DETERMINENTS OF PROFITABILITY OF COMMERCIAL BANKS IN SRI LANKA

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Abstract
The performance of the Sri Lankan commercial banks, measured by the Return on Assets (ROA) and the Return on Equity (ROE) ratios, appeared to be stronger in the recent past compared to the other SARRC counties. This paper examined the impact of bank specific and macroeconomic determinants on the profitability of commercial banks in Sri Lanka. The study uses quarterly data relating to the bank specific and macroeconomic indicators during the period 2001-2011by carrying out a multiple panel regression.
According to the empirical results, it was observed that the large banks are recorded more profits due to economic of scale than the banks which are well sound with a higher regulatory capital ratio. Further, the results from the panel regression suggest that the liquidity and operating cost efficiency banks were negatively related to the commercial bank profitability in Sri Lankan. In addition, interest rate found to be having a significant impact on the bank profitability with a negative relationship between the Return on Assets of a bank implying that lower interest rate scenario would accounted a higher level of profitability with the expansion of banking activities

Key Words: ROI, ROA, Profitability, Sri Lanka, Commercial Banks

1 Overview

1.1 Introduction

Financial intermediaries perform key financial functions in economies such as providing a payment mechanism, matching supply and demand in financial markets, dealing with complex financial instruments and markets, providing markets transparency, performing risk transfer and risk management functions. Therefore, as financial intermediaries, banks play a crucial role in the operation of economies. A proper functioning of banking system facilitates an efficient payments system, enhances savings/investments and thereby contributes for a rapid economic growth.

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During the last two decades, the banking sector all around the world has experienced some profound changes, as innovations in technology and the inevitable forces driving globalization which creates both opportunities for growth and challenges for banking industry to remain profitable in this increasingly competitive environment. These major transformations in environment, resulting in significant impacts on its performance. Bank performance has substantive repercussions (effects) on investment, firm growth, industrial expansion and economic development. Profitability is necessary for a bank to maintain ongoing activity and for its shareholders to obtain fair returns. Thereby, both external and internal factors have been affecting the profitability of banks over time. Therefore, the determinants of bank performance have attracted the interest of academic research as well as of bank management, financial markets and bank supervisors/regulators.

In the past few years, Sri Lankan commercial banks have been significantly more profitable than those of the other countries in the region. However, it is also important for supervisors because it guarantees more flexible capital ratios, even in the context of a riskier business environment. This higher profitability does not appear to have been achieved at the expense of the soundness of the banking system.

Thus, research on the banking system and its effects competition and profitability has important for policy implications, which makes it interesting to study. This paper aims to investigate the bank specific as well as macroeconomic determinants of commercial banks' profitability in Sri Lanka during the period from 2001-2011 while verifying any structural breaks were appeared in the latter part of the sample period (e.g., from 2007 to 2010).

Banking Sector in Sri Lanka

The banking sector in Sri Lanka, which comprises Licensed Commercial Banks (LCBs) and Licensed Specialized Banks (LSBs), dominates the financial system and accounted for about two third of the total assets of the financial system as at end 2011. In terms of the asset base and the magnitude of services provided, the LCBs are the single most important category of financial institution within the banking sector. As at end 2011, the LCBs dominated the financial system with a market share of 44 per cent of the entire financial system's assets and 84 per cent of the banking sector's assets (Financial System Stability Review 2011-Central Bank of Sri Lanka)**.**

Table – 1
Banking Sector in Sri Lanka

Type of Bank	**No. of Institutions As at 31.12.2011**	**No. of Banking Outlets As at 31.12.2011**	**Total Assets (Net) As at 31.12.2011**		**Market Share as at 31.12.2011 (%)**
			Rs. bn	Market Share (%)	
Licensed Commercial Banks (LCBs)	**24**	**1,581**	**3,575**	**84.2**	**85.6**
State Banks	02	650	1,501	35.4	37.2
Private Domestic Banks	10	883	1,605	37.8	37.2
Foreign Banks	12	48	468	11.0	11.2
Licensed Specialized Banks (LSBs)	**09**	**511**	**669**	**15.8**	**14.4**

State Banks	03	445	584	13.8	12.3
Private Banks	06	66	85	2.0	2.1
l	**33**	**2,092**	**4,244**	**100.0**	**100.0**

source: Central Bank of Sri Lanka

Therefore, the health of the financial system depends to a large extent on the soundness of the financial institutions, particularly the LCBs. Financial reforms in Sri Lanka commenced in late 1977 aimed to improve the performance of banks through enhancing competitiveness and efficiency of the industry. Initial reform measures have allowed some structural changes in financial services sector by giving greater freedom to the private sector and the government encouraged new entrants to the financial services market. Those changes were affected to expand the scope of the banking industry as well as to increase the number of firms in the banking industry. Accordingly, there were the numbers of banks stood at 33 comprising 24 LCBs (12 domestic licensed commercial banks, including 02 state owned banks, 12 foreign banks) and 09 LSBs as at the end of year 2011 (Annual Report-Central Bank of Sri Lanka 2011). Since the liberalization of Sri Lankan economy in 1977, there were numerous developments and policy changes have been taken place in the banking sector in Sri Lanka. The more important reforms initiated in the banking sector includes adoption of prudential norms in terms of capital adequacy, assets classification and provisioning, deregulation of interest rates, imposing Statutory Liquidity Ratio (SLR) and lowering Statutory Reserve Ratio (SRR), opening of the sector to private participation, permission to foreign banks to expand their operations through opening of branches and the introduction of Real Time Gross Settlement (RTGS).

The developments in the banking industry have led to the increase in resource productivity, increasing level of deposits, credits and profitability and decrease in non-performing assets. However, the profitability is an important criteria to measure the performance of banks in addition to productivity, financial and operational efficiency. An efficient management of banking operations aimed at ensuring growth in profits and efficiency requires up-to-date knowledge of financial markets on which the bank's profit depends. The banking industry today enjoys a number of advantages compared to past years that would appear to contribute to their ability to generate profits.

The Sri Lankan banking sector has experienced substantial growth and change in recent years, as witnessed by the rapid expansion of its total assets since 1998. In 2011 the total assets of all licensed banks reached Rs. 4,252 bn, more than six times the 1998 total of Rs. 0.703 bn. The assets of Licensed Commercial banks constituted nearly 85% f the total assets of the Sri Lankan banking industry as at end 2011 and increased by 7% since 1998. This period of rapid growth in the SL commercial banking sector has coincided with major structural changes, including the deregulation of the banking industry allowing non-banks to compete in the financial services market. These changes have greatly enhanced the scope for increased competition in financial services bringing wider choices for consumers. It is reasonable to assume that all the above changes posed great challenges to the SL banks as the environment in which they operated changed rapidly, which consequently affected their performance.

Accordingly, the purpose of this paper is to investigate the determinants of profitability of commercial banks in the Sri Lanka during the period 2001-2011, which has witnessed substantial growth and change following deregulation of the Sri Lankan banking industry.

1.3 The Research Problem and the Significance of the Study

The performance of the Sri Lankan commercial banks, measured by the Return on Equity (ROE) and the Return on Assets (ROA) ratios, appeared to be stronger in the recent past compared to the other SARRC counties (Table -2). This study examines the determinants of commercial banks profitability in Sri Lanka, relating to the bank specific and macroeconomic indicators.

Table - 2

Profitability indicators of the SARRC countries

(Commercial Banks/Banking Industry*)

Country	Return on Assets (ROA) - %			Return on Equity (ROE) - %		
	2009	2010	2011	2009	2010	2011
India	1.1	1.0	1.1	-0.74	5.8	6.9
Singapore	1.1	1.2	1.0	10.8	12.2	11.1
Nepal	1.9	1.8	1.8	17.0	14.1	10.8
Pakistan	0.7	1.1	1.3	8.2	11.6	14.3
Bangladesh*	1.0	1.1	1.3	10.8	12.6	14.3
Sri Lanka	**0.9**	**1.7**	**1.6**	**11.1**	**20.9**	**20.3**

Source: Compiled by the writer by using Central Bank's Annual Reports of each country

While there has been a rapidly growing literature on determinant of banking profitability issues in developed countries, little attention has been paid so far on determinant of profitability of banks in developing countries. However, there is an increasing recognition that financial sector development is a top priority to sustain economic growth in developing countries.

