

# Insolvency risk in the Jamaican banking system

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# Outline

- Introduction
- Overview
- Literature Review
- Methodology
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- Data
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# Introduction

- Rationale
  - Global economic crisis and continued weakness trigger sovereign debt crisis in Jamaica.
  - Financial system solvency a concern amid Euro crisis and local debt exchanges.
- Focus
  - Determine present solvency levels.
  - Propose a prudential benchmark based on banking sector distress levels in 1990s Jamaica financial crisis.
  - Use forecasted solvency levels as early warning indicator.

# Overview

- Overleveraged, undercapitalized and Interconnected systemically important financial institutions (SIFIs) triggered 2007-08 global financial crisis (GFC).
- GFC caused funding costs to rise on risky emerging market debtors.
- Jamaica's debt/GDP ratio to increase by 20.2% to 134.2% in FY 2010/11 from pre-crisis levels.
- GOJ forced to restructure debt with launch of JDX (2010) and NDX (2013).
- Margin calls and debt restructuring weakened balance sheets of banks.



1992-1996:  
Indigenous  
financial  
institutions in  
distress



1997:  
Creation of  
FINSAC



1997, 2002,  
2004:  
reforms of  
major  
Banking  
legislation



2007:  
US Subprime  
mortgage  
bubble  
burst



2008:  
Lehman  
Brother  
bankrupt



2009:  
Jamaican  
economy  
record -3.1%  
decline



2010, 2013:  
GOJ  
Selective  
Default, lau  
nch JDX &  
NDX

# Literature Review

- Approaches to measure insolvency risk:
  - Z-score model: Altman (1968); Hannan and Hanweck (1988); Boyd *et al* (1993)
  - Contingent Claims Analysis: Gray, Merton, and Bodie (2005)
- Altman (1968)- develop an accounting-based approach and used a linear combination of five accounting and market variables to produce a credit score.
- Hannan and Hanweck (1988)- develop a probability distribution which depend on the interaction of an institution's leverage, profitability, and potential magnitude of return shocks.
- Regional Studies:
  - Lewis (2010)- Contingent Claim Analysis - based on Black-Scholes-Merton's option pricing theory and estimated the distance-to-default and the probability of default for publicly listed financial institutions in the Jamaican banking sector.

# Methodology

- Z-score (1988) made possible by applying Chebyshev's theorem:

$$P\{X - \mu \geq k\sigma\} \leq \frac{1}{k^2}$$

$$z = \frac{\mu + L}{\sigma}$$

$$P\{X - \mu \geq k\sigma\} \leq \frac{1}{z^2}$$

$$P\{X - \mu \geq z\} = \Phi_{X-\mu}(z)$$

$\mu$ : mean return

$\sigma$  :standard deviation

$k$ : no. of standard deviations from the mean

$L$  :leverage ratio.

# Model Refinement

## Return on risk-adjusted capital (RORAC)

- $RORAC = \frac{\text{Adjusted Income}}{\text{BIS risk-based capital requirement}}$
- Incorporates BIS regulatory capital.
- Captures market risk, credit risk and operational risk.

## Economic Leverage ( $L_e$ )

- $L_e = \frac{\text{BIS capital requirement}}{\text{Assets}_{on-balance} + \text{Assets}_{off-balance}}$
- Traditional leverage measure ignores risk associated with off-balance sheet activity.
- Breuer (2000) propose adding the on-balance sheet asset equivalent of off-balance sheet activity.

Refined model:

$$Z = \frac{\mu_{RORAC} + L_e}{\sigma_{RORAC}}$$

# Methodology

- Macroeconomic model of the system:
  - The reduced form of the Vector Error Correction Model (VECM) is represented by:

$$\Delta\Psi_t = \alpha + \Pi\Psi_{t-1} + \sum_{i=1}^I \beta_i \Delta\Psi_{t-i} + \varepsilon_t$$

With cointegrating equation:

$$\Psi_t = \alpha + \rho\Psi_{t-1} + \varepsilon_t$$

$\Psi_t$  is a vector of endogenous variable : z-score (bank stability), debt/GDP (fiscal impact), terms of trade (external sector effects), interest rates (monetary) and nominal GDP (supply shocks).



