# Do banking regulations affect the competitiveness of Sri Lankan banks by limiting cross-ownership?

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*This study aims to identify whether banking regulations aimed at restricting the percentage ownership of Sri Lankan banks' share capital have an impact on the competitiveness of such banks by way of limiting cross-ownership of multiple banks by investors. The study uses the Panzar-Rosse methodology to calculate an* H-statistic *which will encompass the elasticities of the cost of inputs for the banks, namely deposit funds, personnel and capital. This is done using data for all banks covering the period 2009 – 2018. The calculation has been done using both total gross income and gross interest revenue as dependent variables in order to identify any differences in the level of competitiveness in the markets for loans and fee-generating services. In the event that the markets are not in a monopoly equilibrium, a further test is done to assess whether the respective markets are in a long-run equilibrium before confirming whether the banks face a perfectly competitive or a monopolistically competitive market. The results revealed that banks affected by cross-ownership were operating in conditions of perfect competition and exhibited a higher level of competition when compared to those banks that weren't affected by cross-ownership. The findings suggest that these regulations do not adversely impact the competitiveness of these banks, as the competitiveness of banks affected by cross-ownership is higher than those not affected by it. The higher competitiveness of banks affected by cross-ownership could be attributable to low switching costs for consumers.*

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## 1. Introduction

A casual perusal of the ownership patterns of Sri Lankan banks reveals the presence of a number of investors (including the Government of Sri Lanka) who, either directly or indirectly, own enough shares in multiple banks to put themselves amongst the top 20 shareholders of such banks. Even though many studies have been done with respect to the banking industry in Sri Lanka, none have focused on either explicitly measuring the level of competition in the industry or the impact that banking regulations restricting percentage ownership of banks' shares have on the competitiveness of the industry by way of restricting cross-ownership of banks' shares by multiple investors.

Banks dominate the financial sector of Sri Lanka with 60% of assets held by all firms in the sector. As a result of this, the soundness of the financial system is largely reliant on the health of the banking sector. With the move toward economic liberalisation in the late 1970s, financial reforms were enacted in Sri Lanka with the aim of increasing the efficiency and competitiveness of banks. Until this point, the dominating players in the banking sector were Bank of Ceylon and People's Bank (both being state banks), who were, and remain, the largest banks in the country. However, these financial reforms brought in structural changes by encouraging more participation in the banking industry by the private sector. This was done with the aim of widening the scope of the industry, as well as to increase the number of players in the market and, therefore, its competitiveness. Other reforms brought in included the adoption of prudential regulations in respect of the maintenance of capital adequacy ratios, asset classification & provisioning and statutory liquid asset ratio, as well as introducing Real Time Gross Settlement (RTGS) as a method of settlement of payments amongst banks.

Regulatory directions issued by the Central Bank of Sri Lanka (CBSL) prohibit direct/indirect ownership of a bank's shares of more than 10%[2]. Even if permission has been granted to do so by the CBSL, it would often be with the condition that their voting rights are curtailed to 15% of aggregate voting rights of the company. However, it is generally found that such shareholders are able to exert significant influence due to their financial stake in the bank by way of nominating persons for appointment to the Board of Directors of such banks.

While the aforementioned regulation applies to any investor (including banks themselves), an indirect restriction on share ownership of any banks by other banks is present in the form of the Banking Act Determination issued on 22 August 1997. This determination has been issued by the CBSL by virtue of the powers vested in it by the provisions of section 17A(1)(a) and 17A(1)(b) and specifically restricts any shareholding in publicly listed companies to 10% of the bank's capital funds (subject to such ownership stake being less than 20% of the issued share capital of said company). In addition to this, the determination also limits the aggregate of share ownership in listed companies to 30% of the bank's capital funds. A majority of Sri Lankan banks are listed (with the exception of state banks).

There is a sea of literature on the Sri Lankan banking industry which assess, amongst others, the impact of financial reforms on the industry, as well as determinants of performance and efficiency of the banking sector. However, none have assessed the impact of banking regulations on the competitiveness of banks by limiting cross-ownership of banks. Therefore, this paper looks at financial data from 2009 to 2018 to ascertain whether restrictions on the percentage ownership of banks' shares has had an impact on the competitiveness of banks (determined by calculating an H-statistic using the methodology derived by **Panzar and Rosse (1987)**), primarily by assessing the competitiveness of banks
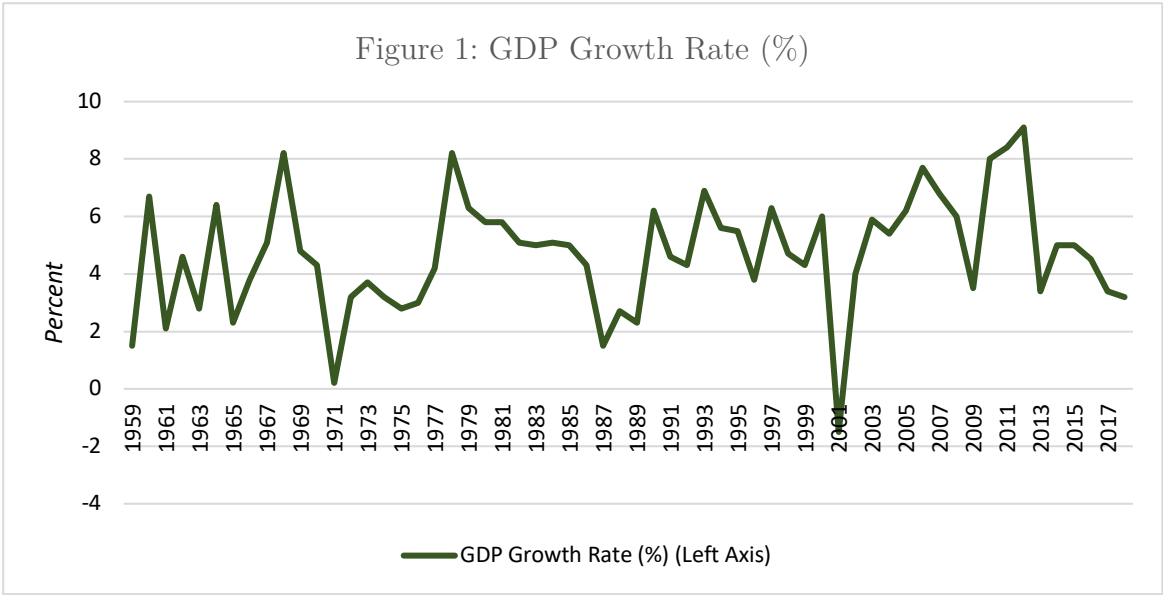
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[2] Banking Act Directions No.1 of 2007 on Ownership of Issued Capital Carrying Voting Rights, dated 19 January, 2007

affected by cross-ownership and comparing it with the competitiveness of those not affected by cross-ownership.
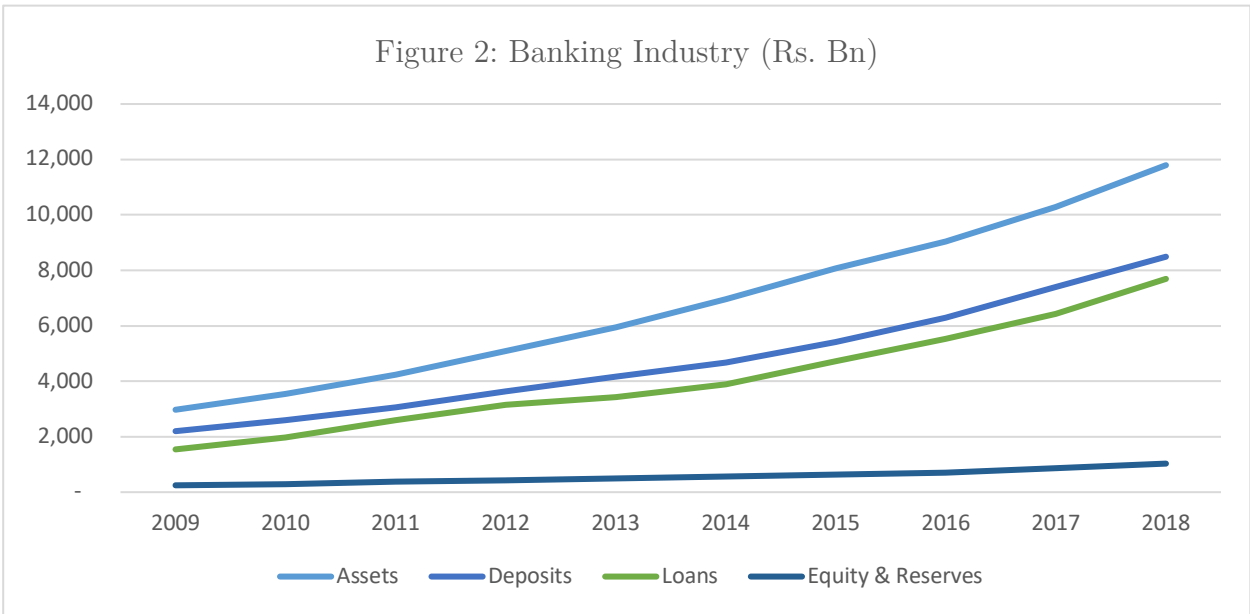
The paper is structured as follows: the next section provides a background to the study, along with some existing literature on the Sri Lankan banking industry. Section 3 outlines the theoretical background which underlies the subject of competitive markets, along with a discussion of empirical studies that have been conducted with regard to bank competitiveness and the effect of cross-ownership. Section 4 describes the data used (along with a presentation of summary statistics). Section 5 describes the research methodology used in this study, as well as outlining the diagnostic and robustness tests carried out. Section 6 presents the main results and discusses them in the context of the study being carried out. Section 7 presents the conclusion.