1.4 Objectives of the study

The overall objective of the present study is, to investigate the impact of bank specific determinants i.e., size, capital, liquidity, credit risk and operational efficiency on profitability of LCBs in Sri Lanka during the period from 2001 to 2011 and also to investigate the impact of selected macro-economic indicators on profitability of LCBs in Sri Lanka.

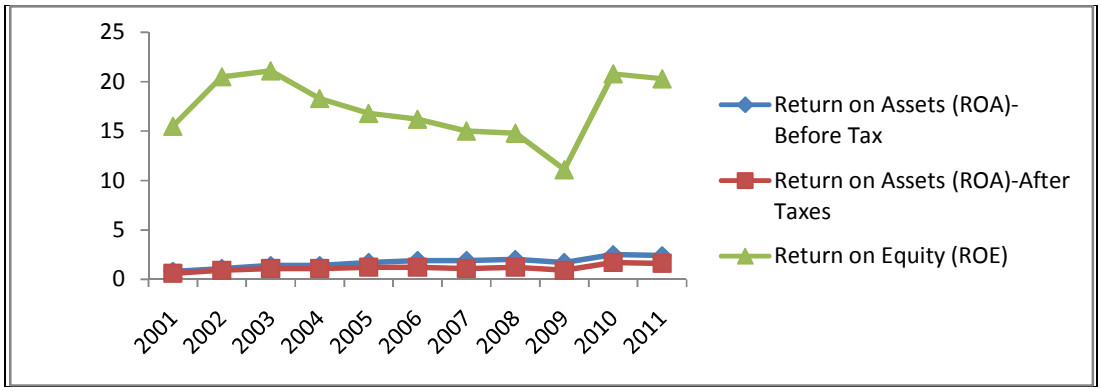
Table - 3

Key profitability Indicators for LCBs

Indicator (%)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Return on Assets (ROA)- Before Tax	0.8	1.1	1.4	1.4	1.7	1.9	1.9	2.0	1.7	2.5	2.4
Return on Assets (ROA)- After Taxes	**0.6**	**0.9**	**1.1**	**1.1**	**1.2**	**1.2**	**1.1**	**1.2**	**0.9**	**1.7**	**1.6**
Return on Equity (ROE)	**15.5**	**20.5**	**21.1**	**18.3**	**16.8**	**16.2**	**15.0**	**14.8**	**11.1**	**20.8**	**20.3**
Cost to Income Ratio	87.6	82.5	77.2	77.5	78.6	77.1	78.7	79.0	77.6	73.4	74.0
Staff Cost to Operating Expenses	47.3	47.4	48.7	46.4	44.4	42.6	42.9	43.5	45.6	44.7	42.7
Interest Margin	3.3	3.8	4.2	4.0	4.1	4.4	4.5	4.7	4.8	4.7	4.3
Interest Income to Total Income Ratio	83.7	82.4	76.6	75.3	79.9	83.3	86.5	86.0	85.8	83.8	84.6
Non-Interest Income to Total Income Ratio	16.3	17.6	23.4	24.7	20.1	16.7	13.5	14.0	14.2	16.2	15.4

Source: Central Bank of Sri Lanka

Figure 1: Profitability Indicators (ROA and ROE)



1.5 Research Hypothesis

The major hypothesis of this study is to examine whether the bank specific determinants as well as macroeconomic indicators are important in explaining commercial banks' profitability in Sri Lanka. The analysis based on quarterly industry data for the LCBs in Sri Lanka for the period 2001-2011.

H1 = Commercial banks' profitability (measured by ROA) has a positive impact on bank Specific determinants/macroeconomic indicators

Ho = Commercial banks' profitability (measured by ROA) has no positive impact on bank Specific determinants/ macroeconomic indicators

1.6 Scope and Methodology of the Study

In this study, the commercial banks' profitability is measured by the return on average assets (ROA). As to the explanatory variables, it was divided them into two different categories, namely bank-specific and macroeconomic determinants of commercial bank profitability.

The rest of this paper is organized as follows: In Section 2, represents the relevant literature on banking profitability. Section 3 describes model, the dependent and independent variables and describes the sample and methodology used. In Sections 4 and 5 present the results from the empirical analysis and conclude, respectively.

2 Review of Literature

In banking literature, the determinants of profitability are empirically well explored although the definition of profitability varies among studies. Thereby, the bank profitability, typically measured by the return on assets (ROA) and/or the return on equity after tax (ROE), is usually expressed as a function of internal and external determinants. Internal determinants are factors that are mainly influenced by a bank's management decisions and policy objectives. Such profitability determinants are the level of liquidity, provisioning policy, capital adequacy, expenses management and bank size. On the other hand, the external determinants, both industry-related and macroeconomic, are variables that reflect the economic and legal environment where the credit institution operates.

The majority of studies on bank profitability, such as Short (1979), Bourke (1989), Molyneux and Thornton (1992), Demirguc-Kunt and Huizinga (2000) and Goddard *et al.* (2004), use linear models to estimate the impact of various factors that may be important in explaining profits. Short (1979) and Bourke (1989) provided the first studies on bank profitability. Some subsequent studies aimed at explaining bank

profitability in a single country were done by Guru *et al.* (1999), Naceur (2003), Athanasoglou *et al.* (2005), Kosmidou (2006), Vong and Chan (2006), Garcia-Herrero *et al.* (2007), Ramlall (2009), Davydenko (2010).

Other studies aim at analyzing bank profitability in groups of countries: Molyneux and Thorton (1992) were the first to investigate a multi-country setting by examining the determinants of bank profitability for a panel of European countries, followed by Staikouras and Wood (2003), analyse the performance of a sample of banks operating in 13 European countries and Pasiouras and Kosmidou (2007) who studied the factors influencing the profitability of domestic and foreign banks in the European Union. Other multi-country studies include Demirguc-Kunt and Huizinga (1999) investigate the determinants of bank interest margins using bank-level data for 80 countries in the years by consider a comprehensive set of bank specific characteristics, as well as macroeconomic conditions, taxation, regulations, financial structure and legal indicators. Goddard *et al.* (2004) used panel and cross-sectional regressions to estimate growth and profit models for a sample of almost 600 banks from five European Union countries over the period 1992-1998. Flamini *et al.* (2009) have used a sample of 389 banks in 41 Sub-Saharan Africa countries to study the determinants of bank profitability.

Bank-specific determinants

There are common factors/determinants influencing profitability identified by several researchers such as cost, size, capital, liquidity, credit risk as internal factors/Bank-specific determinants.

Bank size is generally used to capture potential economies or diseconomies of scale in the banking sector. This variable controls for cost differences and product and risk diversification according to the size of the credit institution. The impact of a bank's size on its profitability is not uniform. The first factor could lead to a positive relationship between size and bank profitability, if there are significant economies of scale, while the second to a negative one, if increased diversification leads to lower credit risk and thus lower returns. In a study of European banks for the period of 1992 to1998, Goddard *et al.* (2004) identified only slight relationship between size and profitability. Some of earlier studies have different results. Short (1979) goes further by claiming that size has a positive influence on profitability through lowering the cost of raising capital for big banks. Later, studies by Flamini *et al.* (2009) support the proposition that increasing a bank's size positively affects profitability and actively diversification by private ownership. However, there is no consensus in the literature on whether an increase in size provides economies of scale to banks. For example, some researches including Pasiouras and Kosmidou (2007) and Athanasoglou *et al,*(2005) claim that there is no significant relationship between profitability and size.

