



FINANCIAL STABILITY IN THE ECCU: DEVELOPING EARLY WARNING SYSTEMS AND A FINANCIAL STABILITY INDEX

KAMILAH ANDERSON*

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ABSTRACT

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Periods of vulnerability in the banking system arising from an external shock or induced by policy will likely interrupt the efficient channel of funds to profitable business investments from household savings. Bank regulators and researchers alike have sought to investigate the common strands preceding these events given the destabilizing effects on the economy. This paper examined indicators which can signal an impending crisis at individual banks in the ECCU. The key indicators were then combined in a macro-prudential index to assess system-wide stability. The indicators fell within discreet bands or thresholds which were dependent on the probability of the occurrence of a distress event, defined as a consistent breach of the reserve requirement¹. The empirical evidence revealed that these thresholds corroborated with the benchmarks used internationally. The model was also able to identify early warning signals prior to actual periods of distress in the financial sector. This analysis provides a guide to events which may precede a financial crisis in the ECCU but are limited at predicting with certainty when such an event would occur in the future.

* Gratitude is expressed to the financial stability group, Hamilton Stephen, Garfield Riley, John Rolle, Janai Leonce, John Venner and Allister Hodge for useful comments. The usual disclaimer applies.

¹The inability of a financial institution to meet the required reserve holdings at the Central Bank indicates poor liquidity management or inadequate provision for claims. However multiple infractions of this requirement over subsequent periods may be a sign of insolvency.

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Introduction

“Achieving financial stability is perhaps the most urgent task facing the world economy at the present time. If the international financial system cannot be made to operate in a more stable way, the prospects for an open and liberal approach to trade and capital flows are poor...the fundamental goals of development and poverty alleviation will be set back.” Andrew Crockett (1998)

Financial stability is paramount in a monetary union due to the high degree of interdependence among financial institutions and the cascading effect a crisis can have on economic stability of member countries. The externalities or spill-over effects from a crisis in an individual bank can inhibit economic growth. Conversely economic downturns can adversely affect asset quality, depleting capital adequacy and increasing the risk aversion towards otherwise acceptable business investments. The link between the macro-economy and the financial sector has become more pronounced particularly for developing countries where a stable economic environment is more crucial. The early warning signs of a potential crisis are therefore critical for improved regulation of the financial sector and to provide a stable macroeconomic environment for growth and development. This paper seeks to examine, firstly, the indicators which can signal an impending crisis point in individual banks, incorporating some measure of contagion throughout the banking sector. Secondly the points of transition into a crisis are explored to assess the trigger points of weak banks. Lastly a macro-prudential index is used to assess banking system stability and give a wider analysis of the early signs of a crisis.

The importance of this analysis stems from the growth enhancing effects of financial intermediation which can be easily reversed by the destabilizing effects on the domestic economy of a banking crisis. Loayza and Ranciere (2006) noted the positive long-run impact that financial development can have on economic growth but emphasized that “financial fragility can hurt economic growth”. Periods of vulnerability in the banking system stemming from an external shock or induced by policy will likely interrupt the efficient channel of funds to the prospective business investments and households. Conditions can destabilize further if there is a loss of confidence in the banking system followed by an inordinate demand for liquid liabilities.

The economic consequences are more pronounced as the interconnectivity of the financial system means that a failure at one institution can reduce the liquidity inflows at another institution which is exposed to it, forming a ripple effect of losses within a short space of time. Restoring stability usually results in a transfer of the costs to the central government who are often constrained by limited fiscal space.

The financial sector in Jamaica experienced a period of heightened vulnerability between 1995 and 1998, precluded by the classic warning signs of instability. It was induced by policy measures aimed at liberalizing the financial sector including the removal of foreign exchange controls in 1991. This shift in regime contributed to a significant growth in the financial sector between 1991 and 1995. Building societies and other similar lending institutions quadrupled while commercial banks' assets grew by more than 250 per cent. The increased competition in the sector contributed to volatility in interest rates and the propensity of institutions to form non-regulated entities and benefit from less stringent requirements. This coupled with fluctuations in the exchange rate and rising stock and real estate prices created a serious concern about the viability of the financial sector. These factors are consistent with the signs of distress which were popularized by Goldstein, Kaminsky and Reinhart (2000). In the Eastern Caribbean, the global financial crisis and the collapse of the CL Financial conglomerate in 2009 exacerbated weaknesses at some financial institutions. Liquidity constraints and increased risk aversion within the banking system limited the flow of funds on the interbank market. Interbank rates peaked in July 2010 following a rapid outflow of deposits from individual banks. These stresses to the financial sector can be averted through prudent supervision and regulation. In this paper a thresholds analysis indicating approximately when financial institutions in the ECCU would be in need of enhanced monitoring are examined. The next sub-section provides stylized facts of the ECCU domestic financial sector. Section two gives a purview of the methodologies employed from previous researchers. Though there is no definitive consensus on the factors leading to a financial crisis there are leading indicators which will signal a destabilizing event may occur. The indicators used are identified in section three, data, and the determination of the most useful indicators in the ECCU is examined in section four, the discussion of the results. Section five provides a succinct conclusion with areas for further research.

Stylised Facts

The ECCU financial sector is comprised of 368 regulated entities, of which 40 are commercial banks. The commercial banks however maintain dominance in the market by holding the major share of total assets, although the non-bank financial institutions have shown a rapid growth in asset size over the last decade. Among the commercial banks there are six systemically important banks (5-10% of the market) by sheer asset size, located in Saint Lucia, Antigua and Barbuda and St. Kitts and Nevis. The monopolistic nature of the financial sector with a few dominant players forms the framework upon which the transmission mechanisms and hence the relevant indicators which precede a crisis can be analysed.

A financial crisis in developing countries typically manifests during the transitional stages of financial development or financial liberalization. This thinking is evidenced by research performed by Loayza and Ranciere (2006) where they highlight the link between financial liberalization and financial depth and also financial fragility as there may be negative short run effects of financial intermediation on growth. Indicators of financial depth are therefore important in this analysis to gauge the stage of development. The indicators used followed King and Levine (1993) where various measures of financial intermediation were proposed (see [Table 1](#) and [Table 2](#)).

Table 1: Selected Economic Indicators - ECCU

	Inflation		Lending rate		Deposit rate		Measures of financial depth EC\$m		
	mean	sd.	mean	sd.	mean	sd.	M2/GDP	PC/GDP	PC/DC
1990's	0.47	0.70	11.75	0.15	4.24	0.11	70.36	68.20	102.87
2000's	0.65	0.87	10.61	1.17	3.66	0.59	94.21	84.54	101.53
1996-2000	0.34	0.87	11.80	0.16	4.28	0.13	72.17	69.90	103.08
2001-2005	0.58	0.48	11.39	1.04	3.96	0.63	91.05	79.30	102.34
2006-2011	0.86	0.98	9.66	0.23	3.24	0.06	99.76	93.15	100.36

Notes:

1. September 2002 the deposit rate floor was reduced to 3% from 4%
2. Inflation rate (end-of-period)
3. PC - Private Sector Credit, DC - Domestic Credit

Table 2: Selected Economic Indicators - CARICOM

	Barbados		Jamaica		T&T	
	M2/GDP	PC/GDP	M2/GDP	PC/GDP	M2/GDP	PC/GDP
	mean	mean	mean	mean	mean	mean
1990's	69.49	52.74	47.02	22.7	46.59	43.78
2000's	123.11	84.96	55.92	22.13	40.54	37.1
1996-2000	70.51	53.64	46.03	17.5	45.97	43.72
2001-2005	115.43	79.11	60.45	23.3	39.52	38.56
2006-2011	144.85	99.2	53.73	27	41.1	33.68

