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Quantitative Analysis of A Financial System The Case of Guyana

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Abstract

The Global Financial Crises (2008) demanded a critical review of stress test approaches practiced by financial institutions and regulators. This work present the results of a published stress test model on the banking sector in Guyana. It measures the financial health of the sector and identifies areas of vulnerability. The breaking point method is applied to the data to identify when capital becomes eroded so as to fall below its statutory minimum. This study shows with appropriate assumptions key areas of risk could be identified early with mitigation measures in place.

This is a working paper for discussion and the view expressed is that of the author.

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1. Introduction

The global financial crisis has forced policy makers to refine the framework for offsite financial supervision. The International Monetary Fund (IMF) has developed the methodology for Financial Soundness Indicator (FSI) and stress test which countries used to prepare Financial Sector Assessment Program (FSAP) report on the health of their financial system. In the past, most Central Banks have utilized stress test as a quantitative risk management tool in financial analysis in both developed and developing countries.

Prior to the recent global financial crisis (2008), countries that are members of the IMF published stress test results as part of their FSAP report in the five years preceding the crisis. However, these reports did not identify any major or significant vulnerability in the financial system. Despite this, stress testing remains a critical tool for risk management practice in the financial system. This study reviews stress testing techniques and their application to an evolving banking system that operates in a liberalized financial environment in Guyana.

The analysis presented in this case study, focuses on Commercial Banks that are the provider of the main financial services in Guyana. It excludes other important financial institution like the New Building Society (NBS) which is the main mortgage institution providing housing loans. Section Two of the paper gives a general overview of the banking system in Guyana, the products offered, ownership, loans concentration and payments system. Section Three reviews the Financial Soundness Indicators in Guyana. It also provides a critical analysis of stress test approaches and the application of a model by Ong, Maino and Duma (2010) to the Guyanese's Banking Sector. Evidence is provided on how the stress test can be utilized in an informative and creative way to provide early warning signals in the event of a financial crisis. The reverse stress scenario that is the breaking point scenario is applied in an effort to identify early warning signals as the financial system weakens when stress intensifies. Finally, the conclusion summarizes the main findings of the study and the way forward.

2. Overview of the Banking System: Structure and Performance

The six commercial banks are by far the most important financial institutions in Guyana with assets worth GY \$296 million (2010) equivalent to 98.8 % of the Gross Domestic Product (GDP). The Guyanese population has access to banking services except in the very small remote hinterland areas and their services are utilized by people of all income groups. The six commercial banks operate twenty eight branches supporting their activities in Guyana .There are three foreign banks along with three domestic privately owned commercial banks serving the community in Guyana.

Non-Bank Financial Institutions are the next largest financial group with assets equaling 42% of GDP. They include Mortgage Bank, Trust Companies, Credit Unions and Pension Funds. The nine Insurance Companies are the next group representing 16.6% of GDP.

Prior to 1990, most of the commercial banks were state owned. However, they were all privatized by the end of the 1990's. Banking activities are concentrated with two commercial banks accounting for the largest share of total assets. Despite this level of concentration, there is no hindrance to new bank entry with the small private banks being effectively managed with a good level of efficiency. The small private banks are equally competitive compared to the more established foreign owned banks with their quality of service and products.

Commercial banks main activities are accepting deposits, providing loans, making payments in both domestic and foreign currency, import and export financing. Most of the depositors in the banking system are households; accounting for roughly 86% of the total savings account. The largest loan category is business enterprises followed by service and distribution that enjoys credit and overdraft facility financing mainly working capital requirements .The top 20 borrowers account for roughly 35% of the total loan on average, which is considered to be highly concentrated by any standard. Agriculture, mining and manufacturing have small loans since the commercial bank loan policy in these sectors is considered to be very conservative and risk adverse. Banks hold a substantial part of their portfolio in Treasury Bills that range from 91 days to 364 days maturity period. Two commercial banks have large net foreign assets in their portfolio and are therefore exposed to foreign currency risk. While there are no barriers to entry in the banking sector, the

country's population that is just below three quarter of a million people is well served by its six banks.

Commercial banks operate a check based payment system. This is followed by a significant amount of cash transactions as their main product, supplemented by both debt and credit cards transactions. The interest rate charged by commercial banks is market determined. However, the spread between the average deposit and loan rates tends to be high and sometime reaching 100% in some instances. Recently, to accommodate the boom in housing, commercial banks were offered special tax concession for mortgage lending that experienced a rapid growth. The large liquidity in the banking system provides for an active inter-bank market for excess reserves with interest rate ranging between 4 and 4.5 % in that market. This rate serves as an important price signal in the transmission of the Central Bank's Monetary Policy.

Commercial Banks in Guyana are very profitable. Their assets are of good quality with a major share or more than 70% invested in Treasury Bills. All the commercial banks have adequate liquidity and solvency ratios that are well above the minimum threshold. Banks are well capitalized and profitable.

Table 1
Structure of Guyana's Financial System 2008

	Number of		Financial System				
			Assets		Loans	Deposits	
	Institutions	Branches	G\$ billion	Percent of Total	Percent of GDP	Percent of Total	Percent of Total
Commercial Banks	6	32	232.6	62.5	98.5	69.5	86.5
Local	3	16	100.3	27.0	42.5	26.8	35.8
Foreign	3	16	132.4	35.6	56.1	42.7	50.7
Nonbank financial institutions	40	-	100.1	26.9	42.4	26.9	7.2
Insurance companies	9	47	39.3	10.6	16.6	3.6	6.4
Total Financial Sector	55	79	372.0	100	157.6	100	100

Source: IMF & Bank of Guyana

3. Financial Sector Soundness and Stress Test

A. Analysis of the Financial Soundness Indicators

An early method utilized by Central Banks in the Caribbean to test the strength of the financial system has been Financial Soundness Indicators. This is an aggregate on the banking sectors and other financial institutions data. It focuses mainly on the solvency of the banking sector and some critical liquidity ratios.