## 2. Background to the study

The year 2009 saw the end of an internal conflict that ravaged Sri Lanka for 26 years and held back the country's growth, the lowest point of which occurred when an attack on the main international airport in Sri Lanka in July 2001 brought the growth rate down to -1.5%. The cessation of the conflict enabled the Sri Lankan economy as a whole, including banks, to operate without the cloud of an internal conflict hanging over them and resulted in a high rate of growth for the country in the preceding years. The gradual mellowing of the GDP growth rate since 2015 is largely a symptom of the Sri Lankan economy's vulnerability to global and domestic disturbances, which was more pronounced in 2018 due to increasing capital outflow from developing markets which occurred largely due to monetary policy normalisation in the U.S. The Sri Lankan economy fell victim to this during the year, which was further aggravated by the political uncertainty experienced during the latter part of the year.
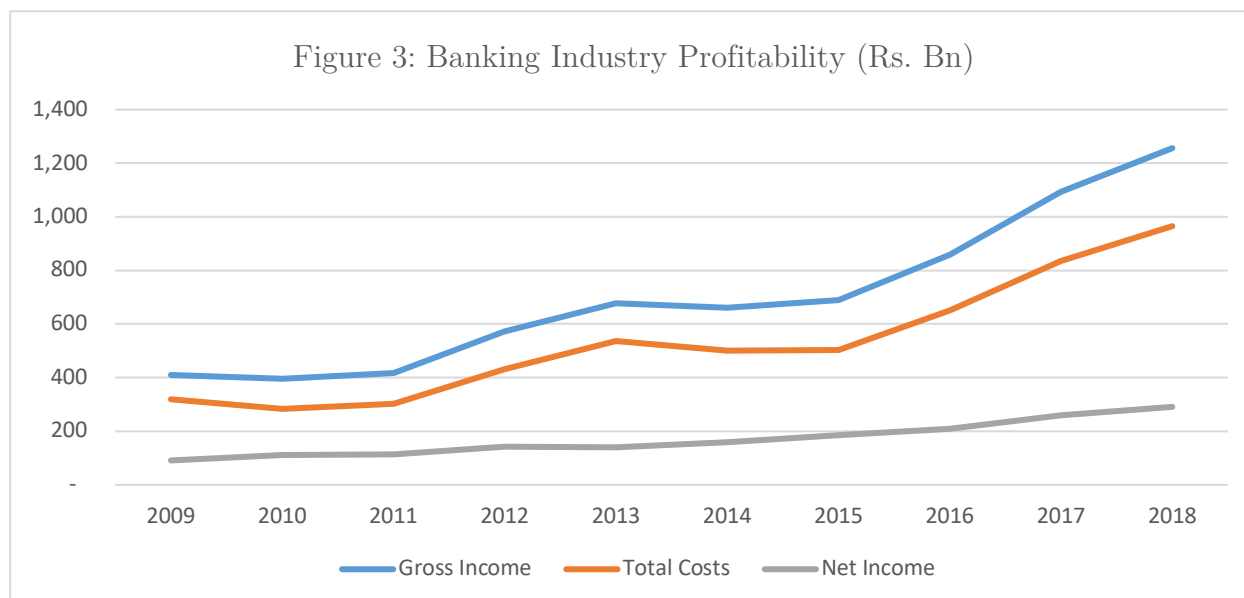
**Figure 1: GDP Growth Rate (%)**

33 banks constitute the Sri Lankan banking sector, which dominates the financial sector of Sri Lankan by way of Rs. 11.8 trillion of assets, which accounted for approximately 60% of the assets of the financial sector. The value of the aggregate loan portfolio of the industry has been on a continually increasing trend, fuelled largely by the increase in deposits, which is on a similar upward trend.

**Figure 2: Banking Industry (Rs. Bn)**

Aggregate income and expenses have been moving in tandem during the period under review. Income and expenses were stagnant during the initial part of the period under review, before commencing an upward trend in 2012, culminating in explosive growth from

2016 onwards. However, it is notable that gross income and total costs have largely moved in lockstep throughout the period, which can explain a very slow but steady rise in aggregate profitability of the industry during the period.



Figure 3: Banking Industry Profitability (Rs. Bn)

In recent years, the Central Bank of Sri Lanka has brought in additional regulatory directions with the aim of strengthening the banking sector and ensuring its stability. This includes guidelines on information security management, enhancement of minimum capital requirements for banks and the implementation of Basel III guidelines on capital requirements & liquidity standards.

**King & Levine (1993)** found that a higher level of development and efficiency of the banking sector automatically translates to higher efficiency of the financial sector as a whole, which will typically lead to a growth in the long-run output of the economy. **Edirisuriya (2007)** assessed the effect of financial sector reforms on the Sri Lankan banking sector. Even though he found that banks became more efficient and competitive due to such reforms, factors such as lack of financial literacy, dominance of state banks and the absence of a clear & stable direction in Government policy continued to hamper the banking sector and that further reforms were necessary to make the banking sector more efficient.

**Athukorala & Rajapatirana (1993)** analyse the impact of the financial policy reforms (which commenced in 1977) and found that the level of financial deepening in the economy had increased, as did financial savings and domestic private savings. However, they add that inconsistencies in policies and mistakes which came up when implementing such reforms primarily contributed to such reforms not having as large an impact as they should have.

**Seelantha (2010)** utilised structure-conduct-performance (SCP) literature to assess the impact of banks' efficiency and market structure on the performance of banks and found that this hypothesis does not hold in the Sri Lankan market. Furthermore, he found that with fewer large banks and a high level of market concentration, competition between them is more intense. He also found that banks were able to attain a higher level of profitability only when they operated efficiently. This implies lower net interest margins and therefore, an improvement of consumer welfare.

**Ajanthan *et al* (2013)** assessed the impact of corporate governance on the performance of banks as well as the relationship between them. They did this by using the size, diversity, and meeting frequency of the Board of Directors, as well as the percentage of Board Directors who are outsiders. They found that all these variables have a positive relationship with the Return on Equity (ROE) of state banks, but, with the exception of 'meeting frequency', all other factors had a negative relationship with the Return on Assets (ROA). In the case of private banks, only Board diversity and meeting frequency had a positive relationship with ROE, while only the percentage of outsiders in the Board and meeting frequency had a positive correlation with ROA.

**Kumari (2014)** studied the factors that determine the net interest margins of Sri Lankan banks for the period January 2002 to March 2011 using the model developed by **Ho & Saunders (1981)** using panel regression and found risk aversion, operating costs, capital adequacy requirements, credit risk and non-interest income to be the key determinants. The

study also found that market competition and risks from macroeconomic variables do not influence banks' net interest margins.

**Weerasinghe & Perera (2013)** found that size of licensed commercial banks played a significant role in their profitability, as measured by the return on assets ratio, in addition to other factors such as liquidity and operational costs. However, a surprising result was the relationship with the capital adequacy ratio, which they found to be negative and insignificant, which ran contrary to findings from previous similar studies. Another key finding made by them was in respect of the impact of macroeconomic variables, where they found that a high interest rate environment negatively affected profitability due to a fall in the growth of credit, while the economy growth rate (as measured by GDP) did not have a significant impact on profitability.

**Fernando & Nimal (2014)** used Data Envelopment Analysis to measure the technical efficiency of the Sri Lankan banking sector by individual, ownership, industry and size factors for the period 2007 to 2011. The results from the study showed that the technical efficiency of banks was very high (at 83.3%) and that most large banks were enjoying increasing returns to scale, while smaller banks were experiencing decreasing returns to scale. They also found privately owned banks to be more efficient than public banks and that size of the bank did not have a significant impact on its technical efficiency.

## 3. Theoretical and Empirical Background

### 3.1 Theory

There are four broad categories of competitive markets that the different sets of banks may be classified into. They are the monopoly market, the oligopoly market, the perfectly competitive market and the monopolistically competitive market.

In a **monopoly** market, there is a single dominant firm in the market, giving it the ability to earn supernormal profits in the long run, while in an **oligopoly** market there are a few dominant firms in the market. The barriers to entry tend to be very high. However, a peculiar feature of these markets is the elasticity of revenue, which is negative since they face downward-sloping demand curves. This implies that an increase in marginal costs can lead to a fall in equilibrium output and revenues.

In the case of a **perfectly competitive** market, all firms are price-takers since they sell a homogeneous product and no individual firm has enough power to influence the price on their own. Additionally, consumers have perfect knowledge of all products in the market. This results in a horizontal demand curve, with the elasticity of revenue equal to 1.

However, in a **monopolistically competitive** market, the competition is largely of a non-price nature since all firms sell differentiated products, none of which are perfectly substitutable. Additionally, consumers do not have perfect information about all products being sold. Changes in input prices leads to a smaller change in revenue but occurs in the same direction due to product differentiation amongst competing firms.

Marginal costs will be equal to marginal revenue under the long-run equilibrium in both perfectly competitive and monopolistically competitive markets. This is because, in the absence of barriers to entry, new firms will continue to enter the market until long-run economic profits fall to zero.

In contrast to this, a firm in a monopoly or oligopoly market will have positive long-run economic profits due to high barriers to entry which make it difficult (if not impossible) for new firms to enter the market.

## 3.2 Empirical Background

The effects of cross-ownership on the competitiveness of firms can be found in the theoretical results of **Gilo (2000)**, where he argues that a passive investment by a firm in its rivals can

substantially harm competition. This is because when the firm undercuts its rivals, it makes additional profits by capturing a larger share of the market. However, at the same time, this action leads to a fall in the profits of its rivals and, therefore, a fall in their value. This loss in value of the rivals subsequently leads to a fall in the value of the investment made by the firm in its rivals, with the possibility that such loss can offset the value of the direct gain made by the firm. The same is shown to apply in instances where a particular individual/company which has an ownership stake in one firm purchases shares in a rival firm.

**Azar et al (2018)** studied the impact of common ownership in the airline industry in the United States by measuring common ownership concentration on various airline routes and found the presence of hidden social costs due to common ownership. This arises in the form of a reduction in competitiveness, an increase in prices and a fall in output.

However, **Lambert & Sykuta (2018)** put forward an interesting argument for taking no action when institutional investors own minor ownership stakes in rival firms. They posit that policy measures proposed by antitrust scholars to tackle this problem would end up rewiring the industry, thereby pushing up the cost of portfolio diversification for the investors concerned, as well as increasing agency costs at public companies. Due to a lack of evidence as to whether the marginal benefits of such policy measures would outweigh their marginal costs, the optimal regulatory approach (as proposed by the authors) is to do nothing, thereby maximising social welfare. This sentiment is echoed by **Koch et al (2019)**, who looked at the link between cross-ownership by institutional investors and product market competition. They too found that there wasn't a significant relationship between common ownership and industry profitability, output prices or non-price competition and questioned the necessity of antitrust measures, whose aim is to limit cross-ownership.

A number of studies have been done on assessing the competitiveness of banks using the tests derived by **Panzar and Rosse (1987)** (this is discussed in further detail in the Methodology section).

The application of this methodology to the study of competitiveness of banks is done on the assumption that banks are single-product firms. This assumption finds support in **Colwell & Davis (1992)**, where they suggest the use of the 'intermediation' approach when measuring the output of banks. In this approach, banks are considered as an intermediary in the provision of financial services, and the value of loans granted and investments made by the bank are considered as output measures. Labour, funds (including deposits from customers) and capital are considered as inputs, meaning that operating costs (including personnel costs) and interest costs are used to measure their costs. This is in contrast to the 'production' approach, where banks are considered to be in the business of generating loan and deposit accounts using capital and labour. In this case, the level of output is measured by the number of accounts or transactions performed in these accounts, while the measure of costs are all the costs incurred to generate the output.

Using data from 50 countries, **Claessens & Laeven (2003)** assessed the drivers of competition amongst banks using the Panzar-Rosse methodology and found that the presence of foreign banks, as well as fewer restrictions on the types of activities that banks can engage in served to increase competitiveness, while barriers to entry had the expected effect of reducing competition. However, contrary to expectations, they found that concentration of market share amongst a limited number of participants led to increased competition.

**De Bandt & Davis (2000)** use the Panzar-Rosse statistic to determine the effect of the Economic and Monetary Union (EMU) of the European Union on the industry conditions for banks which operated in countries which were part of the Eurozone. They measured the level of competition both in terms of interest income and total revenue. This was due to

the increased drive towards diversification of income by increasing non-interest income. This helped to determine whether the market for non-interest income was more or less competitive than that for interest income. Banks are treated as one-product firms (with funds as inputs and loans to customers as outputs), where the level of competition in the loan and deposit market are considered to be independent of each other. Bank-specific input prices were used under the assumption that banks were not price-takers in the factor markets. Comparing the performance (between 1992-1996) of the banks under consideration with banks from the US, they found that large banks were not fully competitive, as opposed to their US counterparts. Smaller banks were found to be even less competitive, especially those in Germany and France.