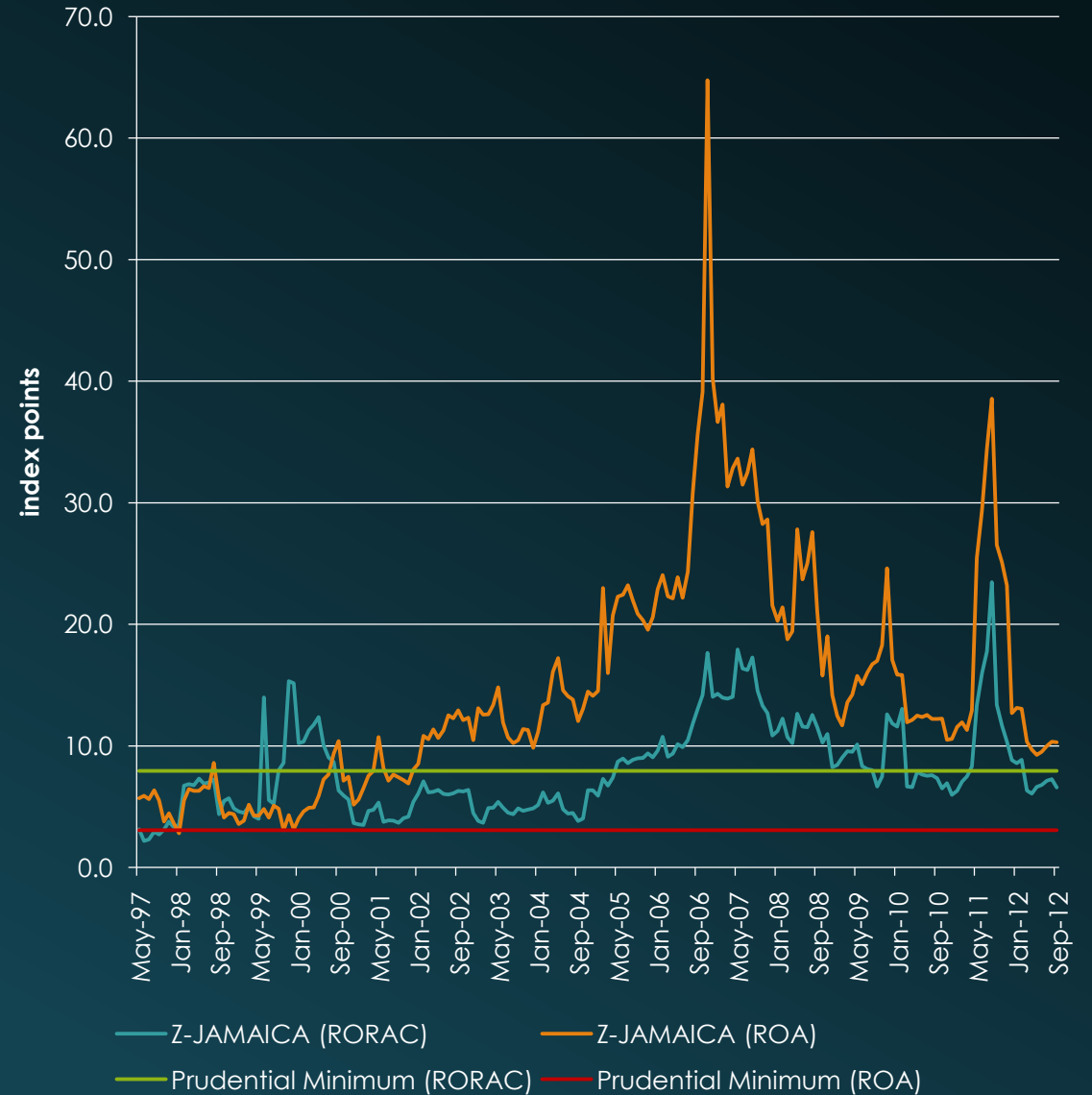
# Data

- June 1996 to September 2012
- Balance sheet data:
  - Monthly total assets, contingent accounts, and buffer capital
  - Quarterly pre-tax profits, Tier 1 and Tier 2 capital
- Macroeconomic variables:
  - Monthly total public debt, 180-day T-bill interest rate, and Terms of Trade index
  - Quarterly real and nominal GDP

