An Investigation of the Determinants & Forecast Performance of Bank Profits: The Case of Jamaican Banks

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Abstract

The aim of this study is to determine the bank-specific and macroeconomic determinants of bank profitability in Jamaica. A GMM technique is applied to a panel of 15 Jamaican banks using quarterly data over the period 2000:1 to 2010:4. The results of the study show that bank expenditures and non-interest income had the highest impact on banks' profitability. In addition, bank capital, expenditure as a share of assets and credit risk were inversely related to banks' profitability while all market structure variables were found to be positively related to banks' profitability. Regarding macroeconomic variables, bank profits were positively related to improvements in the stock market and GDP as well as inflation. Monte Carlo simulations were also used to provide a one-year ahead forecast of bank profits in an effort to assist policymakers in assessing the future state of vulnerability of the banking sector. Forecasted values showed deterioration in the ROA in the near-term.

JEL Classification Numbers: C23; G21; L2
Keywords: Bank profitability, Dynamic panel estimation, Stress testing, Forecasting

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1. Introduction

The role of banks remains fundamental in financing and facilitating economic activity. Recent crises have also strongly reinforced that a crisis in all or part of the banking sector may impose costs on the wider economy.[2] Work by Berger *et al* (2008) highlighted that the banking industry is a major conduit through which instability may be transmitted to other sectors in an economy. As such, enhancing the microstructure and efficient operations of banking institutions as well as improving banking stability oversight have been key priority areas for policymakers.

Coffinet and Lin (2010) emphasized that it is crucial that efforts to ensure banking system solvency involve identifying vulnerabilities in respect of banks' profitability, as this is the first line of defense against unexpected losses. They highlighted that profits are one of the main drivers of bank capital. Specifically, weaknesses in profitability are likely to be transmitted to solvency ratios and ultimately erode banking system strength. In addition, profits are a reliable early-warning indicator of financial distress. Consequently, many early studies on bank performance have primarily focused on investigating the determinants of banks' profitability.[3] Previous studies on Jamaica have also focused on investigating the determinants of different components of banks' profitability; in particular, net interest margins in the context the duopolistic structure of the Jamaican banking sector. One such study by White (2006) found that interest margins were primarily explained by bank-specific variables as well as non-bank specific variables such as exchange rate volatility and the output gap.

The recent global crisis has, however, re-emphasized the importance for policymakers to conduct forward-looking assessments of bank performance. More recent literature on banking sector performance has also focused on predicting the future performance of bank profits, given that this serves as an early warning indicator for policymakers.[4] Work by Athanasoglou et al (2008) and Ramlall (2009) highlighted that a sound and lucrative banking system is better able to handle future negative shocks and hence ensure financial stability.

A key aim of this study is to investigate the determinants of banks' profitability in Jamaica. A dynamic panel estimation technique was applied to Jamaican banking sector data covering the period 2000:1 to 2010:4. Bank-specific and macroeconomic variables are examined in estimating the determinants of banks' performance. In addition, this paper also adds to the literature on bank performance for Jamaica by utilizing Monte Carlo simulations to derive forecasts of bank profits.

The remainder of this paper is organized as follows. Section 2 presents the literature on determinants of banks' profitability while section 3 provides a description of the data used in the study and the empirical model. The findings of the study are discussed in

[2] See Hoggarth (2010).
[3] See Berger (1995) and Goddard et al (2004).
[4] *See* European Central Bank (ECB, 2010).

section 4 while section 5 presents a summary of the stress testing methodology and results. In addition, section 6 provides the conclusions of the study.

2. Literature Review

The factors affecting bank profitability have been widely examined in the literature. It has been shown that banks' performance is not only influenced by bank-specific factors but also external factors such as the nature of the macroeconomic environment.