Note:

1. Data from 1996 to 2009 for Barbados, Jamaica and Trinidad & Tobago

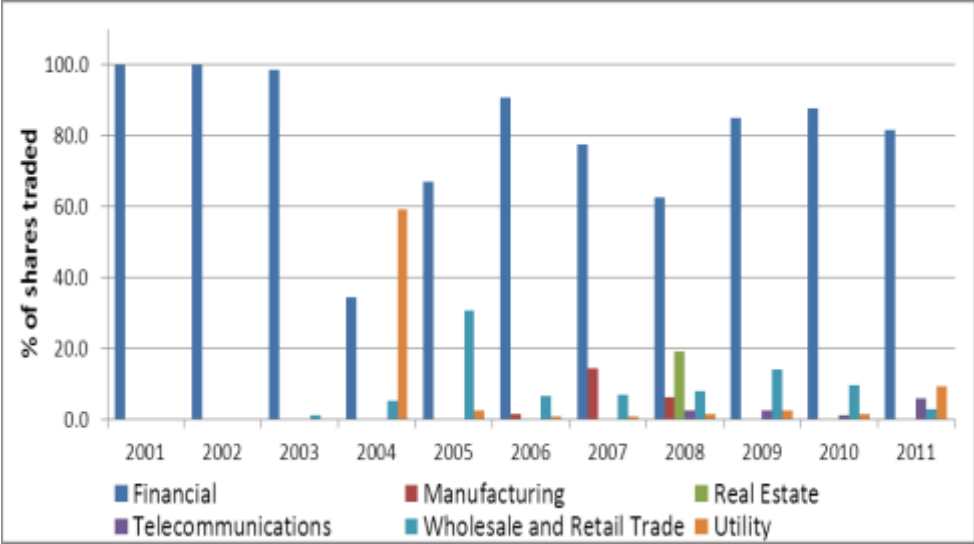
Source: World Bank

The traditional measure of financial depth considers the overall size of the formal financial intermediary system relative to economic activity as measured by the ratio M2 to GDP. This measure of the size of the financial is assumed to be positively related to the provision of financial services. This has grown from 70.3 per cent in the latter half of the 1990's to 94.2 per cent during 2000-2011 in the ECCU. A similar trend is observed in Barbados where this ratio has increased from 69.5 per cent to 123.1 per cent using the same time reference. The

availability of funds to provide financial services from this measure has grown significantly within the last decade. Other major CARICOM markets such as Jamaica and Trinidad and Tobago exhibited a more stable movement with Jamaica showing an 8.9 percentage point difference on average between these two decades while Trinidad and Tobago decelerated by 6.1 percentage points. This measure however does not illustrate the allocation of credit and the sectors to which this credit is allocated.

King and Levine (1993) note that ‘a financial system that simply funnels credit to the government or state-owned enterprises may not be evaluating managers, selecting investment projects, pooling risk, and providing financial services to the same degree as financial systems that allocate credit to private sector’. Claims on the private sector in deposit money banks constitute on average 85 per cent of domestic credit in the ECCU from 1996 to 2011. Household mortgages are the main component of these private sector claims. The loan portfolio of these financial intermediaries is therefore adversely affected by increasing unemployment rates. This factor has attributed to the sharp rise in non-performing loans (NPL) since the onset of the global financial crisis. In Barbados and Jamaica the private sector comprised on average 79 and 51 per cent respectively of total domestic credit provided by monetary authorities and financial institutions. The distribution of domestic assets among private sector agents is thus highest in the ECCU but if the credit is mainly allocated within households, then the allocation of credit for business operations, start-ups and SME’s are relatively lower, thwarting the benefits to be derived from financial intermediation.

Figure 1: Percentage Value of Shares Traded on the ECSE



Another component of the financial sector in the ECCU is the Eastern Caribbean Securities Exchange. Equity trades have grown steadily relative to economic activity over the last decade from 0.08 per cent in 2002 to 0.21 per cent in 2010. Figure 1 shows that the financial sector has dominated equity trades, giving further evidence of the importance of commercial banks in the macro-economy and the impact of a stable banking sector. Stock market activity is however still relatively low compared to other forms of financial intermediation in the ECCU.

A Review of the Empirical Literature

Crockett (1997) defines stability in financial institutions as “the absence of stresses that have the potential to cause measurable economic harm ...” Traditionally policy makers would be concerned with sudden changes in market indicators such as the interest rate spread and the changes in the assessment from credit rating agencies. These indicators however have not exhibited warning signs within sufficient time for policy makers to provide the required adjustment. There are various methods employed to examine the early warning signs of distress in the financial sector. Most studies have looked at non-parametric techniques such as Kaminsky et al (1998) and multivariate logit or probit approaches.

A seminal piece is the signals approach by Kaminsky et al (1998) which identifies indicators, highly correlated with banking crises, that deviate from the ‘norm’ preceding a crisis. The real exchange rate, stock prices and the M2 multiplier were ranked highest in their analysis. Other indicators such as output and domestic credit to GDP were ranked 5th and 11th respectively based on the percent of crisis which the data accurately predicted. This is a non-parametric technique which has the advantage of assessing the trends prior to impending crisis. It may however be limited in explaining the interdependencies among variables as the regression approach. This is important to garner the transmission of the external shock or policy decision which triggered the crisis through various sectors of the economy.

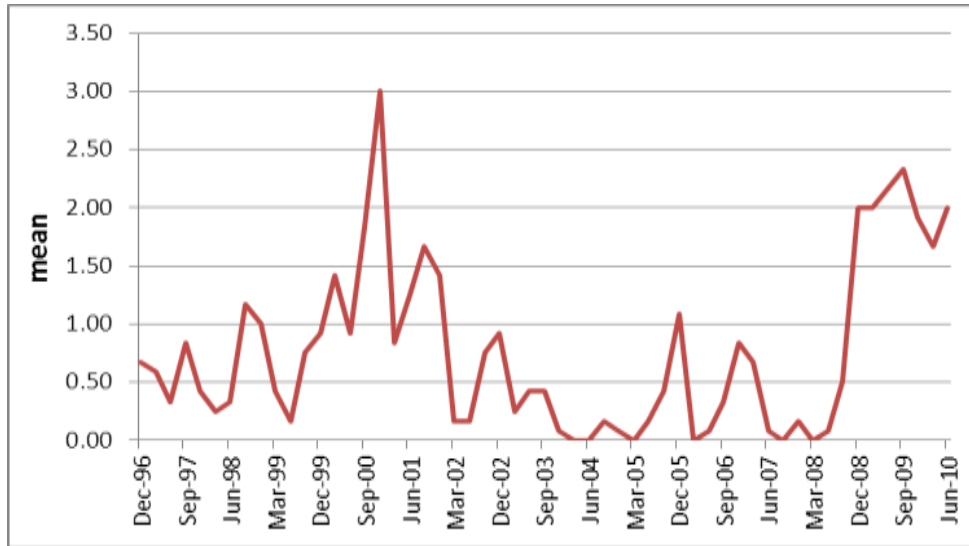
A large number of studies have employed the discriminant analysis or logit approach (Demirguc-Kunt and Detragiache, 1999; Bussiere and Fratzscher, 2002) for investigating the probability of a crisis event at individual banks. Poghosyan et al (2009) notes the advantage over statistical models which do not condition the forecast on assumptions about the future path of any of the variables included in the model. Hardy and Pazarbasioglu (1999) used a multinomial logit approach using macroeconomic and financial variables for the pre-crisis and variants for the severity of the crisis to capture the indicative events leading up to the crisis periods. Based on their analysis, the leading indicators for severe but contained banking crisis were domestic variables; for the Asian crisis proxies for vulnerability in the banking and corporate sector were the best warning signs. Indicators of external developments were best in predicting a full-blown banking crisis. Their findings largely corroborate with Demirguc-Kunt and Detragiache (1999) whose study they sought to build upon.

