



COMPETITIVENESS IN THE COMMERCIAL BANKING INDUSTRY IN BARBADOS

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Introduction

The Barbadian banking sector has traditionally been characterised by a small number of banks, mainly branch operations of international banks and local banks. In recent years, however, there have been a number of mergers and acquisitions leading to the introduction of new players in the market. It is believed that these new entities have heightened the level of competition in the sector and, through the resulting broadening of the product base, have added value to the consumers. With this in mind, the purpose of this paper is to determine the degree of competition in the Barbadian banking industry over the post 1990 period as well as to examine the factors likely to have influence it.

To the best of our knowledge, no study on bank competition has been undertaken for Barbados, although Rambarran (2000) and Duncan (2003) have discussed this issue in the context of the banking sectors of Trinidad and Tobago and Jamaica, respectively. The deficit of research on this topic for the Caribbean is perhaps surprising considering that the banking sectors of the Caribbean, and Barbados in particular, are characterised by a very small number of banks – on average less than ten per country – which, on the surface at least, give the impression of varying levels of collusion.

The early empirical work on bank competition is based on identifying an increasing, monotonic relationship between market concentration and market power. Two paradigms are normally given to justify this relationship. One, the so-called Structure-Conduct-Performance paradigm (Bain, 1951; Gilbert, 1984) which states that fewer and larger banks (higher concentration) are more likely to facilitate collusive agreements, increase market power and therefore raise prices

and profitability of banks. Two, the Relative-Efficiency paradigm which suggests, that efficient firms are able to earn relatively high profits because of lower costs, and thus increase their market share in the process (Gilbert, 1984).

Many researchers and policymakers still draw heavily on bank concentration as a proxy for competition (see Cetorelli, 1999). However, others (for example, Claessens and Laeven, 2004) argue that the empirical evidence does not support the expected inverse relationship between concentration and competition. Moreover, relying on concentration as a measure of bank competition can lead to measurement problems and misleading inferences since concentration measures like the Herfindahl-Hirschman index tend to exaggerate the level of competition in small countries and are increasingly unreliable when the number of banks is small (Bikker, 2004).

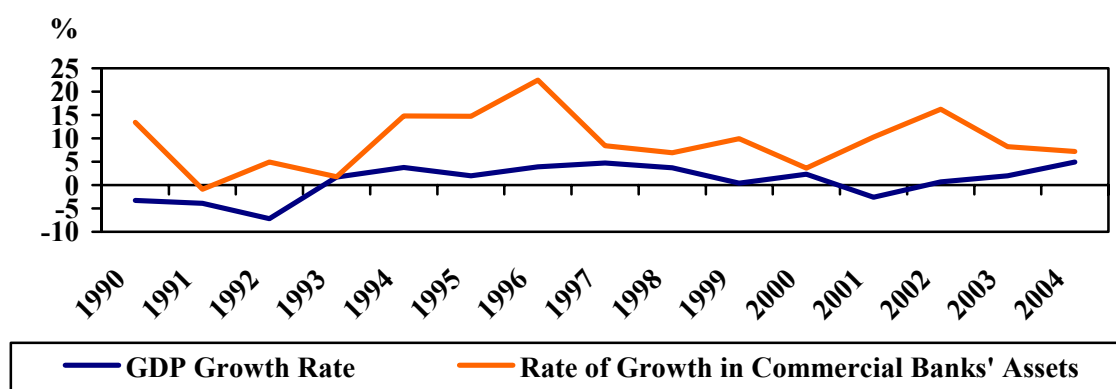
A more recent and dominant method to analyse bank competition is the so-called ‘new empirical Industrial Organisation (IO)’ approach, which uses profit-maximizing comparative static properties (see the survey of Bresnahan, 1989). For empirical studies of banking two procedures are often employed: first, the method of Panzar and Rosse (1987), and second, the conjectural - variation method or its alternative specification generally referred to as the method of Bresnahan (1982) and Lau (1982). The Panzar-Rosse statistic H is based on the sum of elasticities of gross revenue with respect to input prices. On the other hand, the conjectural-variation approach involves the bank’s anticipated response of its rival to an output change. This response depends on the competitive behaviour of all the banks and thus the estimate from the conjectural - variation procedure can be utilised to infer the competitiveness of the entire banking sector (Iwata, 1974; Bresnahan, 1982; Lau, 1982). It is for this reason that the conjectural - variation method of Bresnahan (1982) and Lau (1982) adopted to panel data by Angelini and Cetorelli (2003), Uchida and Tsutsui (2005) and Kubo (2006) for Italian, Japanese and Thai banks, respectively, is employed in this article to estimate the degree of competition within the Barbadian banking sector over the period 1990 to 2004. An additional aspect of this study is to undertake a preliminary quantitative exploration of the factors driving the change in the degree of competition over the review period.

The rest of the paper is organised as follows: Section II describes the developments in the Barbadian banking sector, paying particular attention to those events that could impact on the level of competition; Section III gives a select review of the empirical IO studies on bank competition undertaken for developing countries; Section IV presents the conjectural - variation model; Section V explains the data used and discusses the competition estimates and its likely determinants; and Section VI concludes.