	z-Jamaica	Debt to GDP	Terms of Trade	180-day T-bill	Nominal GDP
Mean ( $\mu$ )	8.51	4.693	4.351	0.012	178895.40
Std. Dev. ( $\sigma$ )	7.40	0.192	0.212	0.004	81967.01
Skewness (S)	24.50	-1.015	-0.454	0.239	0.348
Kurtosis (K)	2.20	2.550	1.924	2.731	1.726
Jarque-Bera	3.95	33.330	15.277	2.320	16.254
Probability	0.96	0.000	0.000	0.313	0.000

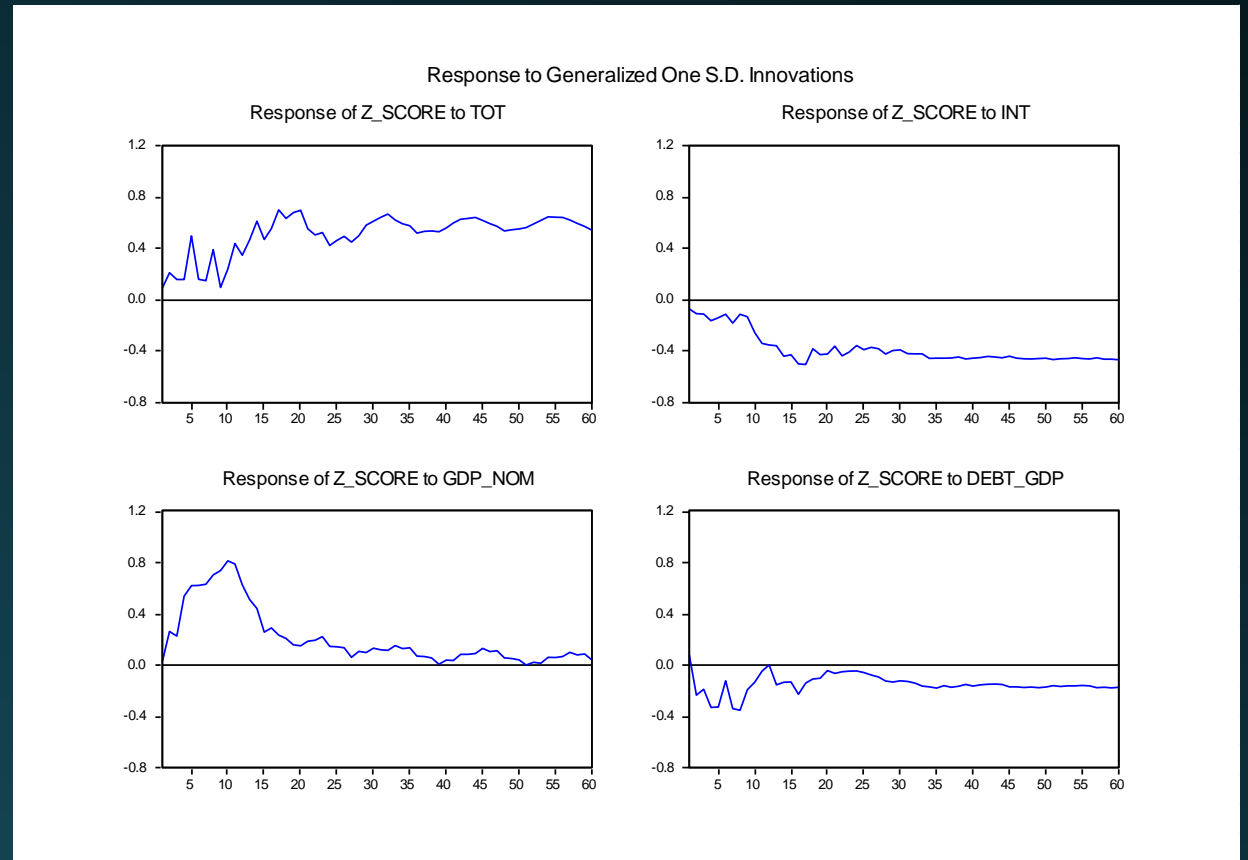
# Results and Discussion

- Traditional z-score indicate lower levels of insolvency risk and greater volatility relative to the modified z-score using RORAC.
- The prudential minimum based on crisis period1 (1997-1999):
  - z-Jamaica (RORAC): 7.94*
  - z-Jamaica (ROA): 3.07*
- The financial system exhibited significant risk of insolvency relative to the prudential minimum up to Q1 2005.