**Molyneux et al (1994)** use the Rosse-Panzar statistic to assess the level of competition in major EU banking markets between 1986 and 1989. In order to account for risk, two additional endogenous variables (loans to assets ratio and risk-capital to assets ratio) were added. They found that the competitive nature of such markets didn't undergo any change during the period. The banking markets in Germany, the UK, Spain and France were found to be monopolistically competitive, while Italy depicted signs of a monopoly. This led to the conclusion that EU banking markets were not highly integrated, even though recent legislative measures were passed to ensure their integration.

**Coccorese (2004)** uses the Rosse-Panzar statistic to assess the competitiveness of the Italian banking industry during the period 1997 to 1999, both on a national and a regional basis. A dummy variable is used for large banks to ascertain whether competitiveness is influenced by the size of the bank. The results of the study indicate that monopolistic competition conditions exist in the Italian banking sector. Additionally, the regional *H-statistics* indicate that good macroeconomic performance of a region is positively related to the level of competition there, and vice versa.

**Hempell (2002)** looked at the competitive behaviour of German banks during the period 1993 - 1998 and found that the industry displayed signs of monopolistic competition. Different levels of competition were identified for different categories of banks. The most surprising result was the conclusion made regarding the competitiveness of banks based on their size. It was found that the *H-statistic* for larger banks was higher than that of smaller banks, which is contrary to the common school of thought that a larger share of the market results in higher pricing power and therefore, less competitiveness.

**Davis & Karim (2013)** looked at the impact of the financial crisis of 2007-2008 on competition between banks in the European Union and found that, in most countries, the level of competition reduced after the onset of the financial crisis.

**Trivieri (2007)** looks at whether cross-ownership of Italian banks can affect competition within the banking sector. This is done by calculating the Panzar-Rosse H-statistic separately for banks involved in cross-ownership, as well as for those not affected by cross-ownership. It was found that banks involved in cross-ownership tended to be less competitive than the others. This supported the view that cross-ownership can lead to reduced competition in order to preserve return levels of the shareholders of these banks.

Therefore, this study will aim to add to the existing literature on the Sri Lankan banking industry by focusing on a possible determinant of competitiveness of banks.


## 4. Research Data

This study will use a panel data set for the period 2009 to 2018.

Financial data in respect of the banks under consideration have been obtained from the Bank Supervision Department of the Central Bank of Sri Lanka, who collect such data from banks on a monthly, quarterly and annual basis. The data set being used is a balanced data set, where observations on all the parameters required for the regression are available for

the period under consideration, except in instances where the bank has either commenced or ceased operations during this period.

Data on ownership of domestic banks was obtained from the respective banks' Annual Reports, which disclose the name and share ownership percentage of the top twenty shareholders. The Annual Reports are made available on their respective websites, and in the event that they are publicly quoted, they can also be obtained from the website of the Colombo Stock Exchange, which is the only stock exchange in the country. In respect of these banks, shareholders who have an ownership stake of over 1% in the bank are always amongst the top 20 shareholders.

As mentioned earlier, regulatory directions issued by the Central Bank of Sri Lanka do not allow direct or indirect ownership of voting shares of more than 10% by an individual, a company or group of companies. On a case-by-case basis, shareholders may be allowed to have a shareholding of upto 15%, unless the bank requires to be restructured to avoid insolvency or possible failure, in which case shareholders are allowed to breach the limit of 15% under the condition that such shareholding is gradually reduced to 15%. Even if permission has been granted to exceed the 15% threshold by the CBSL, it would often be with the condition that their voting rights are curtailed to 15% of aggregate voting rights of the company within a certain period of time as specified by the Monetary Board (which is the governing board of the Central Bank of Sri Lanka) . In the event of such shareholdings being present, the voting rights of the block of shares held by such individuals or companies will be limited to just 10% of the total voting rights of the bank. Such curtailment of voting rights is currently in force in the following banks:

- *Hatton National Bank PLC*, where the voting rights of 17.83% of shares, which are held collectively by Milford Exports (Ceylon) Ltd, Stassen Exports Ltd and Distilleries Company of Sri Lanka PLC, has been limited to 10%;

- *Cargills Bank Ltd*, where the voting rights of 65% of shares collectively held by Cargills (Ceylon) PLC and CT Holdings PLC has been limited to 30%; and

- *Nations Trust Bank PLC*, where the voting rights of shares held by the John Keells Group (29.64%) and the Central Finance Group (19.91%) has been limited to 10% each.

Banks have also been divided into those that are affected by cross-ownership and those that aren't affected by it. For the purposes of identifying cross-ownership patterns amongst banks, any shareholding over 1% has been taken into account. From **Table 5 (Appendix 1)**, it is notable that in addition to the Government having an outright majority ownership stake in 6 banks (MBSL Savings Bank PLC was converted to a Licensed Finance Company and, therefore, no longer operates as a bank), it has substantial ownership stakes in 6 private banks as well. The 'Captain Family' includes the shareholdings of R S Captain, L A Captain and S E Captain, and have been included on an aggregate basis as their combined shareholding has been utilised to obtain a seat on the Board of Directors of Hatton National Bank PLC.

The data has also been split to distinguish between banks which are considered as 'Systemically Important Banks' and those that are not. They are defined by the CBSL as banks "with total assets of Rs. 500Bn and over, as in the latest audited financial statements"[3]. Any bank which is deemed to be a systemically important bank is expected to have a higher capacity to absorb losses if they face adverse business conditions due to the higher level of risk that their possible failure could pose to the health of the financial system. Therefore, the minimum capital ratios for these banks are 1.5% higher than that required for non-systemically important banks. Such higher capital ratio mean that these banks have to set aside more funds to absorb losses. As at the end of the sample period,

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[3] Section 2.2 of Part II(B) of the Banking Act Directions No. 01 of 2016 on Capital Requirements under Basel III for Licensed Commercial Banks and Licensed Specialised Banks, dated 29 December, 2016

the banks which are currently recognised as systemically important banks are Bank of Ceylon, People's Bank, Commercial Bank of Ceylon PLC, Hatton National Bank PLC, National Savings Bank and Sampath Bank PLC.

The final distinction which has been made in the sample is for foreign banks. A foreign bank does not have to be incorporated as a separate company in Sri Lanka but can be established as a branch of their head office. In order to ensure that such branches are ably supported by their head office, the Central Bank of Sri Lanka requires, in addition to a resolution passed by the Board of Directors, a written undertaking that the head office will provide any funds that are required by its branch to fulfil any obligations and liabilities that the branch incurs in the normal course of its business. The key motivation for foreign banks to set up branches in Sri Lanka is to increase the ease of carrying out banking affairs in Sri Lanka by their customers who are located abroad. Additionally, they also make it easy for local business to carry out business transactions abroad.

DFCC Bank PLC had a 99% ownership stake in DFCC Vardhana Bank PLC, which was operating as a subsidiary of DFCC Bank PLC until October 2015. The two banks subsequently merged and commenced operations under the name of DFCC Bank PLC. The data used for the regression identified DFCC Bank PLC before and after the merger as two different entities. The banks will be treated as separate banks up to the year of the merger and as a single bank after the merger.

Summary statistics in respect of the banks under consideration are given in **Table 1** on the next page.

Table 1: Sample descriptive statistics (Rs. millions, unless otherwise indicated)

| | Range of group (min/max) | Pooled Sample | | |
|---|---|---|---|---|
| | | Mean | S.D. | Median |
| Total assets | 1,549 / 2,296,208 | 210,475 | 357,143 | 46,972 |
| Total revenues | 33 / 215,934 | 21,773 | 35,559 | 4,543 |
| Personnel/staff number | 0.32 / 12.13 | 1.82 | 1.32 | 1.45 |
| Personnel/(deposits+loans) | 0.0014 / 0.2603 | 0.0139 | 0.0161 | 0.0113 |
| Interest cost | 0 / 129,698 | 11,618 | 20,985 | 2,208 |
| Other costs | 5 / 19,091 | 2,453 | 3,437 | 864 |
| Equity | -1,170 / 131,739 | 17,477 | 22,599 | 7,370 |
| Fixed assets | 5 / 27,222 | 2,483 | 4,499 | 530 |
| Loans/Assets (%) | 0 / 108 | 56 | 18 | 60 |
| Deposits/Liabilities (%) | 0 / 110 | 66 | 27 | 76 |

Some of the statistics presented in this table do not appear to make sense at first glance. The minimum value of 'interest cost' is Rs. 0, which is attributable to a bank which had commenced operations during the particular financial year, but had not yet started accepting deposits from customers as at the end of the financial year. This is also the reason why the minimum value of the 'Deposit/Liabilities' variable is reported as 0%.

Another such surprising statistic is the minimum value of 'equity', which is a negative value. This arose after a private bank was taken over by the Government and converted to a state bank after the Central Bank of Sri Lanka found that it was engaged in unsound, improper and imprudent practices and mismanagement by the management of said bank. At the time of it being taken over and converted to a state bank via an act of the Sri Lankan Parliament, there was an excess of liabilities over assets and, therefore, it had negative equity. This was the case only in 2009 (the starting year of the period under review).

The minimum value of the 'Loans/Assets' variable is reported as 0%. This is due to two banks which had commenced operations during the period under review and had not yet commenced granting loans to customers as at the end of the financial year in which they commenced operations. Therefore, these two banks reported a value of 0% for this variable in their respective years of commencement.

## 5. Research Methodology

The tests derived by **Panzar and Rosse (1987)**, based on reduced form revenue equations of all players in the industry being studied (which are derived from marginal cost and revenue functions with the assumption that in equilibrium, all players will make zero profits), will be used to ascertain the competitiveness of the banking industry. The level of competition in the loan market and in the deposit market are assumed to be independent of each other.

The following equation will be estimated with a fixed effects panel regression. It is based on the specification used by **De Bandt & Davis (2000)**. However, due to the possibility of reverse causality in the relationship between the absolute revenue of banks and their size, this specification has been altered to express revenue and factor prices as a percentage of total assets:

$$logR_{it} = \sum_{j=1}^{J} \alpha_j \, log \, W_{it}^j \, + \, \sum_{k=1}^{K} \beta_k \, log \, S_{it}^k \, + \, \sum_{n=1}^{N} \gamma_n \, log \, X_{it}^n + \, \varepsilon_{it} \qquad for$$

$$i \, = 1, .....I; \qquad t \, = \, 1, .....T;$$

where R measures the gross revenue (including both interest and non-interest income) as a percentage of assets. W is a three-dimensional vector of factor prices as a percentage of assets (since we consider banks to have three inputs, i.e. funds, labour and capital), S is a vector of variables which will be used to distinguish the size of the firm (scale variables),

and X is a vector of exogenous and bank-specific variables which could influence the income and expenses of the bank. *i* refers to individual banks, while *t* refers to a particular time period. ε is an error term.

