DETERMINANTS OF COMMERCIAL BANKS' PROFITABILITY IN MALAWI: A COINTEGRATION APPROACH

WC/08/99

Ephraim Wadonda Chirwa
University of Malawi and Wadonda Consult

University of Malawi
Chancellor College, Department of Economics
P.O. Box 280, Zomba, Malawi

Working Paper No. WC/08/99

July 1999

DETERMINANTS OF COMMERCIAL BANKS' PROFITABILITY IN MALAWI: A COINTEGRATION APPROACH

Ephraim Wadonda Chirwa[*]

Lecturer in Economics
University of Malawi
Chancellor College, Department of Economics
P.O. Box 280, Zomba, Malawi

Correspondence Address

School of Economic and Social Studies
University of East Anglia
Norwich NR4 7TJ, United Kingdom
E-mail: e.chirwa@uea.ac.uk

July 1999

* I acknowledge financial support from the African Economic Research Consortium (AERC) towards a research project on 'Market Structure, Liberalisation and Performance in the Malawian Banking Industry'.

DETERMINANTS OF COMMERCIAL BANKS' PROFITABILITY IN MALAWI: A COINTEGRATION APPROACH

Abstract : This paper investigates the relationship between market structure and profitability of commercial banks in Malawi using time series data between 1970 and 1994. We use time-series techniques of cointegration and error-correction mechanism to test the collusion hypothesis and determine whether a long-run relationship exists between profits of commercial banks and concentration in the banking industry. The results obtained from the study support the traditional collusion hypothesis of a long-run positive relationship between concentration and performance. The dynamic short-run analysis also shows a high speed of adjustment in profitability from disequilibrium and indicates a positive response in profitability to a negative deviation from a long-run equilibrium.

Keywords: Profitability; Collusion Hypothesis; Cointegration; Malawian Banking

1. Introduction

The relationship between market structure and performance is viewed from two competing hypotheses. On one hand, the traditional market structure-conduct-performance (SCP) or collusion hypothesis postulates that market structure influences conduct or behaviour of firms through for instance pricing and investment policies, and this in turn influences corporate performance (Bain, 1951). The traditional school postulates a one way relationship between concentration and profitability and argues that market concentration lowers the cost of collusion between firms and this results in higher than normal profits. On the other hand, the efficient market hypothesis following Demsetz (1973) and Peltzman (1977) postulates that market concentration is a result of firms' superior efficiency that leads to larger market share and profitability. Several studies with respect to the banking industry have tested these competing hypotheses mostly using cross-section data, but the results are generally mixed (see among others Gilbert, 1984; Smirlock, 1985; Evanoff and Fortier, 1988; Clark, 1986; Molyneux and Forbes, 1995; Chirwa (1997, 1998) and Maudos, 1998).

This study tests the collusion hypothesis on the behaviour of commercial banks in Malawi using time series data between 1970 and 1994. The banking industry in Malawi is relatively small and has been dominated by two commercial banks. However, following financial sector reforms within the framework of structural adjustment programs, since 1989 several existing non-bank financial intermediaries and three new entrants have been granted commercial banking licenses. The increase in the number of financial institutions with commercial banking licenses increased

competition in the main markets for commercial banks. The average three firm concentration ratio significantly fell from 0.944 before liberalisation (1970-1986) to 0.864 after liberalisation (1987- 1994). Other financial sector reforms pursued since 1987 include liberalization of interest rates and deregulation of credit allocation (see Chirwa, 1998).

The paper is organized as follows. Section 2 considers the theoretical underpinnings of the link between market structure and performance, and specify the empirical model. Section 3 describes the data sources and determine time-series characteristics of the variables used in the analysis. Section 4 presents empirical results based on cointegration and error-correction mechanism. Finally, Section 5 provides concluding remarks.

