September 2013

The Nexus between Financial fragility Conditions, Banking Sector Profitability and the Macroeconomic Environment in Jamaica

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ABSTRACT

This paper applies a contingent claims approach (CCA) as employed in papers by Gapen et. al (2004), Gray et. al (2003 and 2007) to derive a measure of the exposure of the Jamaican banking system to default risk between 2004 and 2011. The resulting vulnerability indicator is then used in a Vector Auto Regression (VAR) model of macro-financial variables in order to trace the impact of macro-economic shocks on banking system fragility and vice versa. The results underscore the importance of financial stability in preserving the economy from falling into sharp periods of recession and highlight the increasingly important role that an effective enterprise risk management programme (ERM) implemented by banks will play in ensuring both the sustainability of their profits as well the strategic realignment of their business models to ensure that these profits are sustainable and support increased levels of economic growth.

The 45th Annual Monetary Studies Conference
Jamaica, 2-4 October 2013

Keywords: Financial Stability, Money and Credit, Bank Failure
JEL Classification: E4, E5, G11

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I. INTRODUCTION

The case for greater understanding of the dynamic linkages between the financial system and the macroeconomy can hardly be overstated. The cost of banking crises, historically, has been well documented in the crisis literature including the substantive works of Caprio et al. (2005), Laeven and Valencia (2008), and Reinhart and Rogoff (2009).[2] Systemic banking crises are disruptive events not only to financial systems but to the economy as a whole and while banking crises of the past have differed in terms of underlying causes, triggers, and economic impact, the research has shown that they share many commonalities. Of additional concern are the findings of Laeven and Valencia (2010) that show that the economic cost of the new crises is on average much larger than that of past crises, both in terms of output losses and increases in public debt. They find that the median output loss is 25.0 percent of GDP in recent crises, compared to a historical median of 20.0 percent of GDP, while the median increase in public debt is 24.0 per cent of GDP in recent crises, compared to a historical median of 16.0 percent of GDP.[3,4] These differences in part reflect an increase in the size of financial systems, the increasingly interconnected nature of financial and economic activity, the growing complexity of both the financial instruments (as well as corporations that create, manage and distribute these products) and possibly differences in the size of the initial shock to the financial system. With specific reference to emerging economies in the 1990s, high-levels of non-performing loans, significant growth in the number of financial institutions coupled with internal and external liberalization were features which tended to characterize economies which had severe banking crises. For instance, before the start of a banking crisis, the ratio of bad loans to total loans was Mexico (September 1994) and 9.3 percent in Venezuela (end-1993) (Pazarbasioglu and Van der Vossen, 1997).[5]

Whereas, the costs of financial crises (atleast in a historical sense) are known ex-post, less well known or understood is how financial fragility is transmitted from the banking sector through to the economy and how shocks to the macroeconomic environment are perpetuated and amplified over time and impact the financial stability of the banking system. The lack of understanding of these matters stems almost entirely to the fact that modern macroeconomic frameworks have assumed away the probability that an agent can default. An assumption that is proving costly in the 'new normal' of increasing exposure to shifts in market sentiments, macro-economic shocks and high and rising public debt. As Goodhart (2011) points out, with default assumed away, there can be no role for financial intermediaries, for financial disturbances, or even for money. Models incorporating defaults are, however, harder to construct, in part because the

[2] (Caprio, Klingebiel, Laeven, & Noguera, 2005), (Laeven & Valencia, Systemic Banking Crises: A New Database, 2008), (Reinhart & Rogoff, 2009), (Pazarbasioglu & Van der Vossen, 1997)
[3] Output losses are computed as deviations of actual output from its trend, while the increase in public debt following a banking crisis is computed over the three year period following the start of the crisis.
[4] (Laeven & Valencia, Resolution of Banking Crises: The Good, the Bad, and the Ugly, 2010).

representative agent fiction must be abandoned. As a result, as White (2010) states absent any fears of crisis, few ex ante preparations were made to help improve crisis management (e.g., adequate deposit insurance, special legislation for the insolvency of financial institutions, and so on).

Of course there are significant methodological issues and challenges to be surmounted. Default is hard to model formally, partly because it is a discontinuous variable. Firstly, we must determine what exactly we mean by financial fragility and how this is to be measured. And secondly, we must adopt a methodological framework which can take into account the multiple feedback processes surrounding the propagation of macro-financial shocks on financial stability considerations and well as to trace the impact of heightened financial sector fragility on the macroeconomy.

The key research questions of this paper are i) what is, if any, the relationship between banking sector fragility and economic growth considerations ii) what is, if any, the relationship between banking sector profitability, economic growth and financial stability considerations. These questions are addressed as a fillip to a greater understanding of the role of the banking sector in economy as a means of exploring the increasing important role of risk management functions within banks in an increasingly complex and dynamic world.

The paper proceeds as follows. The next section, Section II, presents the data to be utilized in the analysis. Section III presents the methodological framework. Section IV contains the results, and the conclusion is given in Section V.

II. DATA

Financial Sector Data

Data for deposit-taking institutions consists of four highly liquid stocks listed on the Jamaica Stock Exchange (JSE).[6] Together these firms represent a large proportion of the asset base of the deposit taking institutions in Jamaica over the period. In addition, and perhaps more importantly, their insolvency risk has a direct and significant influence on the health of the Jamaican financial system both directly due to their size as well as indirectly via the interbank market. The sample data covers the period from December 2004 to June 2011. The analysis uses daily stock price data between end-December 2004 and 30 June 2011. Monthly data on the shares outstanding was gathered from hard-copy data available from the JSE. Both these series are used to compute the market value of each institution's equity as well as the volatility of the institution's equity. The historical volatility of equity is measured by taking the standard deviation of the returns on the equity valuations for traded securities over two-hundred and fifty trading days where returns are computed as the log of the ratio of value of equity at time t and closing value of equity at time t-1. The daily volatility of equity returns is annualized by multiplying by

[6] Information on Shares Outstanding was only available hard-copy back do December 2005

the square root of two-hundred and fifty trading days. Bank's balance sheet information are available quarterly from the Bank of Jamaica and are used to gather information on the current liabilities and long-term liabilities which is used to calculate the default barrier (DB). Balance sheet items including Deposits, Due to BOJ, Commercial Banks, Specialized Institutions, Other Specialized Institutions and Securities sold under Repo, and Other Current Liabilities are used to compute the short-term liabilities. Other Liabilities on the balance sheet are used to compute long-term liabilities. The descriptive statistics for the banks used in this study are shown in Table 1. Together these variables are used to derive the quarterly distance-to-default (and the implied probability of default) for the deposit-taking institutions, which when transformed, are used as the measure of the risk of default of the sector over the period. Additionally, the annual change in the value of market value of equity (Eq) of the four listed firms is computed and used to proxy the market's perception of the change in the present value of returns to banks.