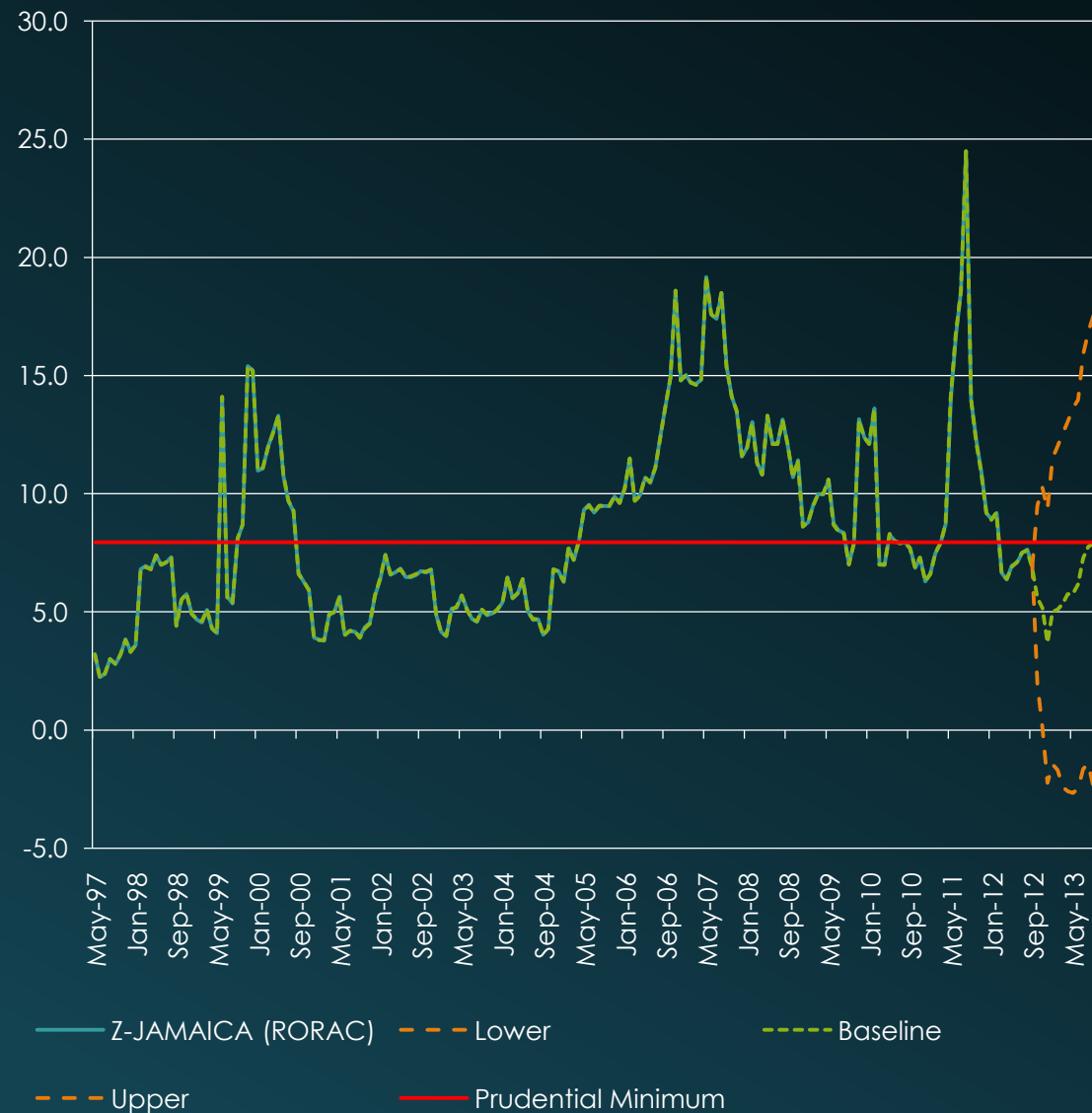
# Impulse response functions

- The results of the impulse response functions (IRF) corresponded with intuitive expectations as an improvement in the real sector of the economy result in an expansion of the banking sector while an increase in bank funding costs and the overall debt overhang had a dampening effect on the banking sector.