2. The Relationship Between Market Structure and Profitability

We view a financial institution as a microeconomic firm that attempts to maximize an objective function in terminal wealth, where the bank firm uses quantity and/or price variables such as asset quantities or prices as control variables (Santomore, 1984). However, according to Clark (1986) there are many models of the banking firm developed to deal with specific aspects of bank behaviour, but no single model is acceptable as descriptive of all bank behaviour although the portfolio theory approach has played an important role.[1] In the portfolio choice models, banks seek to maximize profits defined by a feasible set of assets and liabilities with interest rates set by the bank and per unit costs incurred by the bank of producing each component of assets and liabilities. These bank models have incorporated various aspects of the competitive process and scale economies.

Studies that investigate the relationship between market structure and profitability in banking fall into two categories, with respect to the collusion hypothesis and the efficient market hypothesis. First, the traditional paradigm of assessing the effect market power on profitability performance is the structure-conduct-performance (SCP) model due to the pioneering work of Bain (1951). This is also known as the collusion hypothesis. The hypothesis is that certain market structures

[1] See Klein (1971), Mullineaux (1978) and Santomore (1984) for an extensive survey of models of the banking firm.

are conducive to monopolistic conduct, and this conduct enables firms to raise prices above costs thereby making abnormal profits. Thus, the link between market structure and profitability is through firms' pricing behaviour. In perfectly competitive markets where firms face a perfectly elastic demand, theoretically the model predicts that there will be lower profitability compared with all other markets where the demand is less elastic (George and Joll, 1971). Civelek and Al-Alami (1991) note that the banking industry is so important to the economy and empirical evidence on SCP relationship can help in government regulatory policies and in modifying the environment in which banks operate. Increased bank concentration, by increasing the cost of credit, has the effects of reducing firms' demand for credit and consequently affects the level of intermediation and retard the growth of the economy.

The second hypothesis is the efficient market hypothesis that emerged from the criticism of the collusion hypothesis (Demsetz, 1973 and Peltzman, 1977). Proponents of the efficient market hypothesis hold that the relationship between concentration and profitability is spurious and is a proxy for the relationship between superior efficiency, market share and concentration. The efficient structure hypothesis postulates that market concentration is not a random event, but rather a result of firms with superior efficiency obtaining a large market share and higher profitability. Thus, differences in firm-specific efficiencies within markets create unequal market shares and high levels of concentration. However, others argue that market share, which is included in the profit regression to test the efficient market hypothesis is a poor proxy of the efficiency of firms (Berger, 1995 and Maudos, 1998).

The studies that test these competing hypotheses are based on estimating variants of the following model (see Mullineaux, 1978; Gilbert, 1984; Smirlock, 1985; Clark, 1986; Molyneux and Forbes, 1995; Maudos, 1998):

$$\pi = \beta_0 + \beta_1 CR + \beta_2 MS + \sum_{i=1}^{m} \alpha_1 X_i \qquad (1)$$

where π is a profit measure, CR is a measure of market structure (a concentration measure), MS is a measure of market share and X_i is a vector of control variables included to account for firm-specific and market specific characteristics. The collusion hypothesis is supported by the significance of the coefficient of concentration measure and insignificance of the coefficient of

market share.[2] The significance of the coefficient of market share which is a proxy for efficiency and insignificance of the coefficient of the concentration measure would imply support for the efficient structure hypothesis. Maudos (1998) note that the market share variable can capture the effects that are unrelated to efficiency, and directly includes a measure of overall efficiency.

This study investigates the relationship between market structure and performance motivated by the traditional market structure-conduct-performance or collusion hypothesis. Chirwa (1997, 1998) considers both the collusion and efficient market hypotheses and the results show strong support for the former. Inclusion of the market share of the two commercial banks produces a negative and insignificant coefficient. The long-run relationship between profitability and market structure that we investigate relates to the behaviour of the two commercial banks in the Malawian banking industry. The case for pursuing joint profit maximization in commercial banking is stronger due to the interlocking ownership structure in the two commercial banks.[3] Studying the behaviour of the two commercial banks over time is important in light of entry into commercial banking activities by new and existing financial institutions since the late 1980s. We specify and estimate the following lin-log equation:

