interest-revenue model estimations. This may capture the fact that state-owned banks have embarked on extensive lending to public enterprises which are prone to defer interest payments. Interestingly, the dummy is not significant when it comes to total revenue model estimations. Note also that public ownership is not significant in terms of profitability, as show in Appendix 1.
- Foreign ownership (*DUM2*) is consistently positive and statistically significant in all total revenue model estimations. This result appears to confirm that foreign banks are more effective than public institutions in generating non-interest income, notably through the extensive use of commissions and fees. As regards total interest revenue, the foreign ownership is positive and statistically significant in most of the regressions, which is consistent with the results in Appendix 1 indicating that foreign banks tend to be more profitable across the board. This last result may be explained both in terms of efficiency in generating revenue and in terms of overall more cautious lending policy, as reflected in lower provisioning for bad loans (Table 4). The results presented in Table 8 also illustrate the potentially positive role of foreign ownership on competition in Ghana's banking sector. More generally, however, empirical evidence is still mixed. On the one hand, Claessens and Laeven (2003) found a positive correlation between foreign banks' presence and competition (defined as measured by the H-statistic) in 53 countries, and Gelos and Roldos (2002) reached the same conclusion in eight countries of Latin America and Europe. On the other hand, Yeyati and Micco (2003) found that foreign bank presence actually weakened competition in Latin America.
- The results show that nominal (*NTBR*) and real (*RTBR*) have strong positive effects on both total or interest revenues and this holds true even when controlled for inflation. This offers further confirmation of the private sector crowding-out effect, fueled by the large financing needs of the government, and may even indicate that competition and efficiency in the banking sector have an important fiscal dimension in Ghana. One possible interpretation is that both the banking sector and the government are trapped in a codependency scheme. On the one hand, the persistence of domestic financing needs²⁴ puts the larger banks in a possible price-maker position

²⁴ Assuming no access to foreign capital markets and limited recourse to inflation financing.

regarding interest rates, while the limited competition among these banks tends to affect their bidding behavior, which is apparent from the chronic undersubscription at treasury bill auctions and results in higher interest rates.

- On the other hand, the banking sector's profitability is highly dependent upon high interest rates, which dampens financial intermediation, widens interest spreads at the expense of the private sector, possibly exacerbates the loan quality problem, and ultimately restricts competition.
- Finally, as expected inflation is positive and significantly correlated with revenues. Other macroeconomic variables, such as the nominal exchange rate and banking system credit to government, were not significant.

IV. CONCLUSIONS

The main finding of this paper is that banks in Ghana appear to behave in a noncompetitive manner that could possibly hamper financial intermediation. This result is consistent with the seemingly high profitability of banks, which seems to indicate a persistently low level of market contestability. Several factors are believed to affect banks' behavior, either because they constitute indirect barriers to entry or because they tend to limit competition among banks. The main factors are as follows:

- **Decisive role of size.** Our results show that scale matters substantially in the Ghanaian banking system. In addition, the very small savings base prevents smaller banks from emerging quickly, and thus that size could act as a serious constraint on market entry.
- **Persistent financing needs of the government.** Our results indicate that the persistent domestic financing needs of the government have fostered inefficiency in the banking system as holdings of government securities have become the driving force in the revenue function for banks. Thus, banks' reliance on government securities as a source of large steady profits appears to have limited competition between banks. In addition, large deficit financing through the issuance of treasury bills has not only crowded out the private sector in capturing banks' investments, but may also have put pressure on interest rates, thereby making access to bank lending even more difficult for the private sector and hampering private sector development.
- **High investment costs.** A third impediment to stronger competition among banks could be the high investment costs that are needed to overcome the current telecommunication problems prevailing in Ghana. Our results show that a sizeable portion of total bank revenue is fee-based, and thus dependent upon heavy technology investment, which might further deter potential new entrants.
- **Barriers to competition on interest revenue.** The lack of correlation among costs other than on personnel, funding, and interest revenue—traditionally the main source of revenue for banks—is clearly an indication that competition is stifled in the

Ghanaian banking system. This could be due to the nontransparent fee structure of the banks, which help to shield the bank market structure from competition.

- **Losses on the loan portfolio.** One further explanation for the lack of contestability is the past-due loans element, which does not seem to be related to either revenues or returns. This may suggest some serious definition problems and, hence, a lack of adequate provisioning, which may in turn signal high lending risks to potential entrants. Domestic banks might be more prone to this behavior, as foreign banks appear to be more profitable and the quality of their portfolio tends to be better; however, domestic and foreign banks are equally effective in generating revenue.