Table 1. Descriptive Statistics for Deposit-Taking Institutions Included in Sample, 2004 Q4 to 2010 Q2

	Stats	2004	2005	2006	2007	2008	2009	2010
Bank 1	Max Volatility (%)	21.6	20.0	16.5	13.6	20.1	28.5	26.8
	Current Liabilities (E.O.P)	109.8	110.0	109.3	111.8	115.8	119.4	128.8
	LT Liabilities (E.O.P)	1.8	2.1	2.4	1.7	1.6	1.3	1.0
	Mean Value of Equity	56.9	48.3	43.0	52.9	54.4	34.4	40.7
Bank 2	Max Volatility (%)	22.4	45.84	32.84	12.90	17.71	22.37	23.05
	Current Liabilities (E.O.P)	111.8	110.8	108.0	111.4	117.3	125.3	122.8
	LT Liabilities (E.O.P)	1.7	1.7	2.6	2.0	1.9	1.9	2.1
	Mean Value of Equity	67.5	61.9	61.5	70.4	69.2	53.4	66.7
Bank 3	Max Volatility (%)	36.1	36.97	24.68	31.12	30.66	14.28	14.23
	Current Liabilities (E.O.P)	18.1	18.3	19.1	20.9	21.6	22.3	24.9
	LT Liabilities (E.O.P)	0.1	0.0	0.0	0.0	0.1	0.0	0.0
	Mean Value of Equity	4.0	3.3	4.6	6.2	6.3	4.3	3.5
Bank 4	Max Volatility (%)	24.3	22.77	24.51	26.22	34.35	40.91	41.61
	Current Liabilities (E.O.P)	35.4	35.9	29.3	24.2	28.5	30.4	31.8
	LT Liabilities (E.O.P)	0.8	0.6	0.5	0.4	0.5	0.3	0.3
	Mean Value of Equity	11.0	14.9	9.6	6.7	7.0	3.5	3.6

Notes: Unless otherwise stated all units are in Jamaica Dollar billions. Statistics for 2011 not show as they are not comparable full-year statistics.

Macroeconomic Data

The three macroeconomic variables are used in the analysis are gross domestic product (GDP), the consumer price index (CPI) and short-term interest rates (STINT). Changes in the welfare of the society are proxied by quarterly real changes in gross domestic product. Changes in the CPI are used to compute the inflation rate (INF) and the 180-day

Treasury Bill rate is used to capture short-term interest rates. The first two variables are obtained from the Statistical Institute of Jamaica (STATIN) and the last variable is obtained from the results of Treasury Bill auctions carried out by the Bank of Jamaica. Each of these series, GDP, INF and STINT, are quarterly in frequency between December 2004 and June 2011.

III. METHODOLOGY

3.1 Deriving a Measure of Banking Sector Fragility in Jamaica

The approach followed in this section uses a contingent claims approach (CCA) as employed in papers by Gapen et. al (2004), Gray et. al (2003 and 2007) which proposes a methodology for computing a continuous default measure using high-frequency market data.[7]

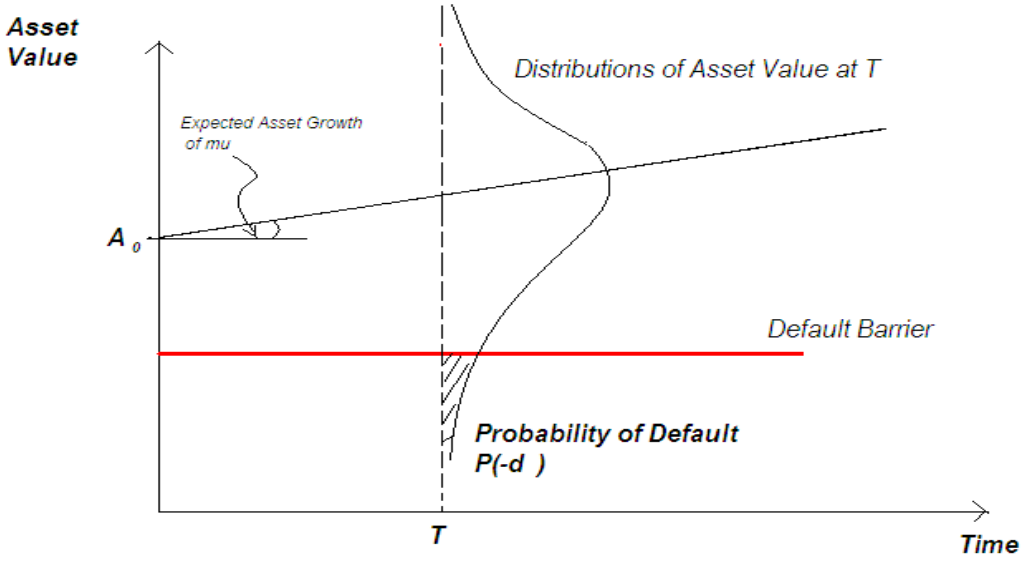
The Merton model is a structural model of bank insolvency, capturing the likelihood that a firm's assets in the future are likely to fall below its liabilities rendering the institution bankrupt. The value of the firm's liabilities is also known as the default barrier (DB). The distance to default is a function of the growth in firm's assets, the volatility of the firm's assets, as well as the difference between the market value of the firm and the default barrier (see **Figure 1**). The intuition behind this approach is the closer that the market value of the banking sector's assets are to its liabilities (default barrier) then the more likely it is that the entity will fail. This distance is captured as the number of standard deviations and by invoking the assumption that the distribution around the mean value of the assets is normally distributed one can transform that distance into a probability measure. The computation of this distance to default is a relatively straight-forward and captured closed form equation shown below:-

$$d_2^* = \frac{LN\left(\frac{V_0}{DB}\right)+\left(\mu-\frac{\sigma_v^2}{2}\right)T}{\sigma_v\sqrt{T}} \qquad (1)$$

Note that V_0 is the market value of the banking sector's assets, DB is the default barrier, μ is the implied growth rate in the banking sector's assets, T is the time horizon for the forward-looking evaluation of value, and σ_v is the volatility in the value of the banking sector's assets. The numerator measures the distance between the expected one-year ahead market value of the firm's assets (assuming T is set to one) and the distress barrier while the denominator is used to scale the numerator with respect to units of standard deviations.