$$\pi_{ct} = \beta_0 + \beta_1 \ell n(CR3_t) + \beta_2 \ell n(CAPAST_{ct}) + \beta_3 \ell n(LTOAST_{ct}) + \beta_4 \ell n(ASSET_{ct}) + \beta_5 \ell n(DDTDEP_{ct}) + \beta_6 \ell n(MKDEP_t) + \beta_7 \ell n(MKGRO_t) + \varepsilon_t \quad (2)$$

where t is time period, ℓn is the natural logarithm, subscript *c* denotes commercial banks, π is a measure of profitability, CR3 is the three-firm concentration ratio, CAPAST is the capital- asset ratio, LOAST is the loan-asset ratio, ASSET are assets of commercial banks, DDTDEP is the ratio of demand deposits to total deposits, MKDEP is the total banking industry deposits, MKGRO is the growth of the banking industry deposits and ε is the error term.

Several authors use different measures of bank profitability in the analysis of the relationship between market structure and performance. The profitability measures mostly used in empirical

---

[2] Smirlock (1985) and Maudos (1998) give alternative explanations of the traditional and efficient market hypotheses when both variables are significant.

[3] Press Corporations Limited controls at least 40 percent in each of the two commercial banks.

studies are rate of return on equity (ROE), rate of return on capital (ROC) or rate of return on assets (ROA). In most bank studies, emphasis is placed on measuring profitability by ROC and ROA. Smirlock (1985) notes that the use of ROA has provided strongest evidence on the concentration-profitability relationship in banking. Keeton and Matsunaga (1985) assert that ROA is especially useful in measuring changes in bank performance over time since bank's income and expense components are more closely related to assets.[4] The basic argument in favour of profitability measures in banking is that banks are essentially multi-product firms and the use of profitability measures eliminates problems associated with cross-subsidization between products and services.[5]

The main variable of interest in the traditional SCP hypothesis is market concentration. We use the three-firm concentration ratio (CR3) as a measure of monopoly power in the banking industry. Several control variables that take into account firm-specific and market-specific characteristics are included in empirical studies of the banking industry. CAPAST accounts for differing levels of risk over time. Lower CAPAST is associated with high risk and hence the hypothesis is the negative relationship between capital-asset ratio and profitability performance.[6] LTOAST is another measure of risk for the dominant banks over time. Portfolio theory postulates that risky investments are usually associated with higher returns than primary assets.

ASSET captures economies of scale. Larger banks compared with smaller banks are in much better position to reap economies of scale and have greater diversification opportunities. However, according to Evanoff and Fortier (1988) and Smirlock (1985) any positive influence on profits from economies of scale may be partially offset by greater ability to diversify assets resulting in a lower risk and a lower required return. Thus, the impact of bank size on profitability may be either positive or negative.

---

[4] See Gilbert (1984) for alternative measures of bank performance that have been used in empirical work.

[5] Other researchers assess performance in terms of bank prices (Berger and Hannan, 1989; Rose and Fraser, 1976). The justification for use of bank prices (interest rates) is that the use of the price-concentration relationship instead of the profit-concentration relationship tests the structure performance hypothesis in a manner that excludes the efficient-structure hypothesis.

[6] See Mitchell (1984) and Evanoff and Fortier (1988).

DDTDEP captures the bank's relative cost of funds (see Evanoff and Fortier, 1988 and Smirlock, 1985). Demand deposits are relatively inexpensive source of funds. We expect that the higher the ratio of demand deposits to total deposits, the higher the level of profitability.

Other variables included capture market demand characteristics. These include market size and market growth rate. Market size is measured by total market deposits (MKDEP). Large markets should be easy to enter and bank customers in such markets tend to be sophisticated, hence a negative relationship between market size and profitability. However, as Evanoff and Fortier (1988) and Smirlock (1985) note, this negative relationship may be partially offset if banks in these markets take on riskier portfolios requiring higher returns. The relationship between market size and bank profitability may be either positive or negative. We include the growth of the market (MKGRO) because rapid market growth expands profit opportunities for existing banks, but if growth encourages entry then we may observe a negative relationship. Civelek and Al-Alami (1991) argue that larger market size or an expanding market enables banks to differentiate its products and consequently generate higher profits.