Developments Affecting the Barbadian Banking Sector

During the sample period, 1990 – 2004, the economy of Barbados grew by just under 1%, on average. On closer look, however, four significant periods could be identified: a recessionary period during the first three years of the sample period, growth averaging 2.8% for the remainder of the 1990s, a recession in 2001 and growth averaging 2.5% from 2002-2004. To get an idea of how the banking sector performed during these periods, it may be useful to look at the growth in assets of commercial banks. Figure 1 shows the GDP growth rates and rate of growth in commercial banks' assets during the sample period. On first glance, there may appear to be a negative relationship between the two, however, the correlation coefficient is positive, although quite low at 0.29.

Figure 1: Comparison of Growth Rates of Commercial Banks' Assets and Real GDP



Throughout the 1990s and into the 21st century, there have been a number of developments within the Barbadian banking sector that may have impacted the behaviour of banks within the industry. One of the earliest was the liberalisation of the weighted average loan rate in 1990. Previously set by the Central Bank of Barbados, this rate was used to enable a certain level of control over the amount of credit in the system at any given time. The central bank reconsidered

the use of this tool, however, as the focus of operations turned towards promoting commercial bank efficiency, mobilising savings within the economy, etc. The wisdom for loan rate ceilings therefore came into question and the regulation of the weighted average lending rate was eventually abolished. In the year following the elimination of this tool, the weighted average loan rate on total loans rose by 2.9 percentage points, but slowly declined to what is considered to be market-determined levels thereafter.

One of the most important developments within the Barbadian financial sector has been the introduction of the Barbados Stock Exchange near the end of the 1980s. This was a critical turning point in the evolution of the financial sector because it offered an alternative source of funds for corporate borrowers as well as a new opportunity for investors seeking to earn more attractive returns than those available at the time on standard savings accounts. Of particular note, two events increased the attractiveness of the stock market as an alternative to traditional bank lending and investment in the country, heightened the awareness of the consumers, and contributed to the development of an active mutual fund market. Firstly, in light of the goal to create a regional stock exchange for the Caribbean Community (CARICOM), in 1991, the stock exchanges of Barbados, Trinidad and Tobago and Jamaica began cross-border trading of listed securities. Secondly, in 1992, the Barbados Stock Exchange introduced a market to assist small, highly leveraged companies in need of capital.

The development of the mutual fund market really picked up in the late 1990s with the number of registered mutual funds more than doubling between 1998 and 1999 and increasing almost four-fold between 1998 and 2004. This is an important fact to note given that various arms of commercial banks managed more than half of the mutual funds in existence in 1999. By the end of the sample period, however, the proportion of commercial bank-managed mutual funds had dropped below 50%, almost entirely due to the introduction of new mutual funds by the non-commercial bank players in the market. It is evident, therefore, that commercial banks faced significant competition from other entities during the review period, a noteworthy observation because mutual funds provide an alternative to the traditional savings accounts offered by commercial banks. It is possible that in the face of competition from outside of the banking sector that, in the mutual fund market at least, there were higher levels of competition than in the

traditional areas of activities simply because most of the competing funds were managed by non-bank entities who probably would not have been involved in collusion with the commercial banks. If this possibility holds true, this competitive behaviour may have filtered into the other more traditional areas of banking services and could be an important determinant of the level of competition in the banking sector.

The changes that the credit union movement within Barbados underwent during the sample period also affected the banking sector. Credit unions have had a strong presence in the Barbadian financial sector since the first credit union was established in 1947. At the end of 2004, there were 38 registered unions operating in Barbados with a membership equal to roughly just under half of the total population. During the sample period, 1990 – 2004, deposits at credit unions grew on average by 20.2% while the average rate of increase in loans outstanding hovered around 13.8%. Despite these growth rates, however, Moore (2005) argued that the industry still did not represent a serious competitor to banks as total credit union savings were ten times less than those reported by commercial banks. On the other hand, given that 82% of total credit union assets were held by 5 of the unions, this high level of concentration implies that the failure of any of these players could have significant consequences for the financial sector (see Moore, 2005). The range of services offered by credit unions has also diversified over the sample period and currently rivals that of commercial banks, with unions now offering automatic teller machines, telephone banking facilities, credit cards, mortgage loans, chequing facilities and bill paying services. As such, credit unions may represent an attractive alternative to traditional banking in Barbados and could be a worthy competitor for the commercial banks.

Towards the end of the sample period, the sector experienced a number of key mergers and acquisitions. The branch operations of two international banks were merged to form a new regional entity headquartered in Barbados and regional interests acquired three local banks (one of which was predominantly government-owned). Consequently, with the exception of two branch operations of international banks, the commercial banking sector now comprises regionally owned structures. This is in contrast to the situation that existed at the end of the 1980s and into the 1990s when the sector consisted of mainly branch operations of international banks. In light of the recent trend of mergers and acquisitions, competition within the sector has

led to the introduction of attractive new financial products and technological advances such as Internet Banking to serve customers. The renewed dynamism within the sector that came about with the mergers and acquisitions is believed to be as a result of a break in the historical close relationships between the previous banks. Many of the “new” entities upon entrance into the market gave the impression of competition without collusion and this change in the way the sector operates could be an important factor behind any increase in the level of competition.