[7] (Gapen, Gray, Lim, & Xiao, 2004), (Gray, Merton, & Bodie, A New Framework for Analyzing and Managing Macrofinancial Risks of an Economy, 2003), (Gray, Merton, & Bodie, New Framework for Measuring and Managing Macrofinancial Risk and Financial Stability, 2007)

Figure 1: Merton's Structural Model of Bank Insolvency



Equation 1 can be converted into a probability of default (PD) using the cumulative normal distribution. That is the probability of default of the banking sector can be derived by evaluating the function, $N(-d_2^*)$ (McDonald, 2002).

3.2 Financial Sector Fragility and Economic Growth and Banking Sector profitability: The Nexus

Since defaults reflect an underlying, credit change indicator that has a standard normal distribution, and by definition lie between 0 and 1, and the paper desires to map the evolution of this variable unto a space defined by the macroeconomic variables that are bounded by plus and negative infinity. Thus a further transformation of our risk measure for banking system stability is made.

$$PoD = N^{-1}(PD) + 5 \quad \text{, Max (2, PoD)} \quad (9)$$

Where N^{-1} is the inverse standard normal cdf. This transformation allows for the modelling the PD as a function of identifiable macroeconomic and financial developments X. Thus the relationship to be modeled can be represented as:

$$Y = XB + e^{8} \qquad (10)$$

[8] An alternative way to understand the purpose for the transformation is the recall that defaults reflect an underlying, continuous credit change indicator ("normal equivalent deviate" in the language of probit analysis) that has a standard normal distribution. Thus, we can state the relationship as: PD = N(XB + e), where the inverse normal cdf transformation converts this equation to a linear problem Y = XB + e.

The construct of second portion of equation 9, is to test the hypothesis that PoD is a threshold variable. That is, when PoD is sufficiently bad, (high PoD), it will bring about a significant decline in real growth (GDP), but once the values of this variable is good enough (below a given threshold), further improvement has no statistically significant effect on the macro-financial variables. That is, PoD, is a threshold[9] variable with a non-linear effect on GDP.

In the evaluation of the impact of financial stability and economic growth this paper follows closely the (Aspachs, Goodhart, Segoviano, Tsomocos, & Zicchino, 2006). Specifically, since GDP and financial fragility have a, possibly, complex, simultaneous relationship Aspachs et. al (2006) employ a Vector Auto Regression to determine whether such a relationship does in fact exist and to trace out the transmission from one variable to the other. Since the VAR approach treats all variables in the system as endogenous it is an ideal framework for this exploration. The reduced form vector auto-regression (VAR) is used primarily to estimate the joint dynamics of the macro-variables on the evolution of financial fragility and vice versa. The VAR expresses each variable as a linear function of its own past value, the past values of all other variables being considered, and a serially uncorrelated error term. Each equation is estimated by ordinary least squares (OLS) regression, while the number of lagged values to include in each equation is determined by a number of different methods discussed below.[10] The error terms in these regressions are the 'surprise' movements in the variables, taking past values into account. If these variables are correlated with each other, then the error terms in the reduced form model will also be correlated across equations.

A general VAR (p) process with white noise can be represented mathematically as

$$\boldsymbol{x}_t = \Phi_1 \boldsymbol{x}_{t-1} + \Phi_2 \boldsymbol{x}_{t-2} + ... + \boldsymbol{\varepsilon}_t \qquad (11)$$

$$= \sum_{j=1}^{p} \Phi_j \boldsymbol{x}_{t-j} + \boldsymbol{\varepsilon}_t$$

or, if the lag operator is used,

$$\Phi(\boldsymbol{L}) = \boldsymbol{\varepsilon}_{t,}$$

where $\Phi(\boldsymbol{L}) = \boldsymbol{I}_k - \Phi_1 \boldsymbol{L} - ... - \Phi_p \boldsymbol{L}^p$.

The error terms follow a vector white noise, i.e.,

$$E(\varepsilon_t \varepsilon_s^{'}) = \begin{cases} \Omega & for \quad t = \quad s \\ 0 & otherwise \end{cases}$$

with Ω a $(\boldsymbol{k} \times \boldsymbol{k})$ symmetric positive define matrix.

The VAR is computed using the macro variables, where the macro variables are given by equation (12)

[9] The threshold of 2 was derived empirically by using a grid search.
[10] See Appendix for the diagnostics for the estimated VAR. See the E-views Manual for more details. (Quantitative Micro Software, LLC, 2004).

$$
\begin{aligned}
X_t &= c + B(L)X_t + v_t \\
X_t &\equiv (PoD_t, GDP_t, Eq_t, Infl_t, \text{Stint}) \qquad (12) \\
v_t &\sim N(0, \Omega)
\end{aligned}
$$

where PoD_t, GDP_t, Eq_t and Inf_t represent the metric for financial instability, the real quarterly growth rate of GDP, annual change in banking sector equity, the quarterly inflation rate, respectively. The reduced form residuals, v_t, are distributed multinomial with mean zero and covariance matrix Ω, and $B(L)$ are the coefficients of the lags. The lag length, L, for the VAR is set at three, which is supported by Final prediction error (FPE), the Hannan-Quinn information criterion (HQ) and the Akaike Information Criterion (see **Appendix**).[11]

The standard practice in VAR analysis is to analyze results from impulse responses, which yield how each variable is affected given a shock at time t. These are reported in the next section.