The literature shows that several internal factors are considered whenever the profitability of banks is explored. Initial work by Berger (1995) examined the impact of market structure on bank performance.[5] Other factors examined in the literature include capital holdings, bank expenditures as well as the risk borne by financial institutions. These factors were included in studies such as Goddard *et al* (2004) and Maudos and Nagore (2005). Maudos and Nagore (2005) also examined the impact of bank size, measured as the logarithm of total assets, on bank performance.[6] Moreover, Kosmidou *et al* (2006) used Discriminant Analysis (DA) and Logistic Regression (LR) to show the performance of 40 large and small banks in the United Kingdom over the period 1998 to 2002. Results of this study showed that small banks out-performed larger banks. In addition, Goddard *et al* (2004) carried out extensive work on the factors which affect the profitability of European banks.

Regarding external or macroeconomic factors, work by Beckman (2007), Ramlall (2009) and Coffinet and Lin (2010) explored the impact of variables such as GDP growth, the change in credit volume and inflation on bank performance. Athanasoglou (2008) also applied a GMM technique to a panel of Greek bank data over the period 1985 to 2001. The results of the study showed that inflation and cyclical output positively influenced the performance of banks. Coffinet and Lin (2010) used supervisory data from French banks over the period 1993 to 2009. Also utilizing a GMM technique, they found that the performance of French banks was positively dependent on growth in GDP. Their findings also support the hypothesis that the performance of profitability is persistent. Rumler and Waschiczek (2010) conducted a study on Austrian banks for the period 1995 to 2009 and found that bank profits in Austria are contingent on the business cycle and are positively influenced by the spread between long-term and short-term interest rates.

Bernoth and Pick (2009) forecast the financial fragility of banks and insurance companies using a panel data set of performance indicators. This study found that financial linkages among banks and between banks and insurance companies are important when analyzing and forecasting their fragility. The study also found that a number of macroeconomic variables and unobserved factors are important in explaining the performance of banks and insurance companies.

[5] Non-interest income as a share of total assets was used as a measure of market structure.
[6] See also Kosmidou et al (2006), Athanasoglou (2008) and Ramlall (2009).

3. Data and Empirical Model

3.1. Data

The paper employs quarterly banking system data for the period March 2000 to December 2010. Data from 15 banks was utilized in the study covering institutions in the commercial banking, building societies' and merchant banking sectors. An unbalanced panel was used since several institutions either went out of operation or were merged during the sample period.

3.1.1. Variables Employed

In this paper, the ROA was utilized as the measure of banks' performance.[7,8] This represents the dependent variable utilized in the study and was computed as the ratio of pre-tax surplus as a share of average total assets. A sector-by-sector analysis showed that the average ROA for the whole sample totalled 1.39 per cent per quarter. For building societies, the average ROA per quarter was 0.59 per cent while for commercial banks it reached 0.92 per cent. Merchant banks recorded the highest average quarterly ROA of 3.17 per cent (*see* Table 1 in the Appendix).

3.1.2. Independent Variables

The independent variables utilized in the study cover bank-specific as well as macroeconomic determinants of bank profitability. The bank-specific determinants of banks' profitability included in this paper are bank capital, loan growth, credit risk, operating expenditure, non-interest income and bank size.[9]

Capital is measured as equity as a share of total assets. It is expected that capital will positively impact the profitability of banks. Well-capitalized banks may enjoy access to cheaper and less risky sources of funds as well as better quality asset markets and thus a high capital ratio may be indicative of high expected profitability.[10] Credit risk is computed as the ratio of loan-loss provisions to total loans. An increased exposure to credit risk may be associated with lower profitability given that higher levels of risky loans are directly linked to a higher level of unpaid loans and reduced earnings.[11]

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[7] There are several measures that can be used to gauge the performance of banks. The traditional approach is to consider aggregate profit measures such as the return on equity (ROE) and the return on assets (ROA). The ROE is generally not utilized because it is not risk-sensitive and may fail to capture differences between performing and non-performing banks.

[8] This variable was also chosen over the Net Interest Margin (NIM). According to Coffinet *et al* (2009), the NIM might not necessarily be an effective aggregate measure of overall profitability.

[9] See Tables 2 to 4 in the Appendix for summary statistics of the all the explanatory variables included in the model. The correlation coefficients of the variables are presented in Table 5.

[10] See Bourke (1989) and Coffinet and Lin (2010).

[11] See Miller and Noulas (1997).