A Review of the Empirical IO studies on Bank Competition in Developing Countries

Most of the empirical work on bank competitiveness has been undertaken on developed countries and useful surveys of this literature are already available (see Bresnahan, 1989; 1997). Consequently, the aim of this section is to review the studies done on developing economies. The survey is selective since the focus is on those articles that applied the new IO method, the *modus operandi* of this research. Basically, this procedure attempts to measure or infer the competitive environment rather than observe it as is done in the structural approaches of estimating bank competition. It does not assume a priori that concentrated markets are not competitive because contestability may depend on the extent of potential competition and not necessarily on market structure. In addition, the new IO method does not require a geographic market to be specified, since the behaviour of banks gives an indicator of market power (for more details, see Casu and Girardone, 2006).

Ribbon and Yosha (1999) explored the level of competition in the Israeli banking sector using the Bresnahan and Lau conjectural-variation method. The authors found that banks lost market power in the aftermath of financial liberalisation, despite the high levels of concentration that remained within the industry. In both the non-indexed local currency loan and deposit markets, the hypothesis of perfect competition is rejected, but the findings indicated that the loan market is less competitive than the deposit market. Over time, the authors found a significant increase in the level of competition in both markets and suggested that international financial liberalisation is at least partly responsible for this expansion.

Móré and Nagy (2004) conducted a similar study on the Hungarian banking sector utilising the Bresnahan-Lau conjectural-variation approach. They, however, divided their sample by market

rather than by geographical region and concluded that the degree of competition in the loan and deposit markets fell between perfect competition and the Cournot equilibrium for the period December 1996 and September 2003, while the consumer credit market was between Cournot equilibrium and perfect collusion for the period March 2001 and September 2003.

According to the preliminary results obtained with the Bresnahan-Lau model, Kubo (2005) found that it was possible that the level of competition declined in Thailand banking sector following the reforms implemented after the East Asian crisis. The author did admit, however, that due to the short sample period used, the robustness of the estimations may be subject to question and the effects of the financial reforms may not have fully worked their way into the financial system.

Within the Caribbean and Latin American region, a study conducted by Duncan (2003) tested the level of competition in the Jamaican banking sector between March 1989 and March 2002 using both the structural Herfindahl-Hirschman index and the non-structural approach of Panzar and Rosse. The two methods gave contradicting results. However, the author believed that the Panzar and Rosse model was more robust than the structural method employed and the results of this approach formed the basis of the conclusion drawn. The results indicated that competition actually fell slightly following the period of financial liberalisation, and suggested that monopolistic competition prevailed for the entire sample period. Furthermore, the level of competition declined over the sample period.

In a study on bank competition in Trinidad and Tobago, Rambarran (2000) also utilised the Rosse-Panzar model and concluded that the level of competition within the Trinidad and Tobago banking sector reflected a partially contestable market with a degree of competitiveness above that of Cournot behaviour. Furthermore, despite the relatively small size of the market by international standards, the sector could benefit from the entry of at least two more average-sized banks. Results from a study on the Brazilian banking sector (see Nakane, 2001) using the Bresnahan-Lau procedure, point to a highly competitive market, although not perfectly competitive, where though the banks have some market power, perfect collusion is not a

characteristic of bank behaviour. Tabular comparisons of these studies are given in Table 1 below.

Table 1: A Comparison of the Studies Conducted on Developing Countries

Author	Country	Period	Method	Products	Results
Rambarran (2000)	Trinidad and Tobago	1969 – 1997	Panzar and Rosse	Not Specified	Reject the monopoly, conjectural variation short-run oligopoly and perfect competition hypotheses. Monopolistic competition evident during the sample period.
			Conjectural variation model	Not Specified	Competition greater than Cournot behaviour, with no increase in the degree of competition after 1989.
Duncan (2003)	Jamaica	1989 Q1 – 2002 Q1	Panzar and Rosse	Not Specified	Decline in competition following the liberalisation period at the end of the 1980s and into the 1990s. Monopolistic competition evident during the entire sample period.
			Structural	Not specified	Marginal increase in competition following the liberalisation period in the early 1990s, followed by a decline in competition in the mid-1990s.
Kubo (2006)	Thailand	1992 – 2004	Bresnahan-Lau	Not Specified	Decline in competition following the East-Asian crisis in 1997-1998
Ribbon and Yosha (1999)	Israel	January 1989 – June 1996	Bresnahan-Lau	Loans; Deposits	Increase in competition as a result of the financial liberalisation process.
Móré and Nagy (2004)	Hungary	December 1996 – September 2003	Bresnahan-Lau	Loans; Deposits; Consumer Credit	The degree of competition in the loan and deposit markets lies between perfect competition and the Cournot oligopoly. However, the degree of competition in the consumer credit market lies between Cournot equilibrium and perfect collusion.
Nakane (2001)	Brazil	August 1994 – August 2000	Bresnahan-Lau	Loans	Highly competitive banking industry, though not perfectly competitive. Hypothesis of Collusive behaviour strongly rejected

Analytical Framework

In this section a model is derived to estimate the degree of competition using first order conditions of profit maximization. It is a version of the method formalized by Bresnahan (1982, 1989) and Lau (1982) and adopted to panel data by Angelini and Cetorelli (2003) for Italian banks, Uchida and Tsutsui (2005) for Japanese banks and Kubo (2006) for Thai banks.

