

Market Structure and Performance in Uganda's Banking Industry.

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Abstract.

This study is intended to sharpen the debate on the financial sector by analysing the competitive behaviour and the structure-performance correlation. In line with the literature on the measurement of competition, we follow the two mainstreams-non-structural and the structural approaches-in analysing the nature of competition and market structure of Uganda's financial system.

By using the non-structural models of competitive behaviour-the Panzar-Rosse model- we measure competition and emphasise the competitive conduct of banks without using explicit information about the structure of the market. Estimations indicate monopolistic competition, competition being weaker in the period 1995-99 in comparison to competition in the period 2000-2005. Moreover, the relationship between competition, measuring conduct, and concentration measuring the market structure, is negative and statistically significant which could suggest that a few large banks can restrict competition. Overall, our results suggest that while competition in the Ugandan banking sector falls within a range of estimates for comparator markets, it tends to be on the weaker side.

The structural approach to model competition includes the structure-conduct-performance (SCP) paradigm and the efficiency hypothesis. Using the SCP framework we investigate whether a highly concentrated market causes collusive behaviour among larger banks resulting in superior market performance; whereas under the efficiency hypothesis we test whether it is the efficiency of larger banks that makes for enhanced performance. Using Granger causation test we establish that efficiency Granger causes concentration and market share and using instrumental variable approach, the study establishes that market power and concentration as measured by market share and Herfindahl index, respectively, positively affect bank profitability. In addition, bank efficiency also affects bank profitability. Other factors that affect bank profitability include operational costs, taxation and core capital requirement.

A major policy implication derived from this analysis is that the Ugandan banking system has been subject to deep structural transformation since the early 1990s. Consolidation and privatization have permitted economies of scale in the production and distribution of services and increased risk diversification. These forces have led to lower costs and, undoubtedly, higher efficiency. However, to ensure that lower costs are passed through to households and firms, greater efficiency must be accompanied by a similar strengthening in the competitive environment in the banking sector.

Table of content.

1. Introduction.....	4
1.1. Statement of research problem.....	6
1.3 Objectives of the study.....	7
1.3.1 Testable hypotheses.....	9
2. Background.....	9
2.1 Financial sector reforms.....	13
2.2 The structure of Uganda Financial Sector.....	15
2.2.1 Intermediation margin.....	19
2.2.2 Commercial banks' assets portfolio shift.....	22
2.2.3 Credit Market Structure.....	23
3. Literature survey aspects.....	25
4. Methodology: Baseline theoretical model.....	29
4.1 The PR model:.....	29
4.1.1. The empirical P-R model.....	32
4.2 Empirical analysis: PR approach.....	33
4.3 Market Concentration and competition in Uganda's banking sector.....	40
4.4 Efficiency and market structure.....	43
4.4.2 Econometric analysis.....	51
4.5. Conclusions.....	57
Bibliography.....	61

1. Introduction.

Financial markets and institutions are central to the process of economic development and growth. In a perfect world characterized by an Arrow-Debreu economy, there is no role for the financial services sector and intermediation, in general. In this perfect world there is a complete set of state contingent claims, and transaction costs are absent, making the role of financial intermediation irrelevant. Miller and Modigliani (1953) argument further underpins the perfect economy world where financing decisions of firms, in this type of world, is irrelevant to the value of the firm. In this case the financial intermediation process does exist but as to how it is utilized it is irrelevant for value of the firm. In reality though, the economy is imperfect and exhibits transaction and information acquisition costs. In this respect the existence of financial intermediaries becomes necessary. The existence of financial intermediaries such as banks assists in the acquisition of information about firms and households and will alter the allocation of credit in the economy. Indeed, any contractual arrangement that ensure the repayment of loans will encourage savers and lenders to lend and this influences the savings pattern. The existence of capital markets allows households and firms to insure against consumption shocks and allocate consumption across time and space via the trading of security instruments.

The economies of East Asia have shown how putting national savings to work in productivity-increasing investment can sustain rapid growth over a generation. Microfinance innovations in Asia and Latin America have helped low-income households manage risks through savings (Beck, Demirgüç-Kunt, and Levine 2004; Beck, et al. 2000; Honohan 2004). Such innovations have empowered energetic microentrepreneurs, giving them the first step up the ladder of prosperity and lifting living standards in the areas where they operate. Innovations in the technology for remittances and novel techniques in insurance have also played an important role in improving welfare. By bridging the gap between savers and entrepreneurs, financial systems not only reduce the risks on both sides but also open up opportunities to both sides. They can reduce the barriers to entry for entrepreneurs, thereby allowing the economy at large to benefit in terms of increasing employment, improving the price and quality of services, and reducing the stifling influence of established monopolies. Given access to the necessary finance, farmers can move to a higher level of productivity and output. Savers, too, can share in the returns on an expanded flow of investment. Housing, insurance, and pension arrangements can be lifted onto a new plane.

Increasingly, scholars acknowledge that supportive policy for financial sector development is a key component of national development policy. Indeed, careful comparative analysis of the growth rates of different countries has produced convincing evidence that having a deeper financial system contributes to growth—and is not merely a reflection of prosperity (Honohan and Beck, 2007). Countries with deep financial systems also seem to have a lower incidence of poverty than others at the same level of national income. At the firm level, growth also responds to access to credit and to the conditions that favor such access.

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. The importance of a strong banking sector to a country's economic growth and development is well established in

the literature (Beck, Levine and Loayza, 2000; Beck, 2002). Efficient financial systems help countries to grow, partly by widening access to external finance and channelling resources to the sectors that need them most. A well-developed financial system also can help an economy cope better with exogenous shocks such as terms of trade volatility and move them away from natural resource based development. In a well functioning economy, 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 channelling savings into investment fostering higher economic growth.

Banks are the predominant financial institutions in most developing countries and in Uganda comprise over 80 percent of the financial system. Banks are the primary mechanisms for the transmission of monetary policy and they play an important role in determining the supply of money in the economy. They also form the backbone of the payments system. Therefore, changes in the structure and performance of banks can have far-reaching implications for the whole economy. Uganda's banking industry is highly concentrated and many studies in the banking literature elsewhere and in the more general industrial organisation literature find a positive statistical relationship between performance and measures of market structure-either concentration or market share. This could therefore suggest that the recent wave of buyout/merger activities in Uganda's banking industry is motivated by the prospective benefits from greater market power created by increasing the concentration or market shares of the merging banks. The traditional structure-conduct-performance hypothesis asserts that this finding reflects the setting of prices that are less favourable to consumers (lower deposit rates, higher loan rates) in more concentrated markets as a result of competitive imperfections in these markets. This study is therefore intended to enrich the debate on the nature of competition and the market structure and performance of the Uganda's banking sector in hindsight that financial sector development is instrumental to the economy's development. Moreover, since Uganda's financial sector has gone through reforms, it is important to understand how this has impacted on the structure of the industry and therefore perhaps deduce how these are likely to impact on the growth potential of the economy. A previous study by Nannyonjo (2002) on the impact of the structure of Uganda's banking sector and its impact on profitability indicated no significant impact. This could have resulted from misspecification as efficiency could cause concentration and market share therefore bias the results if all of these variables are assumed to be weakly exogenous in the profits reduced form equation. This study therefore extends this by testing for causation and adapting appropriate specification and estimation method.

In addition, competition in the financial sector matters for a number of reasons. As in other industries, the degree of competition in the financial sector can matter for the efficiency of the production of financial services, the quality of financial products and the degree of innovation in the sector. There is empirical evidence to the fact that the degree of competition in the financial sector can matter for the access of firms and households to financial services and external financing, in turn affecting overall economic growth (Vives 2001).

1.1. Statement of research problem.

Banks mobilise, allocate, and invest much of society's savings, so bank performance has substantive repercussions on investment, firm growth, industrial expansion, and economic development. Thus, research on the banking system market structure and its effects competition and performance has important policy implications. While there has been a rapidly growing literature on banking efficiency issues in developed countries, little attention has been paid so far to the efficiency of banks in developing countries yet there is an increasing recognition that financial sector development is a top priority to sustain economic growth in developing countries, particularly among the more successful reformers, such as Uganda. Moreover, the consolidation in Uganda's banking industry in recent years has intensified the contemporary policy debate on the influences of concentration and competition in the banking industry.

Literature suggests a relationship between competition and efficiency and between market structure and performance. These relationships have generated competing hypotheses. On one hand, the traditional collusion hypothesis, also called the structure-conduct-performance hypothesis (Bain, 1951), proposes that market concentration lowers the cost of collusion between firms and results in higher than normal profits. On the other hand, the efficient structure hypothesis (Demsetz, 1973) postulates an alternative explanation for the existence of positive correlation between concentration and profitability, affirming that the most efficient firms obtain greater profitability and market share and, consequently, the market becomes more concentrated. In this case, the positive observed relationship between concentration and profits is spurious and simply proxies for the relationship between superior efficiency, market share, and concentration.

Therefore, this study is particularly relevant for Uganda economy given the high degree of concentration in its banking market. It is important to determine the level of competition and how this is linked to concentration, and whether the structure of the banking system does affect profitability. For instance, if the current trends in market structure and performance reflect collusive or other forms of non-competitive behaviour of Ugandan banks, the policy that has permitted some banks which are perceived as being more efficient to acquire the branches of closed banks or to buyout other less efficient banks is likely to lead to a reduction in market competition, raise costs and may lead to welfare losses due to unfavourable interest rates.

Broadly, the knowledge about bank behaviour, pricing and efficiency in Uganda is limited. There is a gap in empirical work on whether market concentration and/or efficiency of the banking system have increased in the era of financial liberalisation. This study attempts to analyse the relationship between banks performance in terms of returns to assets and market structure (concentration and market share) applying stochastic frontier approach to estimate a direct measure of efficiency of Ugandan Banks. The study particularly contributes to the scanty empirical evidence on the behaviour of structure-performance of banks under a liberalised financial system in Uganda.

A couple of studies have been done on Uganda's financial system in recent years after financial liberalisation, which give a rich background for any study on Uganda's financial system. These include Kasekende and Ating-Ego (2003), Mpuga (2002), Birungi (2005), and Nannyonjo (2002). Kasekende and Ating-Ego (2002) analyses the impact of financial liberalisation on Uganda's

domestic system. Mpuga (2002) analyses banking crisis following the insolvency, closure of several banks and bank runs of 1998-1999. Birungi (2005) discusses the causes of high intermediation margins, which to a large extent complements this study as the structure could be a major factor in explaining the high spreads. This study extends Nannyonjo (2002) work on structure-conduct-performance in Uganda's banking system. Nannyonjo (2002) results based on Uganda's banks for the period 1993-1999 indicate that market concentration and market power do not affect bank profitability and even efficiency is non-robust in explaining bank profitability. This study re-examines this issue using the bank data for the period 1995-2005 but uses instrumental estimation method since efficiency may affect concentration and thereby bias the estimated effect of concentration on performance. We also include additional bank control variables such as operational costs and taxes, which the study did not consider.

1.3 Objectives of the study.

A financial system's contribution to the economy depends upon the quantity and quality of its services and the efficiency with which it provides them. As aforementioned, by the late 1980s repressive government interest rate controls and non-price rationing mechanisms severely undermined Uganda's financial sector and this significantly retarded the development process (Kasekende and Ating-Ego,2003). With the thrust of ambitious reforms aimed at redefining the structure and operation of the system and the subsequent easy in entry, removal of financial taxation by eliminating mandatory investments and reduction of the reserve requirement ratio, phasing out direct monetary policy, privatisation of the state owned financial institutions, and strengthening prudential norms, the impact and experience offers no simple solution to the pre-reform glaring deficiencies particularly as it relates to dominance of the industry by few institutions, limited credit extension, and high and rising intermediation margins. In particular, a weak financial market limits the efficient aggregating and allocation of resources and subsequently cause waste in those sectors and enterprises less well linked into the financial pipelines. Moreover, the recent reforms, particularly the privatization of the dominant UCB and consolidation within the banking system, may have resulted in a sound but uncompetitive and thus inefficient system that could have failed to deliver on greater access and financial deepening although they could have increased the sector's profitability.

Uganda's banking Industry is undergoing unprecedented changes, caused by the deregulation of financial services, strengthening of regulatory and supervision frameworks, and developments in information technology. Many of these changes could have had vast implications for competition and concentration in the banking and financial sectors. The combination of improvements and unfulfilled potential warrants a new look at Ugandan banking sector. One of the consequences has been mergers and buyouts which has increased concentrationⁱ. This process of concentration may affect competition, in particular on local markets for retail banking services. Questions may arise such as: Should concentration be slowed down? or Are additional measures needed to ensure sufficient competition in Uganda's banking industry? Besides, increased concentration and the size of the global players may cause concerns about financial stability. In order to judge the implications of these developments, one has to examine the banking industry's current market structure, to determine the degree of competition, and to investigate the impact the concentration is likely to have on the market structure and the behaviour of banks.

A high degree of competition and efficiency in the banking system can contribute to greater financial stability, product innovation, and access by households and firms to financial services, which in turn can improve the prospects for economic growth. In this respect, there is a concern that monopolistic or oligopolistic, inefficient, and fragile banking in Uganda is a major hindrance to economic development. Therefore, it could be important to identify the kind of reforms and environments that may help to promote competition and efficiency in the Uganda's banking system.

The literature on the measurement of competition may be divided into two mainstreams, called the structural and the non-structural approach. The structural approach to model competition includes the structure-conduct-performance (SCP) paradigm and the efficiency structure hypothesis (ESH), as well as a number of formal approaches with roots in industrial organisation theory. The SCP paradigm investigates whether a highly concentrated market causes collusive behaviour among larger banks resulting in superior market performance; whereas the efficiency hypothesis tests whether it is the efficiency of larger banks that makes for enhanced performance. However, the SCP and ESH do not resolve the debate of the bank profitability (Berger, 1995; Berger, et al. 1997). It is argued that both theories centre on profitability rather than the deviation of output price and marginal cost, which is the basis for analysing competition conditions (Paul).

In reaction to the theoretical and empirical deficiencies of the SCP and ESH, the new empirical industrial organisation models show that the competitiveness of an industry cannot be measured by market structure indicators alone such as Herfindahl and other concentration indexes. The threat of entry can be a more important determinant of the behaviour of market participants. This theory also suggests that performance measures, such as the size of the banking margins or profitability, do not necessarily indicate the competitiveness of a banking system. These measures are influenced by a number of factors, such as a country's macro-performance and stability, the form and degree of taxation of financial intermediation, the quality of country's information and judicial systems, and bank specific factors, such as scale of operations and risk preferences. As such, these measures can be poor indicators of the degree of competition.

Financial markets and institutions are central to the process of economic development and growth. They are key to mobilizing domestic savings and essential for facilitating efficient investment. Banks are the predominant financial institutions in Uganda. Therefore, changes in the performance and structure of banks can have far-reaching implications for the whole economy. Indeed, there is a concern that an inefficient and fragile banking system is a hindrance to economic growth.

This study measures the degree of competition in Uganda's banking industry and also investigates the impact of concentration on competition. It also examines the how the banks' profitability is linked to the industry's market structure. Therefore, by providing an analysis of the interrelationship between banks' performance and the market structure, the study contributes to a better understanding of the factors that spur bank performance, and therefore deduce financial sectors factors likely to impact on the growth of the economy.

Specific objectives are:

- To examine the competitiveness of Uganda's banking industry.
- To examine Uganda's banking industry market structure and its impact on banks' profitability.
- To examine bank efficiency and its possible impact on the market structure (concentration and market share).
- To empirically ascertain the relative strength of market power and efficiency in explaining the banks' profitability.

1.3.1 Testable hypotheses.

- a) Uganda's banking sector is uncompetitive.
- b) Competition is negatively correlated with concentration.
- c) Efficiency has a positive impact on market concentration and market share.
- d) The banking industry market structure and efficiency positively affect the banks' profitability.

The remainder of the paper is organised as follows. Section 2 describes the main characteristics of the structure and features of the banking sector in Uganda. Section 3 highlights some literature relating to bank competition, efficiency and performance. Section 4 presents the theoretical models, operationalises them by deriving empirical equations and estimating them. It also summarises the estimation results and concludes.

2. Background.

Uganda from years after independence to the late 1980's pursued a strategy of inward-looking, relying on import-substituting industrialization coupled with pro-active state. In this era the state was the cornerstone of development and it appeared self evident that active state, pursuing interventionist economic policies in accordance with the development plans could master the art of breaking the vicious circle of poverty and under development within a relatively short period. This strategy was by no means exceptional, given the prevailing literature at the time on economic development. Thus, the role of the state was enormous as it undertook investments in sectors seen as key, providing generous incentives - including interest rate and credit subsidies - particularly to state-owned enterprises (SOEs) and to private investments in priority sectors, and using a system of trade and exchange controls to protect industries. Consistent with these policies, most key private enterprises were nationalisedⁱⁱ and banks were part of the firms that were affected as the government took a majority stake and consequently the government obtained exclusive control over the allocation of credit in the economy. In a nutshell, subsequent to this policy the key function assigned to the financial sector was to collect savings at low cost and channel them to the government and to the identified priority sectors.

At independence in 1962, there were four commercial banks, all international banks, namely, Standard Chartered, Barclays, Grindlays and Bank of Baroda. These banks, as in many other newly independent African countries, were widely criticized for lending only short-term, for the finance of foreign trade and the provision of working capital, to companies owned from abroad or by the non-African resident community (Brownbridge, 1998). Thus, there was a discontent over the lending policies of these foreign banks and a belief that government intervention was necessary to ensure that the banking system played a more supportive role in the development of

the economy (Brownbridge, 1998). Consequently, the financial policies in this epoch were aimed to control banking markets, ostensibly for developmental and other non-commercial objectives. The government subsequently established two public banks (Uganda Commercial Bank and Co-operative Bank) which later acquired monopoly of banking virtually everywhere outside Kampala. Given the reasons for which they were created, it was inevitable that the government commercial banks were expected to provide credit to people and sectors of the economy to facilitate government development programmes, although the emphasis of their operations changed with the priorities of different governments.

In particular, successive governments after independence adopted interventionist policies towards the financial sector as interest rates were controlled, the government compulsorily purchased 49 percent equity stakes in the international banks, and variety of administrated lending programmes were established. Nominal interest rate controls were actuated by the belief that the cost of credit had to be kept low to encourage investment and to subsidize favoured borrowers. Exchange controls were also used, most notably to force residents to invest their savings in domestic assets. This meant that commercial banks found it easier to attract deposits and at lower interest rates than would otherwise have been the case.

Subsequently, the state held a dominant stake in the financial sector and as a whole, the system was tightly regulated and taxed through administered interest rates and directed credit, and high legal reserve requirements (Obwona and Mugume, 2001). The role of market mechanisms was substantially limited. This meant that the financial sector's key role in the economy of facilitating the mobilization and allocation of savings, which would have allowed individual entities to smooth consumption and use external financing to carry out ventures by lending and borrowing that otherwise would not have been undertaken, was eroded. The availability of automatic liquidity support from the Bank of Uganda, and the lack of proper accounting procedures allowed the imprudent management of the government owned banks. For instance, by the late 1980s, Uganda Commercial Bank's non-performing loans accounted for about 75 percent of its total loan portfolio. Undoubtedly, although the protracted economic crisis, disruption caused by war and the weak legal system made the lending climate for the banks in Uganda very difficult and undoubtedly made some contribution to the bad debts of the public banks, the scale of the problem is attributable to the poor lending practices rather than exogenous factors (Brownbridge, 1998).

Further, prudential regulation and supervision were not accorded much emphasis by the government and Bank of Uganda (BoU). Supervisory capacities in the BoU were too weak for it to discharge many of the functions it was assigned by the 1969 Banking Act. Prudential regulation and supervision were neglected in part because the foreign banks were subsidiaries of well established and reputable foreign banks which had their own prudential management rules. It was extremely unlikely that they would be allowed to fail by their parent banks. The issuing of detailed prudential regulations and the BoU supervision of banks therefore appeared largely irrelevant. The bank supervision department therefore acquired little or no working experience, and its capacity was further eroded by human capital flight due to insecurity and falling real wages as the economy deteriorated. In addition, it would have been difficult for the central bank to over rule the activities of the government owned banks, especially where the latter were

claiming that they were acting according to government development policies. Moreover, supervision of government banks to prevent their failing could have been unnecessary because the government was expected to rescue them.