Since the actual variance-covariance matrix of the errors is unlikely to be diagonal, to isolate shocks to one of the variables in the system, it is necessary to decompose the residuals in such a way that they become orthogonal. This is achieved by applying a Choleski decomposition of the variance-covariance matrix of the residuals (this is equivalent to transforming the system into a recursive VAR). The identifying assumption is that the variables that come earlier in the ordering affect the following variables contemporaneously, as well as with lags, while the variables that come later affect the previous variables only with lags. The specific order used in this paper is that the probability of default affects all other variables in the system contemporaneously and with lags, while macroeconomic variables such as GDP and inflation affect the default risk of the banking sector only with a lag. [12] The Choleski decomposition is therefore used to identify the shocks and obtain estimates of the impulse-response functions.

IV. THE RESULTS

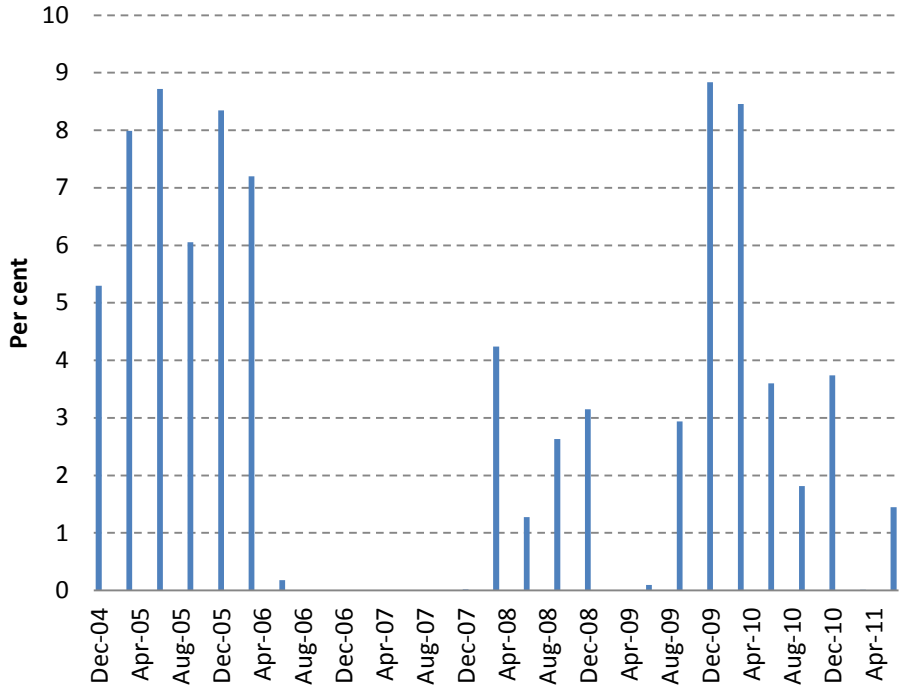
Part 1: The Evolution of Financial Sector Fragility – Deposit Taking Institutions

Although Jamaica did not experience any bank failures it has had spells of heightened financial fragility over the period 2004 through to 2011, particularly in 2005 and towards the end-2009 into early 2010 (see **Figure 1**).

[11] However, the sequential modified LR test statistic (LR) and Schwarz information criterion (SC) both chose a lag-length of one.

[12] Most applications on monetary policy are interested in computing impulse responses and identifying structural shocks from the reduced form.

Figure 1. Evolution of the Probability of Default - Deposit Taking Institutions



The Jamaican economy was challenged during 2005 by a number of exogenous shocks. Primary among these were the impact of two hurricanes which adversely affected inflation as well as inflation expectations and output, specifically from agriculture and tourism. Another negative development in the year was the significant increase of approximately 36.0 per cent in the average price of international crude oil. External supply constraints in the face of rising global petrol consumption, natural disasters and recurring geopolitical concerns were the main sources of rising and volatile oil prices throughout 2005. The oil price shock influenced a widening of the current account deficit of the balance of payments to US$1 078.7 million or 11.5 per cent of GDP from 5.8 per cent in 2004 (Bank of Jamaica, 2005).

The increase in the probability of default (PoD), particularly in 2005, was primarily a function of *increased volatility of equity* while the market value of DTIs assets remained flat growing only by 0.68 per cent for the calendar year. In particular, the volatility of the bank's equity increased to 0.21 at end-2004 relative to 0.14 at end-2004. This was also compounded by an *increase in the volatility of the market value of the banking sector's assets*. The volatility of the baking systems assets increased to 0.07 at end-March 2005 before ending the calendar year at 0.05 relative to 0.04 recorded at end-2004. The increase level of volatility was related to the market's negative assessment of the sustainability of the high levels of profitability which were a 'wind-fall' from the restrictive monetary policy stance taken in 2003 as well as the banking system's increased susceptibility to interest rate risk. In particular, the interest rate repricing profile of banking sector assets lengthened relative to liabilities reflecting increased levels of

interest rate risk over 2005. The worsening repricing profile may have been related to the continued expectation of further reductions in interest rates by market participants (Bank of Jamaica, 2005). Indeed, the lower interest rate environment reduced the interest income margins financial stocks contributing to less than favourable earnings results for many of the listed companies.

The heightened levels of financial fragility observed towards the end-2009 into early 2010 reflected the impact of the onset of the global financial crisis which was exacerbated by macro-economic weaknesses in the Jamaican economy and increasing uncertainty in the domestic financial market. These shocks were transferred to the balance sheets of the financial sector, reflecting itself in lower equity prices, increased asset volatility, and decreasing distance to distress. The banking sector was particularly vulnerable as a direct consequence of (i) their large holdings of GOJ securities, (ii) the short-term nature of their funding base. Equity valuations began to decline in June 2008 and continued to decline on a near-continuous basis before bottoming out in March 2009. By December 2009 the increase fragility of the banking sector reflected the deterioration in the growth rate of the marked to market value of its assets, on the one hand, and deteriorating prospects for future profitability, on the other. In addition, the sharp drop in external demand emanating for the global financial distress had begun to impair the ability of borrowers to service their loans which manifested itself in rising non-performing loans ratios for the banking sector.

Part 2: The Nexus between financial fragility conditions and the macroeconomic environment

In this section, we examine whether financial fragility feed through to affect real economic outcomes – in particular – GDP growth and inflation and banking system performance with an emphasis on banking system profitability. We also want to examine whether those impacts flow the other way. That is, how do macroeconomic variables and banking system performance impact bank fragility. The two-main hypotheses are to be tested. Firstly, that when the bank default rate increases, GDP falls and that there is a non-linear effects between the impact of changes GDP growth and the banking sector fragility. The second hypothesis is that when banking sector profitability rises, the welfare of agents in the economy rises.