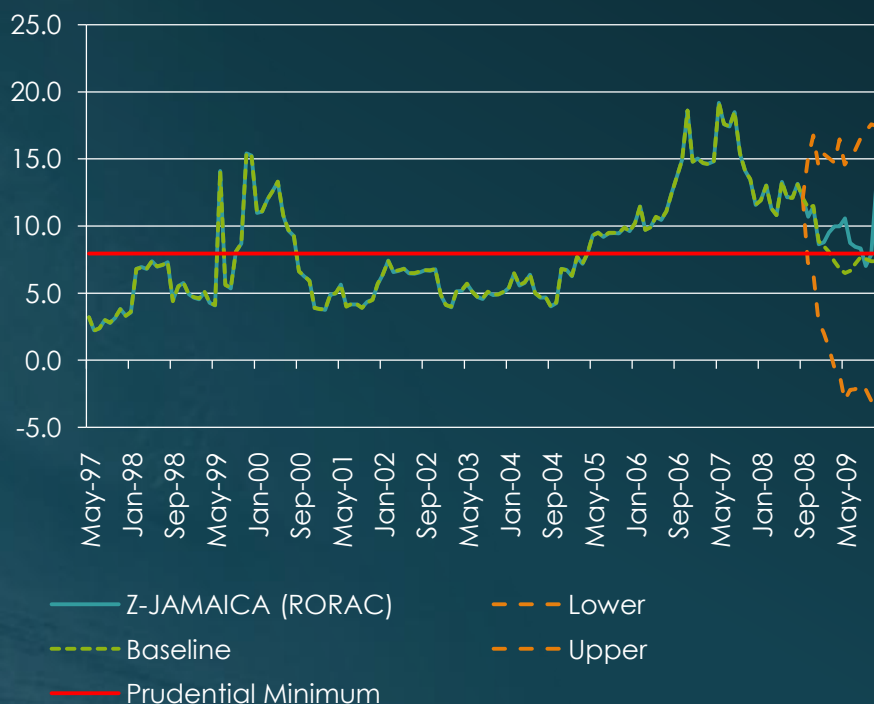


## Forecasted z-score (out-of-sample): Sept 2012-Sept 2013

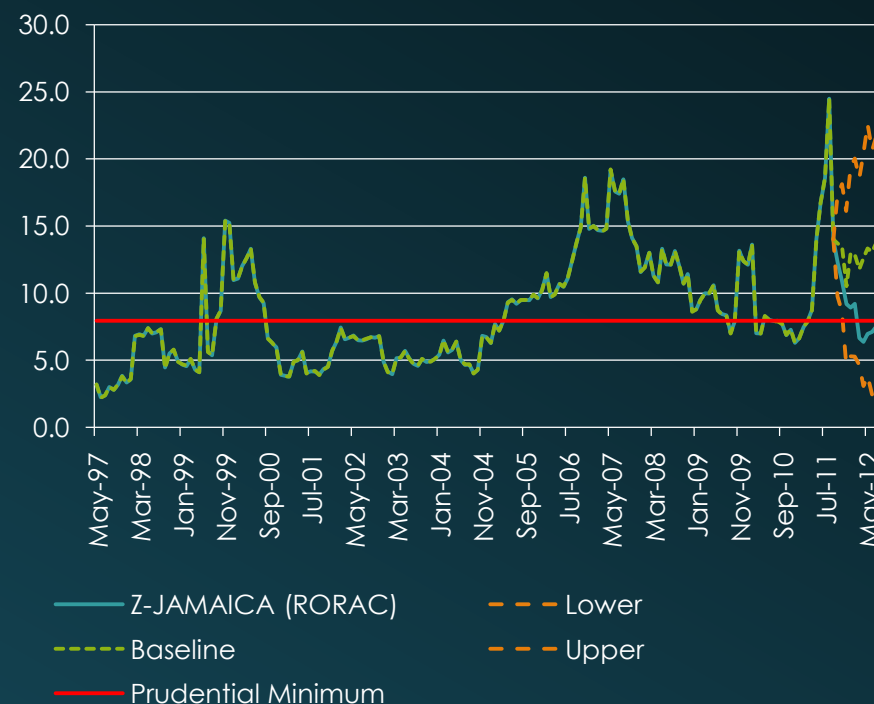
- The VECM is a weak predictor of insolvency risk for both in-sample and out-of-sample forecasts at a 95% confidence level.
- Tended to over-forecast with an average absolute error of 4.19 units
- The failure of the model is more likely due to the inability for an aggregate measure to forecast bank specific risks.