These policies coupled with civil disturbances during the 1970s and the 1980s had very damaging effects on the banking system as financial repression deterred the public from holding bank deposits (Brownbridge, 1998). Subsequently, financial services became concentrated only in few commercial banks around the capital city. Moreover, the government had a monopoly over the entire banking sector as regards their spread and operations, and as such, monetary policy was subordinated to fiscal imperatives. In addition, the policy of directed credit generated an attitude towards public credit or government guaranteed credit, whereby loans were often regarded as grants and therefore reinforced the already weak quality of loan portfolios. Subsequently, the system became concentrated and high bank dependent, the role of market mechanisms was severely limited and with little effective competition for loans and deposits, like any public sector, they became over-staffed, and loans were not made by value-maximizing principles. The lack of competitiveness in the system resulted in excessive rent seeking and the poor performance of the sector as regards its innovation and ability to render quality service. The result was that the credibility of financial institutions was severely impaired. This therefore meant that the financial sector's key role in the economy; that of facilitating the mobilization and intermediation of savings was gradually undermined.

In addition, as inflation accelerated, the result was a portfolio shift from financial to tangible assets, investment in unproductive inflation hedges, and substitution from domestic formal financial assets that could be mobilised to stimulate growth to foreign currency denominated assets, and subsequently this spurred capital flight (Kasekende and Atingi-Ego, 1999). Therefore, the scope of credit remained severely restricted and this reflects the McKinnon-Shaw hypothesis. Moreover, the redistributive policies made credit available to politically favoured classes of borrowers at concessionary interest rates and led to the politisation of commercial life.

Furthermore, the distorted financial institutions produced a bias in favour of current consumption against future consumption as a result of the interest rate ceiling and this had unpleasant consequences for investment and growth. Indeed, there is a large body of empirical work testing the positive relationship between financial depth and economic growth, and the balance of the evidence tends to support the McKinnon-Shaw hypothesis (Fry, 1995; Levine, 1997; Khan and Senhadji, 2000). This therefore meant a vicious circle existed between the financial sector and the macro-economy whereby the insolvent financial system undermined confidence in the financial sector, resulting in a low savings rate, inflation hedges, and a lack of monetary depth. In turn, the lack of monetary depth and other inefficiencies in the financial system contributed to macroeconomic instability and deterred growth.

In a nutshell, consequent to government involvement in the financial sector, the balance sheets of the financial institutions deteriorated as their capital bases eroded in the face of large loan losses. As a result the scope of financial institutions remained severely restricted, which in turn led to the concentration of financial services in the hands of a few commercial banks, the largest being

the government-owned Uganda Commercial Bank (UCB), which in 1986 had more than 70 percent of the total banks assets but operated with very little regard for commercial principles and accumulated a massive portfolio of bad debts as a result (Harvey, 1993).

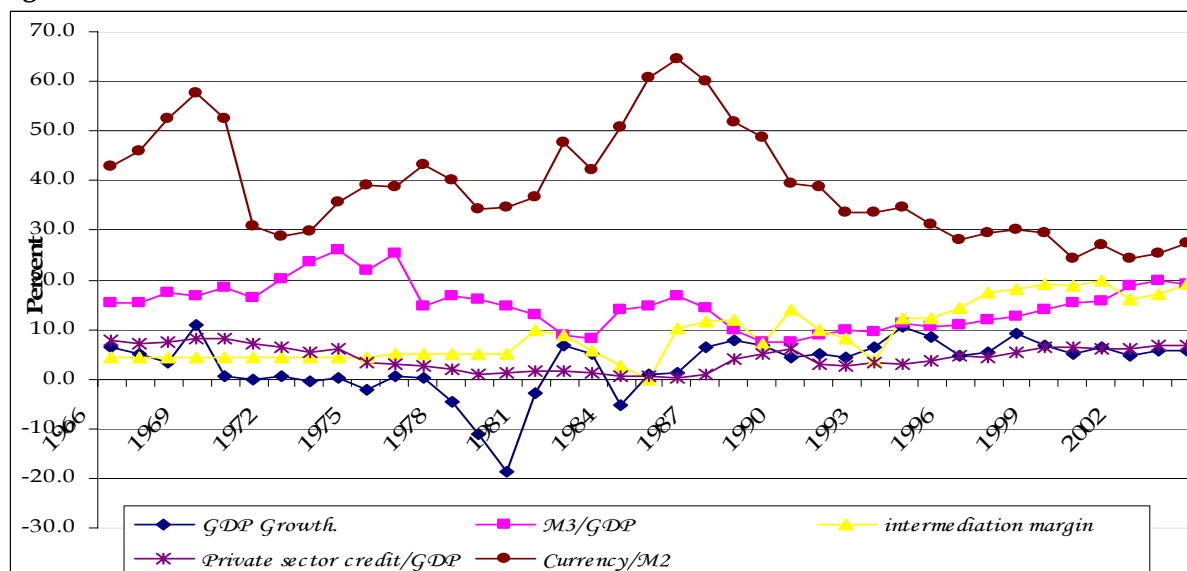
By the late 1970s and early 1980s, the financial system was extremely weak and the government stepped in to meet the credit requirements of firms especially those classified as engaged in productive activities by providing direct support or guarantees of repayment through the central bank. Put simply, this was through provision of high-powered money, which further aggravated the inflationary pressures and hence worsening the already negative real interest rates and the high inflation rates further eroded the capital base of most commercial banks. The capital base decline coupled with a rising volume of non-performing assets of the banking system threatened the solvency of the financial system. Moreover, as the nominal interest rate were held well below the rate of inflation, the negative real returns on monetary assets contributed to the steep decline in financial depth as observed in figure 1. The attractiveness of bank deposits for the Ugandan public was further eroded because the banks operated a very inefficient payments system, hence cash was needed to effect most transactions (Brownbridge, 1998).

Although the severe financial shallowing in Uganda was partly attributable to developments exogenous to the banking system-the share of monetized output in GDP declined as a result of acute security problems and unattractive producer prices paid to farmers-it is no doubt that sustained financial repression had very damaging consequences for the banking system. As evident from figure 1, these troubles spawned severe contraction of Uganda's monetary sector, broad money over GDP declined from 17 percent in 1970 to 5 percent in 1985. The eventual result was that credibility of financial institutions and their products were severely dented, and the financial system became shallow while the proportion of money held in the form of cash increased (Obwona and Mugume, 2001).

As can be noticed from figure 1, the troubles of the 1970s and 1980s spawned a severe contraction of Uganda's monetary sector as evidenced by a decline in financial intermediation, and a loss of financial depth as measured by M_3/GDP . This in part contributed to the observed decline in GDP growth rate. In particular, the distorted financial institutions as a result of interest rate ceiling produced a bias in favour of current consumption against future consumption, and this had unpleasant consequences on investment and growth. Moreover, these policies had redistributive impacts because they made credit available to politically favoured classes of borrowers at concessionary interest rates. Consequently, with little effective competition for loans and deposits, the financial system became extremely weak. At a latter stage, the government stepped in to meet the credit requirements of SOEs and other private firms politically classified as engaged in productive activities by providing direct support or guarantees of repayment through the central bank. Put simply, this was through provision of high-powered money, which aggravated inflationary pressures and hence worsened the already negative real interest rates. The high inflation rates coupled with excessive government intervention eroded the capital base of most commercial banks. Moreover, as inflation accelerated, there was portfolio shift from financial to tangible assets (e.g. land, buildings and animals). Furthermore, due to politicisation of the sector, like any public sector, the banks also became over-staffed with persons not well

trained or recruited on merit, and businesses were not conducted based on value-maximizing principles. The result was that credibility of financial institutions and their products were dented.

Figure 1. Financial sector indicators: 1966-2004.



Source: World Development Indicators, 2004 CD ROM and Bank of Uganda.

Consequently, the balance sheets of these financial institutions deteriorated largely because of the eroded capital base and large loan losses. This in turn led to the failure of many non-bank financial institutions and to the concentration of financial services in the hands of a few commercial banks, the largest being the government-owned Uganda Commercial bank Ltd (UCBL). This period also saw the politicisation of commercial life and an undermining of professional and ethical standards.

2.1 Financial sector reforms.

Faced with increasing economic difficulties and influenced by the worldwide trend toward adjustment policies, the government since 1987, embarked on a wide-ranging structural reform programmes. By the late 1980s, the institutional fabric of the banking industry was severely damaged as a result of misguided financial policies and the effects of civil war and economic decline. This therefore necessitated reforms to liberalise the financial sector and enhance its efficiency. The key financial sector elements in the structural adjustment policy package were the usual traditional policies aimed at resource mobilisation.

Until 1993, the 1969 Banking Act was the basis of prudential regulation and supervision and had become outdated and its provisions were deficient in many respects. The Act failed to delineate appropriate prudential requirements to be followed by the banks. Instead it specified a number of allocative requirements. Consequently, weak prudential regulation failed to curb the prolonged mismanagement of banks, especially the government owned banks and also allowed the emergence of several undercapitalized and imprudently managed banks in the late 1980s and early 1990s (Harvey, 1993). The cornerstone of the financial sector reform was therefore enactment of a new Financial Institutions Act which rectified most of the legislative defects.

Under the 1993 Financial Institutions Act, the minimum paid-up capital for local investors to start a bank was set at Sh 500 million (equivalent to US 500,000). It also specified minimum ratios for core capital and total capital to risk-adjusted assets of 4 percent and 8 percent respectively, along the lines of the Basle accord on capital adequacy. The Act imposed restrictions on insider lending, large credit exposures, and investment in non-bank business and purchase of real estate. Exposure to a single customer or group of customers with a common interest and aggregate lending to a bank's own directors, their families and businesses, were both restricted to a maximum of 25 percent of core capital. It also gave Bank of Uganda (BoU) a range of options for dealing with financial institutions acting imprudently, infringe regulations or have otherwise become insolvent. The 1993 Financial Institutions Act was reinforced by the Bank of Uganda Act of 1993, which sought to enhance and streamline the formulation and implementation of monetary policy by the central bank. This resulted in the lifting of interest rate ceiling and eliminating credit limits, and liberalisation of the foreign exchange market. These were followed by the new Financial Institutions Act of 2002 aimed at reducing the prevalent insider lending and equity concentration, strengthening banks internal management, and strengthening supervision and regulatory roles of the central bank; Micro Finance Deposit taking Institutions Act of 2003 which resulted in licensing of four micro finance institutions to take deposits (Tier III).

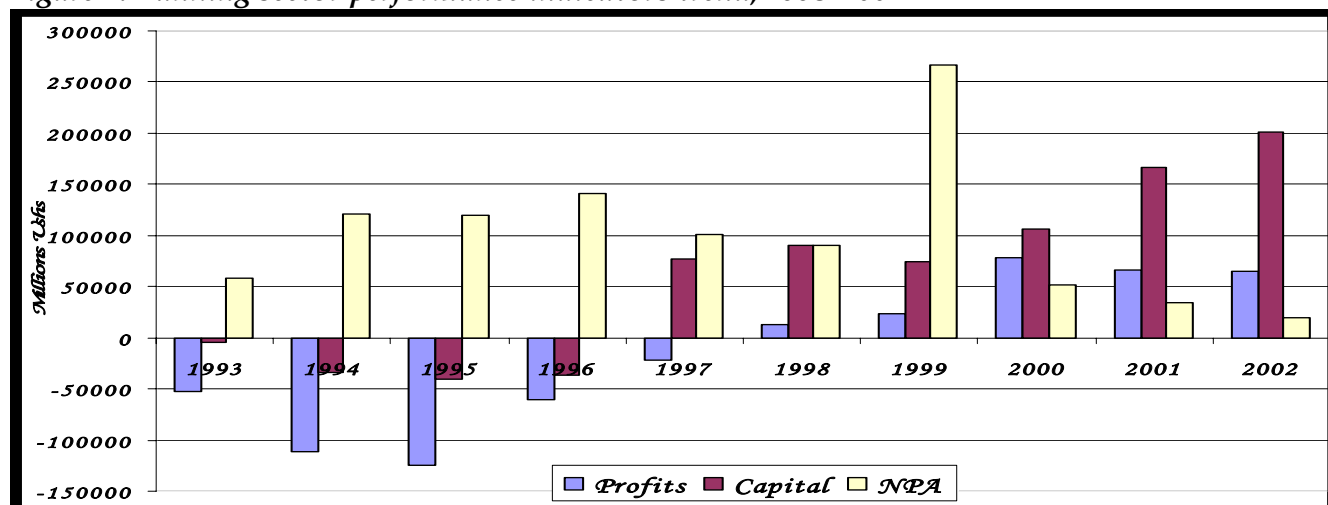
A crucial component of financial reforms was the restructuring of the Uganda Commercial Bank (UCB) and latter its privatization, which by the late 1980s was insolvent, with 75 percent of its loan portfolio non-performing yet it had expanded into a near-monopolistic position in banking market. Government efforts to use the UCB to channel credit to finance to farmers and other priority sectors on developmental grounds made a major contribution to the UCB's financial distress (Brownbridge, 1998). In part, to fulfil its developmental roles, it also over expanded its branch network and staffing levels, which raised overheads to excessive levels. The restructuring therefore involved its restructuring its balance sheet to restore the bank to solvency. This involved establishing a Non-Performing Assets Recovery Trust (NPART) to which non-performing assets were transferred. The cost of restructuring its balance sheet was about Sh90 billion (equivalent to about US \$ 900,000), which was equivalent to 2 percent of GDP.

Overall, a number of failures and ineffective supervision had previously led to a significant loss of confidence, and low levels of intermediation. However, much has been achieved in recent years to remedy the deficiencies. These include:

- i. The privatization of Uganda Commercial Bank, one of the key stability risks that faced the system due to large non-performing assets and imprudent management;
- ii. The clean up of some weak banks from the banking system;
- iii. Improvement in banking supervision with introduction of risk-based approach and passage of the new Financial Institutions Act; and
- iv. The presence of reputable banks that appear to be well capitalized, profitable, and resilient.

With a sufficiently strong capital base, profits, effective management, good corporate governance, and well designed systems and controls, the system is well placed to provide a growing contribution to the development of the economy. The ultimate goal has been to enhance the development of an effective, efficient and competitive financial system.

Figure 2. Banking sector performance indicators trend; 1993-2002



Source: Bank of Uganda, annual report, various years.

Subsequent to these reforms, the banking industry has been strengthened in many important aspects over the last few years and is now stronger and vibrant but still at low levels of development compared to other developing countries. Financial deepening has shown positive trend and in part, this has been achieved through effective supervision and enforcement of prudential regulations in the banking system, increased frequency of on-site inspections and surveillance. In addition, improvements in supervision methodology and the prudent management of monetary and exchange rate policy by the BoU have contributed to strengthening the financial sector. This indeed has contributed to minimizing the non-performing assets (NPA) as well as enhancing the profitability of the sector as evident in Figure 2. NPA fell from 29 percent of the portfolio in 1999 to 12 percent in 2000 and further to 2.6 percent in 2004. The cleanup of the portfolio of UCB and its subsequent merger, and closure of trouble banks are key factors in explaining this improvement. High interest rates margins and the marked reduction in NPA have underpinned banks' profitability. However, this performance is heterogeneous as several of the smaller banks are still riddled with poor lending practices. Moreover, notwithstanding the improvements, the structure of banks' balance sheets still reflects the high credit risk in the economy, a preference for liquid and low-risk assets, and a low level of intermediation. As of 2004, loans constituted only 28 percent of total assets. As a result, funds invested in government securities (29 percent) and placed abroad (22 percent) comprise roughly half of the total sector assets.

2.2 The structure of Uganda Financial Sector.

By early the 1990s, the banking sector was comprised mainly of four foreign banks (Standard Chartered, Standard Bank, Barclays and Baroda), and the two large indigenous banks (UCB and Co-op) that controlled 70 percent of the banking assets and liabilities but were insolvent. By the end of 2005, the system had substantially grown and was made up of a formal and an informal sector. The number of commercial banks increased to 20 in 1996, when a moratorium on banking licences was imposed and after the closure of some banks and consolidation, fell to 15. The formal sector encompassing the Central bank, 15 commercial banks (Tier 1), 8 credit institutions (Tier 2), and since 2004 microfinance deposit-taking institutions (Tier 3), National Social Security

Fund (NSSF), a Postbank, 18 insurance companies, 82 Forex bureaux, 3 development institutions, and a stock exchange. The informal sector comprises of a wide range of moneylenders, Savings and Credit Cooperative Associations (SACCO), Rotating Savings and Credit Association (ROSCAs) and the Microfinance Institutions (MFIs). In terms of the informal financial institutions, there has been a considerable progress in expanding the outreach of these institutions and improving the access to financial services especially by the rural population. However, despite this proliferation, the building societies that had mushroomed in 1980s and early 1990s have long disappeared from the scene, and the current commercial bank branch network of 126 compared to 146 in 1996 and 290 in 1972 appears to depict a contrary picture of the industry. This has resulted in a rapid deterioration in the ratio of customers per bank branch from 34,000 in 1972 to 80,000 and 100,000 in the 1980s and 1990s, respectively, and to about 190,000 in 2002. This compares very poorly with the average of 7000 customers per bank branch for the COMESA region (Mayer, et al, 2004).

While Uganda has a well-developed and diversified microfinance industry; it nonetheless suffers low capitalization and legal restrictions. These handicaps limit the industry's ability to meet the development finance needs of the rural and micro enterprise sector that forms the bulk of Uganda's productive enterprises and account for more than 50 percent of GDP. Thus, microfinance cannot overcome the chronic shortage of larger and longer-term loans to small scale enterprises, especially in the commercial farming sector. On the other hand, Uganda's capital market is not developed enough to play any significant role in furnishing long-term funds to the economy. Similarly, the pension system is very weak where mobilizing long-term funding is concerned. Moreover, the expansion of unregulated SACCOs, ROSCAs and MFIs cause a concern regarding the safety of small-balance deposits which they illegally hold. Some of these institutions use subsidized funds from the government supported Microfinance Support Centre which might introduce distortions by weakening credit culture and thus undermine the viability of these institutions.

Overall, though financial depth remains low, signs of recovery are unmistakable and encouraging. Financial intermediation is low, playing a limited role in the provision of funds for development finance, and dominated by commercial banks. Basic indicators of financial development in figure 1, such as the broad-money/GDP and currency-deposit ratios, suggest that the financial sector is still underdeveloped. For example, Uganda's financial sector had total assets equivalent to approximately 35 percent of GDP in 2005. In addition, the system is dominated by the commercial banking sector, which by 2005 accounted for almost 80 percent of total sector assets. Other financial intermediaries are limited in number, small in size and relatively ineffective. Consequently, only a limited number of financial instruments are available for savings mobilisation, liquidity management and portfolio diversification.

In comparison to East African Community countries, while Liquid Liabilities to GDP, Bank Deposits to GDP and Private Credit to GDP are similar levels as in Tanzania, they are below the level of Kenya and the overall average for Sub-Saharan Africa and the low-income group. The banking system also intermediates a smaller share of deposits into credit to the private sector, as indicated by the lower loan-deposit ratio than in comparator countries. Interest margin and overhead costs are higher than in than in comparator countries suggesting inefficiencies in the

system which may arise out of its small size, higher operating costs, and/or low levels of competition. A significant proportion of deposits is foreign exchange deposits and these deposits are typically held at international banks and a large part of these deposits are not invested onshore but placed in the international money markets.

The banking is dominated by international banks holding in totality at least 88 percent of total sector assets. The two biggest banks namely Standard Chartered and Standard Bank (Stanbic), together hold market share of about 56 percent. In addition, Stanbic Bank, which acquired Uganda Commercial Bank in 2002, is the largest bank with a market share of about 31 percent on top of boasting the largest branch network in the country of 68. When global financial institutions dominate a country, they can squelch the domestic competition. And as they attract depositors away from small banks, they are far more attentive and generous when it comes to making loans to large corporations than they are to providing credit to small businesses and farmers. With this market structure, new and small bank entrants cannot easily find a market niche, and at best are market followers. In light of this, the BoU had placed a moratorium on licensing new banks based on the argument that the economy is over-banked and that new entrants could further weaken the small banks unless they provide new products. Moreover, it is possible to speculate that these few banks took over the price-setting function when the government relinquished it.

In addition, the banking system still offers a limited array of products and is limited mostly to the short end of the maturity curve, only 17 percent of total deposits are time deposits and less than 0.4 percent of time deposits have a maturity of more than 12 months. Only 12 percent of all loans and 35 percent of loan volume has an outstanding maturity of more than one year. Long-term lending is limited to on-lending of a donor line of credit, channelled through the Central bank. Leasing and housing finance alike suffer from the lack of medium-to long-term funding sources. While leasing rates have decreased, they are still above the rates for unsecured lending.