Scale variables are used in the regression equation in order to identify and isolate the impact that the size of a bank can have on the elasticities of the prices of the factors. One of the scale variables that will be used is equity, which is commonly used as a measure of the size of any entity. In addition to this, the sum of fixed assets, cash and other assets (excluding loans granted to customers) will also be used as a scale variable since, as banks grow in size, the value of these items will also grow. The last set of variables include the share of loans and deposits in assets and liabilities respectively. This will enable the identification of the extent to which banks are engaged in 'traditional' banking activities, for which the level of competition tends to be higher. The higher level of competitions is due to the lack of sophistication of capital markets in Sri Lanka, leading to less demand for non-traditional banking services and therefore, less competition in this sector. An *F-test* for the joint statistical significance of the regressors will also be carried out to test the validity of the model.

The test for competitiveness is then measured by calculating an index known as the *H-statistic*, which is the sum of elasticities of the revenue measure to a change in factor prices (which are given by the coefficients of the factor prices as calculated using the above-mentioned regression equation). The value of the *H-statistic* will determine the level of competitiveness in the market:

$$ H \;=\; \sum_{j=1}^{J} \left( \frac{\partial R_i}{\partial w_{j_i}} \frac{w_{j_i}}{R_i} \right) $$

The value of the *H-statistic* will assist in the determining what type of competition currently prevails in the industry.

If the value of the *H-statistic* is less than or equal to 0, this will indicate that the market is a monopoly or a perfectly collusive oligopoly, i.e. a rise in marginal cost would lead to a fall in equilibrium output and revenue.

However, if the value of the *H-statistic* is greater than 0, then, according to Panzar and Rosse, a test of whether the market is in perfect or monopolistic competition would require that the market is in a long-run equilibrium. This is due to the fact that in a long-run equilibrium, a competitive market will ensure that the rate of return is equal across all firms in the industry, thereby meaning that the rate of return should, statistically, not be correlated with the prices of inputs.

Therefore, in order to test whether the market is in a long-run equilibrium or not, the *H-statistic* is calculated using the return on assets as the dependent variable (in place of gross revenue) in the regression equation. An *H-statistic* of less than 0 would mean that the market is not in equilibrium, while a value of 0 would indicate equilibrium. A key assumption of the *H-statistic* is that all banks are profit maximizing firms.

Under the assumption that the market is in a long-run equilibrium, if the *H-statistic* (when considering gross revenue as the dependent variable in the regression) is greater than 0 but less than 1, this means that the market is in a monopolistic competition equilibrium, with the degree of monopolistic competition being higher as the *H-statistic* gets closer to 1. A value of 1 indicates a perfect competition equilibrium. A limitation of this approach which is worth noting is that in the event of certain oligopoly equilibria, the increasing relationship between the level of competition and the value of the *H-statistic* may not hold.

This *H-statistic* will be calculated for the following broad categorisations:

- The overall market;
- Domestic banks;
- Banks affected and not affected by cross-ownership;
- Systemically important banks; and

- Foreign banks.

Sri Lankan banks can be classified into two groups based on the license that they have obtained from the CBSL: Licensed Commercial Banks and Licensed Specialised Banks. The key distinctions between them is that Licensed Specialised Banks cannot operate current accounts for customers[4]. However, no distinction is made between the two types of banks on the basis that they do not compete in segregated markets but, in fact, compete for the same customers. It is also worth noting that, in terms of the **Exchange Control Act No. 24 of 1953**, Licensed Specialised Banks were not permitted to deal in foreign currency (accept foreign currency deposits or lend to customers in foreign currency). This act was subsequently repealed in 20.11.2017 and replaced by the enactment of the **Foreign Exchange Act, No. 12 of 2017**, which allowed Licensed Specialised Banks to deal in foreign currency. However, to date, it is only the National Savings Bank which is engaged in lending to and accepting deposits from customers in foreign currency deposits.

Since bank revenues are driven largely by interest income, the regression is also run with interest income as the dependent variable to check whether the conclusions from the original regression equation are robust to the consideration of interest income as the dependent variable. This will allow a conclusion to be drawn on the relative competitiveness of the market for loans and for fee-generating services.

Four of the banks (Regional Development Bank, Amana Bank PLC, Cargills Bank Ltd and Bank of China Ltd) commenced operations during the period under review. It is possible that these banks may not be able to compete for business as vigorously as existing players and could thereby have an impact on the calculated *H-statistic*. Therefore, the results before and after excluding data in respect of these 4 banks will be compared with the results from

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[4] Part (a) of Schedule IV of the Banking Act, No. 30 of 1988 only permits the acceptance of *time* and *savings* deposits

the overall data set to see whether the conclusions drawn from the results differ. The year in which all banks commenced operations are given in **Table 6** and **Table 7 (Appendix 1)**.

## 5.1 Diagnostic Tests

In order to ensure that a fixed effects panel regression is the most appropriate regression model to estimate revenue given the data being used for the study, a number of diagnostic tests will be conducted.

The first of these is the *Model Test*, which will test for the joint statistical significance of all the regressors. A rejection of the null hypothesis will indicate that the regressors are jointly statistically significant. This will subsequently allow the coefficients for the unit elasticities of factors to be used in the calculation of the *H-statistic*.

Secondly, an *F-test for Fixed Effects* will be conducted to identify whether a significant fixed group effect is present in the data being used. A rejection of the null hypothesis will indicate that the use of a fixed effects panel regression is more appropriate, while a failure to reject the null hypothesis will mean that a pooled ordinary least squares (OLS) regression is more appropriate to model the data.

The *Breusch-Pagan Lagrange Multiplier Test* (LM Test) will allow the testing of whether any individual or time-specific variance components are zero. Rejecting the null hypothesis leads to the conclusion that there are significant random effects in the panel data (necessitating the use of a random effects panel regression model), while a failure to reject the null hypothesis will mean the use of a pooled OLS regression model is more appropriate.

The final diagnostic test that will be conducted is the *Hausman Test*, which will enable the identification of whether it is the fixed effects or the random effects which are more significant and relevant in the panel data. It is essentially a test of whether the random effects estimate is insignificantly different from the unbiased fixed effect estimate. The null hypothesis posits that individual bank effects are uncorrelated with any of the regressors

(meaning that a random effects model is more appropriate), while a rejection of the null hypothesis would mean that individual bank effects are correlated with at least one of the regressors, thereby making a fixed effects model more suitable to model the data.

## 5.2 Robustness Tests

To assess whether the conclusions drawn from this study are sensitive to the model being used, the data used in this study is put through econometric specifications from other studies assessing bank competitiveness in order to check the robustness of the results.

The specification used by **De Bandt and Davis (2000)** does not scale the dependent variable by total assets, but simply takes it as given. Additionally, for unit cost of labour, personnel expenses are divided by number of employees in one specification and by the sum of deposits and loans in the other (the latter is based on the reasoning that the most labour-intensive activities in banks are the generation of loan and deposit business). For unit cost of funds, interest expenses are divided by all deposits and other funding liabilities. The other regressors are specified in the same way as in this study. For the purposes of robustness testing, the latter definition of unit cost of labour was used.

**Trivieri (2007)** also does not scale the dependent variable by total assets, reasoning that even though the problem of endogeneity may be present, scaling revenue as such would transform the estimated equation into a price equation rather than a revenue equation. Unit cost of labour is defined as personnel expenses divided by number of employees, unit cost of funds is defined as interest costs to total funds, and unit cost of capital is defined as other expenses to total assets in one specification and to fixed assets in the other. The latter was used in robustness testing. Total assets are used as the scale variable, while the other regressors were the same as used in this study.

## 6. Analysis and Discussion

The empirical results when using Total Gross Income (which includes interest and non-interest income) are given in **Table 2**, while the results when using only interest income is given in **Table 3**. Both tables can be found in the following two pages.

Table 2

H Statistics when using Total Gross Income[+]

| | OI | DB | CO | NCO | SIB | FB |
|---|---|---|---|---|---|---|
| Number of observations | 318 | 201 | 157 | 161 | 60 | 117 |
| Labour | $0.2582^{***}$ (0.0378) | $0.3008^{***}$ (0.0477) | $0.2911^{***}$ (0.0488) | $0.2565^{***}$ (0.0553) | $0.2188^{***}$ (0.0703) | $0.2131^{***}$ (0.0634) |
| Funds | $0.4265^{***}$ (0.0252) | $0.5408^{***}$ (0.0292) | $0.4941^{***}$ (0.0287) | $0.3837^{***}$ (0.0381) | $0.5753^{***}$ (0.0325) | $0.3207^{***}$ (0.0427) |
| Capital | $0.1114^{***}$ (0.0372) | $0.1378^{***}$ (0.0522) | $0.1754^{***}$ (0.0542) | $0.1057^{**}$ (0.0512) | $0.0942^{**}$ (0.0466) | $0.1059^{*}$ (0.0556) |
| H-Statistic[a] | $0.7961^{MC}$ (0.0483) | $0.9794^{PC}$ (0.0581) | $0.9605^{PC}$ (0.0623) | $0.7459^{MC}$ (0.0713) | $0.8883^{PC}$ (0.0804) | $0.6397^{MC}$ (0.0824) |
| Adjusted $R^2$ | 0.6009 | 0.6851 | 0.7260 | 0.5718 | 0.8916 | 0.5765 |
| Model test (P-value) | 74.05 (0.0000) | 66.31 (0.0000) | 62.48 (0.0000) | 33.81 (0.0000) | 71.05 (0.0000) | 25.13 (0.0000) |
| F-test for FE (P-value) | 9.98 (0.0000) | 5.25 (0.0000) | 6.46 (0.0000) | 9.20 (0.0000) | 0.31 (0.9032) | 7.50 (0.0000) |
| LM Test (P-value) | 185.96 (0.0000) | 22.35 (0.0000) | 9.03 (0.0013) | 54.76 (0.0000) | 0.00 (1.0000) | 26.42 (0.0000) |
| Hausman test (P-value) | 24.64 (0.0009) | 41.34 (0.0000) | 61.89 (0.0000) | 23.30 (0.0015) | 1.16 (0.9917) | 15.88 (0.0263) |
| H = 0 (P-value) | 272.07 (0.0000) | 284.41 (0.0000) | 237.97 (0.0000) | 109.43 (0.0000) | 121.98 (0.0000) | 60.33 (0.0000) |
| H = 1 (P-value) | 17.84 (0.0000) | 0.13 (0.7233) | 0.40 (0.5270) | 12.70 (0.0005) | 1.93 (0.1714) | 19.14 (0.0000) |

[+] OI = Overall Industry; DB = Domestic Banks; CO = Banks affected by cross-ownership; NCO = Banks not affected by cross-ownership; SIB = Systemically Important Banks; FB = Foreign Banks

[a] Superscript 'MC' (Monopolistic Competition) indicates that H>0 and H<1 both are not rejected at the 2.5% significance level. Superscript 'PC'(Perfect Competition) indicates that H = 1 is not rejected at the 5% significance level.