First, assume that a bank i receives funds d_i from depositors and invests them in loans q_i and government bonds b_i . Then, the profits $\Pi_{i,t}$ of bank i at period t are:

$$\Pi_{i,t} = P_t(Q_t)q_{i,t} + r_{i,t}^b b_{i,t} - r_{i,t}^d d_{i,t} - C_{i,t}(q_{i,t}, d_{i,t}) \quad (1)$$

where $P_t(Q_t)$ is the inverse demand function for loans, $Q_t \equiv \sum_{i=1}^n q_{i,t}$, n is the number of banks, $r_{i,t}^b$ is the yields on bonds, $r_{i,t}^d$ is the interest rate on deposits, and $C_{i,t}(q_{i,t}, d_{i,t})$ represents the operating cost function of bank i . The bank's optimization problem is

$$\begin{aligned} & \text{Max} \\ & \{b_{i,t}, q_{i,t}, d_{i,t}\} \quad \Pi_{i,t} \text{ s.t. } b_{i,t} + q_{i,t} = d_{i,t} \end{aligned} \quad (2)$$

From the first order conditions the following expression can be obtained (see, for example, Uchida and Tsutsui, 2005)

$$R_{i,t} = \frac{\theta_{i,t}}{\eta_t} R_{i,t} + r_{i,t}^d q_{i,t} + q_{i,t} \frac{\partial C_{i,t}}{\partial d_{i,t}} + q_{i,t} \frac{\partial C_{i,t}}{\partial q_{i,t}} \quad (3)$$

where $\eta_t \equiv -(P_t/Q_t)(\partial Q_t/\partial P_t)$ is the market demand price elasticity for loans, $S_{i,t} \equiv q_{i,t}/Q_t$ is the market share of loans for bank i , and $\theta_{i,t} \equiv (\partial Q_t/\partial q_{i,t})S_{i,t}$ is bank i 's conjectural elasticity of total loan of the banking industry with respect to its own loans. This term indicates the bank's market power, that is, the extent to which the bank can manipulate the loan supply and the lending interest rate by collusion with other banks. In other words it measures the degree of competition. Note that $\theta_{i,t} = 0$ for perfect competition, $\theta_{i,t} = 1$ for monopoly and $\theta_{i,t} = S_{i,t}$ for Cournot competition. From hereon following Bresnahan (1989), the subscript i is omitted from θ_t to capture the average degree of competition in the banking sector.

There are two ways to compute the degree of competition, θ_t , from Equation (3). One method is to compute a Lerner index ($\theta_t/\eta_t P_t$) - an indicator of the market power of a bank – using the estimate of θ_t/η_t as one parameter (see Angelina and Cetorelli, (2003), Kubo (2006)). Alternatively, as in Uchiba and Tsutsui (2005) and adopted here, θ_t can be identified by separating it from η_t . To carry out this second method, note first that the marginal cost in (3) above is unobservable, so postulate the following translog cost function:

$$\begin{aligned} \ell n C_{i,t} = & a_0 + a_1 \overline{\ell n q_{i,t}} + \frac{1}{2} a_2 (\overline{\ell n q_{i,t}})^2 + a_3 \overline{\ell n d_{i,t}} + \frac{1}{2} a_4 (\overline{\ell n d_{i,t}})^2 \\ & + a_5 \overline{\ell n w_{i,t}} + \frac{1}{2} a_6 (\overline{\ell n w_{i,t}})^2 + a_7 (\overline{\ell n q_{i,t}})(\overline{\ell n w_{i,t}}) \\ & + a_8 (\overline{\ell n q_{i,t}})(\overline{\ell n d_{i,t}}) + a_9 (\overline{\ell n d_{i,t}})(\overline{\ell n w_{i,t}}) + \varepsilon_{i,t}^C \end{aligned} \quad (4)$$

where w is the wage rate of bank i , $\varepsilon_{i,t}^C$ is an error term with the usual classical properties, and to avoid possible multi-collinearity, the convention for translog function is followed by letting the variables with upper bars represent deviation from their means.

Substituting the definition of marginal cost, Equation (3) becomes

$$\begin{aligned} R_{i,t} = & \frac{\theta_t}{\eta_t} R_{i,t} + r_{i,t}^d q_{i,t} + C_{i,t} (a_1 + a_2 \overline{\ell n q_{i,t}} + a_7 \overline{\ell n w_{i,t}} + a_8 \overline{\ell n d_{i,t}}) \\ & C_{i,t} \frac{q_{i,t}}{d_{i,t}} (a_3 + a_4 \overline{\ell n d_{i,t}} + a_8 \overline{\ell n q_{i,t}} + a_9 \overline{\ell n w_{i,t}}) + \varepsilon_{i,t}^S \end{aligned} \quad (5)$$

where $\varepsilon_{i,t}^S$ is an error term.