Operating expenditure is captured as operating costs as a share of total assets and is expected to be negatively related to profitability. Improvements in the managing of operating expenses reflect increased efficiency and are expected to lead to increased profits.[12]

It is expected that the size of a bank will positively influence its profitability. Work done by Athanasoglou *et al* (2006) linked the size of banks to the possibility of benefiting from economies-of-scale since larger banks are able to operate more efficiently and provide services at lower costs. As a result of this, these institutions could gain in market share as well as increases in earnings and profitability.[13]

The loan growth is calculated as the quarterly change in the overall credit of the Jamaican banking sector. Loan growth is a traditional source of revenue for banks and is expected to positively affect bank profitability.

The performance in non-interest income is captured as non-interest income, which is the sum of fees and commissions, trading income and dividends, as a share of to total assets. An increase in non-interest income is expected to positively influence profits, due to a higher level of earnings from this revenue stream.

The macroeconomic and external factors believed to affect banks' profitability are economic growth, inflation, interest rates, stock index return volatility and the structure of the banking market.

GDP growth is used as the measure of economic performance. It defined as the quarterly change in the real Jamaican GDP. It is expected that a positive relationship exists between GDP growth and banking profitability. According to Ramlall (2010), GDP captures upswings and downswings in the business cycle and movements in the general level of economic activity are expected to positively impact banks' profitability.

Inflation is defined as the quarterly change in Jamaica's Consumer Price Index (CPI). The relationship between inflation and bank profitability is sometimes ambiguous. If the inflation rate is fully anticipated and banks can adjust interest rates in order to increase their revenues faster than their costs, it is anticipated that there will be a positive relationship between inflation and bank profitability.[14]

It is anticipated that banks' profits will increase with a rise of interest rates, due to the impact on earnings from loans and investments.[15] In this study, interest rates represented by the 180-day GOJ Treasury bill rate.[16] The impact of the variability in rates was also considered as proxied by the rolling three-quarter standard deviation of the 180-day Treasury bill rate. Stock market volatility may increase banks' trading opportunities

[12] See Athanasoglou *et al* (2008)
[13] See Demirguc-Kunt and Maksimovic (1998), Goddard *et al* (2004) and Molyneux and Thornton (1992).
[14] See Bourke (1989) and Molyneux and Thornton (1992).
[15] Hancock (1985), Molyneux and Thornton (1992) and Demirguc-Kunt and Huizinga (1999)
[16] This Treasury bill rate is often used as the market signal rate.

thereby increasing profitability.[17] Volatility was computed as the rolling three-quarter standard deviation of the growth in the Main Jamaica Stock Exchange Index.

The market structure variable utilized in the model is computed as the ratio of net operating income of the individual banks as a share of total operating income of the banking industry. This variable represents a measure of power and some theories, such as the Structure-Conduct-Performance Hypothesis, suggest that greater market power will lead to increased bank profitability. [18,19]

3.2. Empirical Model

The framework employed to evaluate the determinants of bank profitability is based on the linear form of the general model done by Athanasoglou *et al* (2008) and Coffinet and Lin (2010):

$$\pi_{it} = c + \sum_{j=1}^{J} \beta_j X_{it}^{j} + \sum_{l=1}^{L} \beta_l X_{it}^{l} + \sum_{m=1}^{M} \beta_m X_{it}^{m} + \varepsilon_{it} \quad (1)$$

$$\varepsilon_{it} = v_i + u_{it}$$

where π_{it} is the profitability of bank *i* at time *t*, with $i = 1,\ldots,N$, $t = 1,\ldots,T$, c is a constant term, X_{it}*'s* are the explanatory variables and ε_{it} the disturbance term, with v_i the unobserved bank-specific effect and u_{it} the normal error term. The X_{it}*'s* are grouped into bank-specific - X_{it}^{j} and market-based - X_{it}^{l} and macroeconomic and financial variables - X_{it}^{m}.