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 3

H Statistics when using Gross Interest Income[+]

| | OI | DB | CO | NCO | SIB | FB |
|---|---|---|---|---|---|---|
| Number of observations | 318 | 201 | 157 | 161 | 60 | 117 |
| Labour | 0.2556*** (0.0348) | 0.2534*** (0.0461) | 0.2853*** (0.0504) | 0.2426*** (0.0491) | 0.1994*** (0.0726) | 0.2173*** (0.0581) |
| Funds | 0.4677*** (0.0232) | 0.5326*** (0.0282) | 0.4939*** (0.0297) | 0.4459*** (0.0338) | 0.6302*** (0.0336) | 0.3998*** (0.0392) |
| Capital | 0.1044*** (0.0342) | 0.1133** (0.0505) | 0.2296*** (0.0560) | 0.0822* (0.0454) | 0.1039** (0.0481) | 0.1117** (0.0510) |
| H-Statistic[a] | 0.8277[MC] (0.0444) | 0.8993[MC] (0.0561) | 1.0087[PC] (0.0643) | 0.7707[MC] (0.0632) | 0.9334[PC] (0.0830) | 0.7288[MC] (0.0755) |
| Adjusted $R^2$ | 0.6741 | 0.6900 | 0.7162 | 0.6756 | 0.8901 | 0.6809 |
| Model test (P-value) | 99.52 (0.0000) | 67.73 (0.0000) | 59.66 (0.0000) | 50.90 (0.0000) | 70.01 (0.0000) | 37.93 (0.0000) |
| F-test for FE (P-value) | 10.24 (0.0000) | 10.91 (0.0000) | 7.66 (0.0000) | 6.56 (0.0000) | 2.38 (0.0523) | 3.23 (0.0009) |
| LM Test (P-value) | 211.07 (0.0000) | 82.38 (0.0000) | 12.34 (0.0002) | 54.98 (0.0000) | 0.00 (1.0000) | 0.00 (1.0000) |
| Hausman test (P-value) | 23.94 (0.0012) | 107.37 (0.0000) | 40.52 (0.0000) | 16.10 (0.0243) | 23.24 (0.0015) | 53.57 (0.0000) |
| H = 0 (P-value) | 347.70 (0.0000) | 256.63 (0.0000) | 245.85 (0.0000) | 148.64 (0.0000) | 126.48 (0.0000) | 93.13 (0.0000) |
| H = 1 (P-value) | 15.08 (0.0001) | 3.22 (0.0747) | 0.02 (0.8923) | 13.16 (0.0004) | 0.64 (0.4264) | 12.89 (0.0005) |

[+] OI = Overall Industry; DB = Domestic Banks; CO = Banks affected by cross-ownership; NCO =Banks not affected by cross-ownership; SIB = Systemically Important Banks; FB = Foreign Banks

[a] Superscript 'MC' (Monopolistic Competition) indicates that H>0 and H<1 both are not rejected at the 2.5% significance level. Superscript 'PC' (Perfect Competition) indicates that H = 1 is not rejected at the 5% significance level.

* p < 0.1, ** p < 0.05, *** p < 0.01

The key factor driving the *H-statistic* of all banks, regardless of the subsample under consideration, is the cost of funds, which is to be expected as banks are primarily in the business of accepting deposits from and lending money to customers and the cost of funds account for a significant proportion of the total costs of the bank.

The mean level of the *H-statistic* for the overall industry is significantly above 0. However, it is also significantly below 1, indicating the prevalence of monopolistic competition in the Sri Lankan banking industry, rather than perfect competition or a monopoly. This is the case regardless of whether total gross income or gross interest income is considered as the dependent variable.

The *H-statistic* for domestic banks indicate a different type of competition depending on the measure of revenue used as the dependent variable. When total gross income is used as the dependent variable, the *H-statistic* is close to one, indicating that domestic banks operate in a perfectly competitive environment. When gross interest income is used as the dependent variable, the H-statistic is, again, close to 1, but hypothesis testing suggests that the market is in a state of monopolistic competition. However, the difference between the H-statistic under either measure of revenue is not very high (0.0801), indicating that it would not be incorrect to conclude that domestic banks operate in a perfectly competitive market.

The *H-statistic* for the banks affected by cross-ownership is, contrary to expectations, higher than that of the overall industry. It is very close to 1, indicating perfect competition amongst such banks when either measure of revenue is used.

The *H-statistic* for banks not affected by cross ownership is similar under both measures of revenue and is significantly different than that of banks affected by cross ownership. These banks operate under conditions of monopolistic competition and their competitiveness is notably less than that of banks affected by cross ownership.

The *H-statistic* for systemically important banks is close to 1 under both measures of revenue and is higher than that of the overall industry. This is an indication that these banks operate under conditions of perfect competition. It is worth noting that all systemically important banks are domestic banks, as even the largest foreign bank does not satisfy the threshold for being classified as a systemically important bank.

However, the *H-statistic* reported for foreign banks is the lowest amongst all the sub samples taken, indicating that these banks operate under monopolistically competitive conditions. This could also explain how, despite domestic banks operating in a perfectly competitive market, the banking industry as a whole is operating under monopolistically competitive conditions.

There were four banks which commenced operations during the period under review. The *H-statistics* derived after excluding them are shown in **Table 8** & **9** of **Appendix 2.** There are no major deviations in respect of the inferences made earlier regarding the competitive state of the overall sample and subsamples under consideration. When considering gross interest income as the dependent variable, the *H-statistic* for domestic banks rises by 0.0445 after their exclusion and hypothesis testing indicates they operate in a perfectly competitive market. However, since the difference in *H-statistic* between the two is not very large, it does not invalidate the earlier conclusion made regarding the nature of competitions amongst domestic banks.

In both specifications, the null hypothesis for both the F-test for fixed effects and the LM test was not rejected in the case of systemically important banks. These results signalled that the use of a pooled OLS model would be more appropriate to model these subsets of the data. The results of this are given in **Table 12** and **13** of **Appendix 4**, where it can be seen that the *H-statistic* for both subsets in either specification provides the same conclusion for the level of competitiveness of those respective markets that was arrived at when running these subsets through a fixed effects panel regression.

The null hypothesis for the Hausman test was not rejected for systemically important banks when total gross income was used as the dependent variable, indicating that a random effects panel regression model might be more appropriate. The results of this is given in **Table 10** where, again, the calculated *H-statistic* is very similar to that from the original specification, thereby not changing the conclusions drawn earlier regarding these banks' competitiveness.

As the results of the regression indicated that neither the banking industry, nor the different samples that were considered were operating in monopolistic conditions, we then turn our attention to the results of the tests conducted to check whether these markets are in their long-run equilibrium.

<center>Table 4: Equilibrium Test[+]</center>

|  | H-statistic | Standard Error | $R^2$ |
|:---:|---|---|---|
| OI | 0.1656 | 0.1602 | 0.0011 |
| DB | 0.1318 | 0.2619 | 0.0203 |
| CO | 0.4802[*] | 0.2782 | 0.1869 |
| NCO | 0.1383 | 0.2053 | 0.0082 |
| SIB | 0.7697 | 0.5078 | 0.2722 |
| FB | 0.2686 | 0.2068 | 0.0002 |

[+] OI = Overall Industry; DB = Domestic Banks; CO = Banks affected by cross-ownership; NCO = Banks not affected by cross-ownership; SIB = Systemically Important Banks; FB = Foreign Banks

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

As can be seen in the above table, the results of the equilibrium test confirm the results from the earlier tests; the standard errors in all instances are very high, thereby failing to reject the hypothesis that the modified H-statistic is less than 0. Therefore, the data used in the testing appears to be in equilibrium and is supportive of the conclusions drawn earlier

regarding the type of competition that prevails in the industry as a whole and the sub-categories of the banking industry that are under consideration.

## 6.1 Robustness Tests

When looking at total gross income as the endogenous variable (**Appendix 5 – Table 14**), the specification used by **Trivieri (2007)** classifies banks affected by cross-ownership and systemically important banks as operating in monopolistically competitive markets. However, the absolute value of the *H-statistic* of banks affected by cross ownership is 0.3099 more than that of banks which aren't affected by it, which is a clear indicator that the former group of banks are more competitive than the latter. Again, this specification shows foreign banks to be the least competitive.

The specification (**Appendix 6 – Table 16**) by **De Bandt & Davis (2000)** shows banks affected by cross-ownership to be, again, more competitive than those not affected by it, with the latter group interpreted to be operating in a monopoly market. Foreign banks are concluded to be operating in an oligopolistically competitive market (due to a negative *H-statistic*).

When considering gross interest revenue as the dependent variable, the specification (**Appendix 5 – Table 15**) used by **Trivieri (2007)** returns the same results in terms of classification of the markets in which the various subsets of banks operate. Looking at the absolute value of the H-statistics computed, the major differences lie in those calculated for the overall industry, for banks not affected by cross ownership, and for foreign banks, which are significantly lower.

However, when we consider the specification (**Appendix 6 – Table 17**) used by **De Bandt & Davis (2000)**, the classifications of the markets in which banks affected by cross-ownership and systemically important banks operate in are now classified as monopolistically competitive, while banks not affected by cross ownership and foreign banks

are seen to be operating in monopoly markets. These results do not change the overall conclusion made regarding the various subsets.

## 7. Conclusion

The aim of this study was to carry out an empirical analysis to determine whether restrictions on the percentage ownership of banks' shares has had an impact on the competitiveness of banks, primarily by assessing the competitiveness of banks affected by cross-ownership and comparing it with the competitiveness of those not affected by cross-ownership. Competitiveness was measured using the *H-statistic* developed by Panzar and Rosse by utilizing data for Sri Lanka over the time period of 2009 to 2018 provided by the Bank Supervision Department of the Central Bank of Sri Lanka, who collect such data on a monthly, quarterly and annual basis. As stated by **Panzar and Rosse (1987)**, a monopoly equilibrium is present if the sum of the factors price elasticities are non-positive and, if not, it is possible to deduce whether the market is in a monopolistically competitive or perfectly competitive equilibrium based on the calculated value of the *H-statistic*.

The theory that cross-ownership amongst firms in the same industry can have an adverse impact on competitions amongst them is expounded by various authors in the industrial economics literature. These studies have shown that cross-ownership of firms can lead to a distortion of incentives for firms to compete, thereby resulting in the market moving towards a monopoly equilibrium. This applies even in instances where such cross-ownerships do not result in a controlling stake in these organisations (Gilo, 2000; 'O Brien and Salop, 2000; Gilo & Spiegel, 2003).

A number of conclusions can be drawn from the results of this study. The banking industry, as well as the various sub-categories, were not operating under monopoly conditions, as the test for monopoly equilibrium returned non-negative values. While the *H-statistic* for

domestic banks indicated that they were operating in a perfectly competitive market, the same could not be said for foreign banks, who were found to be operating in monopolistically competitive market conditions. This explains the *H-statistic* for the Sri Lankan banking industry as a whole, which indicated that it was operating in a monopolistically competitive market. The relative lack of competitiveness of foreign banks can be traced to their prime motivation to set up operations in Sri Lanka, which is to facilitate cross-border transactions for Sri Lankan as well as foreign customers, rather than to vigorously compete with domestic banks in the granting of loans to and acceptance of deposits from domestic customers.