3. Data and Estimation Methods

Data used in this study were collected from various issues of the *Financial and Economic Review* published by the Reserve Bank of Malawi and *Annual Accounts and Reports* of eight financial institutions between 1970 and 1994. Data on profitability were taken from *Annual Accounts and Reports* of the financial institutions. Data for the period between 1970 and 1985 are only for five financial institutions. Table A1 reports the definition, measurement and descriptive statistics for the variables used in the regression analysis. We use annual data and three alternative measures of profitability: return on assets (ROA), return on capital (ROC) and return on equity (ROE). The data indicate some losses in commercial banking activities as reflected by the minimum levels of profitability. The losses occurred in 1980, the time the economy was in a crisis that led to the implementation of structural adjustment policies.

We use time-series techniques of cointegration and error-correction mechanism to investigate the relationship between market structure and commercial bank profitability. Unit root tests are performed on the variables to determine the presence of a unit root and order of integration for

the series. Table 1 reports the unit root tests based on the Weighted Symmetric (WS) test, the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test.

We cannot reject the presence of a unit root in the variables in levels, except for LMKGRO based on the PP test at 5 percent level. We then differenced the series once and all the tests in all variables reject the presence of a unit root in differences at 5 percent for at least one of the tests. These tests lead us to conclude that all the series are integrated of order one, I(1).

[Table 1 about here]

These results imply that it is reasonable to proceed with tests for cointegrating relationships among combinations of non-stationary series. Cointegration among integrated variables of order one, implies the existence of a linear combination that yields a stationary series. We test for the existence of long-run relationships using the Engle-Granger two step procedure. Equation (2) is first estimated by ordinary least squares and unit root tests are performed on the residuals in the second stage.

If the series are integrated of the same order and are cointegrated, then there exist a long-run relationship among them, the Engle-Granger Representation Theorem states that the appropriate dynamic form of the model is an Error Correction Mechanism (ECM).[7] Thus, if the variables are integrated of order one and cointegrated, then the short-run dynamic models are vector autoregressions (VARs) in first differences with the lagged error term (the error-correction term) from the cointegration equation included as an explanatory variable. The sign and size of the coefficient of the lagged error-correction term reflects the direction and speed of adjustment in the dependent variable to temporary deviations from the long-run equilibrium relationship.

[7] See Engle and Granger (1987).

4. Empirical Results

4.1 The Long-Run Profit-Concentration Relationships

In determining the existence of the long-run equilibrium relationships we first estimate equation (2) by ordinary least square methods and test for a unit root in the residuals of the estimated model. Table 2 report results of the two-step Engle-Granger cointegration procedure. The unit root tests on the residuals from the regression or the error-correction term (ECT) indicate stationarity and reject the null hypothesis of a unit root at 1 percent level in all specifications using both the ADF and PP tests. We therefore, conclude that the profit models are cointegration regressions. Thus, a long-run relationship between profitability and concentration, capital-asset ratio, loan-asset ratio, assets, demand deposits-deposits ratio, market deposits and market growth exists in commercial banks.

[Table 2 about here]

Diagnostic tests for the cointegration models are satisfactory in all specifications and the null hypotheses cannot be rejected at 5 percent level of significance. The maximum likelihood autocorrelation tests AR(1-2) indicate absence of autocorrelation. ARCH(1) tests show absence of autoregressive-conditional heteroscedasticity at 5 percent levels. The models also pass the Jarque-Bera Normality test, implying that the residuals are white noise. All the models are correctly specified as they pass the Ramsey RESET specification test. The explanatory power of the models is also satisfactory, explaining 73 percent, 81 percent and 59 percent of the variations in ROA, ROC and ROE, respectively.