The impulse response functions of the VAR model are used to evaluate these hypotheses. Figure 2 reports the impulse response for a four factor VAR with three lags. The four factors included in the VAR are the probability of default (PoD), the real growth rate of GDP, annual changes in banking sector equity and quarterly inflation.

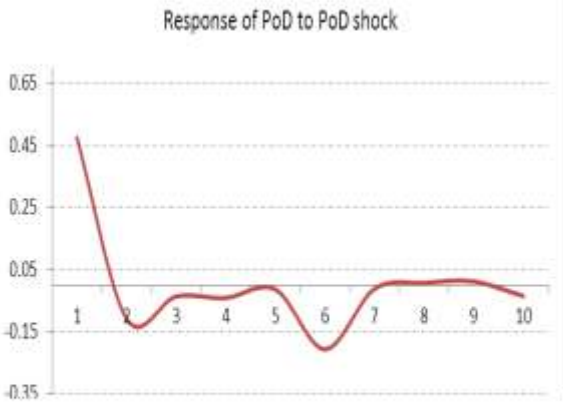
The response of GDP growth to positive shock in PoD is negative, significant and persists for six quarters. That is, an increase in the default probability of deposit-taking institutions induces a significant decrease in the rate of GDP growth. That is, maintaining all other variables constant, a positive shock to the banking sector probability of default (once above a given threshold) has a negative impact on output. This result is consistent

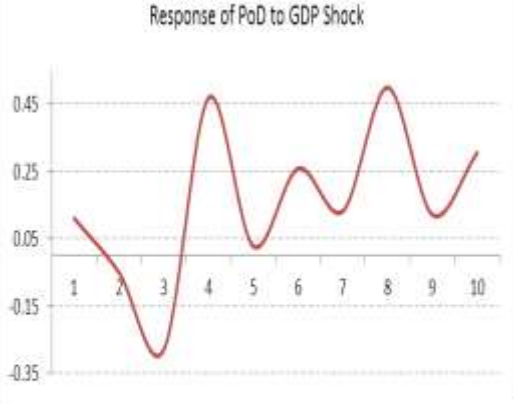
with apriori expectations. On the other hand, the banking system's profitability increases in the short-run to as a result of a positive shock to banking system fragility, but then declines after four quarters. This decline in banking profitability persists for five consecutive quarters. These results suggest that whereas increased risk-taking by banks, which increases banking system fragility, may initially increase profitability in the short-term these profits are not sustainable.

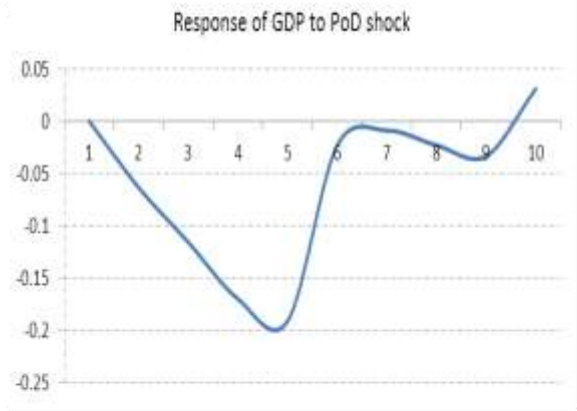
The response of GDP growth to a positive shock on banking sectors equity index is negative and significant. Simply put, the increase in the profitability of the banking sector, as proxied by a rise in banking sector equity values, does not contribute to economic growth. This is counter to apriori expectations which would suggest that when the banking sector is profitable then the intermediation process is efficient and the bank lending channel is effective, both of which are conducive to economic growth. This is also not consistent with the findings in more developed countries of Norway, Japan, Sweden and the UK (see for example, (Aspachs, Goodhart, Segoviano, Tsomocos, & Zicchino, 2006). The negative relationship between increasing banking profitability and economic growth may well have to do with the structure of the balance sheet of the banking sector as well as limitations in the lending channel arising from challenges of moral hazard and asymmetric information. However, a more fulsome discussion of the reasons behind such a finding are beyond the scope of this current paper. Interesting, whereas an innovation to profitability initially results in a reduction financial stability after four quarters the increase in profitability results in excess risk taking leading to an increase in banking fragility as measured by the PoD. One can infer that there is the absence of a strong risk management function within the banking system to curb tendencies towards excess risk taking after periods of 'super-normal' profits. By contrast, a positive shock to GDP results in a significantly positive impact on the profitability of the banking system which is quite persistent and results in decline in inflationary impulses after two quarters which is consistent with the lagged impact of an increase in aggregate supply.

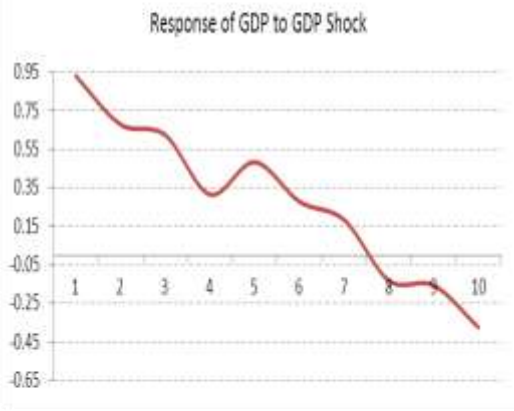
The variance decomposition of the VARs also gives us insight in the contributory factors behind the relationships between bank fragility, profitability and macroeconomic variables. Firstly, we note that both banking system profitability and banking system fragility have a significant effect on economic growth. Specifically, banking system profitability and fragility explain 31.4 per cent and 10.2 per cent of the variation observed in GDP growth over the period for up to 10 quarters after the initial shock, respectively.