Contrary to expectations, banks which were affected by cross-ownership returned the highest *H-statistic*, which was close to 1 under both measures of revenue, indicating that these banks were operating in perfectly competitive market conditions and in fact, were more competitive than banks which were not involved in cross-ownership. The *H-statistic* of systemically important banks, which are the biggest banks in the country and are also affected by cross-ownership, indicated that they operated under perfectly competitive market conditions. These findings are not consistent with the empirical literature on the impact of cross-ownership on competitiveness of firms and leads to the conclusion that banks affected by cross-ownership are more likely to compete more vigorously. This could be ascribed to regulatory directions enforced by the Central Bank of Sri Lanka which do not allow share ownership of more than 10% by a single investor, with exceptions to this granted by the Monetary Board on a case-by-case basis. It is possible that, in the absence of such a restriction, investors may increase their ownership stakes in banks and could be in a better position to get these banks to collude with each other on pricing, thereby reducing their competitiveness and harming consumer welfare. Therefore, it can be concluded that these regulatory directions have had a positive impact on consumer welfare. However, at the same time, it is worth noting that the same regulatory direction does not apply to any bank which has been established by an Act of the Sri Lankan Parliament and in which the majority of voting shares are held either by the Government, a public

corporation or any other statutory body. Despite the presence of 6 banks in which the Government has a 100% ownership stake, as well as another bank in which they have a majority ownership stake, their competitiveness does not seem to have been dampened due to this majority cross-ownership. Therefore, it is possible that the purchase of major ownership stakes by investors in multiple banks is plainly motivated by the lucrativeness of such investments on a stand-alone basis, rather than a desire to influence the business direction of such banks by colluding with each other and subsequently raising prices, and that banking regulations issued to limit concentration of share ownership amongst a limited number of investors are, in fact, not required to regulate the conduct of investors who have major ownership stakes in banks.

The relatively higher level of competitiveness amongst banks affected by cross-ownership will have a positive impact on consumer welfare as no single bank or group of banks can take any pricing action which will adversely impact the customer. This could be attributed to low switching costs for customers, meaning that in the event that a bank modified the pricing of its products in such a way that it adversely impacted the customer, they are able to easily switch to the services of another bank, resulting in the former losing business to its competitor.

These results also give rise to the notion that, despite cross-ownership of multiple banks by investors, some of whom have a seat on the Board of Directors of such banks, such ownership stakes do not give them the power to influence the banks to collude with each other on pricing.

Even though this is not entirely relevant to the research question addressed by this study, a cautionary note spelt out by **Nathan and Neave (1989)** in the conclusion of their study has applicability to the Sri Lankan banking industry and is something that should take priority in the agenda of regulators; they mention the "possible effects of political power that asset concentrations may possess, even if they have little market power". In the context

of Sri Lanka, Bank of Ceylon and People's Bank, both of whom are fully owned by the Government, have a combined market share of 34% (based on share of industry assets as at 31 December, 2018). If the third largest state-owned bank, the National Savings Bank (which is the $5^{th}$ largest bank in the industry) is also considered, their combined market share rises to 43%. With monetary policy now seen as a means to also achieve political objectives[5], the existence of the credit channel and, more specifically, the bank lending channel as a means of monetary policy transmission could result in the possible misuse of ownership concentration of the banking industry by the Government to fulfil their political agendas.

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[5] "Donald Trump's gamble weaves monetary policy into trade war" – Michael MacKenzie (Financial Times)

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# APPENDIX I – Definitions of variables (in logarithms unless otherwise indicated)

*1. Endogenous variables*

- Gross interest income = Gross interest income / Total assets

- Total gross income = (Gross interest income + non-interest income) / Total assets

- Return on assets = (Gross interest income + non-interest income – interest costs – personnel costs – other costs) / Total assets

*2. Factor unit prices*

- Unit price of labour = Personnel costs / Total assets

- Unit price of funds = Interest costs / Total assets

- Unit price of capital = Other costs / Total assets

*3. Scale variables*

- Equity

- Fixed assets + cash + other assets

*4. Exogenous & bank-specific variables*

- Loans / Total assets

- Deposits / Total liabilities

Table 5: Cross-ownership amongst banks in Sri Lanka

| Bank | Owner | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Government of Sri Lanka | K D D Perera | Captain Family | Y S H I Silva | T Senthilverl | LOLC Group | D H S Jayawardena | Hatton National Bank PLC |
| Lankaputhra Development Bank | 100.00 | - | - | - | - | - | - | - |
| MBSL Savings Bank PLC | 78.65 | - | - | - | - | - | - | - |
| National Development Bank PLC | 33.96 | - | - | - | - | - | - | 2.92 |
| National Savings Bank | 100.00 | - | - | - | - | - | - | - |
| Pan Asia Banking Corporation PLC | 5.46 | 29.99 | - | - | - | - | - | - |
| People's Bank | 100.00 | - | - | - | - | - | - | - |
| Regional Development Bank | 100.00 | - | - | - | - | - | - | - |
| Sampath Bank PLC | 10.92 | 9.49 | 1.48 | 9.98 | - | - | - | - |
| Sanasa Development Bank PLC | 2.79 | - | - | - | 14.53 | - | - | - |
| Seylan Bank PLC | 37.45 | - | 9.57 | - | - | 9.55 | - | - |
| Sri Lanka Savings Bank | 100.00 | - | - | - | - | - | - | - |
| State Mortgage and Investment Bank | 100.00 | - | - | - | - | - | - | - |
| Hatton National Bank PLC | 25.12 | - | 8.38 | - | - | - | 15.98 | - |
| Cargills Bank Ltd | 9.96 | - | - | - | - | - | - | - |
| Commercial Bank of Ceylon PLC | 19.84 | - | - | 8.08 | - | - | 4.61 | - |
| DFCC Bank PLC | 35.04 | - | - | - | - | - | 8.36 | 12.22 |
| Housing Development Finance Corporation | 51.50 | - | - | - | 7.56 | 15.00 | - | - |
| Union Bank of Colombo PLC | - | - | - | - | 1.6 | - | - | - |
| Nations Trust Bank PLC | - | - | - | - | - | - | - | 2.52 |

## Table 6

### Year of commencement of Licensed Commercial Banks

| No. | Name | Year of Commencement |
|---|---|---|
| 1. | Amana Bank PLC | 2011 |
| 2. | Axis Bank | 2011 |
| 3. | Bank of China Ltd | 2018 |
| 4. | Cargills Bank | 2014 |
| 5. | Citibank, N.A. | 1979 |
| 6. | Commercial Bank of Ceylon PLC | 1972 |
| 7. | Deutsche Bank AG | 1980 |
| 8. | DFCC Bank PLC* | 1955 |
| 9. | DFCC Vardhana Bank PLC* | 1995 |
| 10. | Habib Bank Ltd | 1951 |
| 11. | Hatton National Bank PLC | 1888 |
| 12. | ICICI Bank Ltd | 2006 |
| 13. | Indian Bank | 1932 |
| 14. | Indian Overseas Bank | 1946 |
| 15. | MCB Bank Ltd | 1994 |
| 16. | National Development Bank PLC | 1979 |
| 17. | Nations Trust Bank PLC | 1999 |
| 18. | Pan Asia Banking Corporation PLC | 1995 |
| 19. | People's Bank | 1961 |
| 20. | Public Bank Berhad | 1992 |
| 21. | Sampath Bank PLC | 1986 |
| 22. | Seylan Bank PLC | 1988 |
| 23. | Standard Chartered Bank | 1869 |
| 24. | State Bank of India | 1864 |
| 25. | The Hongkong & Shanghai Banking Corporation Ltd | 1892 |
| 26. | Union Bank of Colombo PLC | 1995 |

\* DFCC Bank PLC and DFCC Vardhana Bank PLC merged in October 2015, with the merged entity taking the name of DFCC Bank PLC

## Table 7

### Year of commencement of Licensed Specialised Banks

| No. | Name | Year of Commencement |
|-----|------|----------------------|
| 1. | Housing Development Finance Corporation Bank | 1997 |
| 2. | Lankaputhra Development Bank Ltd | 2006 |
| 3. | National Savings Bank | 1972 |
| 4. | Regional Development Bank | 2010 |
| 5. | Sanasa Development Bank PLC | 1997 |
| 6. | Sri Lanka Savings Bank Ltd | 2006 |
| 7. | State Mortgage & Investment Bank | 1979 |

# APPENDIX III – Regression results without banks which commenced operations between 2009 - 2018

Table 8

## H-statistics when using Total Gross Income[+]

|  | OI | DB | CO | NCO | SIB | FB |
|---|---|---|---|---|---|---|
| Number of observations | 290 | 180 | 144 | 146 | 60 | 110 |
| Labour | 0.2230*** (0.0387) | 0.2770*** (0.0476) | 0.3298*** (0.0473) | 0.2118*** (0.0583) | 0.2188*** (0.0703) | 0.2109*** (0.0660) |
| Funds | 0.4263*** (0.0274) | 0.5350*** (0.0350) | 0.5249*** (0.0349) | 0.3702*** (0.0383) | 0.5753*** (0.0325) | 0.3461*** (0.0424) |
| Capital | 0.0935*** (0.0353) | 0.1575*** (0.0516) | 0.1660*** (0.0536) | 0.0929** (0.0471) | 0.0942** (0.0466) | 0.0807 (0.0514) |
| H-Statistic[a] | 0.7428$^{MC}$ (0.0504) | 0.9695$^{PC}$ (0.0646) | 1.0201$^{PC}$ (0.0645) | 0.6749$^{MC}$ (0.0730) | 0.8883$^{PC}$ (0.0804) | 0.6376$^{MC}$ (0.0812) |
| Adjusted $R^2$ | 0.6020 | 0.6546 | 0.7188 | 0.6016 | 0.8916 | 0.6117 |
| Model test (P-value) | 67.73 (0.0000) | 52.18 (0.0000) | 55.37 (0.0000) | 34.28 (0.0000) | 71.05 (0.0000) | 26.96 (0.0000) |
| H = 0 (P-value) | 217.21 (0.0000) | 224.97 (0.0000) | 250.18 (0.0000) | 85.44 (0.0000) | 121.98 (0.0000) | 61.67 (0.0000) |
| H = 1 (P-value) | 26.03 (0.0000) | 0.22 (0.6373) | 0.10 (0.7480) | 19.82 (0.0000) | 1.93 (0.1714) | 19.91 (0.0000) |

[+] OI = Overall Industry; DB = Domestic Banks; CO = Banks affected by cross-ownership; NCO = Banks not affected by cross-ownership; SIB = Systemically Important Banks; FB = Foreign Banks

[a] Superscript 'MC' (Monopolistic Competition) indicates that H>0 and H<1 both are not rejected at the 2.5% significance level. Superscript 'PC' (Perfect Competition) indicates that H = 1 is not rejected at the 5% significance level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 9