The most important policy recommendation arising from this analysis is probably that achieving effective fiscal adjustment may be a necessary condition to deepen and increase the efficiency of the Ghanaian banking system. This is evidenced by the positive impact of the fiscal effort initiated in 2002/03 on domestic interest rates; in particular, T-bill rates have declined steeply, reflecting the reduction in public financing requirements, but the decline in lending rates has been more modest. Sustained fiscal adjustment—a key precondition for further declines in interest rates and higher domestic investment—would reduce the dependence of banks upon government securities as a source of low-risk, high-yielding assets. This would lead to increased competition, as banks would have to identify new lending opportunities and expand their customer base in order to generate income. In turn, increased competition could foster some efficiency gains through consolidation in the banking system. Notwithstanding the importance of maintaining a prudent fiscal stance, other factors contributing to high banking spreads may also need to be addressed. For example, facilitating more transparency in the fee structure of banks and improvements in telecommunication may prove very useful in addressing the high investment costs. In addition, addressing the losses on the loan portfolio, particularly in the domestic banks, seems highly desirable. Such an action would not only require that bank regulation and supervision be further strengthened, but also that key institutional issues affecting investors be addressed at the legal and judiciary levels, most notably in terms of creditor rights.

REFERENCES

- Beck, Thorsten, Asli Demirgüç-Kunt, and Vojislav Maksimovic, 2003, "Bank Competition, Financing Obstacles and Access to Credit," World Bank Policy Research Paper No. 2996 (Washington: World Bank).
- Belaisch, Agnes, 2003, "Do Brazilian Banks Compete?" IMF Working Paper 03/113 (Washington: International Monetary Fund).
- Bhattacharya, Kaushik, 2003, "How Good Is the BankScope Database? A Cross-Validation Exercise with Correction Factors for Market Concentration Measures," BIS Working Paper No. 133 (Basel: Bank for International Settlements).
- Bikker, J.A., and J. M. Groeneveld, 1998, "Competition and Concentration in the EU Banking Industry," Research Series Supervision No. 8, De Nederlandsche Bank.
- Bikker, J.A., and K. Haaf, 2002a, "Measures of Competition and Concentration in the Banking Industry: a Review of the Literature," *Economic and Financial Modeling*, Vol. 9, pp. 53–98.
- , 2002b, "Competition, Concentration and Their Relationship: An Empirical Analysis of the Banking Industry," *Journal of Banking and Finance*, Vol. 26, pp.2191–2214.
- Bosson, Biagio, and Jong-Kun Lee, 2002, "In Finance, Size Matters," IMF Working Paper 02/113 (Washington: International Monetary Fund).
- Bresnahan, T.F., 1989, "Empirical Studies of Industries with Market Power," in *Handbook of Industrial Organisation*, Volume II, pp. 1012–55, ed. by R. Schmalensee and R. D. Willig.
- Cetorelli, Nicola, 1999, "Competitive Analysis in Banking: Appraisal of the Methodologies," *Economic Perspectives* (Chicago: Federal Reserve Bank of Chicago), Issue Q1, pp. 2–15.
- Claessens, Stijn, and Luc Laeven, 2003, "What Drives Bank Competition? Some International Evidence," World Bank Policy Research Paper No. 3113 (Washington: World Bank).
- Coccorese, Paolo, 2002, "Competition Among Dominant Forms in Concentrated Markets: Evidence From the Italian Banking Industry," Università Degli Studi di Salerno, Working Paper No. 89.
- De Bandt, Olivier, and Philip E. Davis, 2000, "Competition, Contestability and Market Structure in European Banking Sectors on the Eve of EMU," *Journal of Banking and Finance*, Vol. 24, pp.1045–66.
- Gelos R. Gaston and Jorge E. Roldos, 2002, "Consolidation and Market Structure in Emerging Market Banking Systems," IMF Working Paper 02/186 (Washington: International Monetary Fund).
- Hawkins, John, and Dubravko Mihaljek, 2001, "The Banking Industry in the Emerging Market Economies: Competition, Consolidation and Systemic Stability—An overview," BIS Working Paper No. 4, pp. 1–44 (Basel: Bank for International Settlements).