Operating costs of a bank as a percentage of its profits are expected to have a negative correlation with profitability. In the literature, the level of operating expenses is viewed as an indicator of the management's efficiency. For example, Pasiouras and Kosmidou (2007) in their study of European Union countries conclude that operating costs have a negative effect on profit measures. The inclusion of bank expenses into the profitability is also supported by Bourke (1989) and Molyneux and Thorton (1992) who find a link between bank profitability and expense management. In relatively uncompetitive markets where banks enjoy market power, costs are passed on to customers; hence there would be a positive correlation between operating costs and profitability (Flamini *et al,* 2009).

Various studies suggest that banks with higher levels of **capital** perform better than their undercapitalized peers. Bank profits provide an important source of equity especially if re-invested into the business. This should lead to safe banks, and as such high profits could promote financial stability (Flamini *et al*, 2009). Staikouras and Wood (2003) claim that there exists a positive link between a greater equity and profitability among EU banks. Goddard *et al.* (2004) supports the prior finding of positive relationship between

capital/asset ratio and bank's earnings. Vong and Chan (2006) investigate the impact of internal and external factors of banks on the Macao Banking industry for 15-year period. Their results show that with greater capitalization, there is a low risk and high profitability for the bank.

Insufficient **liquidity** is one of the major reasons of bank failures. However, holding liquid assets has an opportunity cost of higher returns. Bourke (1989), Athanasoglou *et al,*(2005) and Demirguc-Kunt and Huizinga (1999) find a positive significant link between bank liquidity and profitability. However, instability banks may chose to increase their cash holding to mitigate risk. Unlike Bourke (1989), Molyneux and Thorton (1992) come to a conclusion that there is a negative correlation between liquidity and profitability levels.

Changes in **credit risk** may reflect changes in the health of a bank's loan portfolio, which may affect the performance of the institution. Athanasoglou *et al,*(2005) and Flamini *et al, (*2009) conclude that variations in bank profitability are largely attributable to variations in credit risk, since increased exposure to credit risk is normally associated with decreased firm profitability. Miller and Noulas (1997) suggest that the more financial institutions are exposed to high-risk loans, the higher the accumulation of unpaid loans and the lower the profitability. According to Vong and Chan (2006) the loan-losses provisions affect banks profitability unfavorably. The findings of this study carried out by Staikouras and Wood (2003) revealed that loans-to-assets ratio and the proportion of loan loss provisions are inversely related to banks' return on assets.

Macroeconomic determinants

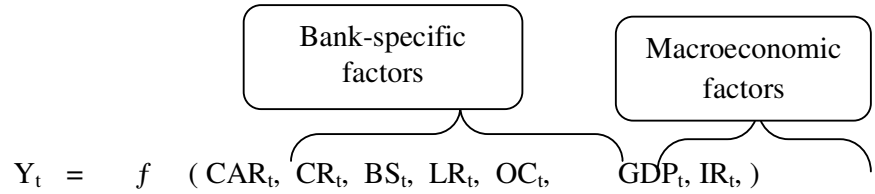
Another group of variables impacting bank profitability are macroeconomic control variables such as GDP, interest rates and inflation. GDP is one of the most common measures of the total economic activity within a country. In the literature, the growth of GDP has significant positive effect on the profitability of the financial sector. Inflation is often cited to be a significant determinant of bank profitability. Among studies that find a significant positive relationship between inflation and bank earnings are those conducted by Molyneux and Thorton (1992) and Bourke (1989). Flamini *et al* (2009) noted that if high returns are the consequence of market power, this implies some degree of inefficiency in the provision of financial services. According to Staikouras and Wood (2003), macroeconomic indicators such as variability of interest rate, growth of GDP had a negative impact on profitability.

As to my best knowledge, there are no similar published empirical studies on profitability on banking sector in Sri Lanka and this study fills an important gap in the literature. Many of the Sri Lankan banking studies have focused on the relationships between the specific bank determinants and its efficiency.

3. Analytical Framework

3.1 The Model

This paper will examine about the determinants of profitability of LCBs in Sri Lanka using multiple regression model.



According to this, the econometric model for the banking industry in Sri Lanka for *t* years is contrasted as follows:

$$Y_t = \alpha + \sum_{i=1}^{n} \beta_i X_{i,t} + \sum_{j=1}^{n} Y_j \ Z_{j,t} + U_t$$

Where,

Y_t = Return on Assets (after Tax) - (ROA)

α = Regression constant term,

β_i = Regression coefficients for the respective variables of the bank specific determinants, $X_{i,t}$ = Vectors of bank specific determinants such as ,

CAR = Capital Adequacy Ratio

CR = Loan Non-Performing Advances /Total loans and Advances (Credit Risk)

BS= Total assets (Bank size)

LR = Liquid assets /Total Assets (Liquidity Risk)

OC= Efficiency Ratio (Operating Cost)

$\square_j$ = Regression coefficients for the respective variables of the macroeconomic determinants,

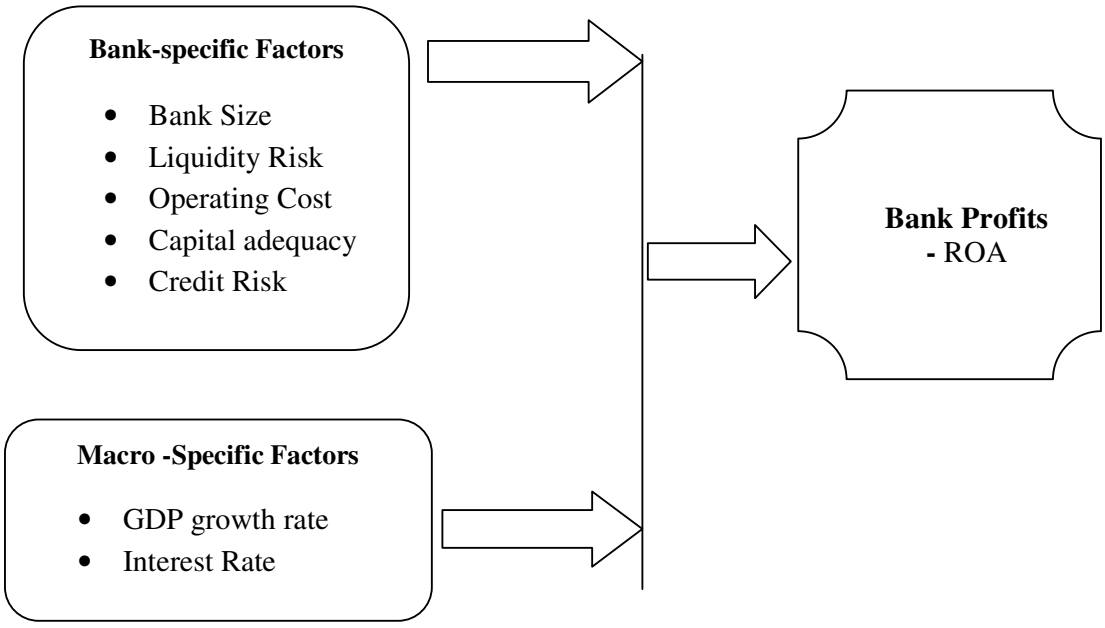
$Z_{j,t}$ = Vectors of macroeconomic determinants such as,

GDP = Growth rate of Gross Domestic Product (GDP growth rate)

IR = Repo overnight rate

u_t = Error Term.

Figure 2: Schematic Diagram showing relationships between variables



3.2 Determinants of bank profitability and variable selection

(a) Dependent variables

In this study, the Return on average Assets (ROA) is the main measure to evaluate bank profitability. The ROA is defined as net profits of average total assets and is expressed in percent. The ROA reflects the

ability of a bank's management to generate profits from the bank's assets. It shows the profits earned per Rupee of assets and indicates how effectively the bank's assets are managed to generate revenues, although it might be biased due to off-balance-sheet activities. Average assets are being used in order to capture changes in assets during the fiscal year. As Flamini *et al* (2009) and Kosmidou *et al* (2005) point out the ROA has emerged as key ratio for the evaluation of bank profitability and has become the most common measure of bank profitability in the literature.