This study adds to this body of literature by employing a logit approach to assess distress periods in the ECCU banking sector. The outcomes of this investigation were to establish first, a set of indicators most useful for signalling distress in a bank in the ECCU and ultimately the thresholds or the probability range within which a bank may be in distress. In addition, while this tool may not be regarded as a predictor of *future* bank distress, it serves as a useful guideline for assessing the factors which currently lead to weak banks. The banks with multiple and consecutive distress periods were modeled with other banks with limited to negligent distress serving as a control group.

Data and Methodology

A distress event in this analysis was identified as the period where banks were unable to meet the weekly 6 per cent reserve ratio. These events were summated within a particular quarter. Failure to meet this ratio is usually a sign of insufficient liquidity levels. In the model a positive outcome is classified as the period where banks were in distress and the alternative when they were not in distress. These take the values one and zero respectively.

Figure 2: Frequency of Distress Events

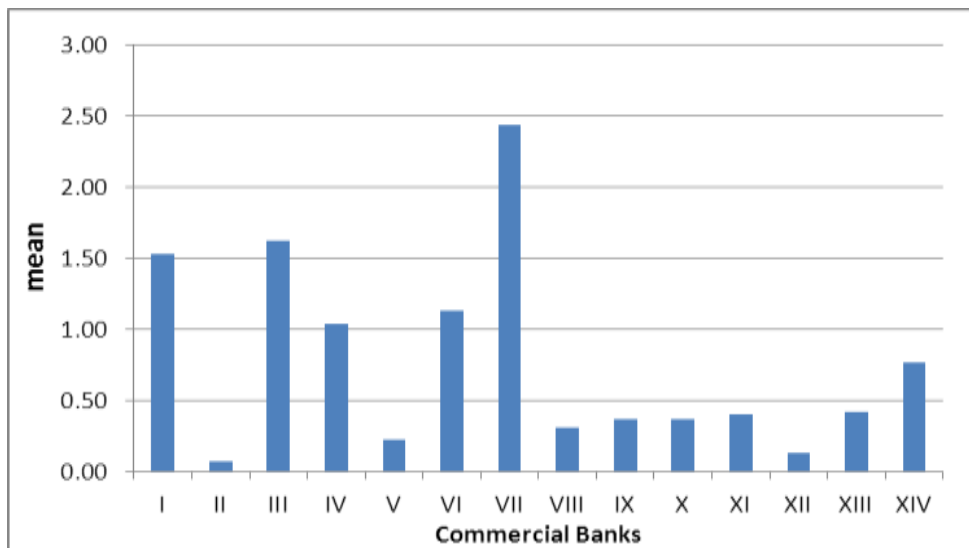


Source: ECCB

The distress events were more frequent during periods of global downturn, 2000-2001 and 2008-2010 and the period of least volatility in 2004 prior to the Cricket World Cup tournament in the Caribbean where investments peaked (see

Figure 2). Over the entire time period six banks incurred the most frequent distress occurrences while the remaining eight were less frequent presenting a counterfactual grouping in the analysis (see **Figure 3).**

Figure 3: Average Distress Events



Source: ECCB

The sample included 14 major ECCU indigenous banks for the period 1996Q4 to 2010Q2 which includes the period of the collapse of a key insurance conglomerate and the onset of the global financial and economic crisis. The manifestation of these events in the banking sector lays the foundation for adopting a macro-prudential approach in this analysis. The literature has shown usage of CAMEL indicators and also inclusive of macroeconomic variables. The CAMEL indicators generally are a prudent measure of liquidity and solvency risks in individual banks. However, more recently researchers have utilized a macro-prudential approach given the impact of economic downturns and rapid credit expansion on the financial sector. These two frameworks were employed in this study including region specific indicators which upon observation would have trended unfavourably before a distress event.

Table 3: Descriptive Statistics

Indicators	Mean	Median	Stdev.
Capital Adequacy Ratio	20.84	17.28	10.94
Non-performing Loan Ratio	15.71	14.13	9.96
Non-interest expense to non-interest income \$EC(M)	0.44	0.31	2.29
Return on Assets Ratio	0.44	0.47	0.64
Net Liquid Assets Ratio	37.57	32.08	21.07
Tier 1 Capital to adjusted risk weighted assets	18.05	14.89	10.23
NPL net specific provision to tier 1 capital (%)	88.45	71.62	81.27
Interbank Exposure (% of total loans)	8.34	1.52	16.38
Public Sector Credit (% of total loans)	64.52	39.02	90.37
Z-score	25.63	24.21	9.63

In the baseline model the capital to adjusted risk weighted assets ratio was used to assess the adequacy of bank capital and the exposure of banks to balance sheet shocks. On average the 14 indigenous banks exceeded the benchmark of 8 per cent for the capital adequacy ratio (see [Table](#)

3). Individually however some banks would have held capital assets below this benchmark in the initial stage of incorporation, prior to 1998. A typical measure of asset quality is the NPL ratio with the prescribed ratio at least 5 per cent of total non-performing loans. An increasing trend signals deterioration in the quality of credit portfolios and consequently, in financial institutions' cash flows, net income, and solvency². NPL's on average have been relatively high in the ECCU, particularly in the indigenous banking sector. At 15.7 per cent over the sample period, it far exceeds the benchmark of 5 per cent for the NPL ratio. These risks can have adverse effects on private investment in the economy as banks may be more reluctant to lend. With the public sector holding on average 64 per cent of total nominal credit private investment is further curtailed. The vulnerability of these financial institutions may also be heightened by a poor management structure, where the non-interest expense ratio³ was used as a proxy. While this proxy may not capture the intricacies of a prudent corporate governance structure, it provides a basis for analysing the management of non-interest expenses. On average this ratio has remain fairly stable at \$0.4m across individual banks. Commercial banks' earnings or profitability was estimated using the return on assets (ROA) ratio where a declining trend in the bank's ROA implies bank losses; however, high profitability may be an indicator of excessive market risk. The health of a financial institution can also be reduced through declining liquidity indicators, proxied by the net liquid assets ratio. The inability to meet short term funding requirements is a crucial measure of bank solvency. The transmission mechanisms among these variables are also important as the risks from a high npl ratio can be moderated by adequate capital assets. Therefore it is not only necessary to examine suitable indicators of a financial crisis but to estimate through a regression framework. These and other macroeconomic variables will therefore be used as distress indicators.

² Evans et al (2000),

³ Non-interest expense ratio – non-interest expense as a percentage of non-interest income

Discussion of Results

The probability of distress based on the indicators used was estimated in a conditional fixed effects logistic regression model. The results of the baseline model are summarised in Table 4.

Table 4: Logit Estimation Results - Baseline

Variables	Coefficient	z-statistic	P> z
Capital adjusted to risk weighted assets ratio	-0.0003	-0.02	0.984
Non-performing loans ratio	0.0251	2.48	0.013***
Non-interest expense ratio	0.0010	1.64	0.101*
Return on assets	0.5628	2.54	0.011***
Net liquid assets ratio	-0.0312	-2.00	0.045**
Log likelihood	-363.9		
Pseudo R-squared	0.051		

Notes:

*** denotes the 1 per cent significance level

** denotes the 5 per cent significance level

* denotes the 10 per cent significance level

In this model all the variables were significant, at the 10 per cent level, in explaining the outcome of the banks with the exception of the capital adequacy ratio. The deterioration of the quality of capital may evolve after the decline in some of the other indicators such as the non-performing loans. Therefore, this indicator may not be significant if modelled at the initial stages of distress.