H Statistics when using Gross Interest Income[+]

| | OI | DB | CO | NCO | SIB | FB |
|---|---|---|---|---|---|---|
| Number of observations | 290 | 180 | 144 | 146 | 60 | 110 |
| Labour | 0.1951*** (0.0340) | 0.2274*** (0.0444) | 0.3188*** (0.0488) | 0.1475*** (0.0475) | 0.1994*** (0.0726) | 0.1488** (0.0576) |
| Funds | 0.5010*** (0.0241) | 0.5677*** (0.0326) | 0.5527*** (0.0360) | 0.4682*** (0.0312) | 0.6302*** (0.0336) | 0.4578*** (0.0370) |
| Capital | 0.0932*** (0.0311) | 0.1486*** (0.0481) | 0.2103*** (0.0552) | 0.0784** (0.0384) | 0.1039** (0.0481) | 0.0787* (0.0449) |
| H-Statistic[a] | 0.7893[MC] (0.0443) | 0.9438[PC] (0.0602) | 1.0819[PC] (0.0666) | 0.6941[MC] (0.0595) | 0.9334[PC] (0.0830) | 0.6853[MC] (0.0709) |
| Adjusted $R^2$ | 0.7108 | 0.6957 | 0.7177 | 0.7519 | 0.8901 | 0.7375 |
| Model test (P-value) | 106.78 (0.0000) | 62.18 (0.0000) | 55.09 (0.0000) | 65.79 (0.0000) | 70.01 (0.0000) | 46.17 (0.0000) |
| H = 0 (P-value) | 316.92 (0.0000) | 245.78 (0.0000) | 264.21 (0.0000) | 135.92 (0.0000) | 126.48 (0.0000) | 93.38 (0.0000) |
| H = 1 (P-value) | 22.58 (0.0000) | 0.87 (0.3518) | 1.51 (0.2211) | 26.41 (0.0001) | 0.64 (0.4264) | 19.69 (0.0000) |

[+] OI = Overall Industry; DB = Domestic Banks; CO = Banks affected by cross-ownership; NCO = Banks not affected by cross-ownership; SIB = Systemically Important Banks; FB = Foreign Banks

[a] Superscript 'MC' (Monopolistic Competition) indicates that H>0 and H<1 both are not rejected at the 2.5% significance level. Superscript 'PC' (Perfect Competition) indicates that H = 1 is not rejected at the 5% significance level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

# APPENDIX IV – Regression results - Random Effects Panel Regression

## Table 10

### H Statistics when using Total Gross Income[+]

| | OI | DB | CO | NCO | SIB | FB |
|---|---|---|---|---|---|---|
| Number of observations | 318 | 201 | 157 | 161 | 60 | 117 |
| Labour | $0.2204^{***}$ (0.0337) | $0.2872^{***}$ (0.0408) | $0.3155^{***}$ (0.0419) | $0.1999^{***}$ (0.0500) | $0.2156^{***}$ (0.0363) | $0.1840^{***}$ (0.0540) |
| Funds | $0.3857^{***}$ (0.0230) | $0.5238^{***}$ (0.0267) | $0.5013^{***}$ (0.0297) | $0.3482^{***}$ (0.0350) | $0.5706^{***}$ (0.0307) | $0.3126^{***}$ (0.0429) |
| Capital | $0.1256^{***}$ (0.0336) | $0.1105^{***}$ (0.0368) | $0.1153^{***}$ (0.0397) | $0.1446^{***}$ (0.0486) | $0.1014^{***}$ (0.0352) | $0.1737^{***}$ (0.0528) |
| H-Statistic[a] | $0.7317^{MC}$ (0.0408) | $0.9216^{PC}$ (0.0543) | $0.9321^{PC}$ (0.0603) | $0.6927^{MC}$ (0.0567) | $0.8876^{MC}$ (0.0546) | $0.6703^{MC}$ (0.0698) |
| $R^2$ | 0.7053 | 0.7437 | 0.7415 | 0.6811 | 0.9248 | 0.7022 |
| Model test (P-value) | 570.74 (0.0000) | 496.02 (0.0000) | 407.02 (0.0000) | 266.99 (0.0000) | 639.25 (0.0000) | 203.94 (0.0000) |
| H = 0 (P-value) | 322.03 (0.0000) | 288.01 (0.0000) | 238.54 (0.0000) | 149.24 (0.0000) | 264.29 (0.0000) | 92.20 (0.0000) |
| H = 1 (P-value) | 43.28 (0.0000) | 2.08 (0.1489) | 1.26 (0.2609) | 29.36 (0.0000) | 4.24 (0.0395) | 22.31 (0.0000) |

[+] OI = Overall Industry; DB = Domestic Banks; CO = Banks affected by cross-ownership; NCO = Banks not affected by cross-ownership; SIB = Systemically Important Banks; FB = Foreign Banks
[a] Superscript 'MC' (Monopolistic Competition) indicates that H>0 and H<1 both are not rejected at the 2.5% significance level. Superscript 'PC' (Perfect Competition) indicates that H = 1 is not rejected at the 5% significance level.
* p < 0.1, ** p < 0.05, *** p < 0.01

<center>Table 11</center>

<center>**H Statistics when using Gross Interest Income[+]**</center>

| | OI | DB | CO | NCO | SIB | FB |
|---|---|---|---|---|---|---|
| Number of observations | 318 | 201 | 157 | 161 | 60 | 117 |
| Labour | $0.2311^{***}$ (0.0308) | $0.2754^{***}$ (0.0443) | $0.3440^{***}$ (0.0452) | $0.1769^{***}$ (0.0421) | $0.2098^{***}$ (0.0412) | $0.0844^{***}$ (0.0371) |
| Funds | $0.4373^{***}$ (0.0210) | $0.5082^{***}$ (0.0281) | $0.5053^{***}$ (0.0316) | $0.4228^{***}$ (0.0295) | $0.6376^{***}$ (0.0348) | $0.3899^{***}$ (0.0370) |
| Capital | $0.0867^{***}$ (0.0307) | $0.0774^{*}$ (0.0435) | $0.1059^{*}$ (0.0434) | $0.0889^{**}$ (0.0411) | $0.0448$ (0.0400) | $0.1278^{***}$ (0.0387) |
| H-Statistic[a] | $0.7551^{MC}$ (0.0372) | $0.8609^{MC}$ (0.0566) | $0.9552^{PC}$ (0.0645) | $0.6886^{MC}$ (0.0474) | $0.8922^{PC}$ (0.0621) | $0.6021^{MC}$ (0.0516) |
| $R^2$ | 0.7729 | 0.6322 | 0.7061 | 0.7948 | 0.9098 | 0.7909 |
| Model test (P-value) | 784.30 (0.0000) | 429.07 (0.0000) | 361.11 (0.0000) | 430.24 (0.0000) | 524.72 (0.0000) | 412.21 (0.0000) |
| H = 0 (P-value) | 411.91 (0.0000) | 231.19 (0.0000) | 219.39 (0.0000) | 211.47 (0.0000) | 206.67 (0.0000) | 136.34 (0.0000) |
| H = 1 (P-value) | 43.33 (0.0000) | 6.03 (0.0141) | 0.48 (0.4875) | 43.26 (0.0000) | 3.02 (0.0823) | 59.56 (0.0000) |

[+] OI = Overall Industry; DB = Domestic Banks; CO = Banks affected by cross-ownership; NCO = Banks not affected by cross-ownership; SIB = Systemically Important Banks; FB = Foreign Banks

[a] Superscript 'MC' (Monopolistic Competition) indicates that H>0 and H<1 both are not rejected at the 2.5% significance level. Superscript 'PC'(Perfect Competition) indicates that H = 1 is not rejected at the 5% significance level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

# APPENDIX V – Regression results - Pooled OLS

Table 12

H Statistics when using Total Gross Income[+]

|  | OI | DB | CO | NCO | SIB | FB |
|---|---|---|---|---|---|---|
| Number of observations | 318 | 201 | 157 | 161 | 60 | 117 |
| Labour | 0.1879*** (0.0466) | 0.2177*** (0.0389) | 0.2429*** (0.0369) | 0.0966 (0.0844) | 0.2156*** (0.0478) | 0.0998 (0.0997) |
| Funds | 0.3109*** (0.0398) | 0.5075*** (0.0455) | 0.4991*** (0.0428) | 0.2775*** (0.0501) | 0.5706*** (0.0275) | 0.2523*** (0.0556) |
| Capital | 0.1767*** (0.0490) | 0.1059** (0.0440) | 0.0876** (0.0405) | 0.2631*** (0.0767) | 0.1014** (0.0363) | 0.2644*** (0.0818) |
| H-Statistic[a] | $0.6755^{MC}$ (0.0548) | $0.8310^{MC}$ (0.0782) | $0.8296^{PC}$ (0.0824) | $0.6372^{MC}$ (0.0650) | $0.8876^{PC}$ (0.0452) | $0.6166^{MC}$ (0.0560) |
| Adjusted $R^2$ | 0.7202 | 0.7480 | 0.7583 | 0.7264 | 0.9146 | 0.7344 |
| Model test (P-value) | 60.58 (0.0000) | 32.34 (0.0000) | 34.62 (0.0000) | 65.44 (0.0000) | 74.96 (0.0000) | 113.55 (0.0000) |
| H = 0 (P-value) | 152.04 (0.0000) | 113.02 (0.0000) | 101.28 (0.0000) | 96.04 (0.0000) | 385.22 (0.0000) | 121.40 (0.0000) |
| H = 1 (P-value) | 35.09 (0.0000) | 4.67 (0.0418) | 4.28 (0.0542) | 31.13 (0.0000) | 6.18 (0.0555) | 46.95 (0.0000) |

[+] OI = Overall Industry; DB = Domestic Banks; CO = Banks affected by cross-ownership; NCO = Banks not affected by cross-ownership; SIB = Systemically Important Banks; FB = Foreign Banks
[a] Superscript 'MC' (Monopolistic Competition) indicates that H>0 and H<1 both are not rejected at the 2.5% significance level. Superscript 'PC' (Perfect Competition) indicates that H = 1 is not rejected at the 5% significance level.
* p < 0.1, ** p < 0.05, *** p < 0.01

Table 13

H Statistics when using Gross Interest Income[+]

| | OI | DB | CO | NCO | SIB | FB |
|---|---|---|---|---|---|---|
| Number of observations | 318 | 201 | 157 | 161 | 60 | 117 |
| Labour | $0.2308^{***}$ (0.0509) | $0.2313^{***}$ (0.0529) | $0.3126^{***}$ (0.0384) | 0.0728 (0.0617) | $0.2098^{*}$ (0.0908) | 0.0844 (0.0671) |
| Funds | $0.3776^{***}$ (0.0349) | $0.4688^{***}$ (0.0692) | $0.5017^{***}$ (0.0430) | $0.3936^{***}$ (0.0446) | $0.6376^{***}$ (0.0222) | $0.3899^{***}$ (0.0478) |
| Capital | $0.0582^{*}$ (0.0342) | 0.0351 (0.0568) | 0.0229 (0.0473) | $0.1449^{***}$ (0.0472) | 0.0447 (0.0643) | $0.1278^{**}$ (0.0467) |
| H-Statistic[a] | $0.6666^{MC}$ (0.0503) | $0.7351^{MC}$ (0.1007) | $0.8373^{PC}$ (0.0851) | $0.6113^{MC}$ (0.0525) | $0.8922^{PC}$ (0.0743) | $0.6021^{MC}$ (0.0361) |
| Adjusted $R^2$ | 0.7727 | 0.6849 | 0.7462 | 0.7959 | 0.8977 | 0.7774 |
| Model test (P-value) | 79.71 (0.0000) | 29.49 (0.0000) | 39.32 (0.0000) | 51.67 (0.0000) | 91.32 (0.0000) | 190.79 (0.0000) |
| H = 0 ((P-value) | 175.35 (0.0000) | 53.24 (0.0000) | 96.74 (0.0000) | 135.69 (0.0000) | 144.35 (0.0001) | 278.76 (0.0000) |
| H = 1 (P-value) | 43.86 (0.0000) | 6.91 (0.0153) | 3.66 (0.0729) | 54.88 (0.0000) | 2.11 (0.2062) | 121.78 (0.0000) |