As it stands θ_t cannot be identified since θ_t/η_t is estimated. Thus the following inverse loan demand function is posited¹ to identify θ_t

¹ This framework presumes loans are heterogeneous, implying that interest rates differ according to size, riskiness and maturity. In essence, this assumption contradicts the derivation of the first order profit maximization condition,

$$\begin{aligned} \ln P_{i,t} = & b_0 - \left(\frac{+}{1/\eta_t} \right) \ln Q_t + \overset{+}{b_2} \ln IIP_t + \overset{-}{b_3} \ln ASL_{i,t} + \overset{+}{b_4} \ln SMSF_{i,t} \\ & + \overset{+}{b_5} \ln OPL_{i,t} + \varepsilon_{i,t}^D \end{aligned} \quad (6)$$

where IIP is the index of industrial production, $ASL_{i,t}$ is the average size of loans of bank i , $SMSF_{i,t}$ is the ratio of outstanding loans of small and medium-sized firms to total loans, $OPL_{i,t}$ is the ratio of outstanding operation funds to the total loans, and $\varepsilon_{i,t}^D$ is a disturbance term. Parameter estimates for θ_t and η_t will be given by simultaneous estimation of (4) to (6). The expected signs are shown under the coefficients.

Note that with this method applied to panel data, calculations can be made of the degree of competition every year, enabling the investigation of short-term changes in the degree of competition. This is contrary to Bresnahan (1982) and Lau (1982) who used aggregated time series data that allows only for estimates of the average degree of competition for a long period.

Data and Estimation Results

This study uses a panel of annual data on all commercial banks in Barbados over the period 1990 to 2004. The commercial bank industry generally comprised seven banks for the majority of the sample period. However, there were two periods when the number of banks in operation fell to six. The first occurrence was from 1991 to 1992 when one bank was temporarily inactive in the market; the second instance was from 2002 onward when two banks merged into a single entity. Variable definitions and descriptive statistics are provided in the appendix. The data was obtained from the Central Bank of Barbados.

The econometric analysis was conducted using Eviews 5 software. To estimate the degree of competition in the banking system, the three equations (4 to 6) were estimated simultaneously utilising the seemingly unrelated regression estimation method on an unbalanced panel with fixed effects over the period 1990 to 2004. Attempts at utilising the three-stage least squares

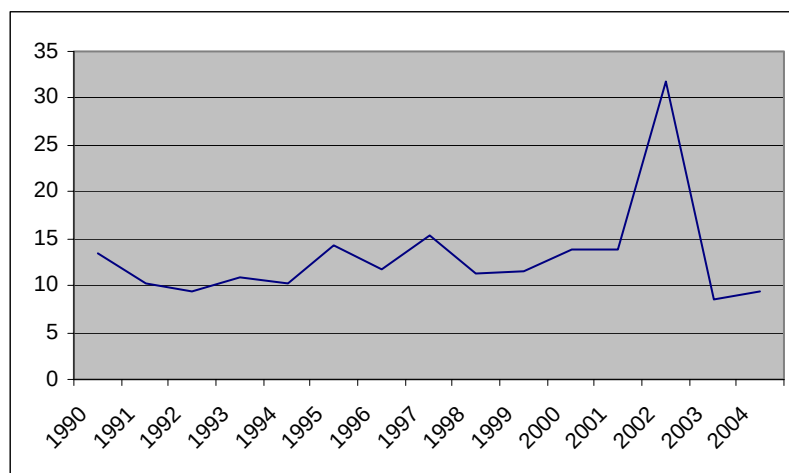
which requires homogeneity of loans. This theoretical disparity is necessary to identify θ from η (see Uchida and Tsutsui, 2005).

technique were unsuccessful due to problems related to the identification of appropriate instruments and the limited number of observations available. This omission will be problematic if the regressors are significantly correlated with the error terms (Baltagi, 2005). It should be noted that the variable SMSF in equation (6) was omitted from the analysis due to the unavailability of the relevant data.

Results of the estimation of equations 4 through 6 are provided in Table 2. Almost all of the coefficients are significant and have economic reasonable signs. In light of the negative relationship between θ and competition, the following discussion focuses on the inverse of the absolute value of θ (i.e. $1/|\theta|$), which can be interpreted directly as the degree of competition. Given this interpretation, the level of competition lies somewhere between perfect competition and Cournot competition.

Figure 2 reveals that despite moderate fluctuations, the degree of competition among commercial banks in Barbados exhibited an overall increasing trend between 1992 and 2002. The results, however, indicate that there was a substantial decrease in competition in 1991 and 2003. These periods of significantly reduced competition correspond to years when the number of commercial banks operating in the industry fell from seven to six as a result of merger and acquisition activity - it may therefore be attributed to a more concentrated market structure. The considerable decline in competition in 1991 and 2003 may also partly reflect the exclusion of two dummy variables from the system for identification purposes.

Figure 2



Factors Affecting the Degree of Competition

Section 2 discussed the evolution of the banking sector in Barbados and highlighted several developments that could have influenced the level of competition. The main factors mentioned were liberalization of the weighted average loan rate, introduction of the Barbados stock exchange, development of the mutual fund market, the credit union movement and merger and acquisition activity.