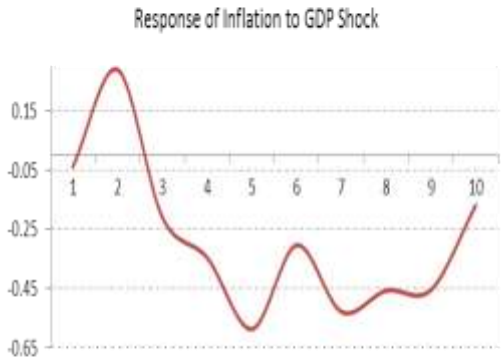
Impulse Responses: 3 lag VAR of PoD, GDP, Equity and Inf

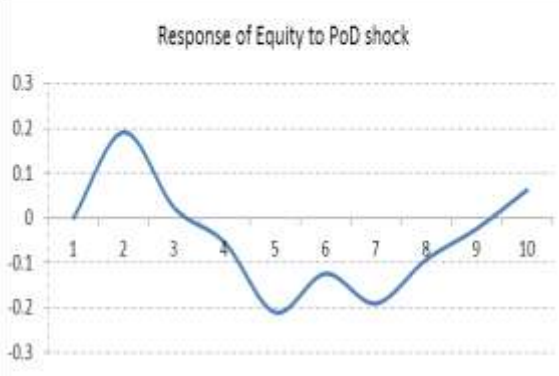


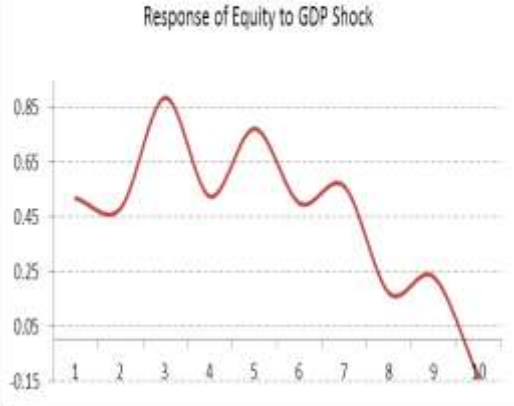






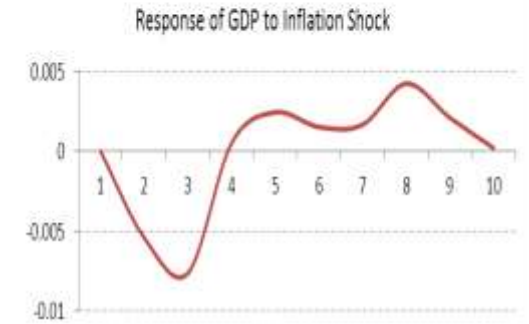


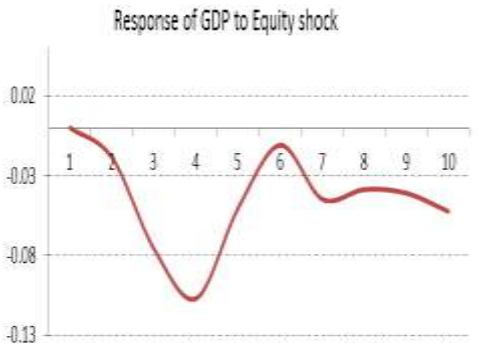




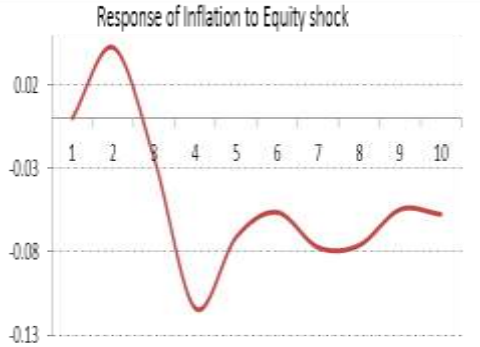
Response of PoD to Inflation Shock
0.02
0.01
0
-0.01
-0.02
1 2 3 4 5 6 7 8 9 10

Response of PoD to Equity Shock
0.05
0
-0.05
-0.1
-0.15
1 2 3 4 5 6 7 8 9 10


Response of GDP to Inflation Shock
0.005
0
-0.005
-0.01
1 2 3 4 5 6 7 8 9 10


Response of GDP to Equity shock
0.02
-0.03
-0.08
-0.13
1 2 3 4 5 6 7 8 9 10

Response of Inflation to Inflation Shock
0.015
0.01
0.005
0
-0.005
1 2 3 4 5 6 7 8 9 10


Response of Inflation to Equity shock
0.02
-0.03
-0.08
-0.13
1 2 3 4 5 6 7 8 9 10

Response of Equity to Inflation Shock
0.005
0.003
0.001
-0.001
-0.003
-0.005
1 2 3 4 5 6 7 8 9 10

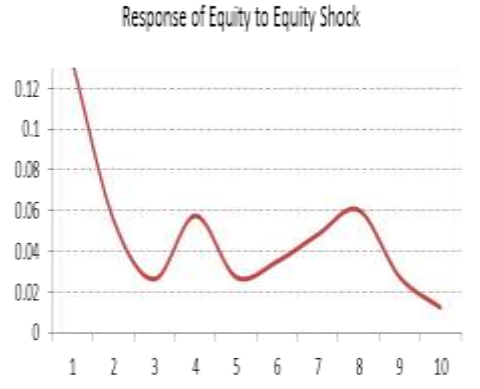

Response of Equity to Equity Shock
0.12
0.1
0.08
0.06
0.04
0.02
0
1 2 3 4 5 6 7 8 9 10

Table 1. Variance Decompositions: percent variations in the row variable explained by the column variable					
	Quarters ahead	*pod*	*gdp*	*equity*	*inflation*
pod	10	58.71	18.08	12.55	10.64
	20	52.49	22.94	14.70	9.85
gdp	10	10.24	51.09	31.41	7.24
	20	9.94	53.04	30.76	6.24
equity	10	23.57	3.21	64.18	9.02
	20	22.60	7.97	60.73	8.68
inflation	10	24.06	16.69	10.88	48.36
	20	22.28	20.47	13.20	44.04

Secondly, banking system fragility explains a non-trivial amount of the variation observed in banking system profitability (23.5 per cent) and inflation (24.06 per cent). Finally, macroeconomic variables have a significant explanatory power in determining the fragility of the banking system.