The relationship between commercial bank profits and concentration is positive and the coefficient is statistically significant at 5 percent level in all specifications. The results support the collusion hypothesis in Malawian banking. Such collusive behaviour in commercial banks in Malawi may be facilitated, among other factors, by the existing interlocking ownership structure.

We also find a positive relationship between profitability and the loan-asset ratio, with the coefficients of LLTOAST being statistically significant at 5 percent level in the ROA specification and at 10 percent level in the ROC specification. In other studies, this measure of bank risk has produced perverse results, suggesting that there is risk reduction behaviour among bank managers (Evanoff and Fortier, 1988; Civelek and Al-Alami 1991; Molyneux and Forbes 1995; Maudos, 1998).

Another important determinant of commercial bank profitability is the ratio of demand deposits to total deposits. The coefficients of LDDTDEP are consistently positively related profitability measures and are statistically significant at 1 percent level. These results confirm the argument that demand deposits are a cheaper source of funds for the banking industry. Other empirical studies (Evanoff and Fortier, 1988 and Smirlock, 1985) also find a significant and positive relationship between the ratio of demand deposits to total deposits and bank profitability.

4.2 The Short-Run Profit-Concentration Relationships

Since a stable cointegrated relationship exists between profitability and explanatory variables, we then estimated error-correction models or short-run dynamic models. Table 3 reports results of short-run equations estimated by ordinary least square methods. The regression models pass the diagnostic tests. The DROA and DROC models are preferred on the basis of R^2 and the F-statistics.

[Table 3 about here]

The coefficient of the lagged error-correction term (ECT) is high and negative and statistically significant at 1 percent level in the DROC and DROE specifications and at 5 percent level in the DROA specification. These results show that negative deviations in the stationary relationship are corrected by increases in profitability. The coefficients of ECT is close to negative one, implying high speed of adjustment towards long-run equilibrium. The dynamic models also indicate that the contemporaneous change in concentration level and demand deposit-deposit ratio significantly influence changes in profitability at 5 percent level in all specification.

Commercial bank profitability measured by ROA and ROC also adjust in the short-run in response to expansion in credit measured by the ratio of loans to assets. This relationship is statistically significant at 5 percent level. Contrary to the expectation, the ROC also increases in the short-run in response to a reduction in the ratio of capital to assets (a measure of risk).

5. Conclusions

This paper has tested the collusion hypothesis using time-series data in the Malawian banking industry. Using cointegration and error correction models we establish the long-run relationship between profitability and market structure and investigate how profitability response to market structure in the short-run. Profitability in commercial banks is measure in three alternative ways as rate of return on assets, return on capital and return on equity. In particular, the study tests the relationship between profitability of commercial banks and concentration in the banking industry in a small developing country.

The results based on the data over the period 1970-94 show that a long-run relationship exists between profitability and market structure in Malawian banking. The collusion hypothesis is strongly supported by the positive and significant relationship between commercial bank profitability and concentration. The dynamic models are also consistent with a positive response of profitability to increases in concentration. Other variables that positively and significantly influence commercial bank profitability in the long-run and short-run are the loan-assets ratio and the demand deposit-deposits ratio. The dynamic short-run analysis also shows that profitability adjusts quickly from a disequilibrium, and we find a positive response in profitability to a negative deviation from a long-run equilibrium. The policy implication of the study is that if financial sector reforms are to benefit consumers through lower cost of financial services, the government should focus on policies that encourage entry of commercial banking activities.