As an alternative profitability measure, it has used the Return on average Equity (ROE), which is the return to shareholders on their equity. Banks with a lower leverage ratio (higher equity) usually report a higher ROA, but a lower ROE. However, note that the ROE disregards the higher risk that is associated with a high leverage. Even though the ROE is also commonly used in the literature, it is not the best profitability indicator. Thereby, in this study it is considered that the ROA as a more significant and better profitability measure and main dependent variable.

(b) Bank specific profitability determinants

Bank Size is described by the accounting value of banks total assets. Size is an important determinant of profitability. The effect of a bank's size on profitability is not settled in the literature. It is expected a positive effect on earnings to be derived from economies of scale and lower perceived probability of default of larger banks. However, increase in size can lead to decreasing profits for banks due to cumbersome bureaucracy.

Liquidity is measured by Liquidity Assets ratio (LAR) which is a ratio of all liquid assets (mainly cash and cash equivalents) over total assets. It is expected a positive coefficient. High liquidity may allow a bank to avoid costly borrowing of funds should the need for cash arise. However, there is also an opportunity cost that banks incur by not investing the cash available to generate returns. Therefore, the sign may appear to be positive.

Operational Cost is measured by the efficiency ratio which is a ratio of administrative expenses including personnel over total assets in order to estimate how efficiently banks manage their expenses relatively to their size. In line with earlier studies, it is expected this effect of expenses ratio on profits to be negative.

The capital level of commercial banks in this study is described by a Capital Adequacy Ratio (CAR) of total capital over total risk weighted assets. Well capitalized banks have lower perceived risk and according to the finance theory should produce lower returns. However, banks with a higher level of capital are viewed as having a safety net in case of liquidation. Being better insured from bankruptcy they also enjoy a lower cost of capital contributing to their profitability. A well-capitalized bank has more flexibility to both pursue unexpected opportunities and deal with unpredicted losses and is thus more profitable. CAR is an endogenous variable for determining profitability. The causality may run in both directions. As explained above, increasing level of capital may enhance profits. However, a portion of profits may be ploughed back into a banks increasing CAR.

Credit risk is modeled by the ratio of Non-performing Advances (NPA). NPA ratio is one of the important measure of asset quality and reflects changes in the health of bank's loan portfolio that affects performance of bank negatively. This provides the ability of bank managers to screen the credit risk and take corrective measures to overcome high NPA ratio in order to increase the profitability.

(c) Macroeconomic indicators

It is used Real GDP growth to account for the growth of the Sri Lankan economy output and expected that the GDP growth to have a significant positive effect on the profitability of banks. In line with the literature, it is expected a strong positive correlation between the overall economic activity and the performance of the financial sector.

It is used the Repo rates published by the Central Bank of Sri Lanka (CBSL) as a proxy for the monetary policy which is used by the CBSL to steer the money supply. Including the Repo rates in this analysis, it is allowed to see whether the monetary policy affects bank profitability and it is expected the central bank interest rate variable to affect banking profitability positively. The expected relationships of variables with the dependent variable of ROA and reasons for such relationships are represented in Table 4 (a) and (b) below.

Table – 4 (a)
Variable Definition and Notation

Nature of the Variables	Variable	Description	Notation	Expected Relation
Independent Variable	Profitability	The return on average total assets	ROA	
Dependent Variable – Bank Specific determinants	Capital Adequacy	Total Capital base/ Risk Weighted Assets	CAR	Positive (+)
	Credit Risk	Total Non-performing Advances/Total Loans and Advances	CR	Negative (-)
	Bank size	Total assets	BS	Positive (+)
	Liquidity Risk	Liquid assets /Total Assets	LR	Negative (-)
	Operating Cost	Efficiency Ratio	OC	Negative (-)
Dependent Variable – macroeconomic determinants	GDP growth rate	Growth rate of Gross Domestic Product	GDP	Positive (+)
	Interest Rate	Repo overnight rate	REPO	Negative/Positive

Source of quarterly data

- Bank Supervision Database and CBSL website for bank specific determinants
- Statistics Department Database and CBSL website for other macroeconomics determinants

Table – 4 (b)
Determinants of Commercial Banks Profitability in Sri Lanka

Variable	Measured by	Expected Relationship	Reason for the Relationship
Bank size	Total Assets	Positive	Due to economic of scale in banks with large assets base
Capital Adequacy	Capital Adequacy Ratio	Positive	Bank's capacity to absorb unforeseen losses determines its

			level of risk
Credit Risk	Non-Performing Advances (NPA)	Negative	Due to less earnings and additional cost on NPAs
Liquidity Risk	Liquidity Ratio	Negative	Less exposure to risk will lead lower return
Operating Cost	Efficiency Ratio	Positive	higher return trough operating efficiency
GDP	GDP growth rate	Positive	Expansion of bank balance sheet through economic enhancement
Interest Rate	Repo rate	Negative/Positive	

3.3 Data and Methodology

In this study uses an unbalanced panel of Licensed Commercial banks operating in Sri during the period 2001-2011. The panel is unbalanced since it contains banks entering or leaving/mergers during the sample period. The quarterly financial data of all Commercial banks operating in Sri Lanka and macroeconomic data over the period 2001-2011 were obtained from the data based at the Bank Supervision Department and Statistics Department of the Central Bank of Sri Lanka. In addition, it was established structural break test to identified any structural breaks for the Sri Lankan Commercial banks' profitability appeared in the latter part of the sample period (e.g., from 2007 to 2010).

The multiple regression analysis was carried-out by using E-View Version 7.0 Econometrics computer software. Further, chow breakpoint test of the same computer software was carried out to identify any structural breaks.

4. Empirical Results

4.1 Descriptive statistics

The descriptive statistics of the variables involved in the regression model represent in **Table -5**. Key figures, including mean, min, max values and standard deviation are reported. This is generated to give overall description about data used in the model. Except the "bank size (BS), all other variables were reported low level of standard deviations with comparatively less deviations in the data points.

As the table -5 shows, Size of the bank which represented by the total assets represents a larger standard deviation with 855.05 compared with other variables. It revealed that the size of the bank has more significant variance than other variables. The variables of external factor measurement present small standard deviation, this implies that macroeconomics in Sri Lanka during the period of 2001 to 2011 remains reasonable stable.

Table-5
Descriptive statistics of the variables

	ROA	SIZE	OPERATIONAL	NPA	LIQUIDITY	IR	GDP	CAR
Mean	1.156818	1772.247	64.15000	9.238636	28.50227	8.687500	5.472727	12.17273
Median	1.100000	1655.285	59.80000	7.600000	28.65000	8.500000	6.250000	12.55000
Maximum	1.800000	4003.480	83.10000	16.80000	31.90000	10.50000	8.600000	15.20000
Minimum	0.800000	603.5000	47.30000	3.400000	25.00000	7.000000	-3.900000	9.000000
Std. Dev.	**0.244376**	**855.0517**	**11.06393**	**4.057449**	**1.852778**	**1.100839**	**2.966194**	**1.841936**
Skewness	1.043255	0.542257	0.366437	0.460330	-0.195550	0.311420	-1.640881	0.054649
Kurtosis	3.428297	2.495073	1.689183	1.649932	2.209743	2.157566	5.344666	1.664663
Jarque-Bera	8.317760	2.623724	4.134796	4.895546	1.425354	2.012315	29.82361	3.290964
Probability	0.015625	0.269318	0.126515	0.086486	0.490330	0.365621	0.000000	0.192920
Sum	50.90000	77978.86	2822.600	406.5000	1254.100	382.2500	240.8000	535.6000
Sum Sq. Dev.	2.567955	31437874	5263.650	707.9043	147.6098	52.10938	378.3273	145.8873
Observations	44	44	44	44	44	44	44	44

Figure 1 of the **Appendix I** plots the time series of all variables used in the study over the period from 2001 to 2011. Operational cost measured by efficiency ratio was displaying an overall downward trend (i.e. increasing trend in efficiency) over the examined period for 44 observations. On average, NPA showed decreasing trend throughout the phase. Size and CAR variables displayed an upward pattern by representing growth of the banking industry over the last 11 years period from 2001. Liquidity appeared to be fluctuating and any noticeable pattern or trend was not observed. Even though the GDP and IR reported fluctuations in the early years of the sample period, GDP shows an upward trend and IR represents a downward trend during the latter part of the sample period.