The sign on these coefficients is the most critical issue at this stage as they portray whether there is an inverse or direct relationship with the probability of distress. All of the four variables which were significant exhibit a positive relationship with the dependent variable implying that deterioration in any of these ratios would lead to a distress outcome for the individual banks. It

is important to note that for the earnings indicator, ROA, an increase in retained earnings or a reduction in assets was associated with a distress outcome for banks in this sample.

Robustness checks on the baseline model involved looking at other indicators which may add to the determination of a distressed event. Therefore, in the second model core capital was used as the basis for the capitalization and asset quality ratios. Core capital is a measure of a bank's financial strength and is composed of retained earnings and equity capital. Inclusion of this measure, however, did not bear any significant changes to the baseline model. The third model used a macro-prudential analysis to ascertain the effects of the macroeconomic environment on the financial sector. In periods of low economic activity for instance gross domestic income may be curtailed, and borrowers default risk magnified reflecting in higher non-performing loans on a bank's portfolio. These macro indicators were not significant, and thus did not add any additional information to the baseline indicators used. The risks of contagion has become of increased concern given the interdependence of the indigenous banks in the ECCU through the interbank market. The indicator used to measure this risk was however marginally significant in the fourth model of bank fragility. It also showed an indirect relationship as the coefficient bore a negative sign. This was contrary to a priori expectations that increased contagion would impact positively on the probability of distress. The risks may not be sufficiently modelled through this indicator.

Table 5: Robustness Checks on Baseline Model

Models	I	II	III	IV
	Baseline	With Core Capital	With Macro Variables	With Contagion Risks
Capital to adjusted risk weighted assets	-0.0003		-0.0027	-0.0027
Non-performing Loan Ratio	0.0251***		0.0183 ⁴	0.0293***
Non-interest expense to non-interest income	0.0010*	0.0008 ⁸	0.0009 ⁸	0.0008 ⁸
Return on Assets	0.5628***	0.5487**	0.5580***	0.5340***
Net Liquid Asset Ratio	-0.0312**	-0.0300*	-0.0362**	-0.0246*
Tier 1 capital to adjusted risk weighted assets		0.0080		
NPL net specific provisions to tier 1 capital		0.3553***		
Real GDP (in logs)			-0.2440	
Real credit to GDP (in logs)			-0.5184	
Inflation rate			-0.1466	
Real lending rate			-0.1111	
Interbank Exposure				-0.0516 ⁸
<i>Number of observations</i>	734	734	726	734
<i>Pseudo R-squared</i>	0.051	0.052	0.059	0.067
<i>Log likelihood</i>	-363.9	-363.4	-357.6	-357.8

⁴ This variable was significant at the 15 per cent level

Table 6: Robustness Checks on Baseline Model II

Models	I	V	VI	VII
	Baseline	With Public Sector Share	With z score	Long term Distress ⁵
Capital to adjusted risk weighted assets	-0.0003	-0.0014	0.0153	-0.0538 ⁶
Non-performing Loan Ratio	0.0251***	0.0258***	0.0262**	0.0328
Non-interest expense to non-interest income	0.0010*	0.0010*	0.0009 ⁴	0.0007***
Return on Assets	0.5628***	0.5654***	0.6082**	0.2678*
Net Liquid Asset Ratio	-0.0312**	-0.0306**	-0.0337*	-0.0908***
Public sector share of credit		0.0045		
Z score			-0.0204	
<i>Number of observations</i>	734	734	734	424
<i>Pseudo R-squared</i>	0.051	0.051	0.052	0.192
<i>Log likelihood</i>	-363.9	-363.8	-363.6	-100.6

The public sector share of credit in some indigenous banks differs considerably from the share loaned to the private sector. When included in the analysis this indicator was not significant. One can conclude however that the non-performing segment of public sector may be more relevant and will be captured in the asset quality indicator. In the sixth model, the z score a measure of bank soundness was included. The z-score⁷ assesses how well the bank is insured against risk to its equity portfolio. It is regarded as a measure of insolvency as it captures the likelihood of a bank's profitability being too low to cover the volatility of its earnings in a given year. This indicator was insignificant in this analysis which suggests there is no additional

⁵ All variables, with the exception of the net liquid asset ratio, were lagged by two quarters

⁶ This variable was significant at the 15 per cent level

⁷ Z score = $\frac{\Sigma ROA + Equity/Assets}{Std dev(ROA)}$

Std dev(ROA)

information to be gained from the inclusion of this variable. A similar result was identified in Poghosyan et al (2009).

The severity of the distress was proxied by an indicator that captures the occurrence of three consecutive reserve requirement infractions in a quarter in the seventh model. The model was re-estimated with this indicator as the dependent variable. The explanatory variables, with the exception of the liquidity indicator, were lagged by two quarters so that the period of severe distress is based on a declining trend in these ratios from the previous two quarters. In this model, NPL ratio was not significant; however, the capital adequacy ratio is now significant at the 15 per cent level. This signals the importance of the capital to assets ratio to the long-term viability of the banks. The sign of the coefficient posits an indirect relationship between the adequacy of the existing capital and the distress outcome for banks in the ECCU. Therefore as this the capital base is eroded the probability of distress increases.

Among these models the baseline model captured the most relevant indicators for predicting the likelihood of a distress outcome. Its predictive power compares fairly well with the other models while using as few parameters as possible. At various cut-off points or thresholds the model can predict banks which were in distress. If the threshold is lowered, the amount of banks deemed to be in distress rises. This, however, also increases the margin of error between the predicted and actual distress outcomes⁸. At the cut-off point 10, with 10 per cent probability of distress there were five predicted distress events. These predicted distress periods occurred in the same period where the bank experienced consecutive reserve infractions per quarter. Table 7 shows this results in four banks which had the most frequent distress periods.

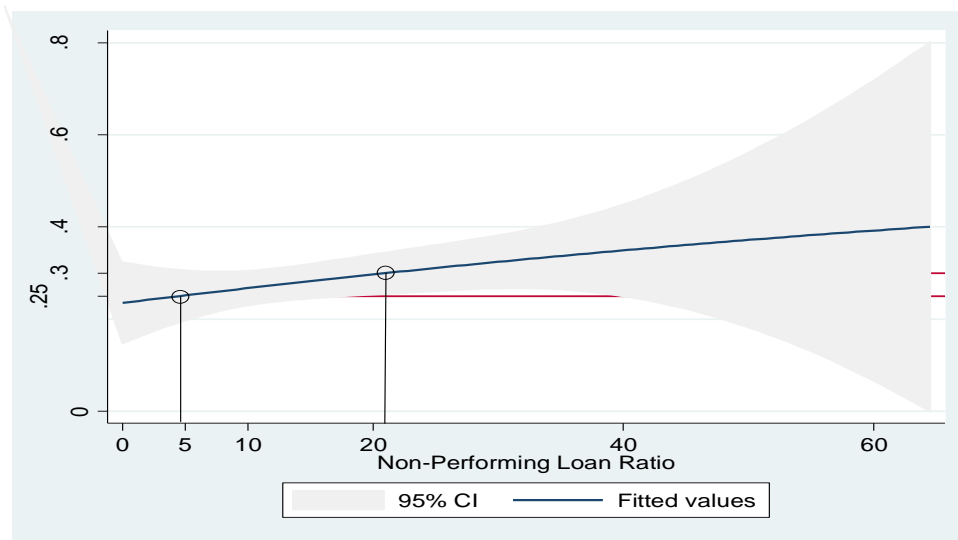
⁸ See Appendix for type I and II errors analysis

Table 7: Actual vs Predicted Distress Periods

Banks ⁹	Consecutive Infractions -Actual Distress	Predicted Distress
Bank I	2008 q4 – 2010 q2	2008 q4
Bank II	2005 q4 & 2006 q2	2005 q4
Bank III	2008 q4 – 2010 q2	2009 q1 & 2010 q2
Bank IV	1999 q3 – 2001 q4	1999 q4

The relationship between the most significant indicators in the baseline model and the probability of distress can be analysed to determine the points at which the indicator falls into a low or high distress region. This is from here-on classified as trigger points. The first trigger point is represented by the low region, 0 to 30 per cent probability of distress, and the second trigger, the high distress region, at the 30 to 50 per cent level.