In the period following liberalization, the bank returns provided to the BoU were inadequate for off-site inspection, and the information they did contain was sometimes not collated and analysed by the BoU, whilst on-site inspections were not conducted regularly. Differences in auditing practices among the banks also complicated the task of supervision. These contributed to banks ignoring banking regulations, such as the liquidity ratios. Moreover, the BoU's willingness to accommodate the credit needs of illiquid banks could have further undermined incentives for bank managers to improve performance. This contributed to several insolvent banks, some of which were restructured and others closed.

Table 1: Financial intermediation across countries, 2004.

	Private credit/GDP	Bank deposit/GDP	Liquid liabilities/GDP	Loan deposit ratio	Overhead costs	Interest margin	Overhead costs	Loan/Deposits	Government and other securities/ Assets	Forex deposits/total deposits
Uganda	5.8%	19.3 %	14.9 %	38.9 %	7.9 %	13.4 %	9.1%	30%	35%	32%
Kenya	22.6 %	42.9 %	34.9 %	60.1 %	6.1 %	6.7 %	5.1%	80%	24%	16%
Tanzania	6.8%	22.2 %	16.7 %	40.9 %	7.0 %	7.7 %	6.4%	34%	20%	37%
SSA	19.1 %	31.3 %	23.6 %	74.2 %	6.1 %	8.3 %	6.7%			
Low-income	15.0 %	30.7 %	22.1 %	70.0 %	5.9 %	7.5 %	6.2%			

Source: IMF/Bank Financial Sector Assessment Program-Update, Nov.2004

2.2.1 Intermediation margin.

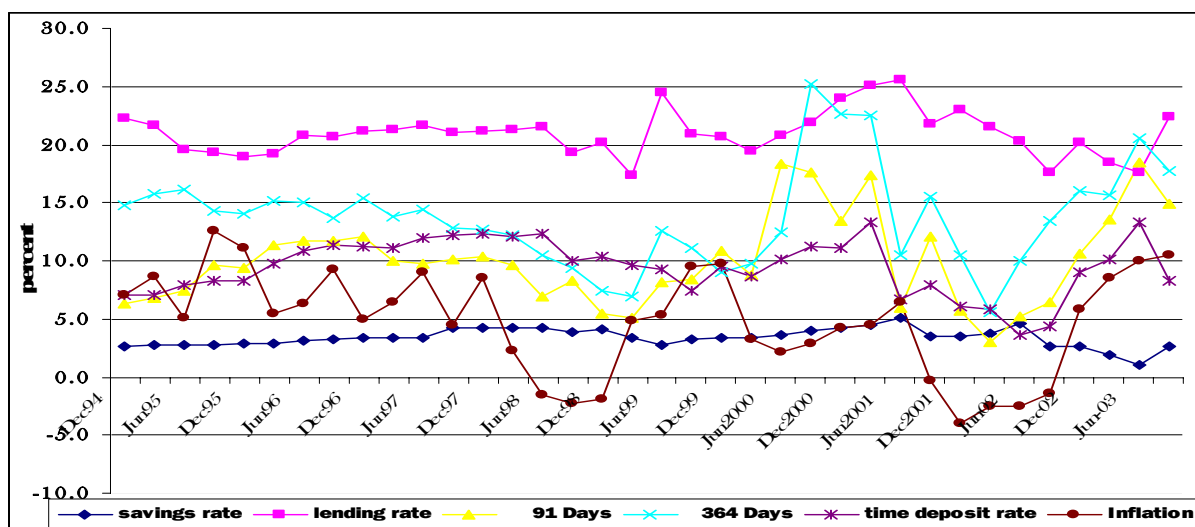
Uganda's banking systems are characterized not only by low levels of intermediation but also by high interest rates, wide intermediation spreads, and substantial bank profitability. High lending interest rates, whether caused by inefficiency or lack of competition, do more than add to borrowers' costs. By pricing the safer borrowers out of the market, high interest rates can increase the risk of lending, making banks less willing to lend and—as has been recognized since the pioneering work of Stiglitz and Weiss (1981)—potentially resulting in credit rationing combined with high bank liquidity. The degree of efficiency and competition in the banking system could be an important factor that explains variation in lending rates.

High interest spread and limited depth and breadth of the financial systems are closely related to each other. Countries with higher interest rate spread have lower levels of credit to the private sector as share of GDP and deposits in the financial system as share of GDP (Honohan and Beck, 2007). If high interest spreads and margins and limited depth and breadth of financial services are the result of underlying deficiencies and impediments in the financial systems, then in order to increase access to financial services and reduce spreads and margins, these underlying causes have to be addressed.

Several other factors could have contributed to these high costs of intermediation. One factor is bank profitability. The overall profitability of Ugandan banks in recent years has been high. High profitability might be due to high risk premiums demanded by bankers, lack of competition, or—most likely—a combination and interaction of both. Bank operating costs are another component of the interest margin. The small size of banks and financial systems in Africa can explain a large part of the large margins and overhead costs. These include: Deficiencies in the system of commercial law for enforcing collateral liquidation in cases of bad loans; Adverse selection due to politically-backed borrowers who in the past were responsible for a large number of non-performing loans; Monetary policy resulting in abundant supplies of high-return risk-free treasury bills; and weak capacity of banks to assess commercial risks, especially of new entrepreneurs, hence their perception of high risk and reluctance to lend. High credit risk and low levels of competition could also be partly responsible for high interest spreads and margins.

Overall, with the far-reaching financial policies, the operations of the industry in credit extension, management, and interest rate determination were expected to reflect market forces thereby lowering intermediation costs, narrowing the spread between the lending and deposit interest rates, and greatly expanding credit. However, contrary to expectations as evident in figure 2, following the financial sector reforms the results were not as expected, real lending interest rate has substantially increased, with large spreads between lending and borrowing rates indicating inefficiency in the banking sector.

Figure 3: Structure of Interest Rates: Dec 1994- Sep 2003.



Source: Bank of Uganda, quarterly reports.

When the intermediation margin is large, it is generally regarded as a considerable impediment to the expansion and development of financial intermediation, as it discourages potential savers because of low returns paid on deposits and limits the financing for potential borrowers, thus reducing feasible investment opportunities and constraining the growth of the economy.

Interest rate spreads are currently 20 percent and have not dropped below 16 percent over the last six years. Decomposition of spreads done by IMF/World bank shows that operating costs constitute almost 50 percent of the spread (nine percentage points) with profits being the second largest component with 30 percent of the overall spread (six percentage points). The significantly higher overhead costs in Uganda account for most of the difference to the interest rate spreads in Kenya. While the 2 percentage points in the spread explained by loan loss provisions can be directly attributed to high credit risk the high overhead costs and the high profit margin can also be partly explained by high credit risk, as banks incur high evaluation, monitoring and enforcement costs.

Table 2: Decomposition of interest spread in Uganda and Kenya.

	Uganda	Kenya	Tanzania
Lending rate	21.7	17.5	12.8
Deposit rate	2.2	3.4	1.4
Overhead costs	9.0	5.1	7.5
Loan loss provisions	2.1	1.7	2.1
Tax	2.3	2.1	1.8
Profit margin	5.7	4.8	1.7
Reserve requirements + deposit insurance premium	0.4	0.4	0.4
Total spread	19.5	14.1	11.4

Source: IMF/Bank Financial Sector Assessment Program-Update, Nov.2004

Lack of credit information sharing on borrowers, wide-spread fraud, dysfunctional land and company registries and deficiencies in the insolvency laws and their administration increase credit risks for banks (Meyer, et al., 2004). The high interest spread and margin also reflect lack of competition within the financial system. The lack of credit information sharing not only increases credit risk and costs for banks, but also undermines the competitiveness of the banking system, as borrowers cannot shop around with their track record.

In 2004, net interest margins, as ratio to total earning assets, were 13.4 percent in Uganda, compared to 8.3 percent in the average Sub-Saharan African country, 7.5 percent in the average low-income country and higher than in the Eastern-Africa community.

Table 3: Interest Rates, Spreads, and Margins in International Comparison, 2004.

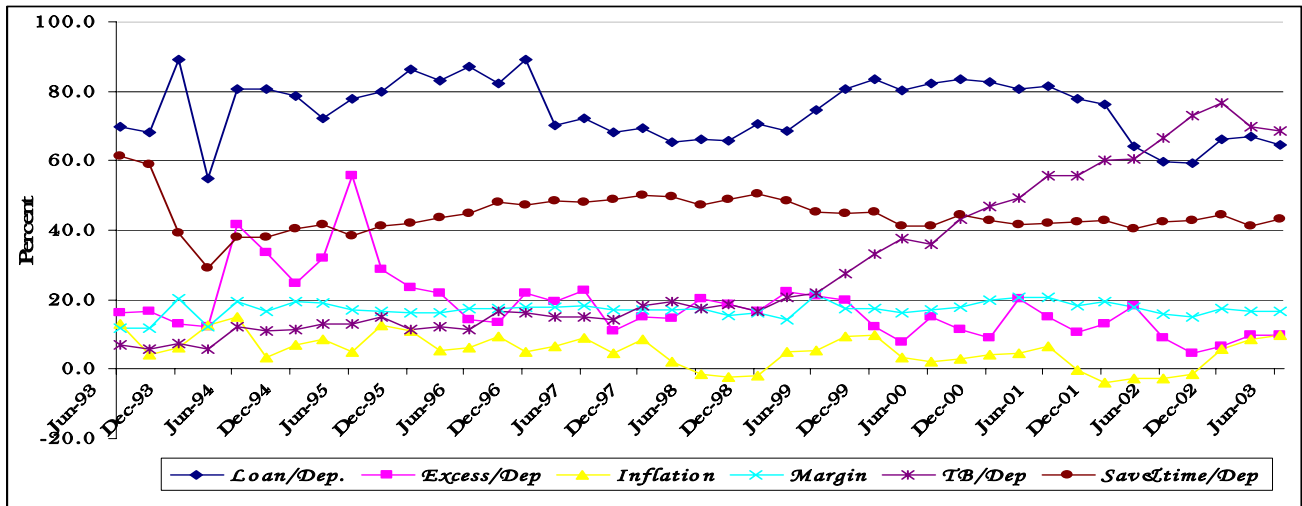
	Real Lending rate ⁱⁱⁱ	Real deposit rate	Interest spread	Interest rate margin ^{iv}
Uganda	19.4	2.9	16.5	13.4
Kenya	16.5	3.5	13.0	6.1
Tanzania	12.0	-1.2	13.1	7.7
SSA	9.9	-1.5	11.5	8.7
Low-income countries	10.8	-1.6	12.4	7.5
OECS countries	4.6	0.5	4.1	3.6

Source: Beck and Fuchs, 2004.

Interest rate spreads could be due to market frictions such as transaction cost and information asymmetries. Transaction costs associated with screening and monitoring borrowers and processing savings and payment services drive a wedge between the interest rate paid to depositors and interest charged to borrowers. These intermediation costs, however, contain an important fixed cost element, at the client, bank and even financial system level. Consistent with this, there is empirical evidence of a negative relationship between the size of banks and financial systems and operating costs and interest spreads and margins. The inability of creditors to diversify risks in a competitive market due to market failures or non-existing markets results in a risk premium in the lending interest rate, increasing the lending interest rate beyond the level necessary to cover the creditor's marginal cost of funds plus the intermediation costs. Consistent with this, banks whose loan portfolios are more exposed to risky and volatile sectors such as agriculture, have often higher ex-ante interest rate spreads. Finally, the inability of the lender to perfectly ascertain the creditworthiness of the borrower and her project ex-ante and monitor the implementation ex-post gives rise to adverse selection and moral hazard, effectively adding another risk premium to lending interest rates. However, lack of possibilities to diversify risks and asymmetric information can also result in higher loan loss provisions for non-performing loans, which will reduce banks' ex-post interest margins. Other bank characteristics can explain variation in spreads and margins. Higher liquidity ratios as protection against sudden withdrawals reduce the share of deposits that can be used for lending, thus increasing ex-ante spreads. More profitable banks might be able to charge lower interest rate spreads or enjoy scale economies, thus charging lower spreads, or use their market power to charge higher spreads.

Interest rate spreads and margins, however, are not only determined by bank characteristics but also by the market structure. More competitive systems are expected to see more efficient banks with lower spreads and margins.

Figure 4: Credit, TBs, Excess reserves, Intermediation margin and inflation: June 1993-June 03.

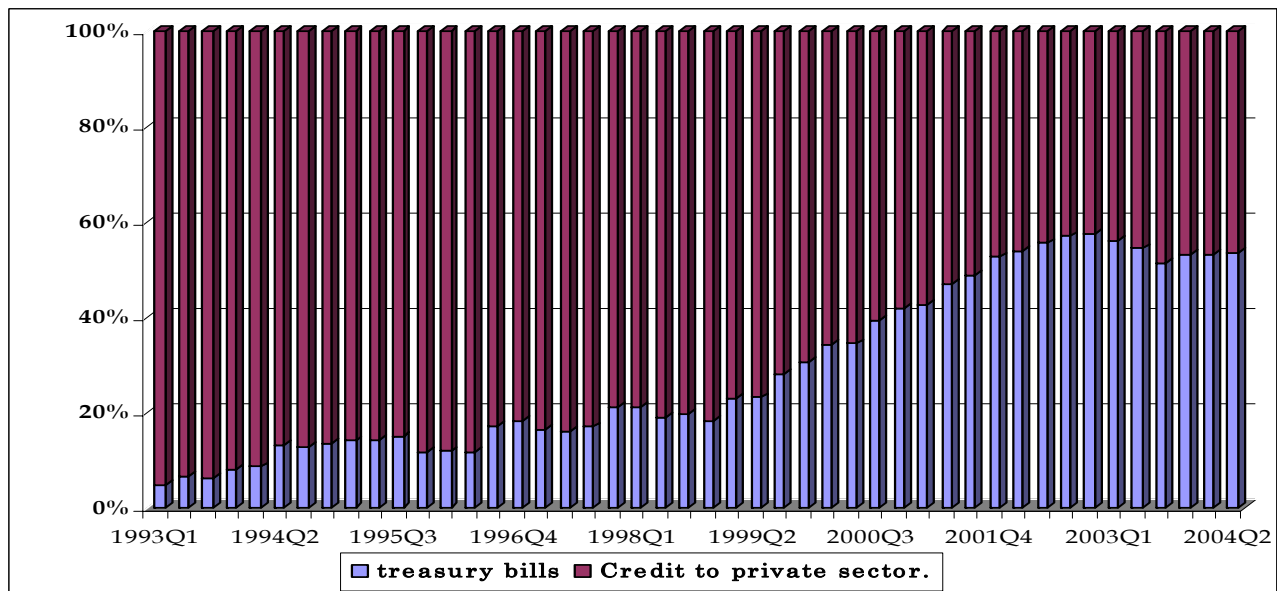


Source: Bank of Uganda, quarterly reports.

2.2.2 Commercial banks' assets portfolio shift.

The structure of commercial bank's balance sheet reflects their preference for liquid low-risk and high yield assets, especially treasury bills.

Figure 5. Banks' portfolio composition-Treasury bills and credit.

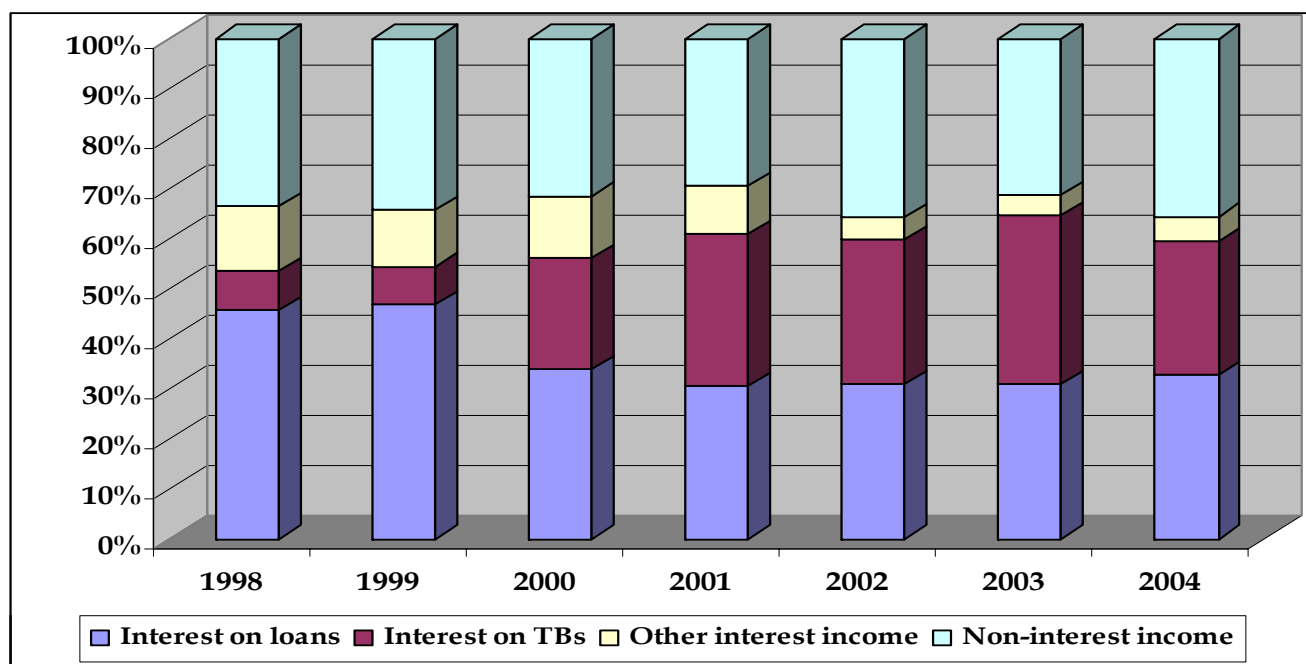


Source: Bank of Uganda, quarterly reports.

Low risk financial instruments, such as short-term working capital loans for domestic trading activities, government bonds, and treasury bills have become the most popular forms of

investment for the commercial banks. Banks with excess liquidity but limiting their lending to prime customers is a chronic and pervasive problem for the country. Total bank deposits have increased almost tenfold since the late 1980s, but they have not been translated into more affordable credit for private investment. Banks in the main have shifted their assets and loan portfolios into TBs and short-term loans. This suggests that even creditworthy customers have had limited access to the formal financial sector. Figure 6 shows clearly that treasury bills have become a lucrative form of investment for the commercial banks although on decline in recent years. Given that commercial banks are the predominant source of external financing, the shift in their asset portfolio away from credit to the private sector is likely to have significant implications for firm performance. Firms that are riskier or have lower profitability are likely to be crowded out of the market for external financing. It follows that small and medium firms will be most affected by this development. Moreover, high interest rates paid on treasury-bills mean that banks can be assured of high and safe returns simply by devoting a large proportion of their assets to them. They have little incentive to seek new lending opportunities. Moreover, as evident in figure 2 the high variability in the TB rate creates uncertainties for banks about future investments, which subsequently could increase the option value for waiting, hence contribute to the build up of excess reserves.

Figure 6: Structure of Commercial Bank Income, 1997-2002



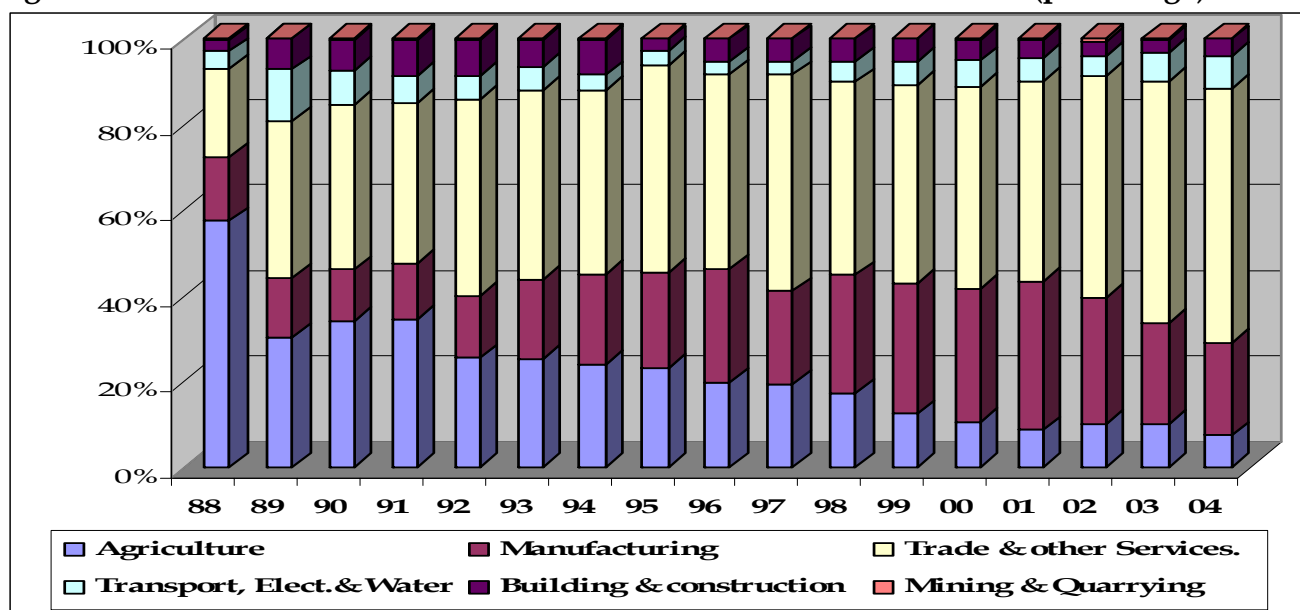
Source: BOU, Bank Supervision annual reports.