In addition to descriptive statistics, a correlation matrix for independent variables was also conducted to detect multicolliearity problem in regression model. As result shows in **Table - 6**, there are fairly low data correlations among the independent variables. These low correlation coefficients shows that there is no problem of multicolliearity, thus enhanced the reliability for regression analysis. (The correlation matrix shows that there is no problems of Multicolliearity since none of the correlation coefficients are more than 0.55).

Table - 6
Coefficient Correlation between the dependent variables

	SIZE	OPERATION	NPA	LIQUIDITY	IR	GDP	CAR
SIZE	1.000000						
OPERATION	-0.241339	1.000000					
NPA	-0.437464	0.015946	1.000000				
LIQUIDIT	-0.487036	0.321478	0.526260	1.000000			
IR	-0.254660	0.003867	-0.094337	-0.177374	1.000000		
GDP	0.334060	-0.324215	-0.473556	-0.303905	-0.033385	1.000000	
CAR	0.112971	-0.035674	-0.148709	-0.416688	-0.180210	0.545899	1.000000

4.2 Stationarity of Series

Economic theory requires that variables be stationary before application of standard econometric techniques. To evaluate the stationarity of the variables in the model, it is used unit root test applicable to unbalanced panels (by using Augmented Dickey - Fuller Test Equation). Stationarity implies that the mean, variance and autocorrelation of a variable do not change with time. The results indicate that all variables are stationary at its levels besides Non-performing Advances (NPV) and Capital Adequacy (CAR) which are stationary at its first differentiate. The summary of the results of ADF Test are given in **Table 7** and detailed results are at **Appendix-II**.

Table 7
Results of ADF Test

Variable	**ADF Statistics and significant level**	**1st Difference and significant level**
Size	-5.519365*	
Operational Cost	-4.284380*	
NPA		-8.797758*
Liquidity	-4.131818*	
IR	-3.090208*	
GDP	-3.954224*	
CAR		-6.053431*

*significant at 1% critical value

Thirdly, it was carried out diagnostic test to identify error terms behavior and thereby ensure reliability of the output of the model used. White-Heteroskedasticity Test used for this purpose and results indicates that no heteroscedasticity problems in the model used as indicated in lower probability values of the test results as indicated in **Table 8.**

Table 8
Results of Heteroskedasticity Test: White

F-statistic	4.340757	Prob. F(7,36)	.0014
Obs*R-squared	20.13930	Prob. Chi-Square(7)	0.0053
Scaled explained SS	15.54510	Prob. Chi-Square(7)	0.0296

4.3 OLS Panel Regression Results

Table 9
Result of Multiple Regression Model

Dependent Variable: ROA
Method: Least Squares
Date: 08/16/13 Time: 10:59
Sample (adjusted): 2001Q1 2011Q4
Included observations: 44 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.450925	1.231348	2.802558	0.0081
BS	0.000119	7.76E-05	1.537111	0.0330
OC	-0.013798	0.007882	-1.750600	0.0485
CR	0.008515	0.015370	0.553998	0.5830
LR	-0.020273	0.014681	-1.380867	0.0258
IR	-0.074943	0.027850	-2.690969	0.0107
GDP	0.015954	0.009781	1.631136	0.1116
CAR	-0.045786	0.038594	-1.186340	0.2433

R-squared	0.743093	Mean dependent var	1.156818
Adjusted R-squared	0.693139	S.D. dependent var	0.244376
S.E. of regression	0.135372	Akaike info criterion	-0.998608
Sum squared resid	0.659725	Schwarz criterion	-0.674210
Log likelihood	29.96937	Hannan-Quinn criter.	-0.878305
F-statistic	14.87551	Durbin-Watson stat	2.205299
Prob(F-statistic)	0.000000		

Based on the above results, the equation can be interpreted as follows.

3.450 + 0.000 BS- 0.013 OC + 0.008 CR– 0.020 LR– 0.074 IR + 0.015 DGP –

0.045 CAR

Table - 9 reports the regression results for the main profitability measure ROA. The overall R2 of the full model with all our explanatory variables amounts to 74%. Out of seven variables there are only four variables were significant at 1% or 5% out of which three Bank specific variables (e.g., Size, Liquidity, Operational Cost and Interest Rate) are significant when determining the profitability (measured by ROA) of the LCBs operating in Sri Lanka. Out of other three insignificant variables (e.g., CAR, NPA and GDP) CAR and NPA have not reported its expected relationships (negative or positive), as per the regression results. However, those have not significant enough to consider as a determinant in profitability measured as ROA for Sri Lankan Commercial Banks.

As expected, Size was showing a positive relationship with ROA and was significant at 5% confident level. Further, with the coefficient of 0.000119, it could be stated that 1% increase in would lead to increase in profitability by 0001% and vice-versa. Based on the evidence of previous studies and considering the scale efficiencies at large banks, a positive relationship between bank

size and the level of efficiencies in Sri Lankan commercial banks were expected. This result is in line with the previous studies carried out by Flamini *et al.* (2009) for the profitability of banks in 41 Sub-Saharan African Countries and Sort (1979). However, there is no consensus in the literature on whether an increase in size provides economies of scale to banks. For example, some researches including Pasiouras and Kosmidou (2007) and Athanasoglou *et al,*(2005) claim that there is no significant relationship between profitability and size.

Operating cost appear to be an important determinant of profitability as OC measured by the efficiency ratio affects ROA at 5% confident level. However, their negative effects means that there is a lack of efficiency in expenses management since banks pass part of increased cost to customers and remaining part to profits, possibly due to the fact that competition does not allow them to overcharge. Clearly, efficient cost management is a prerequisite for improved profitability of Sri Lankan commercial banks which is in line with the results of Athanasoglou et al. (2008), clearly shows that efficient cost management is a prerequisite for improved profitability of Swiss banks.

Liquidity defined as total liquidity assets as a percent of total assets has appeared significant for determining profitability in the panel data model at 5% confident level. In commercial banking sector in Sri Lanka, liquidity has a significant and negative impact on profitability which is in line with prior studies but contrary to the findings of Bourke (1989), Atanasoglou *et al.* (2005) and Demirgue-Kunt and uizinga (19999) who have determined a positive significant correlation of the bank profitability and liquidity.
When considered the macroeconomics variables, Interest Rate (IR) rate which is measured by Repo overnight rate found to be having a significant impact on the bank profitability with a negative relationship between the ROA of a bank implying that lower interest rate scenario would accounted a higher level of profitability with the expansion of banking activities. This result stands in line with the findings of Staikouras and Wood (2003). In contrast, GDP has no statistically significant impact on bank profitability even though it represented the expected positive relationship.

Table – 10
Summary of the Regression Results

Variable	Expected Relationship	Reported Relationship	Significant of Results
Bank Size	Positive	Positive	Significant at 5%
Operational Cost	Negative	Negative	Significant at 5%
Credit Risk	**Negative**	**Positive**	**Not Significant**
Liquidity	Negative	Negative	Significant at 5%
Interest Rate	Negative	Negative	Significant at 1%
GDP	Positive	Positive	Not Significant
CAR	**Positive**	**Negative**	**Not Significant**

According to the results of panel regression, out of the seven main variables used in the equation, only two of them were not reported expected relationship with ROA of commercial banks operating in Sri Lanka i.e. CR and CAR. Results of those two variables were not significant and did not report expected relationship too. Considering the adverse impact on banks income side, a negative relationship was expected between the ROA and CR (measured by non-performing loan portfolio to total loans portfolio). However, the reported relationship between CR was positive and is insignificant. As represents from the estimation results, this variable does not have a statistically significant effect on bank profitability.