Figure 4: Threshold Analysis - Non-Performing Loan Ratio

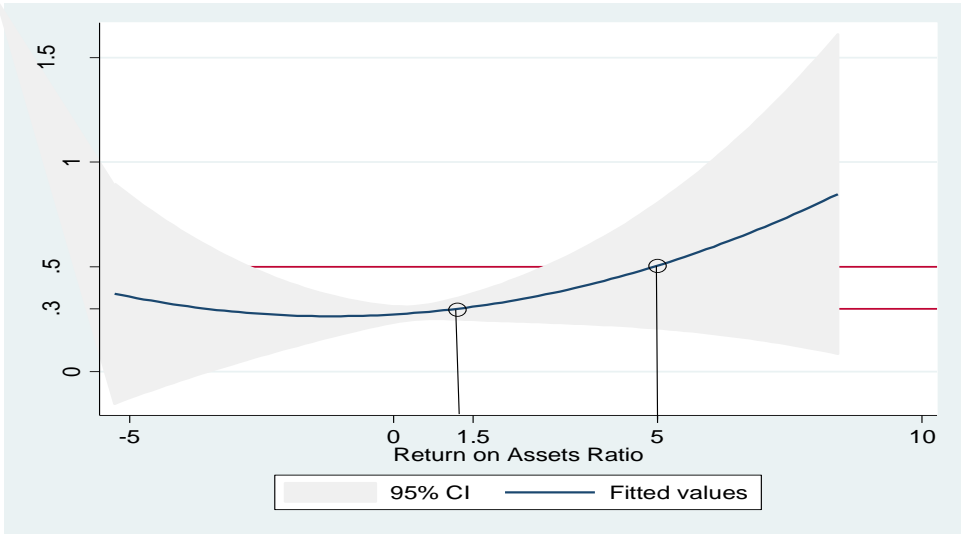


⁹ Bank VII was not predicted as a bank in distress in this analysis despite consecutive infractions in the latter half of the period.

This indicator crossed the low threshold at 5 per cent, in tandem with the current¹⁰ benchmark which prescribes that the non-performing loans be less than 5 per cent of total loans. For the high distress region, the non-performing loan ratio should be at a maximum limit of 20 per cent.

In Figure 5, the return on asset ratio has also maintained a similar limit to the current benchmark of 2 per cent. However based on this analysis the risks to bank soundness are realised if this ratio exceeds 1.5 per cent. The return on asset ratio should also not exceed 5 per cent as this indicates periods of high distress. The rationale for this may be that the banks may show signs of vulnerability where there are excess returns on assets. Figure 6 shows that a sustainable position for ECCU banks would be to hold 50 to 80 per cent of liquid assets to liquid liabilities. Outside of this range would trigger a greater than 20 per cent probability of distress.

Figure 5: Threshold Analysis - Return on Asset Ratio



¹⁰ Benchmarks currently used in the Bank Supervision Department

Figure 6: Threshold Analysis - Net Liquid Asset Ratio

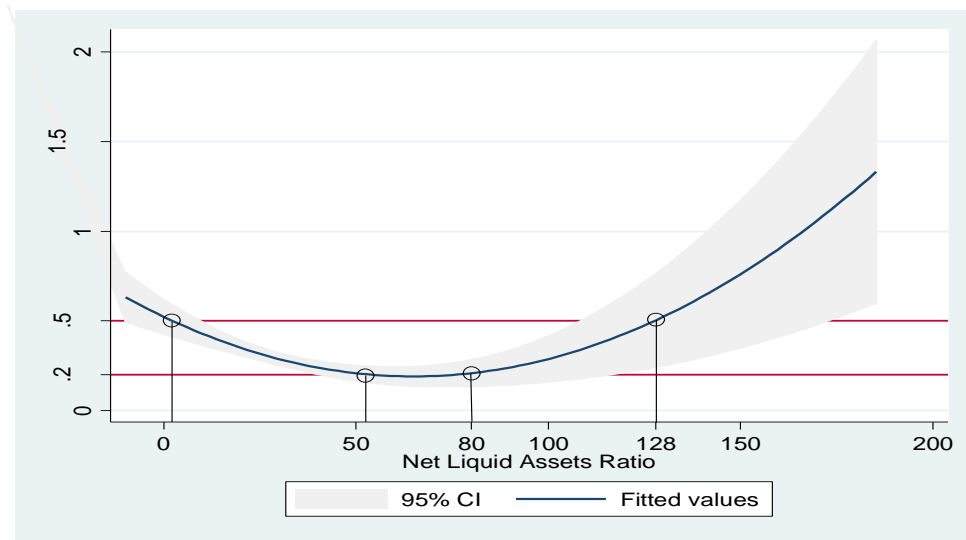


Table 8: Summary of Trigger Points

Indicators	First Trigger (0–30% PD ¹¹)	Second Trigger (30–50% PD)
Non-Performing Loan ratio	if greater than 5%	if greater than 20
Return on Assets ratio	if greater than 1.5%	if greater than 5
Net Liquid Assets ratio	if greater than 80% or if less than 50%	if greater than 128%

Non-parametric approach – Financial Stability Index

A banking sector vulnerability index shows the current trend of leading indicators in the ECCU banking sector. It provides another diagnostic apparatus for informed policy making of a sector. Kaminsky and Reinhart (1998) have looked at a non-parametric analysis observing the behavior of indicators on the eve of a financial crisis. Their research used a signal approach for indicating the onset of a crisis.

¹¹ PD – Probability of Distress

This index examines periods of volatility in the banking sector using the key indicators estimated in the previous analysis with a key macroeconomic indicator, credit growth (see

Figure 7). The interest rate spread, though a commonly used as a crisis predictor, has been noted by Grenade (2007) as being highly leveraged in the ECCU even through periods of stability. Other researchers such as Craigwell and Moore (2000) have noted the monopoly which banks exert in this sector as one of the main reason for the large interest rate spreads. Thus use of this indicator may be misleading. Goldstein et al also note the ‘late reaction’ of interest rate spreads and question the usefulness of this indicator as a prime early warning tool.

The construction of the index involved the determination of a ‘tranquil’¹² period mean for each indicator. This was the average of the least volatile consecutive eight quarters¹³ of the sample of data from 1997q4 to 2010q4. Scores for each indicator were denoted as deviations from this period of stability is recorded and weighted by the standard deviation for the previous eight quarters. The greater the divergence from stability the higher the score placed on each indicator. Prolonged periods of departure from tranquility will also result in higher scores in this analysis¹⁴. The scores of the indicators were aggregated to form a macro-prudential index of the banking sector. This index should present an early warning of forthcoming incidences of instability as marked by increasing trends away from the mean.