[+] OI = Overall Industry; DB = Domestic Banks; CO = Banks affected by cross-ownership; NCO = Banks not affected by cross-ownership; SIB = Systemically Important Banks; FB = Foreign Banks

[a] Superscript 'MC' (Monopolistic Competition) indicates that H>0 and H<1 both are not rejected at the 2.5% significance level. Superscript 'PC'(Perfect Competition) indicates that H = 1 is not rejected at the 5% significance level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

# APPENDIX VI – Regression results - Trivieri (2007) specification

## Table 14

### H Statistics when using Total Gross Income[+]

|  | OI | DB | CO | NCO | SIB | FB |
|---|---|---|---|---|---|---|
| Number of observations | 314 | 197 | 156 | 158 | 60 | 117 |
| Labour | 0.1133*** (0.0397) | 0.1898*** (0.0410) | 0.1850*** (0.0394) | 0.0801 (0.0616) | 0.1579** (0.0666) | 0.0530 (0.0637) |
| Funds | 0.4577*** (0.0263) | 0.6242*** (0.0288) | 0.5800*** (0.0275) | 0.3944*** (0.0398) | 0.5583*** (0.0327) | 0.3142*** (0.0408) |
| Capital | 0.0860** (0.0355) | 0.1292*** (0.0445) | 0.0985*** (0.0455) | 0.0791 (0.0496) | 0.0749 (0.0468) | 0.0269 (0.0510) |
| H-Statistic[a] | $0.6571^{MC}$ (0.0535) | $0.9432^{PC}$ (0.0596) | $0.8635^{MC}$ (0.0607) | $0.5536^{MC}$ (0.0784) | $0.7911^{MC}$ (0.0875) | $0.3941^{MC}$ (0.0830) |
| Adjusted $R^2$ | 0.9029 | 0.9607 | 0.9691 | 0.8450 | 0.9886 | 0.7974 |
| Model test (P-value) | 491.80 (0.0000) | 802.95 (0.0000) | 815.36 (0.0000) | 146.28 (0.0000) | 851.47 (0.0000) | 78.91 (0.0000) |
| H = 0 (P-value) | 150.90 (0.0000) | 250.40 (0.0000) | 202.36 (0.0000) | 49.84 (0.0000) | 81.73 (0.0000) | 22.56 (0.0000) |
| H = 1 (P-value) | 41.10 (0.0000) | 0.91 (0.3421) | 5.05 (0.0262) | 32.41 (0.0000) | 5.70 (0.0210) | 53.35 (0.0000) |

[+] OI = Overall Industry; DB = Domestic Banks; CO = Banks affected by cross-ownership; NCO = Banks not affected by cross-ownership; SIB = Systemically Important Banks; FB = Foreign Banks

[a] Superscript 'MC' (Monopolistic Competition) indicates that H>0 and H<1 both are not rejected at the 2.5% significance level. Superscript 'PC' (Perfect Competition) indicates that H = 1 is not rejected at the 5% significance level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 15

H Statistics when using Gross Interest Income[+]

| | OI | DB | CO | NCO | SIB | FB |
|---|---|---|---|---|---|---|
| Number of observations | 314 | 197 | 156 | 158 | 60 | 117 |
| Labour | $0.0901^{***}$ (0.0347) | $0.1497^{***}$ (0.0363) | $0.1709^{***}$ (0.0391) | 0.0499 (0.0525) | $0.1287^{*}$ (0.0682) | 0.0379 (0.0560) |
| Funds | $0.5162^{***}$ (0.0230) | $0.6192^{***}$ (0.0255) | $0.5883^{***}$ (0.0273) | $0.4756^{***}$ (0.0339) | $0.6159^{***}$ (0.0334) | $0.4144^{***}$ (0.0359) |
| Capital | $0.0786^{**}$ (0.0310) | $0.0771^{*}$ (0.0393) | $0.1374^{***}$ (0.0451) | 0.0614 (0.0423) | $0.0884^{*}$ (0.0479) | 0.0431 (0.0449) |
| H-Statistic[a] | $0.6849^{MC}$ (0.0468) | $0.8460^{MC}$ (0.0527) | $0.8966^{PC}$ (0.0603) | $0.5868^{MC}$ (0.0669) | $0.8330^{PC}$ (0.0896) | $0.4953^{MC}$ (0.0730) |
| Adjusted $R^2$ | 0.9267 | 0.9696 | 0.9701 | 0.8880 | 0.9887 | 0.8453 |
| Model test (P-value) | 666.07 (0.0000) | 1047.11 (0.0000) | 842.93 (0.0000) | 211.06 (0.0000) | 862.84 (0.0000) | 108.45 (0.0000) |
| H = 0 (P-value) | 214.50 (0.0000) | 257.56 (0.0000) | 221.43 (0.0000) | 76.97 (0.0000) | 86.47 (0.0000) | 46.05 (0.0000) |
| H = 1 (P-value) | 45.39 (0.0000) | 8.54 (0.0000) | 2.94 (0.0886) | 38.16 (0.0000) | 3.48 (0.0684) | 47.80 (0.0000) |

[+] OI = Overall Industry; DB = Domestic Banks; CO = Banks affected by cross-ownership; NCO = Banks not affected by cross-ownership; SIB = Systemically Important Banks; FB = Foreign Banks
[a] Superscript 'MC' (Monopolistic Competition) indicates that H>0 and H<1 both are not rejected at the 2.5% significance level. Superscript 'PC' (Perfect Competition) indicates that H = 1 is not rejected at the 5% significance level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

# APPENDIX VII – Regression results - De Bandt & Davis (2000) specification

Table 16

H Statistics when using Total Gross Income[+]

| | OI | DB | CO | NCO | SIB | FB |
|---|---|---|---|---|---|---|
| Number of observations | 318 | 201 | 157 | 161 | 60 | 117 |
| Labour | -0.1451*** | 0.0185 | -0.0509 | -0.1804** | -0.1054 | -0.2875*** |
| | (0.0499) | (0.0719) | (0.0738) | (0.0698) | (0.1300) | (0.0625) |
| Funds | 0.4920*** | 0.7174*** | 0.6599*** | 0.4157*** | 0.5070*** | 0.3070*** |
| | (0.0377) | (0.0496) | (0.0505) | (0.0532) | (0.0605) | (0.0471) |
| Capital | -0.0996* | -0.0458 | -0.3258 | -0.1356* | -0.0533 | -0.0972 |
| | (0.0546) | (0.0836) | (0.0888) | (0.0714) | (0.0878) | (0.0625) |
| H-Statistic[a] | $0.2473^{MC}$ | $0.6901^{MC}$ | $0.5765^{MC}$ | $0.0997^{M}$ | $0.3483^{MC}$ | $-0.0777^{OC}$ |
| | (0.0610) | (0.0872) | (0.0931) | (0.0835) | (0.1451) | (0.0746) |
| Adjusted $R^2$ | 0.8045 | 0.8827 | 0.9003 | 0.7307 | 0.9617 | 0.7329 |
| Model test (P-value) | 192.22 | 219.20 | 204.77 | 65.30 | 213.34 | 48.03 |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| H = 0 (P-value) | 16.44 | 62.60 | 38.38 | 1.43 | 5.76 | 1.09 |
| | (0.0000) | (0.0000) | (0.0000) | (0.2344) | (0.0204) | (0.3001) |
| H = 1 (P-value) | 152.27 | 12.62 | 20.71 | 116.32 | 20.17 | 208.79 |
| | (0.0000) | (0.0005) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |

[+] OI = Overall Industry; DB = Domestic Banks; CO = Banks affected by cross-ownership; NCO = Banks not affected by cross-ownership; SIB = Systemically Important Banks; FB = Foreign Banks
[a] Superscript 'MC' (Monopolistic Competition) indicates that H>0 and H<1 both are not rejected at the 2.5% significance level. Superscript 'PC' (Perfect Competition) indicates that H = 1 is not rejected at the 5% significance level. Superscript 'M' (Monopoly) indicates that H= 0 is not rejected at the 5% significance level. Superscript 'OC' (Oligopolistic Competition) indicates that H< 0 is not rejected at the 5% significance level.
* p < 0.1, ** p < 0.05, *** p < 0.01

<div align="center">

Table 17

**H Statistics when using Gross Interest Income[+]**

</div>

|  | OI | DB | CO | NCO | SIB | FB |
|---|---|---|---|---|---|---|
| Number of observations | 318 | 201 | 157 | 161 | 60 | 117 |
| Labour | -0.1400*** | -0.0028 | -0.0392 | -0.1952*** | -0.1151 | -0.3019*** |
|  | (0.0470) | (0.0689) | (0.0715) | (0.0641) | (0.1323) | (0.0563) |
| Funds | 0.5487*** | 0.7141*** | 0.6709*** | 0.4947*** | 0.5608*** | 0.4025*** |
|  | (0.0355) | (0.0475) | (0.0489) | (0.0489) | (0.0616) | (0.0424) |
| Capital | -0.1188** | -0.0830 | 0.0101 | -0.1686** | -0.0455 | -0.0972* |
|  | (0.0513) | (0.0801) | (0.0859) | (0.0656) | (0.0894) | (0.0563) |
| H-Statistic[a] | $0.2899^{MC}$ | $0.6283^{MC}$ | $0.6417^{MC}$ | $0.1309^{M}$ | $0.4001^{MC}$ | $0.0034^{M}$ |
|  | (0.0574) | (0.0836) | (0.0901) | (0.0767) | (0.1477) | (0.0672) |
| Adjusted $R^2$ | 0.8293 | 0.8937 | 0.9084 | 0.7740 | 0.9626 | 0.7861 |
| Model test (P-value) | 225.85 | 244.26 | 224.50 | 81.58 | 218.91 | 63.48 |
|  | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| H = 0 (P-value) | 25.54 | 56.51 | 50.70 | 2.92 | 7.34 | 0.00 |
|  | (0.0000) | (0.0000) | (0.0000) | (0.0900) | (0.0094) | (0.9598) |
| H = 1 (P-value) | 153.20 | 19.77 | 15.80 | 128.50 | 16.50 | 219.97 |
|  | (0.0000) | (0.0000) | (0.0001) | (0.0000) | (0.0002) | (0.0000) |

[+] OI = Overall Industry; DB = Domestic Banks; CO = Banks affected by cross-ownership; NCO = Banks not affected by cross-ownership; SIB = Systemically Important Banks; FB = Foreign Banks

[a] Superscript 'MC' (Monopolistic Competition) indicates that H>0 and H<1 both are not rejected at the 2.5% ssignificance level. Superscript 'PC' (Perfect Competition) indicates that H = 1 is not rejected at the 5% significance level. Superscript 'M' (Monopoly) indicates that H= 0 is not rejected at the 5% significance level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$