2.2.3 Credit Market Structure.

The amount of credit that the banking sector makes available for productive uses is one of the most significant measures of financial development. Such an indicator of size of the banking sector has been shown to have a significant positive effect on growth (Cetorelli and Gambera 2001). Banks with monopoly power would determine, with respect to perfect competition, an equilibrium with higher loan rates and a smaller quantity of loanable funds.

One of the prime objectives of a good banking system is to provide credit at good terms to those who will repay. In a largely rural economy like Uganda, it is especially important for farmers to be able to obtain credit at reasonable terms to buy inputs. One noticeable change evident in Figure 4 in the credit market is that the period after the financial reforms witnessed a change in the composition of private sector credit from the formal financial institutions. The sectoral breakdown offers some interesting observations. The distribution of credit is lopsided with commercial bank loans to trade and services accounting for more than 60 percent of total private sector lending, while agriculture which used to dominate the credit market, dominates the economy with 36 percent share of GDP in 2004/5, employs about 80 percent of the labour force and generates almost all of the country's exports, receives only about 7 percent of the total credit. This reflects the fact that agriculture is more risky than other sectors. Also agricultural borrowers, mostly small farmers, often lack the necessary collateral as most land, particularly outside of greater Kampala area, is not accepted as collateral or accepted only at a high discount and have limited credit education and this makes their ability to properly manage borrowed resources weak. The government considers this sector the engine of growth and thus envisions eradication of poverty through it. Given its dominant stake in economic development, broader access to credit may have important implications for growth and this creates a potentially positive role for public policy both in establishing the ground rules governing market structures and via a vast variety of more explicitly dirigiste policy intervention. From the bank's point of view, this could be optimal as farmers are small, their incomes more uncertain and they are scattered and therefore costs involved in monitoring and evaluation is substantial. Therefore, whilst it is important to underscore the inefficiencies and distortions caused by the government involvement, liberalisation is not panacea for all the ills in the sector. The denial of the active government for fear of the rent seeking behaviour is likely to be a denial of the possibilities of accelerating development through deliberate government involvement, particularly governance of the market towards greater mobilisation and allocation of resources.

Figure 7: Loans and Advances of Commercial Banks to Economic Sectors (percentage)



Source: Bank of Uganda, Quarterly publications, several series.

In summary, during the past decade, the structure of Uganda's banking system has been undergoing rapid and fundamental changes. Most importantly, the largest, government-owned bank was privatised to a foreign bank, with the result that the share of foreign-owned banks has increased from 62.4 percent in the late 1990s to about 90 percent in 2005 in the deposit market and 61 percent to 82 percent in the loan market. What effect did these structural changes have on the banking industry competition?

In summary, profit margins are higher in Uganda's banks than in the neighbouring countries. One would have expected that intensity of competition should reduce profit margins. However, due to presence of small banks which are unable to exert competitive pressure on few international banks dominating the system, the system is less competitive and inefficient. Overall, the combination of wide interest margins, sizeable overhead costs, and an ample supply of relatively low-risk, high-return government paper could have resulted in high costs of intermediation. Since the large margins also could be a reflection of the non-performing loans, the recent reduction in non-performing loans should be reflected in the improvement of the banks' loan portfolios hence improving the stability of the system.

The preceding section summarises major structural issues in the Uganda's financial sector. These underscore the need to investigate how these traits affect banking system's competition and profitability, hence the development of the economy.

3. Literature survey aspects.

Banking efficiency is instrumental in economic development (Fry, 1995; Barajas, et al., 2000; Chirwa, 2001; Randall, 1998). Inefficiencies in the financial system in most developing countries have persisted even though most countries have undertaken financial liberalisation over the past two decades or so. Gelbard and Leite, (1999) observe that in many SSA countries the range of financial products remain extremely limited, interest rate spread are wide, capital adequacy ratios are often insufficient, loan recovery is a problem, and the share of non-performing loans is large. The expectation is that the removal of government controls on interest rates and of barriers to entry into the financial system would lead to greater competition and improve performance of the financial institutions. A number of studies have argued that unless bank behaviour changes, financial liberalisation cannot be expected to lead to a significant improvement in the efficiency of the financial system. There are several explanations for limited changes in the financial system efficiency following financial liberalisation. First, following Bain's (1951) market structure, conduct and performance hypothesis in the industrial organisation literature, poor performance may persist if financial sector reforms do not significantly alter the structure within which banks operate. Gibson and Tsakalotos (1994) point out that competitive pressures that results from conditions of free entry and competitive pricing will raise the functional efficiency of intermediation by decreasing the spread between deposits and lending rates. Although the empirical evidence of a positive and significant relationship between market structure and banks performance yields non-robust results, there is compelling evidence to suggest that market structure plays an important role in altering the performance of banks (Gilbert, 1984; Berger and Hannan, 1989; Molneux and Forbes, 1995; Maudos, 1998 and Demirguc-Kunt and Huizinga, 1999). The most recent literature (Barajas, et al., 1999; 2000) supports the hypothesis that banks performance indicators are positively related to market power.

Second, the removal of credit controls during financial liberalisation may worsen the quality of loans that may in turn lead to increased risks of systemic crises. Brownbridge and Kirkpatrick (2000) note that liberalisation of interest rates and removal of credit controls may allow those that are not constrained by prudential regulations, to invest in risky asset in order to maintain larger market shares. This may reduce the quality of assets that in turn may result in a higher proportion of non-performing loans and provisions for doubtful debts. Banks tend to offset the cost of screening and monitoring due to bad loans/or the cost of foregone interest revenue by charging higher lending rates (Barajas, et al. 1999). These responses are likely to impact on banking sector's performance. Randell (1998) finds support for the positive and significant association between poor bank performance and provisions for doubtful debts in the Caribbean countries. Barajas, et al., (1999; 2000) further confirm that the cost of poor quality assets is shifted to bank customers through higher spreads in the Colombian financial system. However, Brock and Rojas-Suarez (2000) find a significant negative relationship in the cases of Argentina and Peru.

Third, there is overwhelming empirical evidence that high non-financial costs are also a source of persistent inefficiency in banking sector in developing countries. Non-financial costs reflect variations in physical capital costs, employment, and wage levels. High non-financial costs may result from inefficiency in bank operations that may also be shifted to bank customers, particularly in imperfect markets. Dermirguc-Kunt and Huizinga (1999) find evidence of a negative relationship between bank performance and overhead costs. Barajas, et al. (1999, 2000) and Brock and Rojas-Suarez (2000) also find significant evidence of the positive relationship between bank inefficiency and non-financial costs.

Fourth, Macroeconomic instability and the policy environment may also affect the pricing behaviour of commercial banks and therefore their performance. In order to capture the effects of the macroeconomic and policy environment, the bank performance equations include inflation, growth of output and money market real interest rates as control variables. For example, Claessen, et al. (2001); Dermirguc-Kunt and Huizinga (1999); Brock and Rojas-Suarez (2000) note that banking industry performance and inflation are negatively associated.

In summary, whilst financial liberalisation should generally lead to an improved banking sector performance, whether it actually improves will depend on a number of factors. Generally, banks' efficiency can increase or remain low depending on the competitiveness of the banking system, the cost structure of the market, the sophistication of the banking system, and the macroeconomic environment.

According to the literature on industrial organisation, there are two main explanations for the likely impact of market structure on the conduct and performance of firms: market power and efficiency. The market power explanation has two hypotheses: the structure conduct-performance (SCP) hypothesis and the relative Market Power (RMP) hypothesis. The traditional structure-conduct-performance hypothesis is based on the proposition that the persistence of economic profits is indicative of allocative distortions, and is due to some features of market structure that foster collusion and retard competition among firms in the industry (Bain, 1951). Since concentration facilitates collusive or monopolistic practices, firms in concentrated markets

will earn higher profits than firm operating in less concentrated markets irrespective of their efficiency. This hypothesis suggests that banks in concentrated markets would be able to extract monopolistic rents by their ability to offer low deposit rates and high loan rates. A related theory is the Relative-Market-Power hypothesis (RMP), which states that only firms with large market shares and well-differentiated products are able to exercise market power in pricing these products and earning supernormal profits (Shephard, 1986).

In contrast to these two market-power theories, there are also two efficiency explanations of the positive relationship between profits and either concentration or market share, that is, of the positive relationship between profit-structure relationship. The *X – efficiency* version of the Efficient-Structure hypothesis posited by Demsetz (1973), and Peltzman, (1977), asserts that efficient firms increase in size and market share because of their superiority in producing and marketing products. Here, the positive profit-structure relationship is spurious, rather than of direct origin, with efficiency driving both profits and market structure. It is due to such expansion that the degree of concentration of a market increases, while at the same time the firms increase their profits.

Under the *Scale – Efficiency* version of the efficient-structure hypothesis, firms have essentially equally good management and technology, but some firms simply produce at more efficient scales than others, and therefore have lower unit costs and higher unit profits. These firms are assumed to have large market shares that may result in high levels of concentration, again yielding a positive profit-structure relationship as a spurious outcome (Lambson, 1987). The two market-power (*MP*) hypotheses have radically contrasting implications from the to efficient-structure (*ES*) hypotheses.

The traditional concerns about concentration in product markets focuses on the social loss associated with the exercise of market power at high levels of concentration. The higher prices in concentrated markets bring about a restriction of output relative to the competitive level and thereby misallocate resources. The social cost of this misallocation has been approximated by the difference between loss in consumer surplus and gain in producer surplus occasioned by non-competitive pricing. Another possible social loss associated with the exercise of market power focuses upon lessened effort by managers to maximize operating efficiency due reduction in competitive pressure. Thus, in addition to the traditionally reorganized higher prices and reduced output from market power, there may also be higher cost per unit of output in concentrated markets because of slack management (Berger and Hannan, 1998; Caves and Batton, 1990). This could also result in managers to pursue objectives other than Bank profits or managerial leisure, e.g. the expansion of staff or other utility-enhancing inputs beyond levels justified by profit maximization (expense preference behaviour) or the reduction of risk below levels justified by maximization of shareholder value (Hannan and Mavinga, 1980). Another cost related argument is that managers may expend resources to obtain and maintain market power. For example, banks might spend resources on lobbying efforts to limit the number of banks or to preserve geographic restrictions on branching in order to maintain barriers to entry and impediments to competition. Such expenditures would raise costs and reduce measured cost efficiency, although profits may be higher as a result. In addition, the price cushion provided by

market power may simply allow inefficient managers or practices to persist without any intention to pursue goals other than maximizing bank value. The lack of market discipline in concentrated markets may simply blunt the economic signals that would normally force changes in management to keep costs low, leaving managers in positions for which they do not have competitive advantages. Thus, market power may allow managerial incompetence to persist without any wilful shirking of work effort, pursuit of other goals, or efforts to defend or obtain market power (Hay and Liu, 1997; Berger and Hannan, 1998). Therefore, the preceding discussion points to the fact that banks in concentrated may take advantage of market power, but much of the benefits of this power may be manifested as higher costs rather than as higher profits.

A number of studies, most of them in developed countries, have been carried out to test these hypotheses but there is no conclusive evidence in relation to either (Shephard, 1982; Rhoades, 1985; Brozen, 1982; Smirlock et al, 1984; Smirlock, 1985; Evanoff and Fortier, 1988; Berger and Hannan, 1989; Berger, 1995; Molyneux and Teppet, 1993; Ruthenbug, 1994 and Goldberg and Rai, 1996).

The most recent refinements to the tests of the two hypotheses are done by Berger (1995), who uses direct measures of both X-efficiency and Scale-efficiency in the empirical analysis in order to explain whether the structure-profit relationship reflects superior management or greater market power of firms with large market shares. His results provide no conclusive evidence to support fully any of the two hypotheses.

As a first-order effect, one would expect increased competition in the financial sector to lead to lower costs and enhanced efficiency, even allowing for the fact that financial products are heterogeneous. Recent research has highlighted, however, that the relationships between competition and banking system performance, access to financing, stability and growth are more complex (Vives, 2001). Market power in banking, for example, may up to a degree be beneficial for access to financing.

Using bank level data for 77 countries, Demirguc-Kunt, Leaven, and Levine (2003) investigate the impact of bank concentration and regulations on bank efficiency. They find that concentration has a negative and significant effect on the efficiency of the banking system except in rich countries with well-developed financial systems and more economic freedoms.

Overall, the evidence on the structure-performance relationship in banking is mixed and one area that has remained inconclusive in both methodology of testing the relationship and the results. Whereas Berger (1995) and Goldberg and Rai (1996) make a significant contribution to the methodology of testing the two hypotheses by including measures of efficiency directly into the profit function, the derived efficiency measure may be biased since it does not isolate shifts in the efficiency frontier due to technical change from changes in the average efficiency of banks. Rapid technical progress which leads to the production of more output with the given level of inputs could for instance result in lower average bank efficiency even if banks became increasingly productive over time.

New Empirical Industrial Organisation approach.

These New Empirical Industrial Organisation approaches measure competition and emphasise the analysis of the competitive conduct of banks without using explicit information about the structure of the market. They measure the impact of monopoly and oligopoly power by estimating the deviation between marginal cost and competitive pricing without explicitly using the market structure indicator. The Ross-Panzar (P-R) reduced-form revenue model and the Bresnahan (1982) and Lau (1982) mark-up model are two of the important methods in this strand of literature. Both approaches are derived from profit-maximizing equilibrium conditions. The model of Bresnahan (1982) and Lau (1982), as expanded in Bresnahan (1989), uses the condition of general market equilibrium. The basic idea is that profit-maximising 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 perfect collusion. The Ross-Panzar model works well with firm-specific data on revenues and factor prices, allows for bank-specific differences in production function, and does not require information about equilibrium output prices and quantities for the firm or/and industry. In addition, the Ross-Panzar model is robust even in small empirical samples, while the Bresnahan-Lau mark-up model tends to exhibit an anticompetitive bias in small samples (Sherrill and Shaffer, 2003).

A number of studies have applied either the Bresnahan or the Panzar and Rosse methodology to the issue of competition in the financial sector, although mostly to the banking system specifically. For example, Shaffer (1989) for a sample of US banks, he finds results that strongly reject collusive conduct, but are consistent with perfect competition. Using the same model, Shaffer (1993) finds that the Canadian banking system was competitive over the period 1965-1989, although being relatively concentrated. Shaffer (2001) uses the Bresnahan model for 15 countries in North America, Europe, and Asia during 1979-91. He finds significant market power in five markets and excess capacity in one market. Estimates were consistent with either contestability or Cournot type oligopoly in most these countries. Shaffer (1982) applies the PR model to a sample of New York banks using data for 1979 and found monopolistic competition. Nathan and Neave (1989) studies Canadian banks using the PR methodology and found results consistent with the results of Shaffer (1989) using the Bresnahan methodology, i.e. rejection of monopoly power. Several papers have applied the PR methodology to European banking system (Molyneux et al. 1994; Bikker and Groeneveld, 2000; and De Bandt and Davis, 2000). Generally, these studies reject both perfect collusion as well as perfect competition and find mostly evidence of monopolistic competition. Tests on the competitiveness of banking systems for developing countries and transition economies using these models are few to date.

4. Methodology: Baseline theoretical model.

4.1 The PR model:^v

Rosse and Panzar (1977) and Panzar and Rosse (1987) formulated simple models for oligopolistic, competitive and monopolistic markets and developed a test to discriminate between these models. The model assumes that firms can enter or leave rapidly any market without losing their capital, and that potential competitors possess the same cost functions as firms that already serve in the market. The key argument is that if the market is contestable, the threat of market entry with price-cutting by potential competitors enforces marginal cost pricing by incumbents, so that in equilibrium they will not earn excess profits and no entry is observed to occur. The test of the

model is based on properties of a reduced-form revenue equation at the firm or bank level and uses a test statistic H , which, under certain assumptions, can serve as a measure of competitive behaviour of banks. The test is derived from a general banking market model, which determines equilibrium output and the equilibrium number of banks, by maximising profits at both the bank level and the industry level. This implies, first, that bank i maximises its profits, where marginal revenue equals marginal cost:

$$R'_{ii}(y_{ii}, n_i, k_{ii}) - C'_{ii}(y_{ii}, p_{ii}, q_{ii}) = 0 \quad (1)$$

R_{ii} refers to revenues and C_{ii} to costs of bank i (the prime denoting *marginal*), y_{ii} is the output of bank i , n is the number of banks, p_{ii} is a vector of m factor input prices of bank i , k_{ii} is a vector of exogenous variables that shift the bank's revenue function, q_i is a vector of exogenous variables that shift the bank's cost function. Secondly, at the market level, it means that, in equilibrium, the zero profit constraint holds:

$$R_i^*(y^*, n^*, k^*) - C_i^*(y^*, p, q) = 0 \quad (2)$$

Variables marked with an asterisk (*) represent equilibrium values. Market power is measured by the extent to which a change in factor input prices (dp_{m_i}) is reflected in the equilibrium revenues (dR_i^*) earned by bank i . Panzar and Rosse define a measure of competition H as the sum of the elasticities of the reduced-form revenues with respect to factor prices:

$$H = \sum_{i=1}^m \frac{\partial R_i^*}{\partial p_i} \frac{p_i}{R_i^*} \quad (3)$$

The first market model Panzar and Rosse investigated describes monopoly. The monopoly analysis includes the case of price-taking competitive firms, as long as the prices they face are truly exogenous, that is, as long as their equilibrium values are unaffected by changes in the other exogenous variables in the model. An empirical refutation of 'monopoly' constitutes a rejection of the assumption that the revenues of the banks in question are independent of the decisions made by their actual or potential rivals. Panzar and Rosse proved that under monopoly, an increase in input prices will increase marginal costs, reduce equilibrium output and subsequently reduce revenues; hence H will be zero or negative. This is a very generalised result, requiring little beyond the profit maximisation hypothesis itself. Along similar lines, Vesala (1995) proves that the same result holds for monopolistic competition without the threat of entry, i.e. with a fixed number of banks. Thus, this case also falls under what we call 'monopoly'. In the case where the monopolist faces a demand curve of constant price elasticity $e > 1$ and where a constant returns to scale Cobb-Douglas technology is employed, Panzar and Rosse proved that H is equal to $e-1$. Hence apart from the sign, the magnitude of H may also be of importance, as H yields an estimate of the Lerner index of monopoly power $L = (e-1)/e = H/(H-1)$.

Three other commonly employed models for an industrial market investigated by Panzar and Rosse are monopolistic competition and perfect competition and conjectural variation oligopoly, all of which happen to be consistent with positive values for H . In these models, the revenue function of individual banks depends upon the decisions made by its actual or potential rivals. For monopolistic and perfect competition, the analysis is based on the comparative statics properties of the Chamberlinian equilibrium model. This model introduces interdependence into

banks' structural revenue equations via the hypothesis that, in equilibrium, free entry and exit results in zero profits. Under a set of general assumptions, it can be proved that under monopolistic competition, $0 < H < 1$. Positive values of H indicate that the data are consistent with monopolistic competition but not with individual profit maximisation as under monopoly conditions. In other words, banks produce more and the price is less than would be optimal in each individual case. A priori, monopolistic competition is most plausible for characterising the interaction between banks, as it recognises the existence of product differentiation and is consistent with the observation that banks tend to differ with respect to product quality variables and advertising, although their core business is fairly homogeneous.

In the limit case of the monopolistic competition model, where banks' products are regarded as perfect substitutes of one another, the Chamberlinian model produces the perfectly competitive solution, as demand elasticity approaches infinity. In this perfect competition case, $H=1$. An increase in input prices raises both marginal and average costs without – under certain conditions – altering the optimal output of any individual firm. Exit of some firms increases the demand faced by each of the remaining firms, leading to an increase in prices and revenues equivalent to the rise in costs.