In contrast to the results according to literature, the negative coefficient of the CAR points out that bearing more capital has a negative impact on the ROA. This observation reflects that fact that banks with relatively more equity have automatically also a lower ROA. Therefore, the impact of the CAR approximated by Capital Adequacy Ratio (Total Risk Weighted Assets /Total Capital base), on commercial bank performance is another interesting issue. The theory states that increased CAR and a higher banking business yields reflect higher profitability (expected a positive relationship with profitability). However, the findings of this study outline that there exists a statistically insignificant negative relation between the CAR and the commercial bank profitability (measured by ROA) in Sri Lanka. Therefore, in accordance with the results of panel regression, it can be argued that well capitalized banks in Sri Lanka were suffering from scale inefficiencies due to excessive operations. Thereby, the results of the OLM analysis, suggested that well capitalized banks in Sri Lanka have low level of return. Note that a higher CAR can also be the result of low risk, which accounts with higher profitability. Therefore, this empirical finding, is not in line with findings of Flamini *et al*, (2009) Staikouras and Wood (2003) and Goddard *et al.* (2004) and Vong and Chan (2006) which were supported the prior finding of positive relationship between capital/asset ratio and bank's earnings. Even though, it was recognized by the previous studies that the Capital to assets ratio is an endogenous variable for determining profitability, capital determined by the regulatory capital (Capital Adequacy Ratio) is not a significant variable for determining profitability of the Commercial banks operating in Sri Lanka.

4.4 Results of Chow Breakpoint test

A series of data set can often contain a structural break, due to a change in policy or sudden shock to a economy. The Chow test was applied to test the existence endogenously determined structural breaks in the sample period. Therefore, the study carried out a structural breaker by adopting Chow test Perron (1989) structural break analysis model.

It is estimated the model over the entire time period from 2001 to 2011. In order to investigate the impact of the recent financial crisis which was considered as an external shock to the Sri Lankan economy on the determinants of banking profitability, chow test carried out from 2007 to 2010 (quarterly analysis). According, to the test results, unfavorable macro indicators represented from the early 2009 up to 1st quarter of 2010. Full results of Chow breakpoints test are at Appendix III.

Table – 11: Structural shift in ROA

Year	Quarter	F-statistics	Prob. Value	Significant level
2007	Q1	1.364850	0.2560	
	Q2	0.960312	0.4771	
	Q3	0.790417	0.6010	
	Q4	0.866898	0.5433	
2008	Q1	0.861234	0.5475	
	Q2	1.098061	0.3895	
	Q3	1.095445	0.3910	
	Q4	1.028782	0.4320	
2009	Q1	1.942401	0.0974	10%
	Q2	**3.663633**	**0.0056**	**1%**
	Q3	**3.645765**	**0.0058**	**1%**
	Q4	**2.839353**	**0.0214**	**5%**

2010	**Q1**	**3.730023**	**0.0051**	**1%**
	Q2	0.752681	0.6786	
	Q3	0.353496	0.8392	
	Q4	0.341242	0.8476	

As indicates in the above Table-11 it is evident that the latest financial crisis (the US sub-prime mortgage crisis) has not impacted much on the commercial banks' profitability in Sri Lankan economy. However, global adverse impact have affected significantly at level 1% to 5% from 2th quarter of 2009 to 1st quarter of 2010, on the profitability (measured by ROA) of the commercial banks operating in SL.

6. Conclusion and Policy implications:

This study has examined how bank-specific characteristics and macroeconomic variables affect the profitability of commercial banks in Sri Lanka over the time period from 2001 to 2011. So far, there is no published econometric study that has examined the important issue of the determinants of the banking profitability for the Sri Lankan banking industry, even though Sri Lankan banking industry has experienced a transition period as a consequence of deregulation of financial services sector, development in IT and globalization of the industry during the last two decades. Thereby, an efficient banking system coupled with financial stability contributed for the economic growth which has achieved in the recent past. Therefore, this study contributes to a better understanding of banking performance in Sri Lankan banking sector which is dominated by Commercial Banks.

In this study, Size, Operating Cost, Liquidity Risk, Credit Risk and CAR incorporated as endogenous/bank-specific factors. These factors together with other macroeconomic determinants were included this regression model. The results clearly show that Size, liquidity, Operational Cost and Interest rate have contributed significantly for the profitability of commercial banks operating in Sri Lanka which is measured by ROA. The most interesting result for profitability measure return on average assets is that CAR which has reported a negative insignificant relationship with ROA which is not in line with the previous studies. Looking at the effect of the liquidity and operational efficiency, it is noted that banks with a higher efficiency with lower liquidity would be contributed for higher profitability. Bank credit risk (measured by NPA) does not have an impact on bank profitability. When considered the macroeconomic variables, interest rate is clearly affects for Sri Lankan banks profitability which reported a significant effect on the dependent variable. High interest rate scenario reduces credit expansion by accounting lower profitability. Therefore, policies aimed at controlling interest rates should be given priority in fostering financial intermediation. However, the GDP growth variable does not significantly affects the bank profitability but has reported a positive relationship as expected with ROA.

Overall, the results provide some interesting new insights for a better understanding of the mechanisms that determine the profitability of commercial banks in Sri Lanka. These findings are relevant for several reasons. First, our estimation results confirm findings from former studies on bank profitability expect for the CAR. Thereby, it can be concluded that high CAR signify a bank that is operating over-cautiously and ignoring potentially profitable trading opportunities. Second, it was considered a set of bank- and macro specific determinants of bank profitability, which extend the knowledge about bank profitability with respect to several important dimensions. Finally, it was consider the years from 2001 to 2011 which evidence for a recent time period and also characterized by some important changes in the banking industry as well as the significant changes appeared in the overall economy of the country.

Even though the sample includes all commercial banks operated in Sri Lanka and also considers the main bank profitability determinants as well as factors related to the macroeconomic environment, it has certain limitations. Including additional aspects in the analyses, would help to even better understand the determinants of bank profitability. Also, it could be fruitful to integrate specific characteristics about the management and board members, e.g., education, skill level, experience, independence and corporate governance, all of which are increasingly important factors to understand bank profitability. From this point of view, a dynamic model specification is expected to provide additional insights. Some of these issues will be addressed in future empirical studies.