¹² The tranquil period mean all fell within or very close to the internationally accepted benchmarks for the financial soundness indicators.

¹³ The least volatile period for most indicators was between 2001 and 2003.

¹⁴ The standard deviation would be smaller.

Figure 7: Financial Stability Index



Source: Author's estimates

The most stable¹⁵ periods lay between 2000q3 and 2003q2 as the index revolved around the standardized zero- mean. The index rose towards the upper bands, as the ECCU economies experienced a credit boom and relatively rapid growth in GDP in the years preceding the 2007 ICC world cup held in the Caribbean. Following this period, the credit bubble burst and the banking sector showed signs of increasing vulnerability as the index fell below the lower bound for a protracted period. A similar break of the lower bound was seen during the global financial crisis¹⁶ where the ECCU underwent a 7 per cent decline in real GDP. Recovery from the crisis has been soft and though the index towards the end of 2010 has fallen within the specified bands, the banking sector remains vulnerable as it hovers near the upper bound.

¹⁵ ±1 sd

¹⁶ There was a lagged impact of the global financial crisis on the ECCU economies.

Conclusion

An unsound banking system can have a perverse impact on the macro-economy and similarly an unfavourable macro-economy can inhibit the key functions of the banking system. In developing countries the impact is ever more important given the financial intermediary role which the financial sector plays in private sector development, curtailing the multiplier effect of savings on output growth. In the ECCU, a fully-fledged financial crisis has not occurred, though events in particular sects of the financial system have posed severe challenges and the need for enhanced supervision. The global economic and financial crisis has also permeated the region's banking sector, through increased credit risks, subdued consumer confidence and increased risk aversion by lenders. The macroeconomic consequences have thus spurred renewed interest in early warning systems and more prudent regulation.

This study examined through a logistic regression model, the prime indicators of a forthcoming distress event in fourteen indigenous banks in the ECCU. The results proved that the CAMEL variables were most indicative of adverse these events. The main strength of the model was the ability to identify a greater likelihood of the occurrence of a distress event prior to. However, out-of-sample, these models have generally not performed well. Further extensions of the analysis to include the wider Caribbean or other developing countries with a similar macro environment will provide a wider control group, enhancing the robustness of the results. This paper though provides an insight into the characteristics of the ECCU financial sector. It complements the regulatory tools utilized in bank supervision as it reflects an objective assessment of the soundness of the banking sector. These models cannot be used in isolation however and must be collaborated with other qualitative audits such as onsite examinations.

A corollary to this paper is the impact on the exchange rate regime from a banking crisis in the ECCU, following similar episodes in developing countries. In the existing framework, significant reductions in foreign reserves held at the central bank can spur devaluation; however this is less likely given its legal remit to maintain at least 60 per cent of domestic currency in foreign reserves. Private capital inflows are not sufficiently large to exacerbate a currency crisis

from a sudden reversal in these flows as in the East Asian economies. Further research in this area would shed some light on the possible links between a banking crisis and a currency crisis in the ECCU.

The strengthening of the financial sector is thus paramount in our developing economies as the fiscal and economic costs of a banking crisis are insurmountable. The analysis of key indicators is the continuation of significant strides made to reduce the discretionary bias in decision making. However at the forefront of policy making is the rationalization and continued development of the sector through financial safety-net measures and an enhanced supervisory framework.

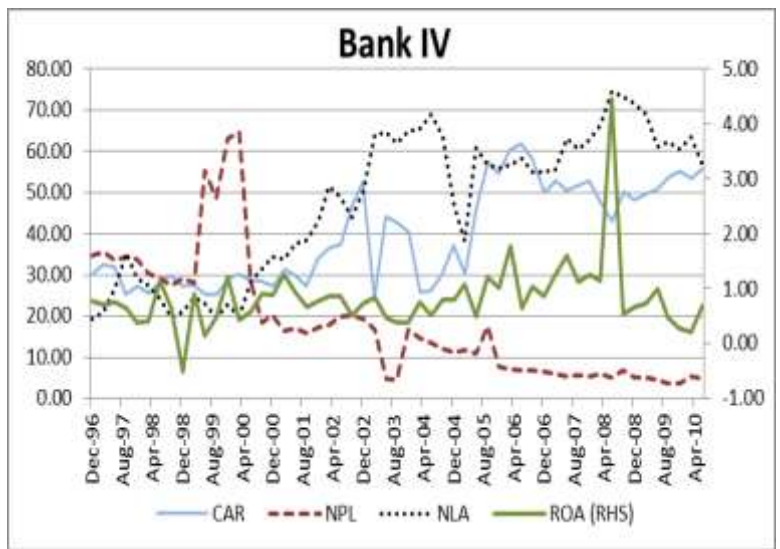
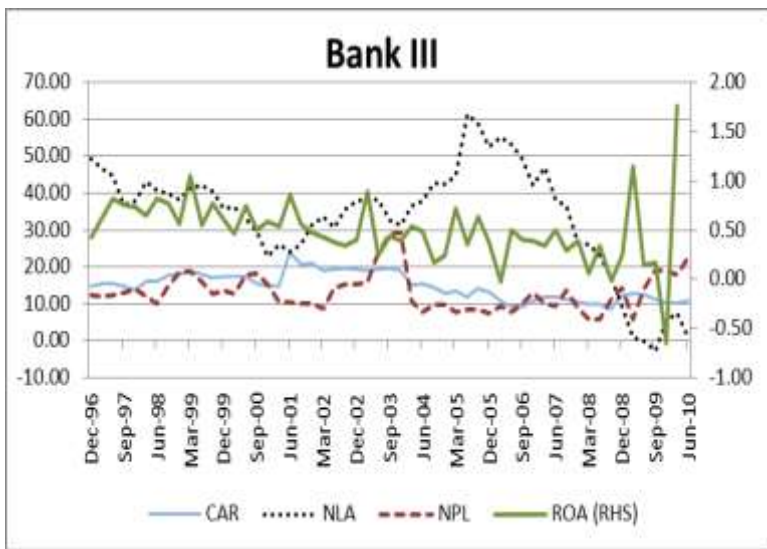
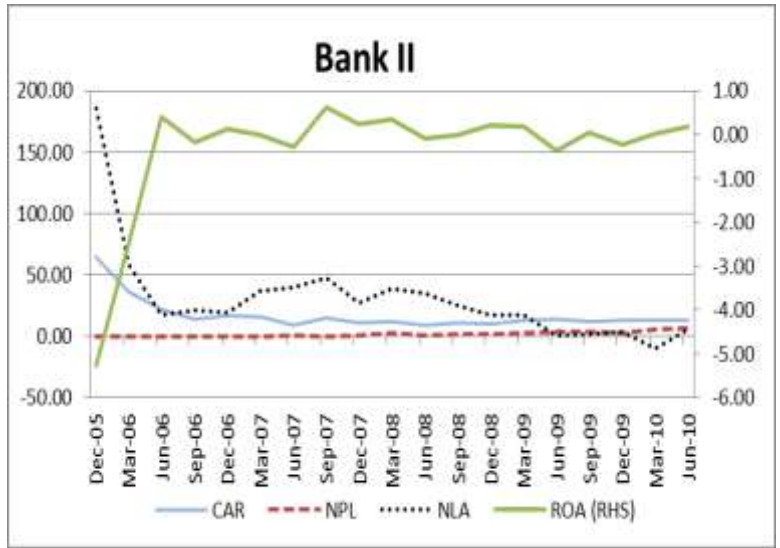
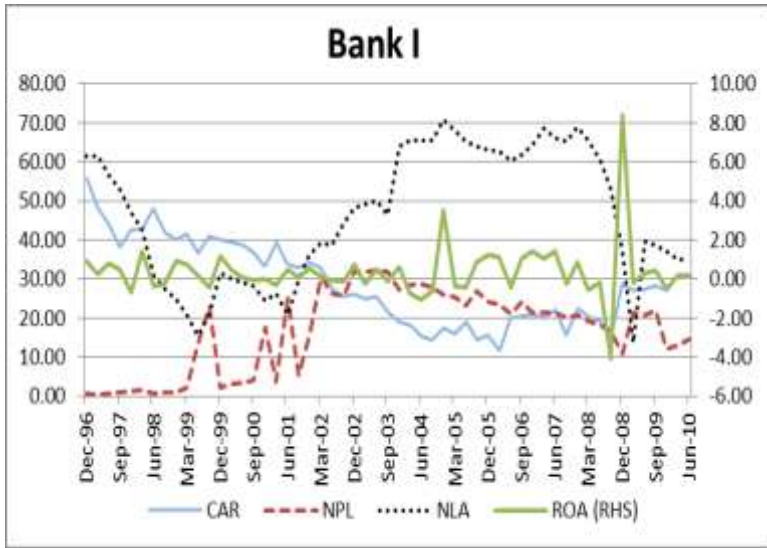
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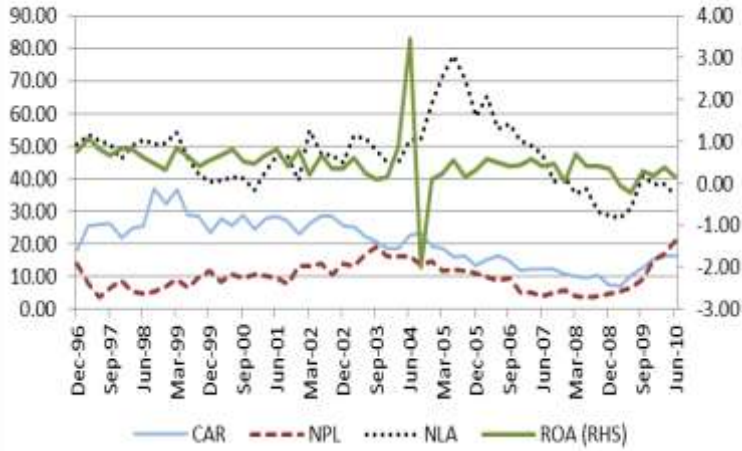
Appendix