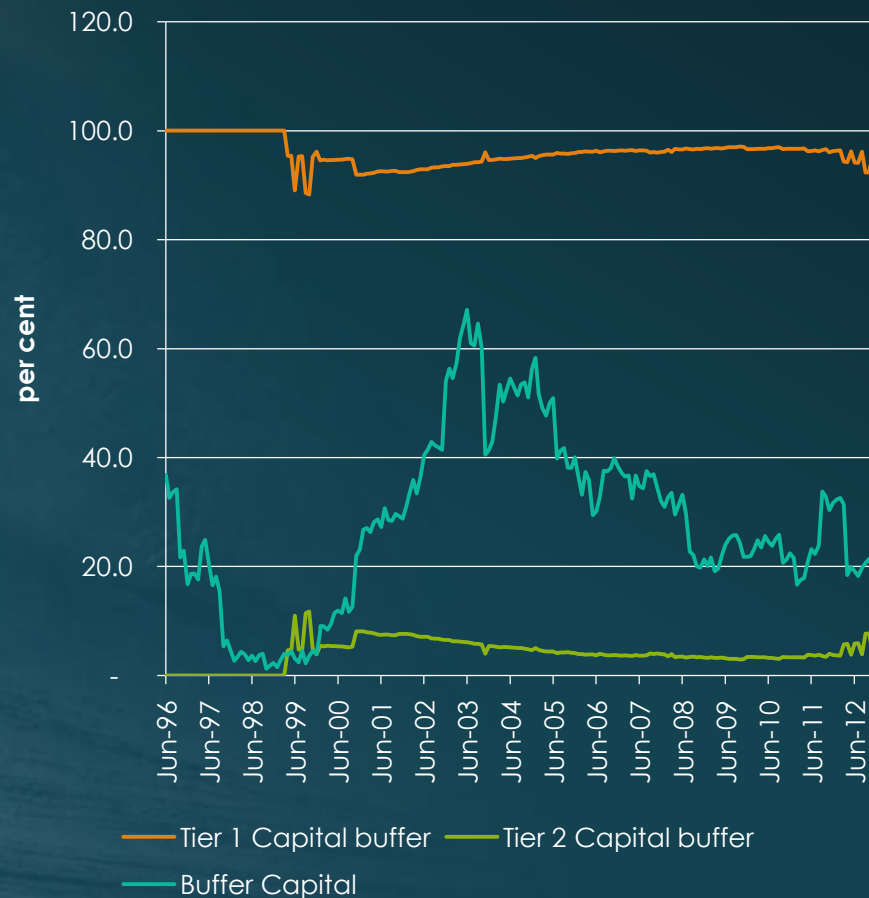
## Forecasted z-score (in-sample): Global financial crisis (Sept. 2008- Nov. 2009)