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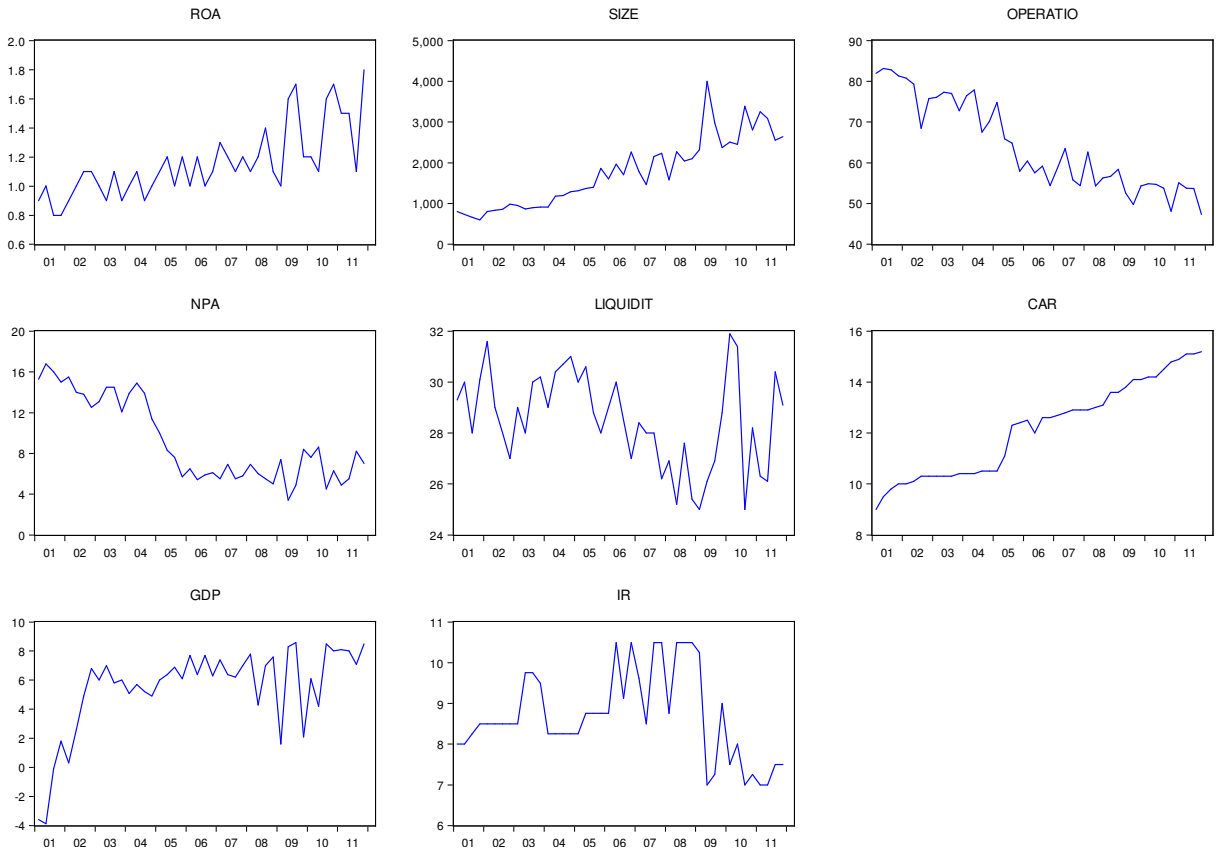
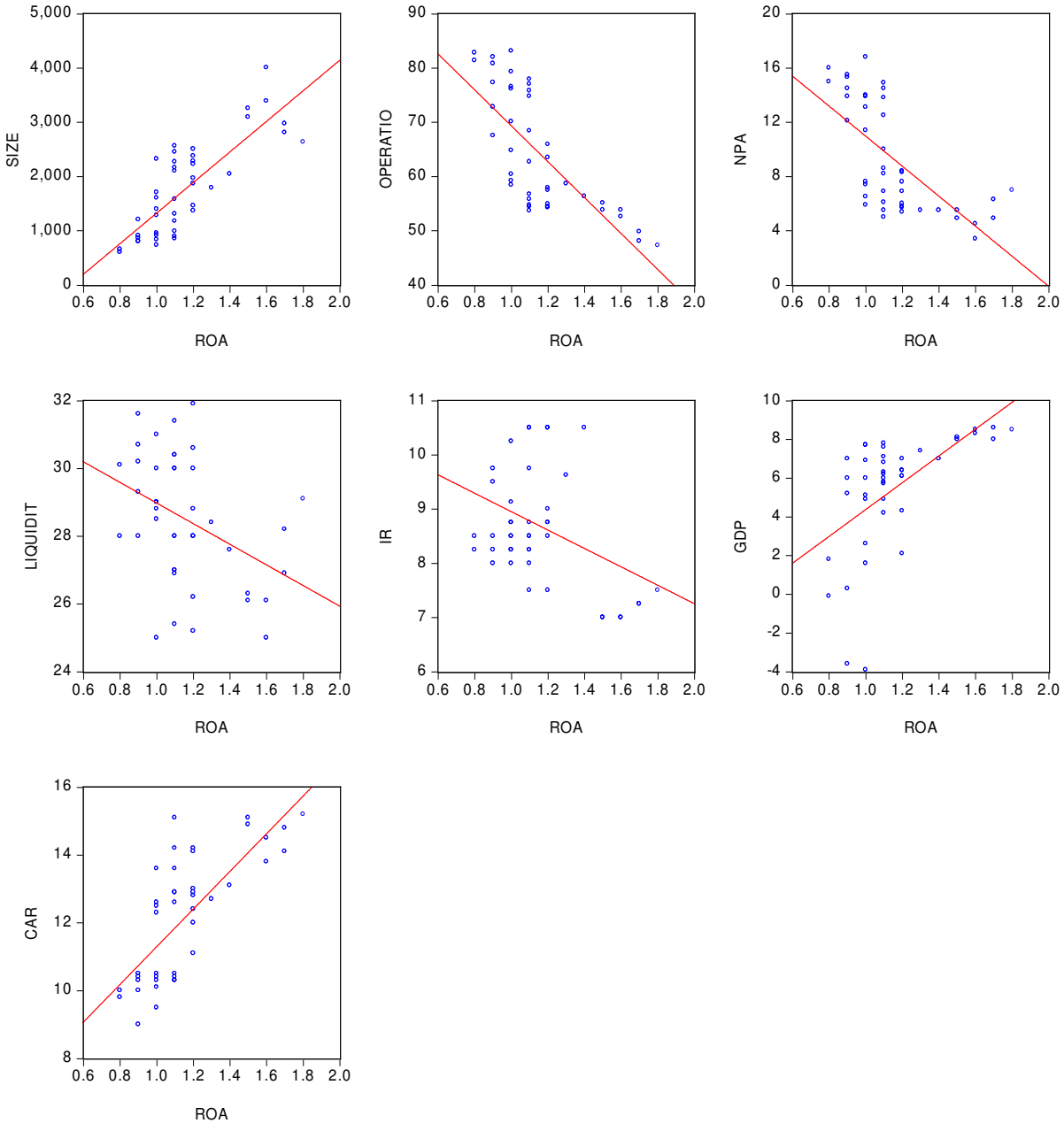
Appendix – I
Plots of time Series of all Variables



Appendix – II

Figure - I
Relationships of Independent Variables Vs Dependent Variable



Appendix-III

Results of Unit Root Tests

Null Hypothesis: SIZE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.519365	0.0002
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SIZE)
Method: Least Squares
Date: 08/16/13 Time: 10:22
Sample (adjusted): 2001Q2 2011Q4
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SIZE(-1)	-0.873726	0.158302	-5.519365	0.0000
C	383.1040	124.6849	3.072578	0.0038
@TREND(2001Q1)	54.11466	10.77314	5.023109	0.0000

S.E. of regression	351.6752	Akaike info criterion	14.63051
Sum squared resid	4947018.	Schwarz criterion	14.75338
Log likelihood	-311.5559	Hannan-Quinn criter.	14.67582
Durbin-Watson stat	1.949617		

Null Hypothesis: OPERATION has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.284380	0.0078
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(OPERATIO)
Method: Least Squares
Date: 08/16/13 Time: 10:25
Sample (adjusted): 2001Q2 2011Q4
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OPERATIO(-1)	-0.628835	0.146774	-4.284380	0.0001
C	50.76924	12.11866	4.189346	0.0001
@TREND(2001Q1)	-0.499546	0.127195	-3.927417	0.0003

R-squared	0.314605	Mean dependent var	-0.806977
Adjusted R-squared	0.280335	S.D. dependent var	4.701438
S.E. of regression	3.988374	Akaike info criterion	5.671858
Sum squared resid	636.2850	Schwarz criterion	5.794733
Log likelihood	-118.9450	Hannan-Quinn criter.	5.717171
F-statistic	9.180255	Durbin-Watson stat	2.061274
Prob(F-statistic)	0.000523		

Null Hypothesis: D(NPA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.797758	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(NPA,2)
Method: Least Squares
Date: 08/16/13 Time: 10:27
Sample (adjusted): 2001Q3 2011Q4
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(NPA(-1))	-1.318750	0.149896	-8.797758	0.0000

C	-0.849518	0.518703	-1.637772	0.1095
@TREND(2001Q1)	0.024991	0.020197	1.237340	0.2234
R-squared	0.664991	Mean dependent var		-0.064286
Adjusted R-squared	0.647811	S.D. dependent var		2.651720
S.E. of regression	1.573677	Akaike info criterion		3.813456
Sum squared resid	96.58190	Schwarz criterion		3.937575
Log likelihood	-77.08258	Hannan-Quinn criter.		3.858951
F-statistic	38.70739	Durbin-Watson stat		2.098905