CONCLUSION

Banks in their role as financial intermediaries face many risks - operational, market and credit related risks. There is some possibility that the firm's operating income will be insufficient to cover those risks should they materialize the firm making the probability of insolvency non-negligible. Even if bankruptcy is avoided, a bank in financial trouble may experience added costs from debt renegotiation, higher costs of funding, foregone value creating financial products, and the opportunity cost of management's time and energy devoted to these problems and related cash flow management issues. It is this broad context that the development and full-implementation of enterprise risk management (ERM) programme is seen as a critical element of any commercial banks strategic plan. These initiatives take on even more significance for two additional reasons within the Caribbean. First, these initiatives are critical given the high fiscal and social costs associated with the failure of banks and the spill-off consequences of losses on welfare (as measured by persistent declines in real GDP). That is, the expected losses arising from the non-implementation of effective ERM programmes is large. But secondly, banks within the Caribbean region operate within economies which face significant exposures to exogenous macro-financial shocks as the last decade has shown. So the *probability* of downside risks is *higher* for financial institutions operating within the Caribbean when compared to their counterparts in more developed economies.

Since an ERM programme is a costly activity, banks would do well to employ risk management to reduce these costs as long as the increase in the value from the reduction is greater than the cost of hedging these risks.[13] This is particularly important after

[13] If the management of these sorts of risks could be done by shareholders then there would be no value-add for firms to undertake extensive risk management programme to reduce or eliminate these costs. On the

periods where the banking system has made significant profits. This study finds that whereas an innovation to profitability initially results in a reduction financial fragility after four quarters the increase in profitability results in excess risk taking leading to an increase in banking fragility as measured by the PoD. One can infer the absence of a strong risk management function within the banking system to curb the tendency towards excessive risk taking after periods of 'super-normal' profits. In order to manage and curb this tendency, banks must become increasingly better and collating the relevant data and measuring these risks systematically and pursuing strategies based not on absolute return but risk-adjusted returns.

More specifically, the challenge for commercial banking over the next few years is whether profitability based on high concentrations in government securities and personal consumption loans is a suitable strategy for pursuing sustainable profits over the medium term. The results of this study shows that the banking system's profitability increases in the short-run to as a result increases in risk-taking which increases banking system fragility but then profitability declines after four quarters. This decline in banking profitability persists for five consecutive quarters. These results suggest that whereas increased risk-taking by banks may initially increase profitability in the short-term these profits are not sustainable. If indeed it is not, then adequate risk thresholds for these risk exposures need to be established and enforced by Senior Management (with oversight by the Board of Directors) and alternate business models and mechanisms to enhance to proper functioning of local credit markets need to be established. These initiatives may not yield to as high a return in the short-run but the reduction in the volatility of earnings will assist in maximizing shareholder value, at worst, and at best will lead to significant reductions in down-side risks in the event of the materialization of these risks.

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other hand, if risk management were costless (which it is not) the firm would certainly eliminate the decrease in firm value due to potential bankruptcy and financial distress costs.

APPENDIX I

Figure 2: Transformed Measure of Banking Fragility

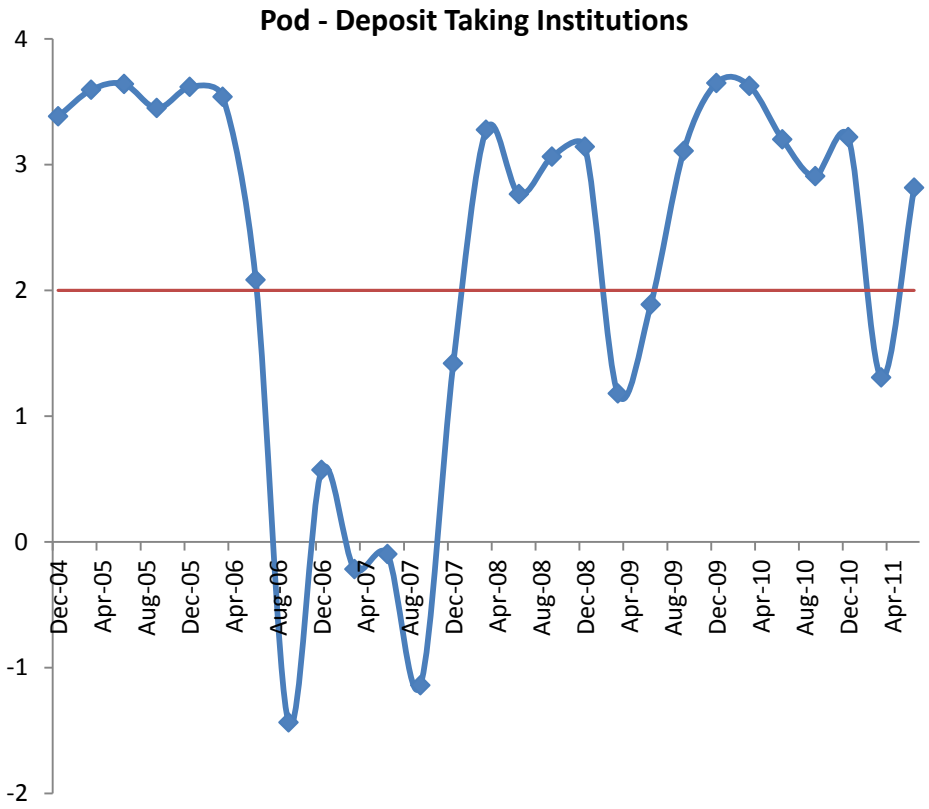


Table 1. VAR Lag Order Selection Criteria[14]