References

Bain, J. S. (1951) The Relation of Profit Rate to Industry Concentration: American Manufacturing, 1936 - 1940. **Quarterly Journal of Economics, 65 (3),** 293-324

Berger, A. N. (1995) The Profit-Relationship in Banking - Tests of Market-Power and efficient-Market Hypotheses, **Journal of Money, Credit and Banking, 27 (2)**, 405-31

Berger, A. N. and Hannan, T. H. (1989) The Price-Concentration Relationship in Banking. **Review of Economics and Statistics, 71 (2)**, 291-299

Civelek, M. M. and Al-Alami, M. W. (1991) An Empirical Investigation of the Concentration-Profitability Relationship in the Jordanian Banking System. **Savings and Development, 15 (3**), 247-259

Chirwa, E. W. (1998) Market Structure, Liberalization and Performance in the Malawian Banking Industry. (Final Research Report) African Economic Research Consortium, Nairobi

Chirwa, E. W. (1997) Market Structure and Performance of Commercial Banks in the Malawian Banking Industry. **African Journal of Economic Policy, 4 (2)**, 29-46

Clark, J. A. (1986) Single-Equation, Multiple Regression Methodology: Is It an Appropriate Methodology for the Structure-Performance Relationship in Banking. **Journal of Monetary Economics, 18 (3)**, 259-312

Demsetz, H. (1973) Industry Structure, Market Rivalry and Public Policy. **Journal of Law and Economics, 16 (1)**, 1-19

Engle, R. F. and Granger, C. W. J. (1987) Co-Integration and Error Correction: Representation, Estimation and Testing. **Econometrica, 55**, 251-276

Evanoff, D. D. and Fortier, D. L. (1988) Reevaluation of the Structure-Conduct-Performance Paradigm in Banking. **Journal of Financial Services Research, 1 (3)**, 249-60

George, K. D. and Joll, C. (1971) **Industrial Organisation: Competition, Growth and Structural Change**. London: George Allen and Unwin

Gilbert, R. A. (1984) Bank Market Structure and Competition: A Survey. **Journal of Money, Credit and Banking, 16 (4)**, 617-45

Keeton, W. R. and Matsunaga, L. (1985) Profits of Commercial Banks in Tenth District States. **Economic Review of Federal Reserve Bank of Kansas City**, June, 3-22

Klein, M. A. (1971) A Theory of the Banking Firm. **Journal of Money, Credit and Banking, 3**, 205-218

Maudos, J. (1998) Market Structure and Performance in Spanish Banking using a Direct Measure of Efficiency. **Applied Financial Economics, 8**, 191-200

Mitchell, K. (1984) Capital Adequacy at Commercial Banks. **Economic Review of Federal Reserve Bank of Kansas City**, September/October, 17-30

Molyneux, P. and Forbes, W. (1995) Market Structure and Performance in European Banking. **Applied Economics, 27 (1)**, 155-159

Molyneux, P., Lloyd-Williams, D. M. and Thornton, J. (1994) Market Structure and Performance in Spanish Banking. **Journal of Banking and Finance, 18**, 433-444

Morris, C. (1985) Banking Market Structure in Tenth District, 1973-83. **Economic Review of Federal Reserve Bank of Kansas City**, July/August, 18-31

Morris, C. (1984) The Competitive Effects of Interstate Banking. **Economic Review of Federal Reserve Bank of Kansas City**, November, 3-16

Mullineaaux, D. (1978) Economies of Scale and Organisational Efficiency in Banking: A Profit Function Approach. **Journal of Finance, 28 (1)**, 259-280

Peltzman, S. (1977) The Gains and Losses from Industrial Concentration. **Journal of Law and Economics, 20 (October)**, 229-263

Rose, S. A. and Fraser, D. R. (1976) The Relationship Between Stability and Change in Market Structure: An Analysis of Bank Prices. **Journal of Industrial Economics, 24 (4)**, 251-266

Santomore, A. M. (1984) Modelling the Banking Firm: A Survey. **Journal of Money, Credit and Banking, 16 (4)**, 576-602

Smirlock, M. (1985) Evidence on the (Non)Relationship Between Concentration and Profitability in Banking. **Journal of Money, Credit and Banking, 17 (1),** 69-83