To empirically examine which factors affect the degree of competition in the banking industry, θ is regressed on selected variables thought to influence the competitive situation. The authors were forced to limit the number of regressors included in the equation since only 15 observations were available to estimate the model. As such, some variables discussed in the second section of this paper were entered into the regression separately.

A variable was included to capture alternative avenues for financing or investing. In this regard, three separate variables were tried: (1) the total assets of mutual funds in Barbados (*MUTUALFUNDS*), to capture the emergence and expansion of the mutual fund industry; (2) the total deposits of credit unions (*CREDITUNION*), to determine the effect of the credit union movement on bank competition; and (3) the market capitalisation of the Barbados Stock Exchange (*STOCKMKT*), to capture the impact of the stock market. Since the authors believe that mergers and acquisitions within the banking industry could alter the competitive landscape, this activity is proxied by a dummy variable (*MERGE_ACQ*) which takes a value of 1 in years when such activity occurs and zero in all other years. As a measure of market concentration in the loan market, the Herfindahl index (*HI*), calculated for each year as the sum of the squared loan share of each bank, is employed. The index can range from 0 to 1, with smaller values indicating a more competitive industry with no dominant players. A decrease in the Herfindahl index, therefore, generally implies an increase in competition. The deregulation of loan rates is represented in the model by a dummy (*FREELOAN*) variable which equals one in those years when some category of loan rate was liberalised and zero otherwise. Finally, the growth rate in real GDP (*GDP*) and/or the rate of inflation (*INFL*) were included in the regression equation as explanatory variables to account for the effects of the business cycle.

The regression equation (7) given below was estimated using ordinary least squares and the findings of the estimation, showing only the significant variables, are given in Table 3. It is important to note, however, that since only 15 observations are included, the results of the estimation should be interpreted with caution.

$$\theta_t = \alpha_0 + \alpha_1 \text{MUTUALFUNDS}_t + \alpha_2 \text{FREELOAN}_t + \alpha_3 \text{HI}_t + \alpha_4 \text{MERGE_ACQ}_t + \alpha_5 \text{GDP}_t + \alpha_6 \text{INFL}_t \quad (7)$$

Only two of the six explanatory variables were shown to significantly influence the degree of competition. In particular, the coefficients on both the GDP and FREELOAN variables are highly significant and positive, implying that increases in economic activity and the deregulation of loan rates resulted in lower levels of competition in the commercial banking industry over the sample period. The positive relationship between θ and GDP or the negative relationship between competition and GDP, suggests that as economic activity expands and agents accumulate income, they tend to invest more and are likely to go to banks for additional financing - this increases business for the banking industry and reduces overall competition. The result for FREELOAN may be explained by the fact that even though loan rates were gradually liberalised, minimum deposit rates were still set by the Central Bank, which meant that if commercial banks were to maintain a profitable spread they were still restricted in the use of loan rates as a competitive tool.

On the other hand, the insignificant coefficients on the remaining variables suggest that market concentration, the inflation environment, mergers and acquisitions, and the growth of the mutual fund industry did not significantly affect the degree of competition. When Equation (7) was re-run with the variable CREDITUNION replacing MUTUALFUNDS, CREDITUNION was found to be an insignificant regressor in the model. This is consistent with the findings of Moore (2005), who suggested that credit unions did not constitute a serious competitor for commercial banks. Similarly, when the variable STOCKMKT replaced CREDITUNION in Equation (7), STOCKMKT was also shown to be an insignificant explanatory variable.

Conclusion

This study investigates the level of competition among commercial banks in Barbados over the period 1990 to 2004. The results suggest that overall competition within the banking industry increased between 1992 and 2002; however, before and after this period there were sharp declines in competition probably related to the effects of merger and acquisition activity. With regard to determinants, the deregulation of loan interest rates and the growth in overall economic activity were the two factors shown to significantly affect the degree of competition. An extended data set would certainly allow for a more rigorous examination of the factors influencing the level of competition in the commercial banking industry in Barbados.

More research in the area of bank competition is warranted in light of Barbados' entry into the CARICOM Single Market and Economy (CSME). While the banking sector will remain fairly open to the entry of non-domestic entities, as part of the country's commitments under the CSME, the Central Bank has been gradually liberalising exchange controls and granting higher levels of authority to the commercial banks. It is expected that this will eventually lead to changes in the types of activities that the banks have traditionally been involved in, with the probable introduction of activities such as cross-border corporate lending. This could be a significant factor that is likely to affect the level of competition within the sector. What should also be noted here is that while there are less than ten banks currently operating within the sector, there could be more than this competing for the business of the sector without ever needing to open offices within the country.