Endogenous variables: Y ANNUALEQUITY INTEREST QTRLYINFL REALGDP

Exogenous variables: C

Date: 10/28/12 Time: 18:54

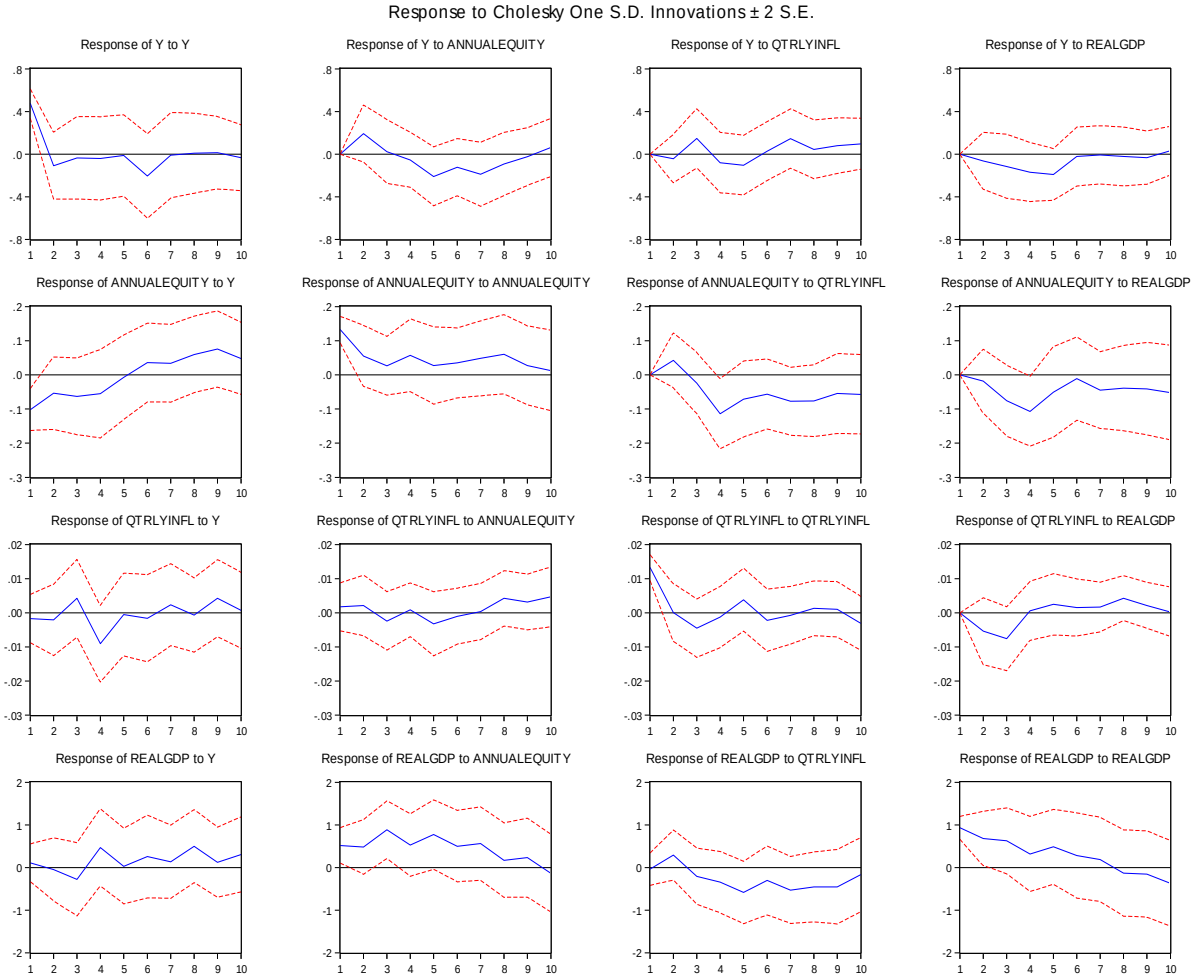
Sample: 2004Q4 2011Q2

Lag	LogL	LR	FPE	AIC	SC	HQ
0	27.95966	NA	1.02e-07	-1.913305	-1.667877	-1.848193
1	91.90271	95.91459*	4.18e-09	-5.158560	-3.685992*	-4.767887
2	120.2485	30.70798	4.33e-09	-5.437378	-2.737672	-4.721145
3	161.7642	27.67714	3.01e-09*	-6.813687*	-2.886841	-5.771894*

* indicates lag order selected by the criterion

[14] LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

Figure 3:
Impulse Response functions with Standard Error Bands



BIBLIOGRAPHY

Aspachs, O., Goodhart, C., Segoviano, M., Tsomocos, D., & Zicchino, L. (2006). Searching for a Metric for Financial Stability. *Work in Progress at the Financial Markets Group, LSE*.

Bank of Jamaica. (2005). *Financial Stability Report: Overview*. Kingston: Bank of Jamaica.

Caprio, G., Klingebiel, D., Laeven, L., & Noguera, G. (2005). Banking Crisis Database. In P. Honohan, & L. Laeven, *Systemic Financial Crises: Containment and Resolution.* Cambridge, U.K: Cambridge University Press.

Gapen, M., Gray, D. F., Lim, C. H., & Xiao, Y. (2004). The Contingent Claims Approach to Corporate Vulnerability: Estimating Default Risk and Economy-Wide Risk Transfer. *IMF Working Paper No. 04/121 (Washington: International Monetary Fund).*

Goodhart, A. E., & Tsomocos, P. D. (2011). The Role of Default in Macroeconomics. *IMES Discussion Paper No. 2011-E-23*.

Gray, D. F., Merton, R. C., & Bodie, Z. (2003). *A New Framework for Analyzing and Managing Macrofinancial Risks of an Economy*. Retrieved 9 16, 2010, from http://www.moodys-mfrisk.com

Gray, D. F., Merton, R. C., & Bodie, Z. (2007). New Framework for Measuring and Managing Macrofinancial Risk and Financial Stability. *Developing a Framework to Assess Financial Stability* (pp. 1-37). Ottawa, Canada: Bank of Canada Conference.

Laeven, L., & Valencia, F. (2008). Systemic Banking Crises: A New Database. *IMF Working Paper No. 08/224*.

Laeven, L., & Valencia, F. (2010). Resolution of Banking Crises: The Good, the Bad, and the Ugly. *International Monetary Fund, IMF Working Paper, WP/10/146*, 1-36.

McDonald, R. (2002). *Derivative Markets.* first edn.

Merton, R. (1974). On the Pricing of Corporate Debt: The Risk Structure of Interest Rates. *Journal of Finance*, 449-70.

Pazarbasioglu, C., & Van der Vossen, W. J. (1997). Main Issues and Challenges in Designing. In V. P. Sundararajan, & G. Sensenbrenner, *Central Bank Reform in the Transition Economies, ed.* Washington: International Monetary Fund.

Quantitative Micro Software, LLC. (2004). *Eviews 5: User's Guide*.

Reinhart, C., & Rogoff, K. (2009). *This Time is Different: Eight Centuries of.* Princeton: Princeton University Press.