Table A1 Definition of Variables and Summary Statistics, 1970-1994

Variables	Definition	Mean	Standard Deviation	Minimum	Maximum
ROA	Return on Assets	0.0324	0.0200	-0.0003	0.0727
ROC	Return on Capital	0.2415	0.1624	-0.0015	0.4682
ROE	Return on Equity	0.4345	0.2411	-0.0049	0.8260
CR3	Three-firm concentration ratio in the banking industry.	0.9184	0.0487	0.7951	0.9615
LCR3	Natural logarithm of CR3.	-0.0865	0.0550	-0.2293	-0.0392
CAPAST	Ratio of capital to assets of commercial banks.	0.1582	0.0490	0.0791	0.2752
LCAPAST	Natural logarithm of CAPAST.	-1.9153	0.3523	-2.6919	-1.2902
LTOAST	Ratio of loans to assets of commercial banks.	0.5675	0.1210	0.3535	0.7790
LLTOAST	Natural logarithm of LTOAST.	-0.5876	0.2287	-1.0399	-0.2497
ASSET	Assets of commercial banks in Millions of Malawi Kwacha.	535.232	6228.29	4.5000	2647.08
LASSET	Natural logarithm of ASSET.	5.6558	1.2011	3.7013	7.8812
DDTDEP	Ratio of demand deposits to total deposits of commercial banks.	0.4231	0.1075	0.2938	0.6568
LDDTDEP	Natural logarithm of DDTDEP.	-0.8890	0.2417	-1.2249	-0.4204
MKDEP	Market deposits in the banking industry in Millions of Malawi Kwacha.	597.095	753.92	41.877	3150.18
LMKDEP	Natural logarithm of MKDEP.	5.7081	1.2283	3.7347	8.0552
MKGRO	Annual growth in market deposits.	0.2023	0.1151	0.0194	0.4491
LMKGRO	Natural logarithm of MKGRO.	-1.8089	0.7462	-3.9427	-0.8004

Table 1 Unit Root Tests: Weighted Symmetric (WS), Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Tests

Variables	Levels			First Difference			Decision
	WS	ADF	PP	WS	ADF	PP	
ROA	-2.340	-2.170	-7.966	-2.973[b]	-2.643[c]	-30.214[a]	I(1)
ROC	-2.128	-1.835	-5.570	-3.029[b]	-2.766[c]	-23.369[a]	I(1)
ROE	-2.561	-2.420	-7.823	-2.964[b]	-2.687[c]	-26.968[a]	I(1)
LCR3	-2.023	-2.780	-3.678	-2.361[c]	-3.428[a]	-17.682[b]	I(1)
LCAPAST	-2.427	-2.153	-13.411	-3.606[a]	-3.907[a]	-25.508[a]	I(1)
LLTOAST	-2.428	-2.218	-8.234	-3.016[b]	-2.758[c]	-15.003[b]	I(1)
LASSET	-1.525	-1.943	-6.366	-2.892[b]	-2.985[b]	-17.686[b]	I(1)
LDDTDEP	-1.265	-0.869	-2.871	-3.647[a]	-3.397[b]	-28.740[a]	I(1)
LMKDEP	-1.395	-0.515	-2.934	-3.159[a]	-2.836[c]	-20.014[b]	I(1)
LMKGRO	-2.396	-1.826	-24.047[b]	-3.435[a]	-3.286[b]	-29.867[a]	I(0)/I(1)

Notes: The 1%, 5% and 10 % levels of significance are indicated by superscripts *a, b* and *c*, respectively.