## Forecasted z-score (in-sample): post-crisis (Oct. 2011-Sept. 2012)

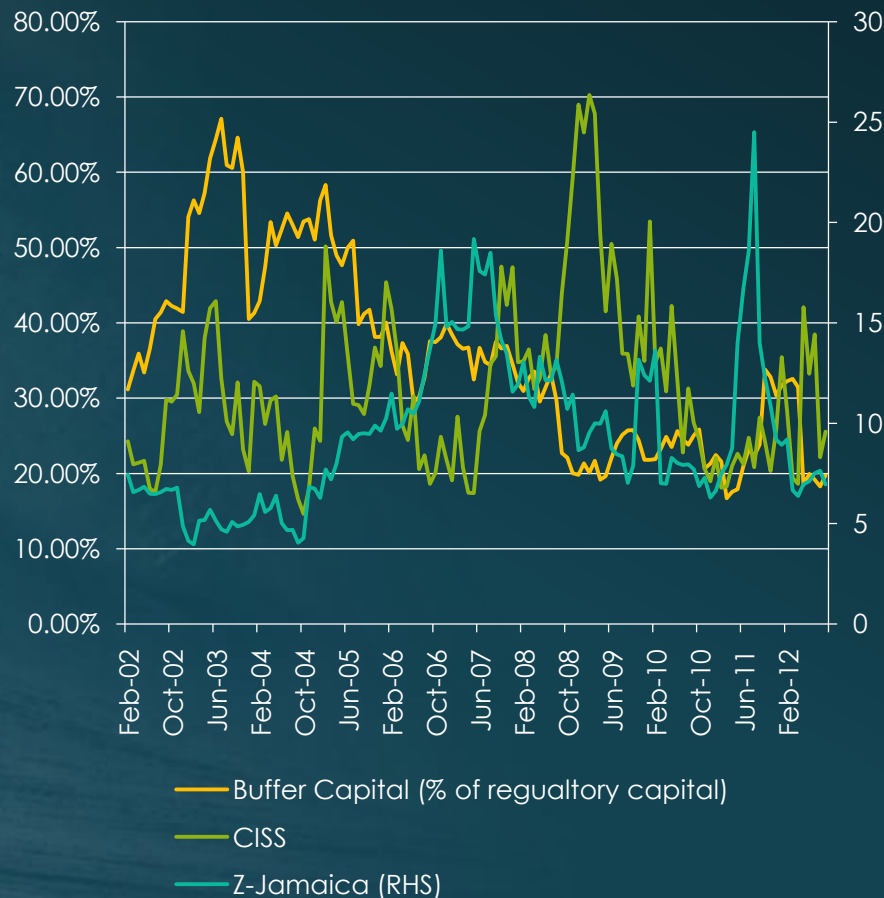


# Discussion on capital and market behavior



- Elizalde and Repullo (2006) analyzed *market discipline* on regulatory, economic and actual capital levels using the single factor model (Vasicek, 2002) of Basel II.
- Actual capital levels were determined by PD, LGD, exposure to systematic risk, loan and deposit rates, funding costs and minimum capital requirement.
- In Jamaican banking system, bank actual capital levels were much greater than the regulatory minimum.
- Following the restructuring of the financial system in June 1999, and the regulatory reforms in 2001 and 2002, banks capital increased to approximately 60.0 per cent above regulatory capital.

# Evolution of bank capital and insolvency risk in Jamaica



- Actual capital was positively affected by both the probability of default and by extension loss given default up until late 2006.
- The increased levels of stress indicated by the Composite Indicator of Systemic Stress (CISS) corresponded with increased risk of insolvency, and bank capital.
- In Dec. 2007, bank capital relationship reversed due to significant losses and tightening of liquidity from fiscal adjustments and financial regulatory reform.

# Summary

- Insolvency risk had significantly improved since the financial crisis in the 1990s at least up until mid-2007.
- The risk of insolvency was markedly higher as indicated by the modified z-score than suggested by the traditional z-score approach (Hannan and Hanweck, 1988).
- Given Jamaica's financial history, it is suggested a prudential minimum of 3.07 be set for the traditional z-score approach and 7.94 for the modified z-score proposed.
- As an early warning signal, the findings of the paper provided a workable predictor of the risk of insolvency. However, further work can be done to improve forecasts.





# Policy recommendations

- The use of economic capital models in determining capital adequacy while taking into account their internal risk-based solutions to the capital levels believed sufficient to mitigate against insolvency.
- Introduction of a leverage ratio recommended by Basel III as a macro-and micro-prudential tool combined with BIS capital requirements.

**THANK YOU**