In keeping with previous work of Berger *et al* (2000), the model was extended to represent a dynamic specification by including an autoregressive component of ROA. Other studies that have examined the persistence of profits in the banking industry such as Levonian (1993) and Roland (1997), have found that bank profits in the United States of America (USA) converged more slowly to their average values than suggested by many studies. Therefore, a lagged endogenous variable was included to account for persistence. The model for each date *t* is shown below:

[17] See Coffinet and Lin (2010).

[18] This hypothesis postulates that the conduct or rivalry in a market is determined by market structure conditions. This rivalry leads to unique levels of prices, profits and other aspects of market performance. (*See* Rasiah (2010))

[19] Heggested and Mingo (1987) also suggested that a bigger market share meant more authority for banks in controlling the prices and services offered to customers, as such, a positive relationship is expected between market power and profitability. Berger (1995) also claimed that only firms with large market shares and well-differentiated products can exercise market power and earn non-competitive profits.

$$\pi_{it} = c + \delta\pi_{i,t-1} \sum_{j=1}^{J} \beta_j X_{it}^j + \sum_{l=1}^{L} \beta_l X_{it}^l + \sum_{m=1}^{M} \beta_m X_{it}^m + \varepsilon_{it} \quad (2)$$

where $\pi_{i,t-1}$ represents one-period lagged profitability and δ is the speed of adjustment to equilibrium. A value of δ between 0 and 1 implies that profits persist, but they will eventually return to their normal level. As such, a value close to 0 means the industry is fairly competitive while a value of δ close to 1 implies a less competitive structure[20].

Model (2) formed the basis of the estimations in this paper. The Generalized Method of Moments (GMM) technique was used to estimate this model. This method is useful in providing unbiased and efficient estimates in dynamic models which have lagged endogenous variables as regressors. This paper utilized the GMM estimator developed by Arellano and Bond (1991) which was applied to model (2) as in Athanasoglou *et al* (2008) and Coffinet and Lin (2010). Arellano and Bond (1991) suggested that it is possible to obtain consistent and efficient estimates by using all available lagged values of the dependent variable plus lagged values of the exogenous variables as instruments. Another important advantage of the GMM methodology, as outlined by Baltagi (2001), is the fact that it accounts for the possibility of correlations between the independent variables.

Before the model was estimated, the stationarity of the panel was tested by using both the Levin, Lin& Chu and Fisher-Augmented Dickey-Fuller (ADF) tests of stationarity. The results are presented in Table 6 of the Appendix. Both tests revealed that the panel was stationary except for capital which was only stationary under the Levin, Lin & Chu test. The stationarity of the macroeconomic and financial variables was also tested using an ADF (see Table 7). The results indicate that all variables are stationary except for the loan growth variable which had to be first-differenced.

4. Empirical Results

Several models were estimated, using various bank-specific and macroeconomic factors as instrumental variables (see Table 1). The results of the most robust model are shown in column 4 and include all macroeconomic and bank specific variables excluding loan growth and the variability in Treasury bill rates.[21] The quality of the results obtained based on the final model was subject to several robustness checks for dynamic panel models. More specifically, the results of the Sargan test showed no evidence of over-identifying restrictions and indicate that the instruments used in the model are valid.

The persistence of profitability is confirmed by the highly significant coefficient on the lagged endogenous variable, *ROA (-1)*. The coefficient is equal to 0.24 which is indicative of profitability being moderately persistent over time. As indicated by Athanasoglou *et al* (2008), a small value for this coefficient means that the banking

[20] *See* Athanasoglou *et al* (2008)
[21] These variables were found to be insignificant based on the other models examined.

industry is competitive (that is, characterized by a high speed of adjustment). This further implies that departures from a perfectly competitive market structure in the Jamaican banking sector may not be large.

The negative coefficient on capital is significant even though this result was not expected. Most of the literature examined such as Bourke (1989), Athanasoglou (2008) and Coffinet and Lin (2010), suggested otherwise. Jamaica operates in an imperfect capital market which, according to Flamini *et al* (2009), could explain the inverse relationship. These authors suggested that well-capitalized banks can borrow less in order to support a given level of assets and are faced with lower prospective bankruptcy costs. Furthermore, these banks are perceived to be less risky and as such lower profits are expected because they appear safer; hence the negative relationship found. It could also be that profits are used as a buffer for capital. This suggests banks in Jamaica may be relying on internal sources such as retained earnings to meet their capital requirements.