Table 2 Profitability in Commercial Banks: Cointegrating Regression Models

Variables	ROA		ROC		ROE	
	coefficient	t-statistics	coefficient	t-statistics	coefficient	t-statistics
Constant	0.0221	0.508	-0.2582	-0.878	0.4761	0.746
LCR3	0.4580	2.807[b]	2.9223	2.649[b]	6.8575	2.865[b]
LCAPAST	0.0120	0.666	-0.1484	-1.217	0.1128	0.426
LLTOAST	0.0468	2.485[b]	0.2427	1.904[c]	0.3447	1.247
LASSET	-0.0388	-0.412	-0.1565	-0.246	-0.4347	-0.315
LDDTDEP	0.1384	5.255[a]	0.9282	5.212[a]	1.7673	4.575[a]
LMKDEP	0.0780	0.811	0.4057	0.624	0.8793	0.624
LMKGRO	0.0011	0.251	-0.0028	-0.099	0.0108	0.175
R^2	0.7257		0.8096		0.5932	
RSS	0.0026		0.12060		0.5674	
σ	0.0125		0.0842		0.1827	
DW	2.09		1.81		1.95	
F	6.43[a]		10.33[a]		3.54[b]	
	Unit Root Tests on ECT		*Unit Root Tests on ECT*		*Unit Root Tests on ECT*	
ADF	-2.914 (0.003)		-3.3671 (0.001)		-2.8438 (0.004)	
PP	-27.554 (0.000)		-22.1992 (0.001)		-26.5295 (0.000)	
	Diagnostic Tests		*Diagnostic Tests*		*Diagnostic Tests*	
AR(1-2)	0.3864E-05 (0.998)		0.1877 (0.665)		0.1386 (0.710)	
ARCH(1)	2.7118 (0.100)		1.3206 (0.250)		3.3834 (0.066)	
Normality	0.5524 (0.759)		0.7331 (0.693)		1.3059 (0.521)	
RESET	0.3460 (0.565)		0.7161 (0.410)		0.7255 (0.407)	

Notes: ECT is the error-correction term (residuals from the regression). The figures in parentheses are probabilities of rejecting the null hypothesis. The 1%, 5% and 10 % levels of significance are indicated by superscripts *a, b* and *c*, respectively.

Table 3 Profitability in Commercial Banks: Error-Correction Models

Variables	DROA		DROC		DROE	
	coefficient	t-statistics	coefficient	t-statistics	coefficient	t-statistics
Constant	0.0620	1.720	0.0596	1.120	0.1611	1.229
DLCR3	0.5328	2.933[b]	3.8813	3.775[a]	6.3815	2.739[b]
DLCAPAST	-0.0014	-0.196	-0.1849	-4.721[a]	-0.0538	-0.561
DLCAPAST(-1)	0.0063	0.419	0.1065	1.155	0.0220	0.106
DLLTOAST	0.0586	2.658[b]	0.3361	2.647[b]	0.4909	1.607
DLASSET(-1)	-0.0072	-0.080	0.0077	0.015	0.3224	0.256
DLDDTDEP	0.1323	4.699[a]	0.7904	4.865[a]	1.5268	4.002[a]
DLMKDEP(-1)	-0.0394	-0.514	-0.0494	-0.114	-0.7197	-0.686
DLMKGRO(-1)	0.0038	1.058	0.0256	1.227	0.0422	0.841
ECT(-1)	-0.9428	-2.843[b]	-0.8723	-3.443[a]	-0.9547	-3.043[a]
DROA(-1)	0.0778	0.366	-	-	-	-
DROC(-1)	-	-	0.3078	1.663	-	-
DROE(-1)	-	-	-	-	0.1339	0.668
R^2	0.7253		0.8109		0.6574	
RSS	0.0016		0.0519		0.3083	
σ	0.0116		0.0658		0.1603	
DW	2.09		2.37		2.14	
F	3.17 [b]		5.15[a]		2.30[c]	
	Diagnostic Tests		*Diagnostic Tests*		*Diagnostic Tests*	
AR(1-2)	1.4895 (0.222)		0.4627 (0.483)		1.2372 (0.266)	
ARCH(1)	0.7664 (0.381)		0.9813 (0.322)		0.6210 (0.431)	
Normality	1.1147 (0.573)		1.6881 (0.430)		0.3259 (0.850)	
RESET	1.6998 (0.219)		0.5059 (0.492)		1.3960 (0.262)	

Notes: ECT is the error-correction term (residuals from the regression). The figures in parentheses are probabilities of rejecting the null hypothesis. The 1%, 5% and 10 % levels of significance are indicated by superscripts *a, b* and *c*, respectively.