Finally, analysing the conjectural variation oligopoly case, Panzar and Rosse show that strategic interactions among a fixed number of banks may also be consistent with positive values of H . In general, the value of H is not restricted. In the special case of *perfect* collusion oligopoly or a perfect cartel, the value of H is non-positive, similar to the monopoly model. The table below summarises the discriminatory power of H .

Discriminatory power of H

Values of H	Competitive environment
$H \leq 0$	Monopoly equilibrium: each bank operates independently as under monopoly profit maximisation conditions (H is a decreasing function of the perceived demand elasticity) or perfect cartel.
$0 < H < 1$	Monopolistic competition free entry equilibrium (H is an increasing function of the perceived demand elasticity).
$H = 1$	Perfect competition. Free entry equilibrium with full efficient capacity utilisation.

The Chamberlinian equilibrium model described above provides a simple link between H and the number of banks, so between market behaviour and market structure. The model is based on free entry of banks and determines not only the output level but also the equilibrium number of banks. Vesala (1995) proves that H is an increasing function of the demand elasticity e , that is, the less market power is exercised on the part of banks, the higher H becomes. This implies that H is not used solely to reject certain types of market behaviour, but that its magnitude serves as a measure of competition. One of the general assumptions underlying the Chamberlinian equilibrium model mentioned above is that the elasticity of perceived demand facing the individual firm, $e(x,n,w)$, is a non-decreasing function of the number of rival banks. Panzar and Rosse call this a standard assumption, eminently plausible and almost a truism. Vesala's result and this assumption together provide a positive (theoretical) relationship between H and the

number of banks, or – in a more loose interpretation – an inverse relationship between H and banking concentration.

De Bandt and Davis (2000) show that the P-R approach requires a number of working assumptions. First, banks must be treated as single product firms. Consistent with the intermediation approach to banking, banks are viewed as producing intermediation services using labour, physical capital, and financial capital as inputs. Second, higher input prices must not be correlated with higher quality services that generate higher revenues, because such a correlation would bias the computed H statistic. This means, however, that if one rejects the hypothesis of a contestable competitive market, this bias cannot be too large (Molyneux et al., 1996). Third, banks must be in long-run equilibrium.

4.1.1. The empirical P-R model

The empirical application of the P-R approach assumes a log-linear marginal cost function (dropping subscripts referring to bank i)

$$\ln MC = \beta_0 + \beta_1 \ln y + \sum_{i=1}^m \delta_i \ln p_i + \sum_{j=1}^g \gamma_j \ln q_j \quad (4)$$

where y is output of the bank, p_i are the factor input prices (regarding e.g. funding, personnel expenses and other non-interest expenses) and q are other variables, exogenous to the cost function as in equation 1. Equally, the underlying marginal revenue function has been assumed to be log-linear of the form

$$\ln MR = \alpha_0 + \alpha_1 \ln y + \sum_{i=1}^h \varphi_i \ln k_i \quad (5)$$

where k_i are variables related to the bank-specific demand function. For a profit-maximising bank, marginal costs equal marginal revenues in equilibrium, yielding the equilibrium value for output (denoted by an asterisk):

$$\ln y^* = \left[\left(\beta_0 - \alpha_0 + \sum_{i=1}^m \delta_i \ln p_i + \sum_{j=1}^g \gamma_j \ln q_j - \sum_{i=1}^h \varphi_i \ln k_i \right) / (\alpha_1 - \beta_1) \right] \quad (6)$$

The reduced-form equation for revenues of bank i is the product of the equilibrium values of output of bank i and the common price level, determined by the inverse-demand equation, in logarithms, of the form $\ln P = \varpi + \eta \ln \sum_i y_i^*$

In the empirical analysis, the following operationalisation of the reduced-form revenue equation is used:

$$\ln R_{it} = \phi_0 + \phi_1 \ln IF_{it} + \phi_2 \ln PE_{it} + \phi_3 \ln KE_{it} + \sum_{k=1}^K \lambda_k \aleph_{kit} + \sum_{n=1}^N \gamma_n Z_{nt} + \phi_4 D + \varepsilon_{it} \quad (7)$$

where R represents the ratio of revenue to total assets of the bank i at time t , IF is the ratio of annual interest expenses to total funds, or the average funding rate, PE is the ratio of personnel expenses to the total balance sheet, or the (approximated) price of personnel expenses, KE is the ratio of physical capital expenditure and other expenses to fixed assets, or the (approximated) price of capital expenditure, \aleph is a vector of bank specific exogenous factors (without explicit

reference to their origin from the cost or revenue function). Bank-specific factors (\aleph) reflect differences in risks, costs, size and structures of banks and should, at least theoretically, stem from the marginal revenue and cost functions underlying the empirical P-R. Specifically, total assets (TA) to control for potential size effects, the risk component can be proxied by the ratio of non-performing loans to total assets (NPA). Z is a vector of macro variables that affect banking market as a whole, specifically the nominal treasury bill rate (TBR) and inflation (Inf). We allow for the privatisation of UCB to Stanbic bank with a zero-one dummy ($2002 - 2005 = 1$,) and zero otherwise. In addition we include a dummy variable (D) for large banks. ε is a stochastic error term. To allow for heterogeneity across the sample of banks, we use the error-component method, specifically one-way error component described by: $\varepsilon_{it} = \eta_i + \psi_{it}$, where η_i denotes the unobservable bank specific effect and ψ_{it} denotes a random term which is assumed to be white noise. IF, PE, KE are the unit prices of the inputs of the banks: funds, labour and capital, or proxies of these prices. In the notation of (7), the H statistic is given by $\phi_1 + \phi_2 + \phi_3$.

The dependent variable is the 'ratio of total *interest* revenue to the total balance sheet', as in Molyneux et al. (1994). The decision to consider only the interest part of the total revenue of banks is consistent with the underlying notion inherent in the P-R model, that financial intermediation is the core business of most banks. However, Shaffer (1982) and Nathan and Neave (1989) took total revenue as their dependent variable.

An important feature of the H - statistic is that the tests must be undertaken on observations that are in long run equilibrium. This suggests that competitive capital markets will equalise risk-adjusted rates of return across banks such that, in equilibrium, rates of returns should be uncorrelated with input prices. Thus, in the context of the theory of competitiveness and contestability set out in the model above, we specify a model for obtaining measures of the competitive banking environment by including a specification for equilibrium condition:

$$\ln \pi_{it} = \phi_0 + \sum_{j=1}^3 \phi_j' \ln P_{jit} + \sum_{k=1}^K \lambda_k' \aleph_{kit} + \sum_{n=1}^N \gamma_n' Z_{nt} + \phi_4 D + v_{it} \quad (8)$$

Where, π_{it} are net profits to total assets, v is a stochastic term, P_i are the inputs IF, PE and KE , and the remaining variables are as in (7). A condition for long-run equilibrium is that $\Omega = \sum_{j=1}^3 \phi_j = 0$. Hence, to test for equilibrium, the Ross-Panzar statistic is calculated with the

return on assets replacing bank revenue as the left hand variable in the regression equation. If we find that $\Omega < 0$, we infer market disequilibrium; whereas $\Omega = 0$ would indicate equilibrium.

4.2 Empirical analysis: PR approach.

Table 4: Summary statistics and correlations.

Variable	mean	median	Std.dev.	minimum	maximum
Margin	0.097	0.090	0.045	-0.252	0.291
Spread	0.181	0.190	0.044	0.010	0.31
Overhead	0.097	0.069	0.041	0.016	0.195
ROA(Pre-tax Return on Assets)	0.019	0.033	0.103	-1.005	0.210

NPA	0.192	0.041	0.43	0.000	0.295
Liquidity ratio	0.863	0.798	0.359	0.138	2.652
Market share deposits	0.057	0.026	0.076	0.001	0.323
Market share loans	0.062	0.019	0.085	0.000	0.403
EFF (X-efficiency)	0.132	0.276	0.145	0.102	0.345
HERF(Herfindahl asset concentration ratio)	1821.6	1799.8	183.0	1432.9	2257.1
CAS (Ratio of core capital to net assets)	0.24	0.12	0.044	0.10	0.310
GASS (Growth of bank's assets)	10.2	1.18	11.7	0.00	13.9
TR (Ratio of taxes to revenue)	15.1	14.6	6.5	12.4	15.4

The correlations show a significant and positive correlation between margins and spreads. Overhead costs and loan loss provisions are positively correlated and market share in deposits and loans are negatively correlated with spreads. Overhead costs and ROA are positively correlated with margins

Table 5: Correlations.

	Spread	Margin	Overhead	ROA	NPA	LR	MSD	MSL
Spread	1	0.342***	0.358***	0.121**	0.281***	-0.04	-0.262***	-0.139***
Margin		1	0.61***	0.222**	0.034	-0.03	-0.093*	0.014
Overhead			1	-0.18***	0.343***	-0.192***	-0.32***	-0.218***
ROA				1	-0.542***	0.143***	0.133***	0.136***
NPA					1	-0.154***	-0.288***	-0.264***
LR						1	-0.115**	-0.194***
MSD							1	0.876***
MSL								1

*significant at 10%; ** significant at 5%; *** significant at 1%

MSD denotes market share in deposits, and MSL denotes market share in loans.

Estimation results.

The estimation is based on equation 7. We use un-scaled total revenue, revenue-assets ratio and interest revenue-assets ratio as dependent variables. Using bank-level quarterly data for the period 1995-2005 and applying an adapted version of the Panzar and Rosse (1987) methodology, we estimate the degree of competition in Uganda's banking system. We estimated the model for the entire period, 1995-2005, and for two sub-periods, 1995-1999 and 2000-2005, because the 1995-1999 period was characterised by bank failures and this could have had an impact on the overall performance of the industry. The second period, 1999-2005 was characterised by regulatory reforms and a more strengthened financial sector but also more concentrated after mergers and closure of some banks. The panel can be estimated by fixed effects estimator or random effects estimator depending on the nature of the individual effects, η_i . We use the Hausman test to determine the appropriate estimation method and hence report the results based on the appropriate estimation technique.

The table 6 below reports the results of our econometric analysis. The estimates reveal that the estimated value of H is always non-negative and as such that the Ugandan banking sector is

characterised by monopolistic competition according to the Panzar and Rosse classification. Irrespective of model specification, estimation method and the sample period, the H-statistic consistently lies between 0 and 1, with a value of 0.28 on average for the entire period, 0.40 for the 2000-2005 period and 0.31 for the 1995-1999 period. H-statistic also differs significantly from 1. We interpret H between 0 and 1 as a continuous measure of the level of competition, in the sense that higher values of H indicate stronger competition than lower values. Thus, it seems that competition has increased in the recent years.

The model seems to be relatively precisely estimated with a number of statistically significant variables. The results indicate that there has been an increase in competition after the cleaning up of the sector (2000-2005) period. The positive value of H statistic indicate that the industry is characterised by monopolistic competition hence recognising the existence of product differentiation and the fact that banks tend to differ with respect to product quality and advertising, although their core business is fairly homogeneous.

The unit cost of funds has a positive sign and is statistically significant at the 1 percent level. Also the unit cost of labour is statistically significant. The results indicate that, for the period 1995-2005, the price of funds provides the highest contribution to the explanation of interest revenues and therefore to the H-statistics, followed by the price of labour. The unit price of labour is significant in all specifications and with similar positive coefficients. This result appears to suggest that personnel costs could be an important driver of overhead costs, which are quite high in Uganda as noted in section 2.

The bank size measured by the asset is positively related to revenues, hinting at the beneficial effects of size. Other things being equal, the larger the bank, the higher the revenues. This demonstrates strong economies of scale, which not only indicates that the profitability structure of the banking sector is skewed towards the larger banks, but also implies that there could be scope for greater consolidation in the sector in the future.

The estimates based on these two sub-periods highlight two salient features. First, the H-statistic increased during the second sub-period as compared to the first, although it was significantly different from both 0 and 1 during both sub-periods. Second, while the coefficient for capital was uniform across both sub-periods, the coefficient on unit cost of labour increased significantly in the second period and so was the coefficient on the cost of funds.

The non-performing assets have a statistically significant negative effect but only in the period 1995-1999 conforming that regulatory reforms have strengthened the banking sector particularly as a result of cleaning up the banking system. The treasury bill rate has had a significant and positive effect on interest revenue in both periods which indeed supports the inclination of banks holding significant proportion of their portfolio in treasury bill. The dummy for large banks is also statistically significant, which could suggest that small banks could be vulnerable in the event that their main earning assets, treasury bill, dries up.

For robustness, we estimate an alternative reduced revenue equation where we include the ratio of total revenue to total assets as the dependent variable. Also, as noted figure 6, the non-interest

revenues of banks have been increasing significantly over the sample period. To take account of the increasing share of non-interest revenues in total revenue, we also estimate the alternative specification of the revenue function, where we replace the dependent variable, interest revenue, with the ratio of total revenue to total assets. The results obtained broadly mirror the earlier findings. Specifically, the value of H -statistic for the entire period is positive although slightly lower than earlier, conforming the existence of a monopolistic free-entry equilibrium. Broadly, the results are similar with the earlier results.

In sum, the results reject the monopoly and perfect competition hypothesis and lend credence to the proposition that Ugandan banks earn their revenues as if under monopolistic competition. These results seem to be compatible with the contestable markets theory, if it is assumed that the incumbent set their prices close to the competitive level because of potential competition.

Comparing these results with those obtained elsewhere in Africa using the similar methodology, we find that the H statistic obtained on Uganda is much lower compared to 0.56 for Ghana, 0.58 for Kenya, 0.67 for Nigeria and 0.85 for South Africa, which indicates a much lower level of competition in the sense that higher values of H indicates stronger competition than lower values. Overall, it fair to conclude that the little competition in Uganda's banking system is effectively limited to large international banks. As a result, the international banks are largely insulated from vigorous competition by their size, reputation for deposit safety, and international links. Competition between these large banks is largely limited to the top tier corporate clients. The entry restriction imposed in 1996 but which was lifted in 2002 could have also reduced competition.

A critical feature of the H statistic is that the P - R approach must be based on observations that are in long run equilibrium. An equilibrium test exploits the fact that in competitive capital markets, risk-adjusted rates of return will be equalised across banks. In such a case, the return rates will not be correlated with input prices. An equilibrium test is provided by equation 7, after replacement of the dependent variables by the rate of return on total assets (ROA). $H = 0$ would then indicate equilibrium, whereas $H < 0$ would point to disequilibrium. We find that the hypothesis of equilibrium ($H = 0$) cannot be rejected at 5 percent significant level. With the possible exception of the input price of interest expenses, input prices are not statistically different from zero at 5 percent level of significance and have not affected returns to assets in the period 1995-2005. However, the definition of equilibrium is not very clear in the $P - R$ model. Given the internal logic of the model, it is best to think of equilibrium as a steady-state, reflecting adjustments to shocks.

Table 7: Test of equilibrium

	LogROA		
	1995-2005	1995-1999	2000-2005
	Fixed effects	Fixed effects	Fixed effects
Constant	0.018*	0.12	0.19
LogIF	0.081	0.064	0.102*
LogPE	-0.059	-0.045	-0.068*
LogKE	-0.0058	-0.0087*	0.0009
LogTA	0.523**	0.96**	0.65**

LogNPA	-0.078*	-0.14**	-0.043*
LogTBR	0.125***	0.09***	0.167***
LogINFI	-0.009	-0.05***	-0.001
Dummy	0.076**	0.045	0.079**
UCB-Dummy	0.08**	0.009	0.10***
Adj. R-squared	0.682	0.615	0.636
F-test	317.3	299.5	325.9
Prob > F	0.000	0.000	0.000
H-Statistic	0.016	0.0103	0.035
HO: H=0	F=0.18 accept	F=0.194 accept	F=0.188 accept
SE	0.052	0.056	0.063
Observations	660	300	360

*significant at 10%; ** significant at 5%; *** significant at 1%

Given the dynamic changes within the Ugandan banking scene since financial liberalization it would be no surprise to find that market equilibrium may not have held over the sample period. An approach to deal with this is by using recursive or rolling estimation approach (Matthews et al. 2007). We test for market equilibrium by running a rolling regression with the aim of identifying periods when the banking market was not in equilibrium. The approach is to fit the model to the first K observations, in our case the starting point is 1995 quarter 1 and next is to use the first $K + 1$ data points and compute the coefficient vector again. The same procedure is repeated, adding one sample point a time, until the final coefficient vector is obtained, based on all n sample points. A summary of the results is reported in table 8.

Table 8: Test of equilibrium(Rolling sample) dependent variable **LogROA**

Period	LogIF	LogPE	LogKE	H	$H_0 : H = 0,$ F-statistic
1995q1-1997q4	0.0006	-0.0096	0.0117	0.0027	0.17
1995q2-1998q1	0.0059	-0.0009	-0.0013	0.0037	0.21
1995q3-1998q2	0.0001	0.0006	0.0018	0.0025	0.51
1995q4-1998q3	0.0047	0.0007	0.0014	0.0068	0.80
1996q1-1998q4	0.0071	0.0002	-0.0071	0.0002	0.12
1996q2-1999q1	0.0091	0.0003	-0.0101	-0.0007	0.27
1996q3-1999q2	0.0085	0.0007	-0.0101	-0.0009	0.29
1996q4-1999q3	0.0019	-0.0005	-0.0026	-0.0012	0.32
1997q1-1999q4	0.0051	0.0001	-0.0045	0.0007	0.47
1997q2-2000q1	0.0012	0.0007	-0.0016	0.0003	0.57
1997q3-2000q2	0.0002	0.0001	0.0002	0.0005	0.95
1997q4-2000q3	0.0036	0.0059	-0.0069	0.0026	0.68
1998q1-2000q4	0.0097	0.0007	-0.0102	0.0002	0.92
1998q2-2001q1	0.0102	-0.0008	-0.0107	-0.0013	0.79
1998q3-2001q2	0.0107	-0.001	-0.0106	-0.0009	1.29
1998q4-2001q3	0.0098	-0.0012	-0.0091	-0.0005	2.48*
1999q1-2001q4	0.0083	-0.0089	0.0005	-0.0001	4.23**
1999q2-2002q1	0.012	-0.0019	-0.0109	-0.0008	3.18**

1999q3-2002q2	0.0135	-0.0015	-0.0249	-0.0129	4.98**
1999q4-2002q3	0.0099	-0.0105	-0.0082	-0.0088	3.58**
2000q1-2002q4	0.0079	0.0006	-0.008	0.0005	0.89
2000q2-2003q1	0.0081	0.0035	-0.0115	0.0001	1.09
2000q3-2003q2	0.006	0.0029	-0.0086	0.0003	0.99
2000q4-2003q3	0.0097	0.0021	-0.0107	0.0011	1.17
2001q1-2003q4	0.0104	0.0012	-0.0047	0.0069	1.06
2001q2-2004q1	0.0107	0.0007	-0.0039	0.0075	2.08
2001q3-2004q2	0.0119	0.0002	-0.0112	0.0009	0.77
2001q4-2004q3	0.0105	0.0001	-0.0102	0.0004	0.98
2002q1-2004q4	0.0112	0.0007	-0.0074	0.0045	0.94
2002q2-2005q1	0.0105	0.0006	-0.0105	0.0006	1.85
2002q3-2005q2	0.0101	0.0004	-0.0098	0.0007	1.32
2002q4-2005q3	0.0117	0.0015	-0.0115	0.0012	1.87
2003q1-2005q4	0.0101	0.0018	-0.0104	0.0015	0.69
1995q1-2005q4	0.0810	-0.0590	-0.0058	0.016	0.18

**significant at 10%; ** significant at 5%.*

The rolling sample results indicate that the market equilibrium over the entire sample period was in equilibrium. However, for the 1998-2002, the elasticities reject that banking market was in equilibrium. This was the period of banking crisis that culminated in bank runs and closure of some bank and also bank consolidation. Thus while the banking industry was not in equilibrium for some of the sample period, we cannot reject that it was in equilibrium for the most part of the sample period and for the whole entire sample period.

Overall, our results suggest that while competition in the Ugandan banking sector falls within a range of estimates for comparator markets, it tends to be on the weaker side. Based on the computed market power coefficients we conclude that Uganda's banks seem to earn their revenues, as if operating under conditions of monopolistic competition. In banking services such conditions are, of course, expected a priori from the results of previous empirical studies and from economic theory, since banks (a) are licensed, regulated, and supervised, and (b) engage in product (service) differentiation.

Table 6. Results of the Panzar and Rosse Model for Uganda: Sub-period 2000-2005.