There is a negative and significant relationship between the expenditure variable and profits. This means that a reduction in the operating costs faced by the banks would positively affect profits. Moreover, a 1.0 per cent decrease in the operating expenditure ratio would increase the banks' ROA by 62.8 per cent. Based on the regression results shown, this variable has the highest impact on the profitability of Jamaican banks. The other variable that strongly explains the level of profitability is the relative share of non-interest income as a proportion of assets, *NNII*, which also has a highly significant coefficient. Net interest income is primarily the main source of revenue for banks. However, this result highlights the increasing importance of non-interest income as source of revenue for banks in Jamaica.

In examining the effect of the macroeconomic and financial variables on profitability, it was found that the volatility of the JSE index demonstrated the highest influence on profits followed by the GDP growth rate. Inflation has the least impact on banks' profitability. A one percent increase in stock market volatility is associated with a 6.08 per cent increase in the ROA. The positive relationship between stock market variability and bank profits reflects the impact of increases in stock market returns, which also is a proxy for the performance in economic activity, on banks' earnings performance. This suggests that banks in Jamaica actively engage in the stock market activities as a means of generating income. The coefficient on GDP growth means that an increase in GDP growth by 1.0 per cent increase in the ROA of Jamaican banks by 0.04 per cent. This, of course, is important since the average ROA over sample was 1.39 per cent. There is a positive and significant relationship between inflation and bank profits, suggesting that banks forecast future inflation correctly and promptly enough to adjust interest rates and margins. This result is consistent with those reported in Perry (1992), Molyneux and Thornton (1992) and Flamini *et al* (2009). However, the results show that the overall impact of inflation on the profitability of Jamaican banks is low.

Table 1*: Results for Arellano-Bond Dynamic Panel Data Estimation (2000 – 2010)*

Explanatory Variables	(1)	(2)	(3)	(4)
Constant	0.0832*** (0.0251)	0.0776*** (0.0255)	0.0793*** (0.0261)	0.0807*** (0.0202)
ROA (-1)	0.22953*** (0.0810)	0.2196*** (0.0795)	0.2052*** (0.0802)	0.2421*** (0.0611)
Capital	- 0.0146*** (0.0044)	- 0.0161*** (0.0039)	- 0.0157*** (0.0037)	- 0.0154*** (0.0033)
Expend	- 0.5902*** (0.0980)	- 0.6008*** (0.0953)	- 0.6255*** (0.0824)	- 0.6279*** (0.0879)
NNII	0.5595*** (0.0990)	0.6049*** (0.0974)	0.6221*** (0.0986)	0.6091*** (0.0615)
Risk	- 0.0203** (0.0086)	- 0.0186** (0.0087)	- 0.0165* (0.0090)	- 0.0211*** (0.0076)
Power	0.0007*** (0.0002)	0.0007*** (0.0003)	0.0006*** (0.0002)	0.0005*** (0.0002)
JSE	0.0508*** (0.0145)	0.0549*** (0.0129)	0.0524*** (0.0123)	0.0608*** (0.0092)
CPI	0.0002 (0.0002)	0.0002 (0.0001)	0.0002 (0.0001)	0.0002** (0.0001)
GDP	0.0003* (0.0002)	0.0004* (0.0002)	0.0004** (0.0002)	0.0004*** (0.0001)
Size	- 0.0036*** (0.0014)	- 0.0033*** (0.0015)	- 0.0033** (0.0015)	- 0.0035*** (0.0011)
VTB	0.0000 (0.0003)			
ΔLoan	0.0071 (0.0135)	0.0072 (0.0133)		
Observations	569	569	569	569
Adjusted R^2	0.5753	0.5768	0.5782	0.5760
Sargan test[#]	0.9961	0.9967	0.9823	0.9927

Dependent Variable: Return on Assets (ROA).
For the notation of the Explanatory variables see *Table 2*.
White's Cross-Section Standard Errors are in parentheses.
Levels of Significance are indicated by asterisks: 1% (***), 5% (**), 10% (*).
[#] – The test for over-identifying restrictions in GMM dynamic model estimation.
Δ – Indicates a variable that has been first-differenced to attain stationarity.
ROA (-1) – This is a one period lag of a ROA which is used to account for persistence in bank profits.