- Hempell, Hannah S., 2002, "Testing for Competition Among German Banks," Deutsche Bank Discussion Paper 04/02.
- Hondroyiannis, George, Sarantis Lolos, and Evengelia Papapetrou, 1999, "Assessing Competitive Conditions in the Greek Banking System," *Journal of International Financial Markets, Institutions and Money*, Vol. 9, Issue No. 4, pp. 377–91.
- Levy Yeyati, Eduardo L., and Alejandro Micco, 2003, "Concentration and Foreign Penetration in Latin American Banking Sector: Impact on Competition and Risk," IDB Working Paper No. 499 (Washington: International Monetary Fund).
- Maudos, J., and F. Pérez, 2002 "Competencia Versus Poder de Mercado en la Banco Española," (unpublished; Valencia: University of Valencia).
- Molyneux, Phil, D. M. Lloyd-Williams, and John Thornton, 1994, "Competitive Conditions in European Banking," *Journal of Banking and Finance*, Vol. 18, pp. 445–59.
- , 1996, "Competition and Market Contestability in Japanese Commercial Banking," *Journal of Economics and Business*, Vol. 48, pp. 33–45.
- Nathan, Alli, and Edwin H. Neave, 1989, "Competition and Contestability in Canada's Financial System," *Canadian Journal of Economics*, Vol. 22, pp. 576–94.
- Panzar, John, and James Rosse, 1987, "Testing for Monopoly Equilibrium," *The Journal of Industrial Economics*, Vol. 35, No. 4, pp. 443–56.
- Rime, B., 1999, "Mesure du Degré de Concurrence dans le Système Bancaire Suisse à l'Aide du Modèle de Panzar et Rosse," *Revue Suisse d'Economie Politique et de Statistique*, Vol. 135, No. 1, pp. 21-40.
- Shaffer, Sherrill, 1982, "A Nonstructural Test for Competition in Financial Markets" in *Bank Structure and Competition*, Conference Proceedings, pp. 225–43 (Chicago: Federal Reserve Bank of Chicago).
- , 1989, "Competition in the U.S. Banking Industry," *Economic Letters*, Vol. 29, No. 4, pp. 349–53.
- Vesala, J., 1995, "Testing Competition in Banking: Behavioral Evidence From Finland," *Bank of Finland Studies E:1*.
- Vives, Xavier, 2001, "Competition in the Changing World of Banking," *Oxford Review of Economic Policy*, Vol. 17, No. 4, pp. 535–47.
- Yildirim, Semih, and George C. Philippatos, 2002, "Competition and Contestability in Central and Eastern European Banking Markets," Economics Working Paper No. 0310004 (St. Louis: Washington University).
- Zambrano Sequin, Luis Z., 2003, "Competencia Monopolística y Sistema Bancario en Venezuela," (unpublished; Caracas: National Assembly).

Following the existing literature,²⁵ we also estimated the following equation (9), to carry out the equilibrium test E defined in equation (10):

$$\text{Log}(1 + ROA_{it}) = \lambda + \sum_{j=1}^j \mu_j P_{it}^j + \rho \log Y_{it} + \sum_{n=1}^n \sigma_n Z_{it}^n + \varepsilon_{it} \quad (9)$$

$$E_i = \sum_{j=1}^j \mu_j = 0 \quad (10)$$

Where ROA is the pre-tax return on assets. As ROA can take on negative values on occasion, the dependent variable is simply computed as $\ln(1+ROA)$ for convenience²⁶. The equilibrium test E is computed as a standard F-test, the intuition being that in equilibrium, returns on assets should not be statistically correlated with input prices. The results of the equilibrium tests for the pooled data over the whole period are presented in the table below, and a standard Wald-test is used to test the H=0 hypothesis. The results show that the market equilibrium condition cannot be rejected at the 5 percent level over the whole period. With the possible exception of the unit cost of funds, the unit costs of factors are thus not statistically different from zero and do not affect returns on assets.²⁷ Interestingly, returns on assets are positively associated with the loan ratio, the nominal T-bill rate and with the foreign ownership dummy, implying that foreign banks are associated with larger profitability.

²⁵ See Molyneux et al. (1996) and Claessens and Laeven (2003) among others.

²⁶ Note that this approximation does slightly change the mathematical properties of the regression by reducing the size of the elasticities of the right-hand side coefficients. Empirically however, results did not seem to be affected by this approximation.

²⁷ Note that the left-side variable is gross returns, and thus not affected by the 2000/01 shock to the banking system as the losses associated with the shock has yet to work its way through the provisioning system.

Table A1. Market Equilibrium Test Results

Dependent variable: Return on Assets (ROA)		
C	0.128**	0.047
UPL2	0.007	0.007
UPF	-0.020**	-0.018
UPC	0.008	0.005
TA	0.000	0.001
RC1	-0.005	-0.005
RC2	0.032**	0.027**
DUM1	0.010	0.009
DUM2	0.020**	0.020**
RTBR	...	0.021**
NTBR	0.070**	...
INFL	...	0.038**
<i>(**) Statistically significant at the 5 percent level</i>		
<i>Memorandum items</i>		
R-squared	0.481	0.507
Adjusted R-squared	0.396	0.416
S.E. of regression	0.022	0.021
F-statistic	5.655	5.561
Prob(F-statistic)	0.000	0.000
Mean dependent var	0.060	0.060
S.D. dependent var	0.028	0.028
Sum squared resid	0.026	0.025
Durbin-Watson stat	1.742	1.746
	<i>p-value</i>	<i>p-value</i>
Wald-Test (E=0)	0.734	0.674
	<i>Null hypothesis cannot be rejected</i>	<i>Null hypothesis cannot be rejected</i>

Source: Authors' calculations.