	Total Revenue			Total Revenue-Asset Ratio			Interest Revenue-Asset Ratio		
	1995-2005	1995-1999	2000-2005	1995-2005	1995-1999	2000-2005	1995-2005	1995-1999	2000-2005
Constant	0.238**	-3.123**	-0.424	0.483	0.172	0.161	0.014	0.12	0.136
LogIF	0.119**	0.109*	0.182**	0.105**	0.127**	0.169**	0.126**	0.132**	0.153**
LogPE	0.155**	0.148**	0.21*	0.102**	0.118**	0.178*	0.116**	0.181**	0.198**
LogKE	0.041**	0.021**	0.045*	0.042**	0.039**	0.020**	0.022*	0.043*	0.053**
LogTA	1.026**	0.979**	0.957**						
LogNPA	-0.022*	0.940**	-0.011	-0.023*	-0.053**	-0.010	-0.102**	-0.073**	0.017
LogTBR	0.007**	0.023	0.004	0.007**	0.009**	0.003	0.091**	0.073**	0.086**
LogINFI	-0.001	0.009**	-0.019*	-0.001	0.005	-0.016*	-0.09	0.002	0.031
Dummy	0.100**	0.100**	0.553**	0.551**	0.108**	0.111**	0.115**	0.117**	0.100**
UCB-dummy	0.005***	-0.08**	0.09*	0.0065***	-0.092**	0.104*	0.07***	-0.008	0.003
Adj. R-squared	0.98	0.97	0.98	0.691	0.698	0.634	0.627	0.64	0.67
F-test	486.9	444.9	317.9	17.7	15.657	14.115	12.126	10.277	16.42
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
Hausman test	6.458	33.42	7.34	58.61	21.8	6.92	1.04	1.14	6.77
Prob > chi2	0.259	0.003	0.24	0.00	0.00	0.567	0.998	0.992	0.453
H-Statistic	0.315	0.278	0.437	0.249	0.284	0.367	0.264	0.356	0.404
HO: H=0	F=228 Reject	F=198 Reject	F=187.6 Reject	F=89.7 Reject	F=97.3 Reject	F=89.6 Reject	F=54.2 Reject	F=49.8 Reject	F=46.8 Reject
HO:H=1	F=122 Reject	F=111.7 Reject	F=125.6 Reject	F=69.8 Reject	F=57.2 Reject	F=45.9 Reject	F=42.8 Reject	F=27.2 Reject	F=28.7 Reject
SE	0.047	0.053	0.051	0.043	0.04	0.048	0.046	0.052	.055
Observations	660	300	360	660	300	360	660	300	360

significant at 10%; ** significant at 5%; * significant at 1%*

4.3 Market Concentration and competition in Uganda's banking sector.

Uganda's banking system is highly concentrated. This is not surprising, given the small size of the national markets. Concentrated banking systems are not necessarily uncompetitive—for example, in open systems, the threat of entry can restrain incumbents from overcharging (Claessens and Laeven 2004; Demirgüç-Kunt, Laeven, and Levine 2004). But concentration does often go hand in hand with market power, especially when contestability is weak. Indeed, economic theory provides conflicting predictions about the relationship between the concentration and the competitiveness of the banking industry and banking system fragility. Some theoretical arguments and country comparisons suggest that a less concentrated banking sector with many banks is more prone to financial crises than a concentrated banking sector with a few banks (Allen and Gale, 2004). First, concentrated banking systems may enhance market power and boost bank profits. High profits provide a “buffer” against adverse shocks and increase the charter or franchise value of the bank, reducing incentives for bank owners and managers to take excessive risk and thus reducing the probability of systemic banking distress (Hellman et al., 2000; Matutes and Vives, 2000). Second, some hold that it is substantially easier to monitor a few banks in a concentrated banking system than it is to monitor lots of banks in a diffuse banking system. From this perspective, supervision of banks will be more effective and the risks of contagion and thus systemic crisis less pronounced in a concentrated banking system.

Some proponents of the “concentration–stability” view argue that—holding other things constant—(i) banks in concentrated systems will be larger than banks in more diffuse systems and (ii) larger banks tend to be better diversified than smaller banks. Based on these assumptions, concentrated banking systems with a few large banks will be less fragile than banking systems with many small banks. Models by Diamond (1984), Boyd and Prescott (1986), Allen (1990), and others predict economies of scale in intermediation.

An opposing view is that a more concentrated banking structure enhances bank fragility. First, proponents of this argument argue that the standard argument that market power in banking boosts profits and hence bank stability ignores the potential impact of banks' market power on firm behavior. Concentrated banking systems could enhance market power, which allows banks to boost the interest rate they charge to firms. These higher interest rates may induce firms to assume greater risk. Thus, there could be a positive relationship between concentration and bank fragility and thus the probability of systemic distress (Caminal and Matutes 2002). They also note that less competition can lead to less credit rationing, larger loans and higher probability of failure if loans are subject to multiplicative uncertainty. Second, advocates of the “concentration–fragility” view argue that (i) relative to diffuse banking systems, concentrated banking systems generally have fewer banks and (ii) policymakers are more concerned about bank failures when there are only a few banks. Based on these assumptions, banks in concentrated systems will tend to receive larger subsidies through implicit “too important to fail” policies that intensify risk-taking incentives and hence increase banking system fragility (Mishkin, 1999).

Proponents of the concentration–fragility view would also disagree with the proposition that a concentrated banking system characterized by a few banks is easier to monitor than a less concentrated banking system with many banks. The countervailing argument is as follows. Bank size is positively correlated with complexity so that large banks are harder to monitor than small

banks. Holding all other features of the economy constant, concentrated banking systems tend to have larger banks. Thus, this argument predicts a positive relationship between concentration and fragility. In the following section, we investigate the link between concentration and competitiveness.

As already noted, a key feature of the Ugandan banking sector is the degree of concentration on both the loan and deposit sides, reflecting both the structure of the economy and the size of the banking system. Loans to the top five borrowers for each bank on the aggregate represent about 24 percent of total loans of the system and on deposit side, top five depositors for each bank on the aggregate account for about 21 percent of total deposit in the system. In addition, concentration increased after the 1998/99 bank crises due to reputational bias against small banks. However, in comparison to small banks, large banks lend more as measured by loan-to-deposits ratio, have lower spread, have lower overhead costs and non-performing assets, and higher profits margins. They also have much of deposits as foreign exchange deposits. This in part could be attributed to the type of the clients they deal with, relatively less risky clients, the corporate clients.

	<i>Large banks</i>	<i>Small banks</i>
<i>Lending rate</i>	18.5	23.5
<i>Deposit rate</i>	0.7	3.5
<i>Spread</i>	17.8	19.9
<i>Overhead costs</i>	5.7	13.3
<i>ROA</i>	8.5	5.5
<i>NPA</i>	3.0	5.6
<i>Loan/deposits</i>	38	36
<i>Forex deposits/total deposits</i>	40	29

Source: Uganda commercial banks data, 1995-2005.

Traditionally, research and public policy concerns about concentration in product markets have focused on the social loss associated with the exercise of market power at high levels of concentration. The higher prices in concentrated markets bring about restriction of output relative to the competitive level and thereby misallocated resources (Berger and Hannan, 1998). In addition to the traditionally recognised higher prices and reduced output from market power, there may also be higher cost per unit of output in concentrated markets because of slack management. The P-R approach although provides a measure of competition, it ignores the size distribution of banks or inequality in given market. As concentration indices, weighted averages of banks' market shares, take both the size distribution and the number of banks into account and they are often used as a simple proxy of the market structure.

There are two frequently used indices of market concentration. The first is the k -bank concentration ratio which takes the market shares of the k largest banks in the market. This index is based on the idea that the behaviour of a market is dominated by a small number of large banks. We use $k = 3$, that is, we measure the three-bank asset concentration index, market concentration average 55.5 percent between 1993 and 1998 and increased to 64.6 between 1999

and 2005. The share of deposits increased from 54.3 to 72.2 in the same periods but the share of loans remained at the same level. This could be attributed to the financial crisis of the period 1998-1999, which led to the closure of several banks. Overall, Uganda's banking sector is heavily concentrated and as noted earlier, this could have impact on efficiency.

Table 8: Structure of Banking Industry.

Year	NO. of banks	NO. of Branches	Market share of 3 largest			Total assets (Billions)
			deposits	loans	assets	
1993	14	229	66	71	64	473
1994	15	146	64	74	65	588
1995	15	144	58	63	62	706
1996	20	152	48	54	51	806
1997	20	147	47	38	48	1052
1998	20	144	43	37	43	1279
1999	17	136	61	54	61	1352
2000	17	132	69	55	63	1845
2001	16	128	74	57	65	2038
2002	15	126	78	58	66	2456
2003	15	126	80	60	68	2947
2004	15	132	89	62	75	3315
2005	15	142	88	64	80	3689

Source: Bank of Uganda, Various annual reports and Bank returns.

The second measure is the Herfindahl index ($HERF$), the sum of squared market shares of all banks operating in the market.

In order to investigate the relationship between competition and market structure in the banking industry, we relate the H statistic for all banks, a measure of competition, to the concentration index as a measure of market structure, that is, $H = \delta_0 + \delta_1 C + \delta_2 D + \delta_3 (D \times C) + \nu$, D represents a dummy for the period after 1999.

Table 9: Competition and concentration relationship.

	Dependent variable-H		
	$k = 3$ (Assets)	$k = 3$ (Deposits)	HERF
Constant	1.2 (5.4)	1.08 (2.9)	1.32 (3.5)
Concentration	-0.85 (3.6)	-0.74 (4.2)	-0.56 (6.6)
<i>Dummy</i> × <i>Concentration</i>	0.08 (1.9)	0.12 (2.6)	0.04 (2.4)
Dummy	0.17 (2.5)	0.08 (2.64)	0.13 (4.0)
Adj. R-square	0.45	0.51	0.50

t -values in parenthesis.

For both regressions, the coefficient of the concentration index shows the expected negative sign indicating that competition is decreasing with increasing market concentration. However, there is

no one-to-one relationship between concentration and competition. The dummy variable, is also statistically significant indicating the change in concentration and competition after 1999.

4.4 Efficiency and market structure.

As a first order effect, one would expect increased competition to lead to lower costs and enhanced efficiency. However, as Vives (2001) highlights the relationship between competition and banking system performance are more complex. Market power in banking, for example, may up to a degree be beneficial for access to financing and the view that competition is unambiguously good for financial sector performance could be more naïve than in other industries as vigorous rivalry may not be the first best for financial sector performance. Further, in a dynamic world, a bank and borrower establish relationships to overcome information problems. The higher its market power, the more likely the bank invests in information gathering about firms, especially to informationally opaque banks, and the more likely it provides credit (Vives 2001). More competition can then undermine the incentives of banks to invest in relationship. But the relationship involves sunk costs and leads to a hold-up problem: the incumbent bank has more information about the borrower than its competitors. This increases the switching costs for the borrower, especially for better quality borrowers since they will face adverse conditions when trying to look for financing from another bank, as they will be perceived as a poor credit. Borrowers will be less willing to enter a relationship with a bank if they are less likely subject to a hold-up problem, for example, when the market for external financing is more competitive. The net effect of these problems can vary with the overall competitive environment. Boot and Thakor (2000), for example, show that increased inter-bank competition may induce banks to make not less, but more relationship loans. There can also be effects from the type of information problem on the scope for potential competition.

The existence of a relationship between market structure and banks' behaviour is indicated by, among others, the P-R model described in the preceding section. However, the P-R model puts at the back stage the relevance of market structure for banks' conduct and performance and, as a description of the market structure, it is a rather limited. For instance, it fully ignores the size distribution of banks (or inequality) in a market. Moreover, DeYoung (1998) suggests that bank management quality is positively related to cost efficiency, which is in turn related to asset quality. Thus, robust evidence is essential on one hand to corroborate the monopolistic market structure evidence obtained under the P-R framework and also to examine how the market structure impacts on the performance of the banks. To achieve this, we analyse the bank efficiency and how it relates to bank returns in the following section. Thus, this section aims to measure the degree of x -inefficiency in Uganda's commercial banks and how it relates to the bank profitability using a stochastic frontier approach. We also analyse the relationship between profitability and market structure (concentration and/or market share).

Theoretical work in the area of productive efficiency has yielded the concept of X-efficiency. In the context of a production function, X-efficiency is defined as any deviation from the fully efficient amount of output as represented by the efficient production frontier. The empirical estimation of X-efficiency has resulted in an extensive literature addressing both the econometric theory of efficiency estimation and the empirical application of the concepts in different

situations. Of the approaches used to estimate frontiers and the inefficiency component, the two most popular are stochastic frontier analysis (SFA) and data envelopment analysis (DEA). SFA is a regression approach that typically includes a normally distributed error and an inefficiency component assumed to follow a one-sided distribution (e.g. exponential, gamma). DEA uses a nonparametric linear programming approach to estimate the frontier and the inefficiency component. Both methods have their strengths and weaknesses. SFA is stochastic, but requires the choice of a functional form and an *ad-hoc* assumption about the distribution of the inefficiency component. DEA does not require distributional assumptions or a specific functional form, but it is non-stochastic.

One way to test for the competition hypotheses of market share and concentration is to take both market share and concentration into account at the same time by estimating a performance equation that includes both market share and concentration as independent variables and to examine the significance of their coefficients (Smirlock, 1985). This baseline model for this approach could be expressed as: $\pi_{it} = f(M_{it}, C_{it}, MC_{it}, Z_{it})$ (9)

where MC is an interaction term defined as market share multiplied by concentration.

The usefulness of (9) in discriminating between the two hypotheses is straightforward. Ignoring the interaction term, a significant and positive coefficient on M and insignificant coefficient on C would imply that firms with market share are more efficient than their rivals and earn rents because of this efficiency while also indicating that increased market concentration does not result in banks earning any monopoly rents which would support the efficient structure hypothesis. Conversely, a combination of a significant and positive coefficient on concentration with insignificant coefficient on market share implies that market share does not affect firm rents and that rents reflected in higher performance indicators are monopoly rents that result from market concentration. If the coefficients on M and C are both positive, this could be interpreted as a demonstration that all banks in concentrated markets earn monopoly rents from collusion and that these benefits are distributed unevenly with the larger firms in the market capturing the lions share of monopoly rents. However, this could also suggest that the leading banks are more efficient than their rivals and that market concentration fosters collusion that results in monopoly rents being earned. An indirect test of the cause of the market share effect involves employing the interaction of market share and concentration, MC . If high concentration is associated with collusive behaviour that is characterised by disproportionate rent sharing in favour of the larger firms, then a positive coefficient on MC should be observed (Smirlock, 1985).

The theoretical structural model that tests the Efficient-Structure (ES) and Market-Power (MP) hypotheses pioneered by Berger (1995) can be summarised as follows:

$$\pi_{it} = f_1(\Psi_{it}, Z_{it}) + \varepsilon_{1it} \dots \dots \dots 10$$

$$M_{it} = f_2(\Psi_{it}, Z_{it}) + \varepsilon_{2it} \dots \dots \dots 11$$

$$C = f_3(M_{it}), \forall_i \dots \dots \dots 12$$

where π_{it} measures a bank's performance indicator, Ψ represent efficiency, M and C represent market share and concentration, respectively, Z represents a vector of variables that prior studies have found to affect bank profitability and $\varepsilon_j, j = 1,2$, are random errors, i , represents a bank and t is a time subscript.

Equation 10 represents the ES hypothesis. Under this setting, higher performance reflects efficiency, depending on which of the two versions of the ES hypothesis.

Equation 11 implies that under the ES hypothesis, more efficient banks gain dominant market shares. This could occur in a number of different ways:

- a) If the products of banks within a local market are homogeneous each market may be in a competitive equilibrium with a common competitive equilibrium with a common price equal to every bank's marginal cost. More efficient firms are larger and have greater shares if they have lower marginal cost at every scale.
- b) If the products of banks are differentiated by location under spatial competition, more efficient banks could set more favourable prices to consumers and attract customers from further distances and,
- c) More efficient banks could have larger shares in equilibrium, because of past out-of-equilibrium behaviour in which more efficient banks gained shares through price competition or through acquisition of less efficient banks.

Equation 12 implies that on average banks with higher market shares have higher concentration (C). Concentration variable in this function applies to all banks and could be the Herfindahl Index or the k -firm concentration ratio, e.g. the market share of the three largest banks.

Following Berger (1995), the two versions of the Market-Power (MP) hypothesis, SCP and RMP can be represented by the following model:

$$\pi_{it} = g_1(P_{it}, Z_{it}) + \varepsilon_{3it} \dots\dots\dots 13$$

$$P_{it} = g_2(S, Z_{it}) + \varepsilon_{4it} \dots\dots\dots 14$$

$$C = f_3(M_{it}), \forall_i \dots\dots\dots 12$$

Where P is a vector of output prices and S is a measure of market structure, either concentration (C) or market shares (M), depending on whether the SCP or RMP hypothesis is being tested.

Equation 13 implies that higher profitability is due to banks' charging unfavourable prices to consumers. For instance, a bank may offer low deposit rates or charge high lending rates to its customers. This does not rule out efficiency as affecting performance under the market-power hypotheses; the effects of efficiency are just viewed as less important than the exogenous effects of market-power acting through prices.

In equation 14 prices are primarily determined by the market structure. Under the SCP relationship, concentration is the key exogenous variable represented by S , implying that all firms in concentrated markets charge prices that are relatively unfavourable to consumers. On the other hand, if the RMP hypothesis applies S is the key exogenous variable in (14), implying that firms' with large market shares have well differentiated products because of advantages such as advertising and location. Firms are therefore able to exercise market power in pricing these products. This does not rule out the possible effects of the efficiency variable on P , these

possible effects are just viewed as relatively unimportant. Under the SCP hypothesis, the positive profit-concentration relationship comes about because C affects P in (14) and P affects π in (13). Under either of these hypotheses, performance measures and the other market structure variables are spuriously positively correlated in (12).

The estimatable model which is a reduced for π of all the four hypotheses (SCP, RMP, efficiency and scale-efficiency) is of the form:

$$\pi_{it} = f(C, M_{it}, EFF_{it}, Z_{it}) + \varepsilon_{it} \dots \dots \dots 15$$

Under the ES hypothesis, the coefficient of the appropriate efficiency variable is positive and the coefficient of all the other key variables are either relatively small or zero. Similarly, under the MP hypothesis the appropriate market structure variable C , or M has a positive coefficient and remaining are irrelevant. The disturbance term is assumed to follow a one-way error component process: $\varepsilon_{it} = \mu_i + \nu_{it}$. Where μ_i represents any unobservable bank specific effects that are not included in the regression, e.g., unobservable managerial skills of the managers of banks. They are fixed parameters and can be estimated by introducing a dummy variable for each bank. ν_{it} varies by bank and by time and represents all other market imperfections and regulatory restrictions that affect the return on assets (ROA) of banks randomly.

A second condition for the ES hypothesis is that the market structure variables (M & C) be positively related to efficiency. In order to test for this additional condition, the following reduced form equations can be estimated:

$$M_{it} = f(EFF_{it}, Z_{it}) + \varepsilon_{5it} \dots \dots \dots 16$$

$$C = f(EFF_{it}, Z_{it}) + \varepsilon_{6it} \dots \dots \dots 17$$

The efficiency provides a measure of the effectiveness of a bank in producing output with a given level of inputs.

Control variables.

The control variables include: The ratio of non-performing loans to total loans (NPA). This was included to control for differences in costs due default risk. The costs include foregone principal and interest payments and expenses on monitoring and administering the portion of a bank's existing loan portfolio that is currently performing. A high level of defaults is expected to have a negative effect on the profitability of banks.

The ratio of core capital to net assets (CAS) was included, first, to control for differences in costs due insolvency risk. Insolvency risk affects the costs and profits of a bank via the interest rates the bank has to pay for un-insured debt and through the intensity of risk management activities the bank undertakes. Second, the capital level of a bank directly affects costs since it may provide an alternative source of funding earning assets. Because raising equity typically involves higher costs than raising deposit capital, differences in profits of banks may to some extent reflect differences in the sources of funding. The sign is ambiguous a priori.

Operating Costs, Implicit and Explicit Taxes.

Central to the real or operating decisions of financial institutions are the costs of inputs, or the factors that are used in producing services, with labour and capital being the most important ones. However, the availability of technology such as computers, visual and communications systems is essential for the most efficient management and combination of these inputs in order to produce financial output at the lowest possible cost. If banks were fully efficient, they would maximize profits at the lowest possible cost. However, there are a number of sources of cost inefficiency in banking. Important among these is operational inefficiency, such as excessive labour, as opposed to financial inefficiency that involves excessive interest rate payments (see Berger et al. 1991, 1997). High operating costs widen the spread between deposit and loan rates and reduce the size of the financial system. To capture this argument, we include the ratio of operation cost to revenue (OP) and we expect that the higher the relative operational costs the lower the profits.