5. Forecasting Banks' Profits using Monte Carlo Simulation

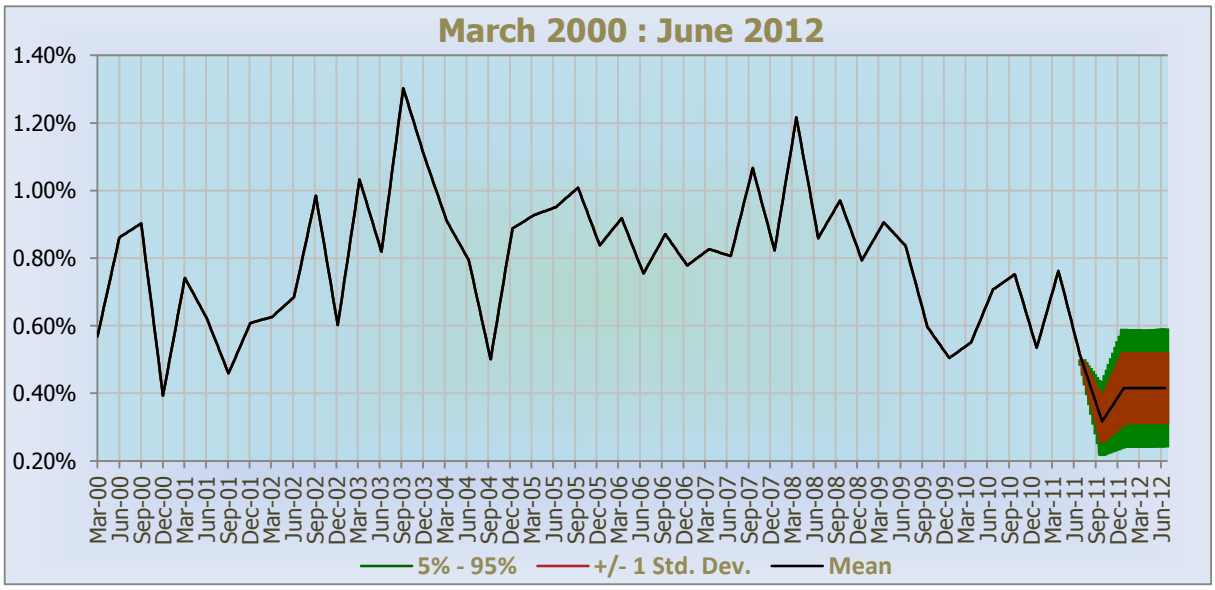
An empirical assessment was also conducted to forecast the performance of the ROA in response to key macroeconomic variables. A weighted aggregate ROA measure was computed and utilized in the assessment in order to reflect the contribution of each individual bank in the sample. This measure was computed based on quarterly data for the period March 2000 to June 2011. As an added robustness measure, an ordinary least squares (OLS) model was estimated using the determinants derived from the GMM framework. The results from the OLS model were largely consistent with the findings from the GMM framework in terms of the significance and sign of the explanatory variables. [22] As such, the significant macroeconomic variables from the OLS model utilized in the forecast are real GDP growth and inflation (see Table 8 in Appendix).

The historical values of the aggregate ROA variable and the exogenous macroeconomic variables were combined to create a forecast of the banks' profitability. The variables were fitted with a normal distribution function based on their historical values. Using the fitted distributions as well as the correlation between the explanatory variables, Monte Carlo simulations (10 000 iterations) were used to generate a one-year ahead forecast of the ROA as well as a fan chart of the forecasted values of this variable (*see* Figure 1).

Forecasted results show deterioration in profitability during the September 2011 quarter, as well as marginal improvement in profits during the remainder of the forecast period, and reflect that overall profitability will be constrained by the performance in GDP.[23]

[22] The residuals from OLS model were normally distributed as required. The model reflected an r-squared value of 61.9 per cent. Additionally, the model showed a Durbin-Watson statistic of 1.85.
[23] The GDP variable was de-seasonalized prior to use in the forecast.