References

- Angelini, P. and Cetorelli, N., 2003. Bank Competition and Regulatory Reform: The Case of the Italian Banking Industry. *Journal of Money, Credit and Banking*, 35, 663-684.
- Bain, J. 1951. Relation of the Profit Rate to Industry Concentration: American Manufacturing, 1936-1940. *Quarterly Journal of Economics*, 65, 293-324.
- Baltagi, B. (2005), *Econometric Analysis Of Panel Data*, John Wiley And Sons: New Jersey.
- Bikker, J. A., 2004. *Competition and Efficiency in a Unified European Banking Market*. (Cheltenham: Edward Elgar).
- Bresnahan, T. F., 1982. The Oligopoly Solution Concept is Identified. *Economics Letters*, 10, 87-92.
- Bresnahan, T. F., 1989. Empirical Studies of Industries with Market Power. In: Schmalensee, R., Willig, R. (Eds.), *Handbook of Industrial Organization*. North-Holland, Amsterdam.
- Bresnahan, T. F., 1997. Testing and Measurement in Competition Models. In: Kreps, D. M., Wallis, K. F. (Eds.), *Advances in Economics and Econometrics: Theory and Applications*. Seventh World Congress, Vol. III. Cambridge University Press.
- Casu, B. and Girardone, C., 2006. Bank Competition, Concentration and Efficiency in the Single European Market, *The Manchester School*, 74, 441-468.
- Cetorelli, N., 1999. Competitive Analysis in Banking: Appraisal of the Methodologies. *Economic Perspectives*, Federal Reserve Bank of Chicago, Issue Q1, 2-15.
- Cetorelli, N., 2002. Entry and Competition in Highly Concentrated Banking Markets. *Federal Reserve Bank of Chicago Economic Perspectives*, 4Q, 18-27.

Claessens, S. and Laeven, L., 2004. What Drives Bank Competition? Some International Evidence. *Journal of Money, Credit and Banking*, 36, 563-83.

Duncan, D. 2003. Testing for Competition in the Jamaican Banking Sector: Evidence From Banking Sector: Evidence From Bank Level Data. Bank of Jamaica, mimeo.

Gilbert, R.A., 1984. Studies of Bank Market Structure and Competition: A Review and Evaluation. *Journal of Money, Credit and Banking*, 16, 617-44.

Iwata, G., 1974. Measurement of Conjectural Variation in Oligopoly. *Econometrica*, 42, 947-66.

Kubo, K., 2006. The Degree of Competition in the Thai Banking Industry before and after the East Asia Crisis. Discussion Paper No. 56, Institute of Developing Economics.

Moore, W., 2005. Is Efficiency Imperative for the Growth of the Barbadian Credit Union Industry? *Journal of Eastern Caribbean Studies*, Vol. 30, No. 3.

Móré, C. and Nagy, M., 2004. Competition in the Hungarian Banking Market. Working Paper, Magyar Nemzeti Bank, Budapest.

Nakane, M. I., 2001. A Test of Competition in Brazilian Banking. Working Paper Series 12.

Panzar, J.C. and Rosse, J.N., 1987. Testing for Monopoly Equilibrium. *Journal of Industrial Economics*, 35, 443-56.

Rambarran, A., 2000. Bank Competition and Contestability in Trinidad and Tobago: A Case for Further Commitments under the GATS. *Money Affairs*, XIII, 17-37.

Ribbon, S. and Yosha, O., 1999. Financial Liberalisation and Competition in Banking: An Empirical Investigation, *Discussion Paper No. 99.05*, The Bank of Israel.

Uchida, H. and Tsutsui, Y., 2005. Has Competition in the Japanese Banking Sector Improved?
Journal of Banking and Finance, 29, 419-439.

Table 2: Results of Seemingly Unrelated Regression (1990-2004)

Parameter	Estimated Coefficients			
	Coefficient	Std. Error	t-Statistic	Prob.
α_1	0.160	0.009	18.432	0.000
α_2	0.023	0.009	2.581	0.010
α_3	-0.325	0.016	-20.219	0.000
α_4	0.313	0.039	8.038	0.000
α_5	1.198	0.023	52.813	0.000
α_6	0.660	0.141	4.673	0.000
α_7	0.004	0.019	0.195	0.845
α_8	-0.056	0.016	-3.423	0.001
α_9	-0.108	0.042	-2.594	0.010
θ/η 1990	0.763	0.005	145.226	0.000
θ/η 1991	0.760	0.005	148.080	0.000
θ/η 1992	0.770	0.005	154.947	0.000
θ/η 1993	0.796	0.007	118.902	0.000
θ/η 1994	0.801	0.006	131.335	0.000
θ/η 1995	0.774	0.006	139.881	0.000
θ/η 1996	0.755	0.005	144.928	0.000
θ/η 1997	0.755	0.005	153.509	0.000
θ/η 1998	0.784	0.005	158.793	0.000
θ/η 1999	0.751	0.004	176.039	0.000
θ/η 2000	0.710	0.004	183.592	0.000
θ/η 2001	0.762	0.004	199.778	0.000
θ/η 2002	0.814	0.004	193.672	0.000
θ/η 2003	0.827	0.005	174.452	0.000
θ/η 2004	0.826	0.005	160.380	0.000
$1/\eta$ 1990	-10.251	3.362	-3.049	0.003
$1/\eta$ 1991	7.731	3.903	1.981	0.049
$1/\eta$ 1992	7.274	3.425	2.124	0.035
$1/\eta$ 1993	8.688	3.697	2.350	0.020
$1/\eta$ 1994	8.187	3.804	2.152	0.032
$1/\eta$ 1995	11.014	3.636	3.029	0.003
$1/\eta$ 1996	8.932	3.572	2.500	0.013
$1/\eta$ 1997	11.525	3.503	3.290	0.001
$1/\eta$ 1998	8.912	3.491	2.553	0.011
$1/\eta$ 1999	8.699	3.449	2.522	0.012
$1/\eta$ 2000	9.799	3.409	2.875	0.004
$1/\eta$ 2001	10.624	3.370	3.152	0.002
$1/\eta$ 2002	25.826	3.522	7.333	0.000
$1/\eta$ 2003	7.138	3.780	1.888	0.060
$1/\eta$ 2004	7.827	3.652	2.143	0.033
b_2	18.765	8.599	2.182	0.030
b_3	-1.669	0.761	-2.192	0.029
b_5	-14.957	0.819	-18.256	0.000