The operating cost ratios of banks may also be raised through implicit and explicit taxation. Cash reserve requirements usually imposed on financial institutions are, for instance, often viewed by financial institutions as similar to a tax and a positive cost of undertaking intermediation. Moreover, inflation increases the reserve requirement tax; leading to a substantial drop in the real deposit rate and the real demand for money, thus further raising the operating resource cost ratios. Conventional taxes such as interest withholding taxes, stamp duties, transaction taxes, value added taxes, profit taxes and licence fees which are levied on the financial intermediation are yet another cause for a rise in operating cost ratios, and do widen the spread between deposit and loan rates of interest. They therefore reduce the real volume of financial intermediation and hence saving and investment, as do higher operating costs. Since 1993, legal reserve requirement has remained at 7 and 8 percent for demand and saving-time deposits respectively. However, taxes such as profit tax, taxes on earning assets etc have changes. To capture the effect on performance we incorporate the ratio of total taxes to total bank revenue (TR).

Measurement of efficiency.

In order to derive a measure of efficiency, we use a frontier function model. Frontier functions can be estimated statistically or not according to whether we adopt certain assumptions related to the stochastic properties of the data (Berger and Humphrey, 1997). Further more parametric and non-parametric approaches can be used depending on whether or not a specific functional form between the variables is assumed. Another way to classify frontier functions distinguishes between a deterministic and a stochastic approach. In the first case, it is assumed that all deviations from the frontier are due to inefficient behaviour whilst in the second case deviations can be due to inefficiency as well as to circumstances not under the control of the firm. The stochastic approach seems to be more appealing. We therefore adopt it and in what follows we provide its basic formalisation.

Stochastic frontier analysis (SFA) has been applied widely to banking and other industries since its introduction by Aigner et al. (1977) and Meeusen and van den Broeck (1977). Reviews of much of this research are provided in Forsund, Lovell and Schmidt (1980), Schmidt (1986), Bauer (1990), Battese (1992) and Greene (1993). More recent econometric developments are summarized in Kumbhakar and Lovell (2000) and Berger and Mester (1997) discuss applications to banking. SFA starts with a standard cost or profit function and estimates the minimum cost or maximum profit

frontier for the entire sample from balance sheet data. The efficiency measure for a specific bank observation is its distance from the frontier.

The analysis of inefficiency in this modelling framework consists of two (or three steps). At the first, we will obtain estimates of the technology parameters. This estimation step also produces estimates of the parameters of the distributions of the error terms in the model, σ_ω and σ_v . In the analysis of inefficiency, these structural parameters may or may not hold any intrinsic interest for the analyst. With the parameter estimates in hand, it is possible to estimate the composed deviation, $\varphi_{it} = v_{it} - \omega_{it} = y_{it} - \beta'x_{it}$ by plugging in the observed data for banks in year t and the estimated parameters. But, the objective is estimation of ω_{it} not v_{it} , which contains the bank specific heterogeneity. Note that the estimator is the expected value of the inefficiency term given an observation on the sum of inefficiency and the firm specific heterogeneity. The estimated ω_{it} is then used in regression analysis of profitability on $\hat{\omega}_{it}$ (the estimates) and other interesting covariates in order to explain how profitability is affected by the efficiency.

Existing studies show that x-inefficiency can be measured in a number of ways. The first is cost inefficiency. The cost concept assumes that the primary objective of the bank is to minimise cost (Berger and Mester, 1997). We illustrate the methodology using cost efficiency as follows. Suppose that total costs for the i -th bank in year t , C_{it} , are given by equation (18) in which y_{it} represents the various products or services produced by the bank and P_{it} represents the prices of inputs. The random disturbance term has two components; V_{it} represents measurement error and other uncontrollable factors while U_{it} represents technical and allocative inefficiency aspects that can be influenced by management.

Hence, we have:

$$C_{it} = f(y_{it}, P_{it}) + (V_{it} + \omega_{it}) \quad (18)$$

As is common in the efficiency literature, we use a translog specification for the cost function in (18) with the standard symmetry and homogeneity assumptions.

The second way of measuring x-inefficiency is by analysing profit inefficiency (Berger, 1995; Goldberg and Rai, 1996). The analysis is based on either a standard profit function. The standard profit function seeks to maximise profits at a given level of input and output prices. It therefore takes into account input prices as well as revenues generated from output. However, the output prices are taken as exogenous, which implies that maximising profit is determined by the input inefficiencies. The standard profit function is given by: $\pi_{it} = f(y_{it}, P_{it}) + (V_{it} + \omega_{it})$ where π is profit.

The SFA approach maintains that managerial or controllable inefficiencies, i.e., ω_{it} , increase costs only above, or profits only below, the frontier or best-practice levels. However, random fluctuations, i.e., V_{it} , may either increase or decrease costs or profits from these benchmarks. Hence, the frontier itself is stochastic and the term ω_{it} represent inefficiency or the distance from best practice.

Furthermore, the V_{it} terms are assumed to be identically distributed as normal variates with zero mean and variance equal to σ_v^2 . The ω_{it} terms are nonnegative random variables distributed normally but truncated below zero. We assume that the ω_{it} terms are distributed independently but not identically. Hence, for the i -th bank in year t , technical inefficiency, ω_{it} , is assumed to follow a half normal distribution, i.e., $N(\mu_{it}, \sigma_{\omega_{it}}^2)$, in which both the mean μ_{it} and variance $\sigma_{\omega_{it}}^2$ may vary. Because structural conditions in banking and general macroeconomic conditions may generate differences in banking efficiency we include time effects in the estimation of the frontier. Specifically, in addition to the half normal specification with constant mean and variance, we estimate frontiers that allow for a mean shift or for a heteroscedastic variance.

The stochastic frontier approach assumes that the output of a firm will vary from its frontier due to two economically distinguishable random disturbances, ω_i and v_i . The disturbance ω_i reflects the fact that the output of each firm must lie on or below its frontier. Any such deviation is the result of factors under the control of the firm, e.g. technical and economic inefficiency and the will and effort of the producer and his employees. However, the frontier itself is stochastic due to unpredictable factors which are beyond the control of the firm, with a random disturbance $v_i \stackrel{\leq}{\geq} 0$ accounting for factors that are beyond the control of the firm such as luck, labour market conflicts, machine performance, measurement errors in the dependent variable and left-out explanatory variables (Battese and Coelli, 1992).

The analysis of inefficiency in this modelling framework consists of two (or three steps). At the first, we will obtain estimates of the technology parameters. This estimation step also produces estimates of the parameters of the distributions of the error terms in the model, σ_u and σ_ω . In the analysis of inefficiency, these structural parameters may or may not hold any intrinsic interest. With the parameter estimates in hand, it is possible to estimate the composed deviation, $\varphi_{it} = v_{it} - \omega_{it} = C_{it} - \beta'x_{it}$ by "plugging in" the observed data for a given bank in year t and the estimated parameters. But, the objective is usually estimation of ω_{it} not φ_{it} , which contains the bank specific heterogeneity.

The technical inefficiency effects are defined by: $\omega_{it} = \omega_i \{\exp[-\eta(t-T)]\}$ Where η is an unknown parameter to be estimated, whilst ω_i can be considered as the technical inefficiency effects for the i -th firm in the last period of the panel. Battese and Coelli, (1992) have shown that an appropriate predictor for the technical efficiency of the i -th firm at the t -th time period, involves the conditional expectation of $\exp(-\omega_{it})$ given the vector of random variables $\varphi_{it} = v_{it} - \omega_{it}$. That is, the technical efficiency predictor may be derived using: $TE_{it} = E[\exp(-\omega_{it})/\varphi_{it}]$.

Battese and Coelli, (1992) also show that the conditional expectation of $\exp(-\omega_{it})$ given the vector of random variables φ_{it} is:

$$E[\exp(-\omega_{it})/\varphi_{it}] = \left\{ \exp\left[-\eta_{it}\tilde{\mu}_i + \frac{1}{2}\eta_{it}^2\tilde{\sigma}_i^2\right] \right\} \times \left\{ \frac{1 - \Phi[\eta_{it}\tilde{\sigma}_i - (\tilde{\mu}_i/\tilde{\sigma}_i)]}{1 - \Phi(-\tilde{\mu}_i/\tilde{\sigma}_i)} \right\} \dots\dots\dots 19$$

where $\tilde{\mu}_i = \frac{\mu\sigma_v^2 - \eta'_i\phi_i\sigma^2}{\sigma_v^2 + \eta'_i\eta_i\sigma^2}$, $\tilde{\sigma}_i^2 = \frac{\sigma_v^2\sigma^2}{\sigma_v^2 + \eta'_i\eta_i\sigma^2}$, $\Phi(\bullet)$ denotes the distribution function of the standard normal random variable.

Another disentangling approach is by Jondrow, Lovell, Materov, and Schmidt (1982). Their

estimator of ω_{it} is $E(\omega_{it}|\phi_{it}) = \frac{\sigma\lambda}{1+\lambda^2} \left[\frac{\phi(a_{it})}{1-\Phi(a_{it})} - a_{it} \right]$.

Where $\sigma = [\sigma_\omega^2 + \sigma_v^2]^{1/2}$, $\lambda = \sigma_\omega/\sigma_v$

$a_{it} = \pm\phi_{it} \lambda/\sigma$

$\phi(a_{it})$ = the standard normal density evaluated at a_{it}

$\Phi(a_{it})$ = the standard normal CDF (integral from $-\infty$ to a_{it}) evaluated at a_{it} .

To obtain an operational predictor for the technical efficiency of the i -th bank at the t -th time period, the unknown parameters in equation 10 are replaced with the maximum likelihood estimates.

In order to estimate the cost frontier, a translog functional form assumed to be homogenous in inputs of the form below can be used:

$$\ln C_{it} = \gamma_0 + \sum_j \lambda_j \ln x_{jit} + \frac{1}{2} \left\{ \sum_j \sum_k \gamma_{jk} \ln x_{jit} \ln x_{kit} \right\} + v_{it} - \omega_{it} \dots \dots \dots 20$$

Inputs are defined as loanable funds plus implicit resource costs involved in producing services to depositors, plus explicit interest payments to the depositors. Inputs, include:

- Total deposits,
- Other liabilities including financial capital. These provide an alternative to deposits as a source of funding the earning assets of a bank,
- Interest expenses,
- Labour costs,
- Other expenses including those on physical capital and depreciation,
- Time trend which accounts for the fact that output is not only influenced by inputs but also by technical progress.

4.4.1 Data sources.

The data used is a quarterly panel spanning post financial liberalisation era, 1995-2005. This was obtained from the commercial banks returns submitted to the Central bank. The data could not be extended to 1993 because of missing data.

We use several bank-specific variables computed from balance sheet and income statements to explain the banks' performance. Tables 4 and 5 provided summary statistics and correlations for some of the variables. Overhead costs are the costs for salaries, motor vehicles, fixed assets etc over total assets and average 9.7 percent across banks over the sample period, 1995-2005. Overhead costs for the sector have shown an increasing trend over the period. Banks' recent investments in physical infrastructure such as increased outreach efforts, very high costs for

power might explain the recent increase in operating costs. ROA defined as profits over total assets averaged 1.9 percent across banks over the sample period. While banks' profitability hit a bottom after the banking crisis in 1998 due to failed privatisation of the Uganda Commercial Bank and closure of several banks, it has recovered to have shown signs of increasing since then. Loan loss provisions are given by provisions for bad debts over total assets and have been falling over the last decade. They averaged 4.6 percent across the sample. The liquidity ratio is a function of liquid assets relative to short-term liabilities and has been relatively stable over the last decade, with an average of 86.3 percent. The market share of deposits and loans proxy both for market power of individual banks but also bank size. The average market share is 6 percent, however, it ranges from 1 percent to 32 percent in deposits and 40 percent in loans.

4.4.2 *Econometric analysis*

Methodology.

In this study, we measure efficiency as the ability of a bank to produce a given set of outputs with minimal cost of inputs, under the assumption of variable returns to scale. To calculate the efficiency, an empirical frontier is estimated. A bank is technically efficient if it lies on the frontier and to establish the frontier we use a stochastic frontier framework. However, modelling of a bank's production process poses a challenge. The most obvious problem is that it is not clear whether services to customers are an input to the production of assets or an output. There are two major approaches to this in the literature. The first, referred to as the production approach models banks as using labour and capital to produce services for account holders, approximated by the number of transactions. This approach, however, does not include interest expense, which is a major portion of total costs. The second approach, which we adopt, the intermediation approach, models financial institutions as intermediating funds between savers and investors. Here, the production process of a bank is modelled as banks using deposits as inputs which they intermediate into loans and securities as outputs.

Total costs are the sum of interest and non-interest costs. The input prices are the price of capital, measured by the ratio of non-interest expenses to total fixed assets, and the price of funds, measured by the ratio of interest expenses to total deposits. The output variables and costs are normalized by total loans and the input variable is the ratio of the price of capital to the price of funds. Thus, the specification assumes homogeneity with respect to prices and constant returns to scale. In addition, we test for robustness with respect to the normalization and specification of the cost and profit functions by reporting results that include only three outputs, namely liquid assets, deposits and loans, and normalize costs and outputs by equity rather than loans. For these cases, the assumption of constant returns to scale is not imposed.

The value of the log likelihood function is shown in the first row. The next two rows report some parameters of the estimated frontiers, namely the ratio of the standard deviation of the inefficiency component of the disturbance to the random component (σ_w/σ_v) and the standard deviation of the composite disturbance (σ). The fourth row contains the proportion of the variance in disturbance that is due to inefficiency, $\lambda = \sigma_w^2/\sigma^2$.

Since the cost and profit frontiers are translog functions, efficiency is defined as $e^{-\omega}$, where ω is the estimated inefficiency. Hence, efficiency is always positive and it is equal to one for the best practice or zero inefficient bank. Thus, individual bank efficiency is measured relative to best practice. The last row reports the mean efficiency from each frontier estimate.

Table 10. Stochastic frontier estimates.

	Cost frontier		Profit frontier	
	<i>Heteroscedastic case</i>		<i>Heteroscedastic case</i>	
Log likelihood	-229.8	-239.8	-324.87	-362.9
σ_{ω}/σ_v	1.97	2.12 (0.55)	2.08	2.47 (0.29)
σ	0.38	0.48 (0.09)	0.43	0.90 (0.02)
λ	0.768	0.824	0.794	0.867
Mean efficiency	0.661	0.6549	0.686	0.676

Standard errors are in parentheses for the estimated parameters. In the heteroscedastic case, the statistics are based on the estimated variances averages over the observations.

From the Table 10, allowing for heteroscedasticity in the specification for both the cost and output specifications have the highest log likelihood values. Hence, we take the efficiency scores from these specifications as measures of efficiency in banks' performance regressions to investigate the effect of efficiency on bank performance. Average efficiency scores are appended in appendix 3.

Given the translog function and share equations, we use the cost as well as the profit measure of x-inefficiency and attempt to establish whether or not the two measures generate significantly different results when applied to the same data set. The x-inefficiency measures are reported in appendix. The results show that the mean value for cost x-inefficiency is 34. This result suggests that on average banks are 66 percent cost efficient. The mean value of profit x-inefficiency is 32 which is slightly lower than cost x-inefficiency. This suggests that banks are on average 68 percent profit efficient. Overall, these estimates are consistent with the results reported by Berger and Humphrey (1997) in their comprehensive survey of bank efficiency estimates internationally. The average cost efficiency score for the entire sample period range between a minimum of 46 and a maximum of 94 percent with overall mean of about 66 percent implying that efficiency varies substantially between banks and that the banks are non-homogenous.

Bank efficiency and performance.

The econometric analysis is based on equations 15,16, and 17 using return of assets (ROA) as a proxy for gross profits (performance). We use this measure because it represents the benefits obtained by the banks before taxes, provision for insolvency and extraordinary items, and reflect the difference between earnings and costs derived from lending and from bank services. We have used gross profits rather than net profits after taxes because net profits would capture the effects of random factors that are sometimes beyond the firm's control. This closely follows the Berger (1995) methodology that incorporates efficiency measures directly into the bank performance

function summarised in equation 16, in order to distinguish between the effects of efficiency from the effects of market power on the structure-profitability relationship. We use efficiency score derived from the cost efficiency stochastic frontier as a measure of efficiency since profit as a measure of performance erodes the impact of scores derived from the profit frontier. Berger (1995) analysis does not control for possible endogeneity that might bias the estimated effects. We control for this by instrumenting measures of concentration and market share. Another major difference regards control variables included in the models. Berger (1995) uses population of the market in which each bank operates concentration of stocks, state dummies and size dummies as control variables. These are of no significance in Ugandan case and as such the Berger (1995) model cannot be duplicated in Uganda.

In addition, we control for the effects of asset quality and risk on the level of bank efficiency by deducting non-performing loans from earning assets, defined as output of banks. In so doing, we avoid overstating the level of efficiency of banks. For instance, banks scrimping on credit evaluations or producing excessively risky loans might be labelled as efficient when compared to banks spending resources to ensure that their loans are of higher quality.

4.4.3 Pairwise Granger Causality Tests.

A major methodological concern is the endogeneity problem as bank efficiency could affect market share and concentration, hence estimating the equations as specified in equations 15,16, and 17 would bias the estimated effects.

To investigate whether there is endogeneity problem, we use Granger causality test. Causality in the sense defined by Granger (1969) is said to exist if a variable X_t , in this case EFF, helps to improve the forecasts of another variable(s) Y_t , in this case concentration and market share. Denoting by $Y_{t+h}|\Omega$ the optimal h -step forecast of Y_t at origin t based on the set of all the relevant information in the universe Ω_t , we may define X_t to be Granger-non causal for Y_t if and only if $Y_{t+h}|\Omega = Y_{t+h}|\Omega \setminus \{X_{t,s}|s \leq t\}$, $h = 1, 2, \dots$ (21)

Thus, X_t is not causal for Y_t if removing the past of X_t from the information set does not change the optimal forecast horizon. In turn, X_t is Granger-causal for Y_t , if (21) does not hold for at least one h , and thus a better forecast of Y_t is obtained for some forecast horizon by including the past of X_t in the information set. If Ω_t contains past values of Y_t and X_t only, i.e. $\Omega_t = \{Y_{t,s}, X_{t,s}\}' | s \leq t$ and $(Y_t, X_t)'$ is generated by a bivariate VAR(p) process of the form

$$\begin{bmatrix} Y_t \\ X_t \end{bmatrix} = \sum_{i=1}^p \begin{bmatrix} \alpha_i & \beta_i \\ \gamma_i & \delta_i \end{bmatrix} \begin{bmatrix} Y_{t-i} \\ X_{t-i} \end{bmatrix} + u_t \quad (22)$$

then (21) is equivalent to $\beta_i = 0, i = 1, \dots, p$

In other words, X_t is not Granger-causal for Y_t if its lags do not appear in the Y_t equation. Analogously, Y_t is not Granger-causal for X_t if the lags of the former variable do not enter the second equation.

The general causal model, which is a modification of Granger (1969), suggested by Sargent (1976) can be written as:

$$C_t = \varpi_0 + \sum_{i=1}^m \alpha_i (EFF)_{t-i} + \sum_{j=1}^n \beta_j (C)_{t-j} + \varepsilon_t$$

$$EFF_t = \chi_0 + \sum_{i=1}^n \gamma_i (EFF)_{t-i} + \sum_{j=1}^m \delta_j (C)_{t-j} + v_t$$

$$MS_t = \varpi_0 + \sum_{i=1}^m \alpha_i (MS)_{t-i} + \sum_{j=1}^p \psi_j (EFF)_{t-j} + \varepsilon_t$$

$$EFF_t = \varpi_0 + \sum_{i=1}^n \varphi_i (EFF)_{t-i} + \sum_{j=1}^p \phi_j (MS)_{t-j} + \eta_t$$

The VAR is used to test the hypotheses that $\beta_j = 0, \delta_i = 0, \psi_j = 0, \phi_j = 0, \theta_i = 0, \alpha_i = 0, \gamma_i = 0$. The lag length is selected automatically based on Schwarz information criteria. This test is only valid when the variables in are integrated of order 0 i.e. stationary. Test results for the order of integration given in appendix 1 surprisingly indicate that all the variables are integrated of order 0. Using this approach, the summary results reported below seems to indicate Granger causality. In other words, the causality test seems to indicate that efficiency is Granger causal for market concentration and market share. Given this causation, any OLS regression including efficiency, market share and concentration would bias the estimated marginal effects.