Figure 1: ***One-Year Ahead Forecast of ROA for Jamaican Banks***



5. Conclusion and Policy Implications

This paper investigated the bank-specific and macroeconomic determinants of banks' profitability in Jamaica. The paper also provides a forecast of the performance of bank profits in response to movements in key macroeconomic variables. The results of the study show that bank expenditures and non-interest income had the highest impact on bank performance in Jamaica and are significantly inversely related to banks' profitability. In addition, bank capital, expenditure as a share of assets and credit risk were significantly inversely related to banks' profitability. Furthermore, all market structure variables, in particular, their degree of market power in the industry, were found to be positively related to banks' profitability. Regarding macroeconomic variables, bank profits were positively related to improvements in the stock market, GDP growth, volatility in stock market returns and inflation. These results are largely consistent with the findings in the literature. Supporting evidence was also found regarding the persistence of profits in the banking industry in keeping with the literature. Forecasted ROA values showed deterioration in the near-term largely reflective the impact of the performance in GDP.

Of importance is that forecasts of this nature can be used as an early warning tool for policy makers and is crucial given that fragility in the banking sector can be transmitted to other sectors. This tool can also assist policymakers in employing a more proactive approach to the conduct of policy, which can help in anticipating and possibly offsetting the effects of macroeconomic and bank-specific shocks on the stability of the banking sector.

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Appendix

Table 1: Descriptive Statistics of ROA

		Sub-Groups		
2000 - 2010	All Banks	Building Societies	Commercial Banks	Merchant Banks
Average	0.0139	0.0059	0.0092	0.0317
Std. Dev.	0.0283	0.0054	0.0098	0.0508
Minimum	-0.1179	-0.0232	-0.0343	-0.1179
Maximum	0.2499	0.0242	0.0550	0.2499
Observations	644	176	308	160

Table 2*: Specification and Expected Sign of Variables*

Variables	Specification	Notation	Expected Signs
Dependent Variable:			
Profitability	Net profit before taxes / average total assets	ROA	
Explanatory Variables:			
Capital	Capital / total assets	Cap	+
Credit risk	Loan-loss provisions / total loans	Risk	-
Expenditures	Operating cost / total assets	Expend	-
Market Power	Individual net operating income / total net operating income of the banking industry	Power	+
Non-interest income	Non-interest income / total assets	NNII	+
Size	Natural log of total assets	Size	+
Economic growth	Real GDP quarterly growth rate	GDP	+
Inflation	Quarterly inflation rate	CPI	+
Loan	Quarterly growth rate of aggregated loans	Loan	+
Interest rates	Volatility of BOJ's 180-days Treasury bill rate	VTB	+
Financial market volatility	Volatility of the JSE index's quarterly return	JSE	+

Table 3: *Descriptive Statistics of Macroeconomic Variables*

	GDP	CPI	JSE	LOAN	VTB
Mean	0.7737	2.6883	0.0362	0.0471	0.8629
Maximum	4.2574	7.2729	0.1155	0.1852	8.6718
Minimum	-3.8724	-0.4533	0.0038	-0.0223	0.0153
Std. Dev.	2.0609	1.8364	0.0310	0.0395	1.4167

Table 4*: Correlation Coefficients between Bank-specific and Macroeconomic Variables*