Notes: Parameters α_1 - α_9 relate to the cost function, parameters b_2 - b_5 relate to the price equation, θ relates to the degree of competition, and η is the market demand elasticity for loans.

Table 3: Estimation Results (1990-2004) – Factors Influencing θ

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.051	0.013	3.982	0.002
FREELOAN	0.079	0.029	2.704	0.019
GDP	0.008	0.003	2.394	0.034
R-squared	0.414			
Adjusted R-squared	0.317			
Durbin-Watson stat	1.316			

APPENDIX: Variable Definitions

Variable	Definition
$R_{i,t}$	Loan interest revenue for bank 'i' at time t
$q_{i,t}$	Outstanding balance of loans for bank 'i' at time t
Q_t	Sum of $q_{i,t}$ over all banks at time t
$d_{i,t}$	Outstanding deposits of bank 'i' at time t
$C_{i,t}$	Operating cost for bank 'i' at time t
$r_{i,t}$	(Interest paid for deposits)/(total deposits) for bank 'i' at time t
$w_{i,t}$	(Personel expenses + welfare expenses)/(number of employees) for bank 'i' at time t
$P_{i,t}$	$R_{i,t}/q_{i,t}$: loan interest rates for bank 'i' at time t
$ASL_{i,t}$	$q_{i,t}/(\text{number of loans for bank 'i' at time t})$
$SMSF_{i,t}$	(Amount of loans small and medium-sized firms)/ $q_{i,t}$
$OPL_{i,t}$	(Amount of loans for operations funds)/(amount of loans for operation funds + loans for equipment funds for bank 'i' at time t)
IIP_t	Index of industrial production at time t
GDP_t	Real GDP Growth Rate at time t
$INFL_t$	Inflation rate at time t
$FREELOAN_t$	Dummy variable which equals 1 in years when some category of loan rate was liberalised and zero otherwise
$MERGE_ACQ_t$	Dummy variable which equals 1 in years when mergers or acquisitions occur and zero otherwise
HI_t	Herfindahl Index: calculated for each year as the sum of the squared loan share of each bank
$MUTUALFUNDS_t$	Total assets of mutual funds in Barbados at time t
$CREDITUNION_t$	Total deposits of credit unions in Barbados at time t
$STOCKMKT_t$	Market capitalisation of the Barbados Stock Exchange at time t

APPENDIX: Descriptive Statistics

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Observations
R	29889.090	25313.500	69681.000	3970.000	16083.911	0.572	2.379	7.060	100
q	227811.010	159895.000	842943.000	9105.000	190510.010	1.356	4.287	38.279	102
d	505358.304	396010.000	2148146.000	53864.000	394514.658	1.623	6.317	91.549	102
C	23943.510	18876.000	91434.000	2008.000	15766.083	1.780	7.380	132.770	100
r ^d	0.035	0.034	0.077	0.004	0.014	0.374	3.657	4.136	100
P	0.163	0.153	0.596	0.053	0.073	2.862	15.500	787.627	100
ASL	36.071	33.598	69.503	4.253	15.200	0.407	2.585	3.474	100
OPL	0.345	0.299	0.874	0.079	0.214	1.121	3.371	21.955	102
w	41.144	40.918	83.402	14.706	12.689	0.525	4.207	10.663	100
θ	0.074	0.086	0.116	-0.074	0.046	-2.405	8.444	32.983	15
GDP	0.993	2.000	6.200	-7.200	3.781	-0.665	2.585	1.213	15
FREELOAN	0.200	0.000	1.000	0.000	0.414	1.500	3.250	5.664	15
HI	0.191	0.185	0.230	0.176	0.018	1.274	3.116	4.068	15
INFL	2.520	1.900	7.700	-1.200	2.392	0.817	2.970	1.669	15
MUTUALFUNDS	73692.200	3427.000	276067.000	0.000	102655.691	1.158	2.761	3.387	15
CREDITUNION	70063.200	54258.000	194828.000	17209.000	56884.626	0.937	2.644	2.274	15
MERGE_ACQ	0.267	0.000	1.000	0.000	0.458	1.055	2.114	3.275	15
STOCKMKT	3232522.773	2282819.500	10407248.600	518466.900	2987025.918	1.054	3.189	2.799	15

Notes: R, q, d, C, ASL, w, MUTUALFUNDS, CREDITUNION and STOCKMKT are measured in thousands of Barbados dollars. r^d, P, OPL, are ratios, while FREELOAN and MERGE_ACQ are dummy variables.