<i>Null Hypothesis:</i>	<i>F-Statistic</i>	<i>Probability</i>
MS does not Granger Cause EFF	0.20040	0.81995
EFF does not Granger Cause MS	4.57451	0.02244
C does not Granger Cause EFF	0.62848	0.3026
EFF does not Granger Cause C	9.11088	0.00142

Therefore, the nature of causation and the relations shown in the models specification, we use two-stage-least-squares (2SLS) procedure by instrumenting C and MS by their predicted values, i.e. \hat{C}, \hat{MS} , respectively.

4.4.4 Empirical results.

Empirical analysis is based on estimating reduced form equations, in which profitability measure is regressed on efficiency (EFF), concentration (C), market share (MS), and the control variables (NPA,CAS,OP,TR) as already noted. That is,

$$\pi_{it} = \beta_0 + \beta_1 \hat{C}_t + \beta_2 MS_{it} + \beta_3 \hat{EFF}_{it} + \beta_4 Z_{it} + \beta_5 D + \varepsilon_{it}$$

We first obtain predicted values for C and MS which we use as instruments to control for bias resulting from endogeneity. \hat{EFF} is obtained from the stochastic frontier model.

The regression results for concentration and market share are appended in appendix 2 and corroborate Granger causation results as efficiency significantly affect concentration and market share. This seems to suggest that efficient banks increase their market shares, which in turn

increases market concentration.

On the profitability equation, the summary of the results reported below show that the signs on the variables are consistent with expectations as efficiency; market power and concentration do explain bank performance. The results are generally consistent with the literature as discussed in section 3. In comparison to Nanyonjo (2002), she analysed the relationship between market structure and profitability in Ugandan commercial banking for the period covering 1993-1999. She regressed a profitability measure (*ROA*) on efficiency a derived using stochastic frontier approach, market structure variables, (market concentration, market share), and other variables like non-performing assets and core capital. Her findings indicated no impact of efficiency and market structure on profitability. The only variables statistically significant were the non-performing assets and core capital, and even these, the magnitudes were no different from zero. For instance the coefficient on non-performing assets was -0.0001. Our results contradict her findings. We find the coefficients on the efficiency measure (*EFF*), and the market structure, (*MS* and *C*) to be significantly different from zero. This could be explained in part by the fact that she used a period immediately after financial liberalisation and also because she did not control for endogeneity of the market structure variables. However, the results provide partial support for efficient structure hypothesis since the explanatory power of efficiency variable far exceeds those of market structure (sum of explanatory power on concentration and market share). Each coefficient gives the marginal effect of one hypothesis on performance measured by return on assets.

The coefficient on concentration is positive indicating support for SCP. An increase in concentration by one percent would result in the increase in profits by 1.4 percent. The coefficient on market share suggests that there is a significant influence on the profitability of banks by market share. This might suggest that Relative Market Power hypothesis (*RMP*) may explain part of the profit-structure relationship and therefore indicates that market share enables banks to reap benefits associated with market power. However, *MS* could represent market power of the larger banks in the market gained for example through international banking and failure of several small banks, etc., rather than efficiency. In addition, since the coefficients on the market share and concentration are all positive, this could be interpreted as demonstrating that all banks earn monopoly rents from collusion and that these benefits, as suggested by theories of oligopolistic behaviour, are distributed unevenly with the larger banks in the market capturing the lion's share of monopoly rents.

The coefficient on the efficiency measure is positive and statistically significant with a larger effect compare to the market share and concentration, which supports efficiency hypothesis. This suggests that higher profitability of some banks may be explained by their superiority performance in producing and marketing banking services. A coefficient of 0.13 on the efficiency variable predicts a 13 percent increase in the Return on Assets of banks from a one percent improvement in efficiency, *ceteris paribus*. This difference in the results from those obtained by Nanyonjo (2002) using could be attributed to misspecification since endogeneity could have biased her results.

Table 11. Estimation results.

Dependent variable: ROA(all variables deflated by CPI)		
Estimation method: fixed effects		
Variable	Coefficient	z-statistic
\hat{C}	0.014	4.62
\hat{MS}	0.025	8.13
\hat{EFF}	0.13	6.38
NPA	-0.002	-1.32
OP	-0.056	-16.58
CAS	-0.005	-3.66
TR	-0.09	-2.98
Dummy	0.017	1.89
cons	0.03	3.18
$F - stat = 19.85 (prob = 0.00)$		
$R - Sq = 0.53$		

Dependent variable: ROA(all variables deflated by CPI)		
Estimation method: fixed effects		
Variable	Coefficient	z-statistic
\hat{C}	0.010	3.34
\hat{MS}	0.019	5.89
\hat{EFF}	0.12	6.24
MSC	-0.18	-2.69
NPA	-0.006	-0.89
OP	-0.063	-8.16
CAS	-0.003	-2.56
TR	-0.082	-2.73
Dummy	0.013	1.74
cons	0.12	1.17
$F - stat = 22.51 (prob = 0.00)$		
$R - Sq = 0.56$		

To appropriately interpret this finding requires determining whether the effect of market share on profitability is primarily related to efficiency or collusion. This is done by introducing an interactive term of market share and concentration (MSC) as argued by Smirlock (1985). If high concentration is associated with collusive behaviour that is characterised by disproportionate rent sharing in favour of the larger firms, then a positive coefficient on MSC should be observed. If collusion is not an extant, then the coefficient should be negative. In this case the estimated model is:

$$\pi_{it} = \beta_0 + \beta_1 \hat{C}_t + \beta_2 \hat{MS}_{it} + \beta_3 \hat{EFF}_{it} + \beta_4 Z_{it} + \beta_5 D + \beta_6 MSC + \varepsilon_{it}$$

The results obtained using this approach reported below indicate that the coefficient on MSC is negative which is consistent with the above interpretation.

The estimator for the measure of inefficiency is the expected value of the inefficiency term given an observation on the sum of inefficiency and the firm specific heterogeneity following Jondrow, Lovell, Materov, and Schmidt (1982) or Battese and Coelli, (1992) disentangling approaches.

As noted in section one, Uganda's banking sector has high operational costs. Its effect on the performance of banks is shown by its significant impact on profitability. One percent increase in operational cost relative to revenue would reduce profits by 5.6 percent *ceteris paribus*. This in part explains the low ratio of advances to deposits and low branch network. Taxes paid and capital requirement also significantly affect profitability of banks. With exception of capital requirement, the other control variables were excluded from Nannyonjo (2002) study which could have also resulted in misspecification and therefore biased results. The coefficient on CAS is negative and significant in contrast to Nannyonjo's (2002) results. This suggests that capital requirement partly to strengthen banks but also to act as insurance mechanism in case of insolvency reduce bank profitability. CAS also captures the insolvency risk, i.e. risk that a bank may not have enough capital to absorb portfolio losses, due to risks such as default and liquidity. Thus, the higher the insolvency risk, the lower the profits. However, the magnitude is substantially small.

In summary, although Uganda's banking system does not unambiguously support efficiency-structure hypothesis, it is nevertheless fair to say that the efficiency in banks result in concentrated markets and high market shares, which in turn increase profitability. The non-competitive market structure in the Ugandan banking system may be hampering financial intermediation. The structure, as well as the other market characteristics, may constitute an indirect barrier to entry thereby shielding the large profits in the Ugandan banking system. The monopolistic behaviour could also have contributed to higher intermediation costs and diseconomies of management than under a competitive structure. In this sense, the non-competitive behaviour 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.

4.5. Conclusions.

In the banking literature and the more general industrial organization literature, there are two major empirical approaches for assessing market structure and competition: The structural approach to modelling competition embraces the Structure-Conduct-Performance (SCP) paradigm and the Efficient Structure Hypothesis (ESH). The SCP paradigm establishes a direct link from industry structure to bank conduct, and from bank conduct to industry performance. This view assumes that banks in a concentrated market can ignore potential competitors and stay inefficient due to technological and regulatory barriers to entry; implying that concentration in the industry can generate market power, allowing banks to earn monopolistic profits by offering lower deposit rates and charging higher loan rates. Proponents of this view use the frequently observed positive relationship between market concentration and profitability to justify their arguments. The ESH interprets the positive relationship between profitability and market concentration in a different way by suggesting that the positive relationship is not a consequence of market power but of the greater efficiency of firms with larger market share. In other words, the superior performance of the market leaders endogenously determines the market structure,

implying that higher efficiency produces both higher concentration and greater profitability. According to ESH, highly efficient banks (due to firm specific factors such as technological or managerial skills, etc.) can maximize their profits by reducing prices and expanding bank size, thus gaining market share at the expense of other relatively inefficient firms. Based on these arguments bank efficiency serves as the leading force to market concentration.

Alternatively, non-structural models do not infer the competitive conduct of banks through the analysis of market structure, but rather recognize that banks behave differently depending on the market structure in which they operate. The basic tenet of these models is that there is no clear evidence that the use of market power would be greater in more concentrated industries. Under this framework, the Contestable Markets Theory stresses that a concentrated industry can behave competitively if the barriers for new entrants to the market are low. This assumes that banks can enter or leave rapidly any market without losing their capital. Therefore the incumbent banks are always vulnerable to hit-and-run entry when they try to exercise their potential market power.

This paper contributes to this debate by attempting to use the two approaches to measure bank competition and the degree of x-inefficiency in commercial banks in Uganda and then attempts to investigate how the degree of efficiency affects banks profitability in relation to efficient structure hypothesis. It also uses banking market share and concentration as measures of market structure to analyse how the market structure affects profitability in relation to Structure-Conduct-Performance hypothesis. While some of these relationships between competition and banking system performance and stability have been analyzed in the developed countries, empirical research in developing countries is to the best still at an early stage. In particular, this paper makes important contributions to the literature on bank efficiency and how it affects banks performance. Since most studies on the efficiency and market structure of banking systems have focused on non African countries. First, we complement other studies on the nature of bank competition. Second, we investigate the interaction between competition and concentration and finally, we examine how bank profitability is affected by market structure and efficiency.

Using interest revenue and total revenue as ratios to total banks' assets and also un-scaled total revenue as dependent variables, the resulting H statistic provides strong evidence that the Uganda's banking market is characterised by monopolistic competition and that the degree of competition among banks in Uganda is broadly in line with estimates reported in the literature for other countries. Overall, our results suggest that while competition in the Ugandan banking sector falls within a range of estimates for comparator markets, it tends to be on the weaker side. Based on the computed market power coefficients we conclude that Uganda's banks seem to earn their revenues, as if operating under conditions of monopolistic competition and concentration in banking markets does lead to a lower level of competition. In banking services such conditions are, of course, expected a priori from the results of previous empirical studies and from economic theory, since banks are licensed, regulated, and supervised, and engage in product (service) differentiation. That is, the study finds H statistic to be between 0 and 1, with a value of 0.28 on average for the entire period pointing to monopolistic behaviour of banks, which may impede financial intermediation. There is also evidence that competition has increased during the period 2000-2005 following the cleanup of the financial system, which could point to the potential benefits of strengthening the regulatory and supervisory frameworks in fostering a competitive

banking system. This result is of no surprise as it confirms the findings of a number of researchers. One implication one could deduce from this result is that since the banking system is heavily concentrated, small banks may come under pressure as competitive pressure build up, especially since the supply of treasury bills is declining and this has been a major source of revenue. On the other hand, a reduction in net treasury bill issuance may reduce the dependency of banks upon government securities as a source of low-risk, high-yielding assets, which could lead to increased competition, as banks would have to identify new lending opportunities and expand their customer base in order to generate income.

A major policy implication derived from this analysis is that the Ugandan banking system has been subject to deep structural transformation since the early 1990s. Consolidation and privatization have permitted economies of scale in the production and distribution of services and increased risk diversification. These forces have led to lower costs and, undoubtedly, higher efficiency. However, to ensure that lower costs are passed through to households and firms, greater efficiency must be accompanied by a similar strengthening in the competitive environment in the banking sector.

In order to investigate the relationship between the competition, measuring conduct and concentration measuring the market structure, we regress concentration indices (k – bank concentration ratio and the Herfindahl index) on the H statistic and we find both market structure measures significant which could suggest that a few large banks can restrict competition.

However, the P-R framework does not reflect on the banking systems' functioning and performance. Although the measure of competition is crucial, it may not be the most important characteristics for their profitability. This consideration suggests some advantages of using a more structural approach to assessing the degree of competition in the financial sector. While one cannot expect to address all issues, a more formal test of the degree of competition will allow one to overcome some of these concerns. It will also allow a comparison of results. Moreover, persistently high operating profits, coupled with high revenues and/or high costs, are frequently associated with non competitive behaviour. However, the contestability literature, argues that competitive outcomes can occur in very concentrated markets, and that collusion can occur even when there are a high number of firms. To robustly conclude on the nature of Uganda's banking market we measure the degree of market efficiency and relate it to the profitability of the banks. One widely used method which we adopt is the X-efficiency approach, which attempts to capture the efficiency of a bank (given its inputs, outputs, and prices) relative to other banks. An industry-wide "best-practice" cost frontier is calculated and an individual bank's efficiency (or lack thereof) is based on its distance from the frontier. X-efficiency approach finds that there are large cost inefficiencies, on average, there are cost inefficiencies in the order of 34 percent and profit inefficiencies in the order of 32 percent.

Using the computed efficiency scores from the stochastic frontier, we analyse the relationship between market structure and profitability in Ugandan commercial banking by testing two hypotheses: the Market Power hypothesis and the Efficient-Structure hypothesis. The results are not conclusive. First, concentration and higher market share is positively related to higher bank

returns, which provides some support for the market power theory. Second, higher efficiency is related to higher profits, and the relationship between higher efficiency and higher concentration is strong. This provides limited support for the ES hypothesis. Overall, there is some evidence favoring both the effects of both market power and efficiency on profitability.

In summary, although Uganda's banking industry competitiveness has risen since the closure of insolvent banks, the Uganda's banking system remains underdeveloped, inefficient and performs only limited intermediation role, despite recent reform efforts. This is due to the existence of various impediments to banking sector lending, competition, and development in general. Large international banks are effectively insulated from various competition, because of their size, reputation for deposit safety and international links. In addition, the recent steps undertaken to strengthen the system by closing weak banks and improving regulatory, supervisory and legal framework have removed some impediments to financial intermediation but have also resulted in a highly concentrated system. Overall, this illustrates that solely opening the banking sector and privatising state-owned banks does not solve the problems in banking efficiency, enhance the provision of banking services or transform the banking sector into an engine of economic growth.

It suffices also to point out that Uganda's market size may offer limited possibilities of exploiting economies of scale from overhead in administrative operations and information gathering, as well as economies of scope. Thus, it might be difficult to reduce spreads and increase efficiency and competition in the Uganda's banking industry without increasing the level of exploiting economies of scale and scope. It can be expected that the measures underway to strengthen the financial sector will increase the public's confidence in the sector and lead to a broader and better structured deposit base, and to more efficient financial intermediation. Nonetheless, the effects of these measures might be felt in the long-term. Given the low level of competition and the attractive options to invest in low-risk liquid assets, it is doubtful, whether the banking structure and characteristics will change.

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Appendix.

Appendix 1. Unit root tests.

The tests are based on an equation of the form $y_{it} = \rho_i y_{it-1} + X'_{it} \delta + \varepsilon_{it}$

X_{it} represents the exogenous variables, including fixed effects or individual trends, ρ_i are the autoregressive coefficients, and the errors ε_{it} are assumed to be mutually independent idiosyncratic disturbance. If $|\rho_i| < 1$, y_i is said to be weakly stationary, on the other hand, if $|\rho_i| = 1$, then y_i contains a unit root. We allow ρ_i to vary freely across cross-sections hence adapt Im, Pesaran, and Shin (IPS), and Fisher-ADF and Fisher-PP tests.

Variable	Im, Pesaran and Shin-W-stat	ADF- Fisher Chi-square	PP-Fisher Chi-square
C	-4.812	58.12	66.32
MS	-3.97	19.32	25.3
EFF	-7.36	34.06	30.96
NPA	-6.26	26.15	59.91
OP	-5.08	48.31	52.32
CAS	-3.42	16.86	23.16
TR	-7.90	72.19	96.31
GASS	-4.97	68.62	62.31

Appendix.2

Dependent variable (fixed effects): Market share (MS)		
Variable	Coefficient	z-statistic
<i>EFF</i>	0.87	22.1
NPA	-0.07	-2.21
OP	-0.02	-0.89
gASS	0.001	0.05
cons	0.05	7.91
<i>F - sta</i> = 41.56 (<i>prob</i> = 0.00)		
<i>R - Sq</i> = 0.435		

Dependent variable (fixed effects): Concentration(C)		
Variable	Coefficient	z-statistic
<i>EFF</i>	0.35	2.1
NPA	-0.045	-2.44
OP	-0.05	-3.61
gASS	0.003	4.51
cons	-0.01	-2.4
<i>F - sta</i> = 28.1 (<i>prob</i> = 0.00)		
<i>R - Sq</i> = 0.36		

Appendix 3. Efficiency scores

Bank	Average cost efficiency score	Average Profit efficiency score	Bank market share of assets	Period Average NPA	Period average RoA
Standard chartered	0.795	0.82	0.245	0.072	0.029
Barclays	0.765	0.795	0.15	0.125	0.021
Baroda	0.682	0.754	0.052	0.145	0.012
Stanbic	0.751	0.812	0.324	0.091	0.032
Tropical	0.554	0.569	0.006	0.342	0.004
Crane	0.678	0.694	0.032	0.069	0.016
Cairo	0.723	0.761	0.009	0.015	0.008
Centenary Rural Development	0.578	0.601	0.02	0.253	0.001
Nile	0.527	0.539	0.024	0.395	0.009
Allied	0.542	0.532	0.015	0.329	0.011
Orient	0.664	0.712	0.022	0.022	0.018
National Bank of Commerce Ltd	0.552	0.538	0.001	0.287	0.0004
Diamond Trust Bank (U) Ltd.	0.456	0.465	0.008	0.128	0.006
DFCU Bank Ltd.	0.718	0.735	0.027	0.174	0.0045
Citibank (U) Ltd.	0.935	0.958	0.065	0.031	0.025
Overall Average	0.661	0.686			

Appendix 4: Summary of the results (Fixed effects).

Production frontier: Translog functional form.

Log likelihood = -342.53858 Wald chi2(6) = 39133.10
 Prob > chi2 = 0.0000

Variable	Coef.	Std. Err.	Z	P> z
Lgdttd	.6358907	.0251796	25.25	0.000
lgrwages	.0422995	.0095044	4.45	0.000
lgdint	-.0895473	.0146479	-6.11	0.000
lgOrliab	.8923581	.091411	9.76	0.000
0.5(lg rtd.lg rwages)	.1801718	.0192669	9.35	0.000
0.5(lg rtd.lg rint)	.1273656	.0197288	6.46	0.000
0.5(lg rtd.lg orliab)	-.25522	.0442361	-6.20	0.000
0.5(lg rwages.lg rint)	-.0151	.0019453	-7.89	0.000
0.5(lg rwages.lg orliab)	-.04210	.0310864	-1.72	0.151
0.5(lg rint.lg orliab)	.060121	.0180258	3.060	0.000
lgtime	-.0543436	.0398231	-1.36	0.172
cons	1.050939	.1500237	7.01	0.000

ω	.2719085	.0977315	2.784	0.005
/lnsigma2	-1.089894	.4081715	-2.67	0.008
/ilgtgamma	-.1081133	.8592583	-0.13	0.900

σ^2	.3362521	.1372485		.1510876
gamma	.472998	.2141881		.1427997
σ_ω^2	.1590466	.1365699		-.1086255
σ_ν^2	.1772055	.0106172		.1563963

ⁱ This has included Stanbic bank acquiring one of the largest and old banks, Uganda Commercial Bank, Orient bank acquiring of the Trust bank, and recently Barclays acquiring the Nile Bank.

ⁱⁱ This policy regime began in 1970 when the government sought a 60% participation in a number of private industrial, commercial, and financial undertakings. The military regime initially turned down this policy reducing the participation to 49%. However, the nationalization drive was revived during the "Economic war" of 1972.

ⁱⁱⁱ Real lending (deposit) interest rate are the difference between average lending (deposit) interest rates for 2004 and the log of CPI inflation for 2004. The interest spread is the difference between deposit and lending rates.

^{iv} The net interest margins is the net interest revenue relative to total earning assets.

^v Note that the model is subject to several assumptions: banks are operating in long-run equilibrium; the performance of the banks is influenced by other participants' actions; the cost structure is homogenous and the production function is a standard Cobb-Douglas function with a constant returns to scale; and the price elasticity of demand is greater than unity.

^{vi} The symbol $A \setminus B$ denotes the set of all elements of a set A not contained in the set B .