The trends in selected indicators in individual banks show the sudden change in the variables at particular periods. In Bank 1, for instance, the volatility in the return on assets ratio was significant during 2008, during the period of acute liquidity risks within this bank. Similar trends were noticed in the following banks during periods of heightened vulnerability.

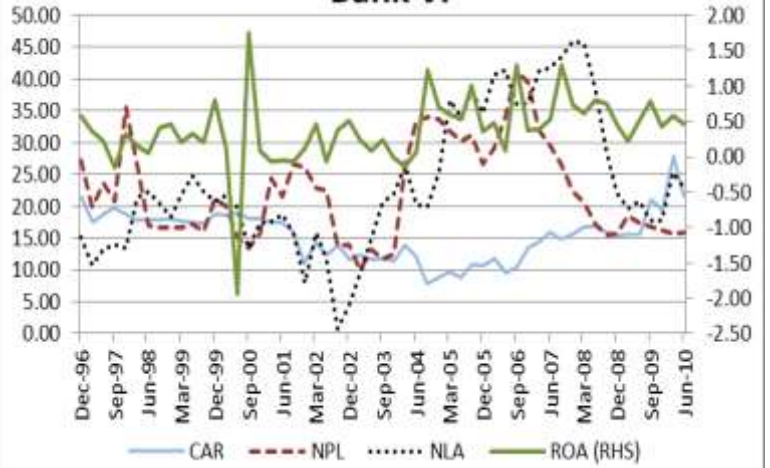
Figure 8: Trends in CAMEL Indicators by Bank



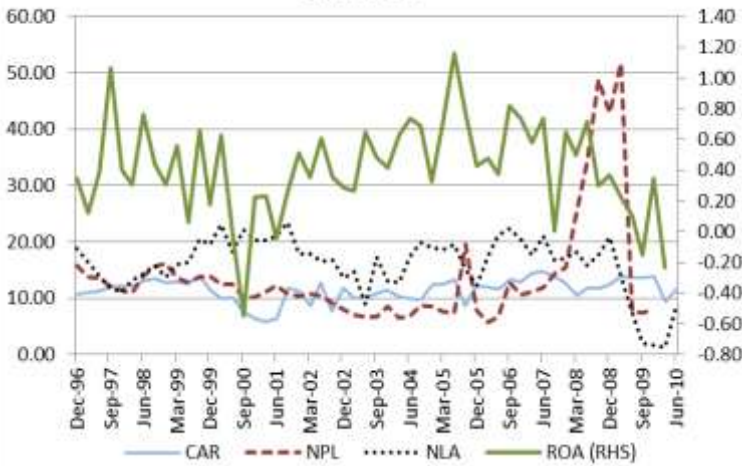
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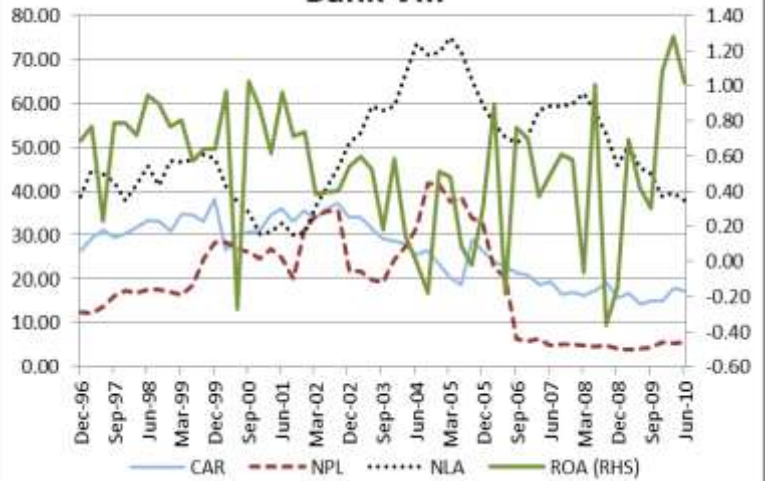
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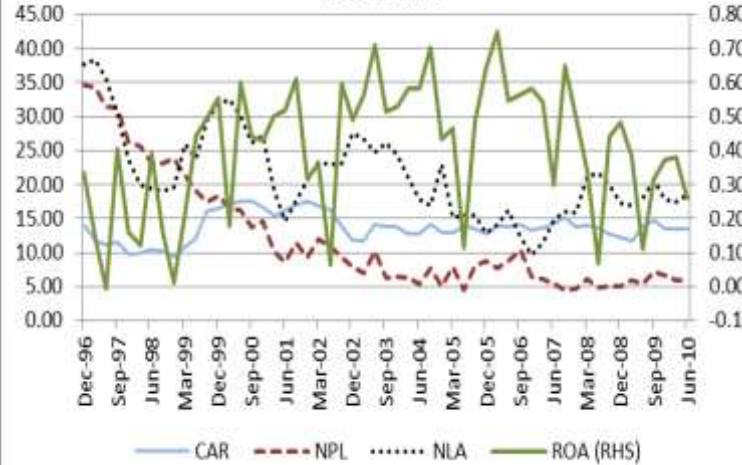
Bank VII