	ROA	ROA(-1)	CAP	EXPEND	GDP	CPI	JSE	LOAN	POWER	RISK	SIZE	NNII	VTB
ROA	1												
ROA (-1)	0.6606	1											
CAP	0.0187	0.0171	1										
EXPEND	0.4018	0.4538	0.2604	1									
GDP	0.0895	0.0831	0.0553	0.0640	1								
INF	-0.0129	-0.0358	-0.0252	-0.1210	-0.0950	1							
JSE	0.0621	-0.0011	0.0449	0.1740	0.1020	-0.1803	1						
LOAN	0.0791	0.0713	-0.0017	0.1537	0.3405	-0.0528	0.0838	1					
POWER	-0.0253	-0.0458	0.0065	-0.0904	-0.0159	0.0107	-0.0056	-0.0143	1				
RISK	-0.1204	-0.1243	-0.1713	0.0771	0.0646	-0.1669	0.1662	0.0902	-0.0165	1			
SIZE	-0.3427	-0.3453	-0.5505	-0.4754	-0.1730	0.1096	-0.1382	-0.1224	0.1358	0.0707	1		
NNII	0.2892	0.2445	0.5219	0.5438	0.0926	-0.1361	0.1108	0.0977	-0.0400	0.1284	-0.4719	1	
VTB	0.0094	0.0004	0.0013	0.1025	0.1689	-0.3769	-0.0766	0.2241	-0.0112	0.0721	-0.0656	0.1319	1

Note: ROA (-1) is the one-quarter lag of the dependent variable, ROA. The relationships to pay close attention to are: capital and size (0.5505), NNII and capital (0.5219) and expenditure and NNII (0.5438) since they have the highest correlation coefficients and may contribute to an endogeneity problem in the model.

Table 5*: Results of Stationarity Tests for the Bank-Specific Variables*

Variables	Levin, Lin & Chu		Fisher - ADF		Order of Integration
	t-stat	p-value	χ^2	p-value	
ROA	-5.5839	0.0000	82.7052	0.0000	I(0)
Cap	-2.4604	0.0069	35.0155	0.2421	I(0)
Risk	-10.3503	0.0000	160.1610	0.0000	I(0)
Expend	-5.3658	0.0000	63.4891	0.0003	I(0)
Size	-4.4173	0.0000	54.8508	0.0037	I(0)
Power	-7.6441	0.0000	181.9010	0.0000	I(0)
NNII	-5.9309	0.0000	101.6070	0.0000	I(0)

Note: Variables that are stationary on levels are indicated by I(0) while variables that are non-stationary on levels but their first-differences are stationary are indicated by I(1). The Levin, Lin & Chu test has the null hypothesis that a common unit root process exists across the sample while the Fisher-ADF has the null hypothesis that an individual unit root process exists. Notice that the stationarity test results for capital variable are contradictory. However, the Levin, Lin & Chu test was the main reference test so the decision was made use that particular result.

Table 6: *Results of Stationarity Tests for the Macroeconomic Variables*

Variables	Augmented-Dickey-Fuller (ADF) Test		Order of Integration
	t-stat	p-value	
GDP	-1.6983	0.0844	I(0)
CPI	-2.2816	0.0233	I(0)
Loan	-1.5246	0.1180	I(1)
VTB	-4.4905	0.0000	I(0)
JSE	-6.2157	0.0000	I(0)

Note: Variables that are stationary on levels are indicated by I(0) while variables that are non-stationary on levels but their first-differences are stationary are indicated by I(1). The Augmented Dickey-Fuller (AF) test has a null hypothesis that a unit root is present in a series.

Table 7: OLS Results

Variables	Coefficient	t-Statistic	p-Value
C	0.0028 (0.0015)	1.8101	0.0800
GDP¥	0.0807 (0.0246)	3.2796	0.0026
CPI(-1)	0.0005 (0.0001)	4.2897	0.0002
VTB(-2)	0.0004 (0.0000)	4.7664	0.0000
CAPπ(-3)	0.0155 (0.0053)	2.9139	0.0066
RISK(-1)	-0.007 (0.0036)	-1.9504	0.0602
POWER(-3)	0.0007 (0.0001)	5.0879	0.0000
D(NNII(-1))	0.0500 (0.0152)	3.2906	0.0025
EXPEND(-2)	0.0320 (0.0151)	2.1287	0.0413
D(LOAN(-3))	0.0118 (0.0057)	2.0868	0.0452

Note: The Dependent Variable is Aggregate ROA.
The Durbin-Watson statistic for this regression is 2.17.
White's Heterescedasticity Standard Errors are in Parentheses.
The Adjusted R^2 is 54.
¥ – Indicates a de-seasonalized variable.
π – Indicates a de-trended variable.