Null Hypothesis: LIQUIDIT has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.131818	0.0115
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIQUIDIT)
Method: Least Squares
Date: 08/16/13 Time: 10:28
Sample (adjusted): 2001Q2 2011Q4
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIQUIDIT(-1)	-0.611221	0.147930	-4.131818	0.0002
C	18.11486	4.439417	4.080458	0.0002
@TREND(2001Q1)	0.032128	0.022059	-1.456456	0.1531
R-squared	0.299777	Mean dependent var		-0.004651
Adjusted R-squared	0.264766	S.D. dependent var		1.915594
S.E. of regression	1.642541	Akaike info criterion		3.897581
Sum squared resid	107.9177	Schwarz criterion		4.020455
Log likelihood	-80.79798	Hannan-Quinn criter.		3.942893
F-statistic	8.562338	Durbin-Watson stat		1.968628
Prob(F-statistic)	0.000803			

Null Hypothesis: IR has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.090208	0.0348
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IR)
Method: Least Squares
Date: 08/17/13 Time: 06:26
Sample (adjusted): 2001Q2 2011Q4
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IR(-1)	-0.387065	0.125255	-3.090208	0.0036
C	3.361687	1.100049	3.055943	0.0039

R-squared	0.188912	Mean dependent var	-0.011628
Adjusted R-squared	0.169129	S.D. dependent var	0.978114
S.E. of regression	0.891571	Akaike info criterion	2.653733
Sum squared resid	32.59088	Schwarz criterion	2.735649
Log likelihood	-55.05526	Hannan-Quinn criter.	2.683941
F-statistic	9.549386	Durbin-Watson stat	2.192970
Prob(F-statistic)	0.003586		

Null Hypothesis: GDP has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.954223	0.0038
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	

	10% level	-2.603944

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GDP)

Method: Least Squares

Date: 08/16/13 Time: 10:31

Sample (adjusted): 2001Q2 2011Q4

Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.418236	0.105769	-3.954223	0.0003
C	2.540843	0.649991	3.909046	0.0003

R-squared	0.276077	Mean dependent var	0.281395
Adjusted R-squared	0.258421	S.D. dependent var	2.359202
S.E. of regression	2.031627	Akaike info criterion	4.300946
Sum squared resid	169.2279	Schwarz criterion	4.382863
Log likelihood	-90.47035	Hannan-Quinn criter.	4.331155
F-statistic	15.63588	Durbin-Watson stat	2.583871
Prob(F-statistic)	0.000297		

Null Hypothesis: D(CAR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.053431	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CAR,2)

Method: Least Squares
Date: 08/16/13 Time: 10:32
Sample (adjusted): 2001Q3 2011Q4
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CAR(-1))	-0.931629	0.153901	-6.053431	0.0000
C	0.125784	0.044744	2.811222	0.0076

R-squared	0.478107	Mean dependent var	-0.009524
Adjusted R-squared	0.465059	S.D. dependent var	0.343447
S.E. of regression	0.251196	Akaike info criterion	0.121281
Sum squared resid	2.523975	Schwarz criterion	0.204027
Log likelihood	-0.546895	Hannan-Quinn criter.	0.151610
F-statistic	36.64402	Durbin-Watson stat	2.026104
Prob(F-statistic)	0.000000		

Appendix -III
Results of Chow Breakpoint Tests

Chow Breakpoint Test: 2007Q1
Null Hypothesis: No breaks at specified breakpoints

Equation Sample: 2001Q1 2011Q4

F-statistic	1.364850	Prob. F(7,30)	0.2560
Log likelihood ratio	12.16460	Prob. Chi-Square(7)	0.0953

Chow Breakpoint Test: 2007Q2
Null Hypothesis: No breaks at specified breakpoints

Equation Sample: 2001Q1 2011Q4

F-statistic	0.960312	Prob. F(7,30)	0.4771
Log likelihood ratio	8.896081	Prob. Chi-Square(7)	0.2602

Chow Breakpoint Test: 2007Q3
Null Hypothesis: No breaks at specified breakpoints

Equation Sample: 2001Q1 2011Q4

F-statistic	0.790417	Prob. F(7,30)	0.6010
Log likelihood ratio	7.447533	Prob. Chi-Square(7)	0.3838

Chow Breakpoint Test: 2007Q4
Null Hypothesis: No breaks at specified breakpoints

Equation Sample: 2001Q1 2011Q4

F-statistic	0.866898	Prob. F(7,30)	0.5433
Log likelihood ratio	8.105533	Prob. Chi-Square(7)	0.3234

Chow Breakpoint Test: 2008Q1
Null Hypothesis: No breaks at specified breakpoints

Equation Sample: 2001Q1 2011Q4

F-statistic	0.861234	Prob. F(7,30)	0.5475
Log likelihood ratio	8.057136	Prob. Chi-Square(7)	0.3276

Chow Breakpoint Test: 2008Q2
Null Hypothesis: No breaks at specified breakpoints

Equation Sample: 2001Q1 2011Q4

F-statistic	1.098061	Prob. F(7,30)	0.3895
Log likelihood ratio	10.03651	Prob. Chi-Square(7)	0.1865

Chow Breakpoint Test: 2008Q3
Null Hypothesis: No breaks at specified breakpoints

Equation Sample: 2001Q1 2011Q4

F-statistic	1.095445	Prob. F(7,30)	0.3910
Log likelihood ratio	10.01513	Prob. Chi-Square(7)	0.1877

Chow Breakpoint Test: 2008Q4
Null Hypothesis: No breaks at specified breakpoints

Equation Sample: 2001Q1 2011Q4

F-statistic	1.028782	Prob. F(7,30)	0.4320
Log likelihood ratio	9.466648	Prob. Chi-Square(7)	0.2209

Chow Breakpoint Test: 2009Q1
Null Hypothesis: No breaks at specified breakpoints

Equation Sample: 2001Q1 2011Q4

F-statistic	1.942401	Prob. F(7,30)	0.0974
Log likelihood ratio	16.44661	Prob. Chi-Square(7)	0.0213

Chow Breakpoint Test: 2009Q2
Null Hypothesis: No breaks at specified breakpoints

Equation Sample: 2001Q1 2011Q4

F-statistic	3.663633	Prob. F(7,30)	0.0056
Log likelihood ratio	27.18331	Prob. Chi-Square(7)	0.0003

Chow Breakpoint Test: 2009Q3
Null Hypothesis: No breaks at specified breakpoints

Equation Sample: 2001Q1 2011Q4

F-statistic	3.645765	Prob. F(7,30)	0.0058
Log likelihood ratio	27.08430	Prob. Chi-Square(7)	0.0003

Chow Breakpoint Test: 2009Q4
Null Hypothesis: No breaks at specified breakpoints

Equation Sample: 2001Q1 2011Q4

F-statistic	2.839353	Prob. F(7,30)	0.0214
Log likelihood ratio	22.36660	Prob. Chi-Square(7)	0.0022

Chow Breakpoint Test: 2010Q1
Null Hypothesis: No breaks at specified breakpoints

Equation Sample: 2001Q1 2011Q4

F-statistic	3.730023	Prob. F(7,30)	0.0051
Log likelihood ratio	27.54926	Prob. Chi-Square(7)	0.0003

Chow Breakpoint Test: 2010Q3
Null Hypothesis: No breaks at specified breakpoints

Equation Sample: 2001Q1 2011Q4

F-statistic	0.353496	Prob. F(4,26)	0.8392
Log likelihood ratio	1.800529	Prob. Chi-Square(4)	0.7724
Wald Statistic	5.502327	Prob. Chi-Square(4)	0.2395

Chow Breakpoint Test: 2010Q4
Null Hypothesis: No breaks at specified breakpoints

Equation Sample: 2001Q1 2011Q4

F-statistic	0.341242	Prob. F(4,26)	0.8476
Log likelihood ratio	1.739683	Prob. Chi-Square(4)	0.7835
Wald Statistic	6.840005	Prob. Chi-Square(4)	0.1446