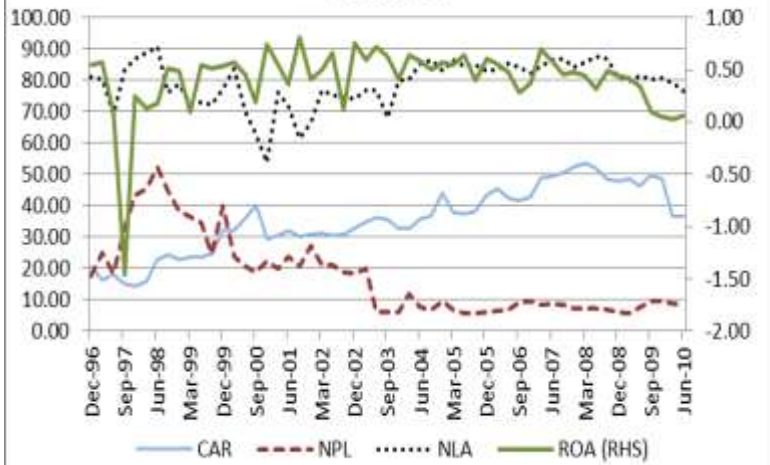
Bank VIII



Bank IX



Bank X



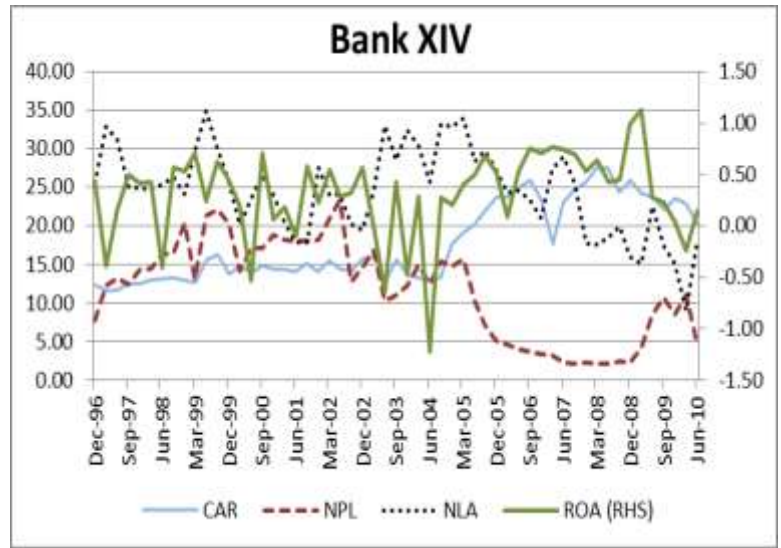
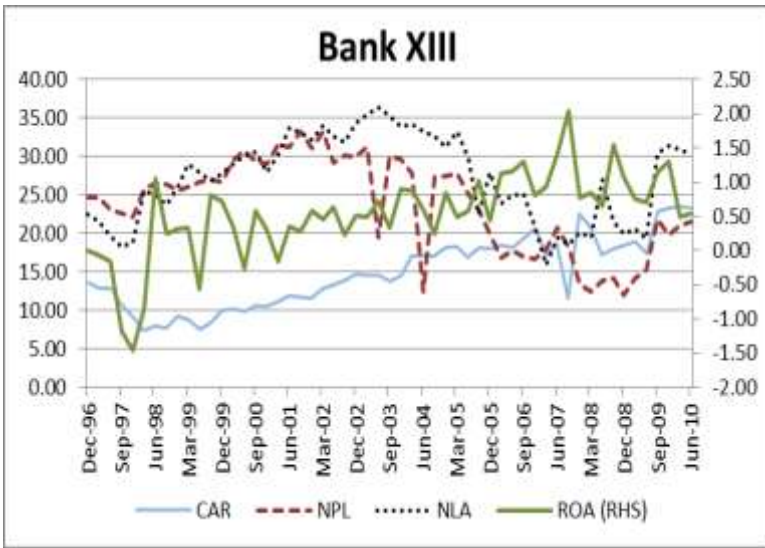
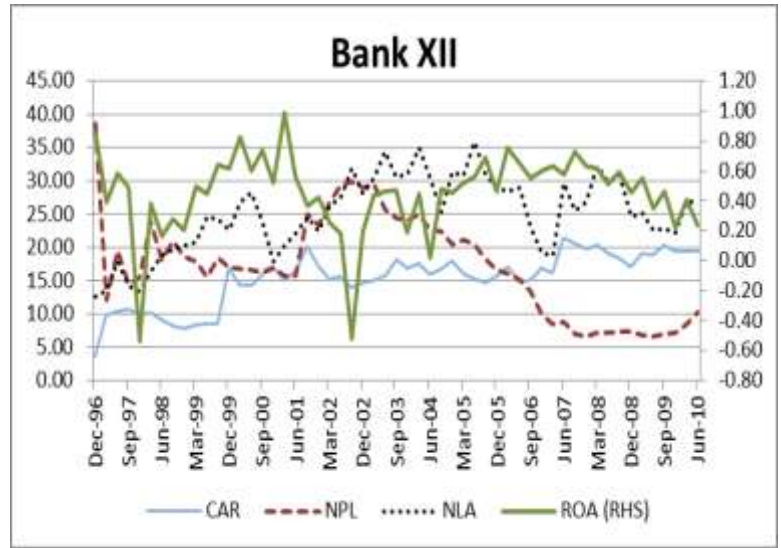
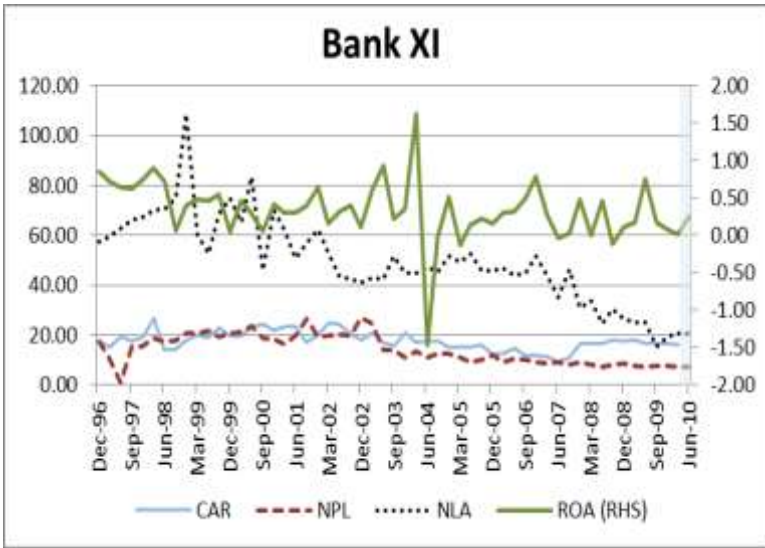


Table 9: Type I and II Errors

Infractions per quarter (Actual Distress)	Predicted Distress (threshold level – 10%)		
	0	1	Total
0	526	0	526
1	203	5	208
Total	729	5	734

The type one and two errors measure the accuracy of the prediction to the actual distress outcomes (in this study the liquidity infractions). The type one error is realized if a distress outcome is predicted when in fact there was none. The type two errors occur when a bank is predicted to be healthy when in fact it was in distress. Table 9 shows that the type one error is null while the type two error is incurred in 203 instances. However, this may be primarily due to the actual data set which counts every reserve infraction per quarter while the model predicts a distress outcome if the reserve infractions occurs at a higher frequency.