The data in Table 2 on the Financial Soundness Indicator shows that the banking system is fairly healthy in Guyana. Capital to risk adjusted assets increased to 18.8% above the Basel threshold. The Non Performing Loan has shown a declining trend with more than adequate provision for loan loss. Return on equity at 28.9% is relatively good by regional standard. The provision for loan loss increased to 75 percent.

However, the only perceived risk is the high concentration of loan that has been declining and has been closely monitored by regulators and supervisors. The ratio declines further when the top 20 borrowers are measured against total exposure. They are convinced that these borrowers are credit worthy and their loans are in good standing. All ratios showed improvement in 2010(Table 2).

Table 2
Financial Soundness Indicator, 2005-10 (In percent)

	2005	2006	2007	2008	2009	2010
Capital to risk-adjusted assets	14.4	15.5	15.0	14.9	18.3	18.9
NPL to total loan	13.9	11.6	10.7	9.5	8.3	6.5
Provision for loan loss to NPLs	44.4	41.0	54.2	49.3	53.8	75.0
Return on assets	1.9	2.3	2.4	2.3	2.7	0.6
Return on equity	23.1	27.7	27.6	25.2	26.6	28.9
Liquid asset to total assets	32.5	33.0	26.5	29.8	30.9	26.4
Related Party loans to total loans	5.0	3.8	3.7	4.5	4.5	3.8
Top 20 borrowers to total loans	44.5	44.4	39.2	33.2	35.5	29.8

Sources: Guyanese authorities and IMF

B. Stress Testing on a Banking System

Stress test is performed on different types of risk with credit, liquidity, market, and operational risks being the most prominent. Most stress tests utilize historical statistical data to forecast the development of risk. However, the recent global financial crisis revealed serious flaws on relying solely on that method. The use of stress test as an offsite supervisory and risk management tool has gained momentum especially in a typically evolving financial system in Guyana.

In the new millennium, the methodology, availability of timely and reliable data and assumption of stress test have come under intense scrutiny and debate with constant refinement in the last few years . This section of the study analyses the application of stress test on credit risk on a developing financial system and its impact on that sector. The result of the stress test is used to determine the solvency of the banking institution. An alternative method or the 'breaking point' which is essentially 'stressing as it breaks' exercise is applied on the data that looks at the speed with which capital is eroded and as stress is intensified in a banking sector.

This illustration is modeled by utilizing data in a hypothetical case of six commercial banks operating in Guyana. The data extracted from the Banking System is assumed as follows:

- Capitalization and credit data comprising the six commercial banks operating in Guyana are used as the baseline.
- The definition of loan classification and their corresponding provisions are assumed utilizing pass practices
- The Capital Adequacy Ratio (CAR) for the banks is above 12%, below which banks will need to recapitalize.

There are several other assumptions that are made with regards to the calculation of the CAR.

- First, profits are assumed to be zero since the full impact is absorbed by capital and secondly
- Where loans by classifications are available, they will be fully provisioned for prior to any shocks and may be under provisioned where more granular information is absent.

This methodology is extracted from Ong, Maino and Duma paper entitled “Into the Great Unknown: Stress testing with Weak Data” (2010) and is applied to the banking sector in Guyana.

There are a variety of methods that are used for stress testing that can range from the very simple to economically complex ways that involve econometric models. The empirical evidence and results of stress test has had varying degree of success in the past. Moreover, the recent financial crisis has highlighted severe methodological flaws, weakness and short coming in stress testing. Most of the models utilized historical statistical relationship to access risk; however, the results of these models have not been robust. There is strong evidence that historical perspective did not provide the inputs necessary for good results. As a result, the process is gradually being refined and upgraded in keeping with new information and lessons of past experience.

Therefore, in the application of a simple stress test framework Alfaro and Drehmann (2009) pointed out that there are three fundamental requirements that any stress test should entail to be fully informative:

- I. It should use the correct model to capture the potential unfolding of a crisis in a realistic yet stylized fashion
- II. Scenarios should represent a severe event that ex-ante are not beyond the realm of possibility and
- III. Models should be robust particularly during the crisis period they aim to stimulate

There had not been any universally successful stress test methods. However, the Bank for International Settlement has pointed out after the onset of the last financial crisis that ad hoc “hot-spot stress testing” which has been used by some banks remained an important tool to inform management of an impending crisis. BIS also stated that the ability to conduct stress test at very short notice has proven to be extremely valuable especially during period of rapidly changing market conditions.

Table 3
Loan Classification and Provisioning Requirements

Classification	Definition	Provisioning Requirement (in percent of outstanding amount)
<u>Performing loans</u>		
Normal and pass loans	Assets in this category are performing in accordance with contractual terms and are expected to continue doing so.	1
Special mention loans	Any loan which is past due 30 days or more but less than 90 days	5 ¹
<u>NPL</u>		
Substandard loans	Any loan which is past due 90 days or more but less than 180 days	50
Doubtful loans	Any loan which is past due 180 days or more but less than 360 days	20
Loss loans	Any loan which is past due 360 days or more	100

Source: Ong, Maino, Duma (2010)

¹ Provision requirement rounded to 5% by author

Baseline Analysis of Selected Balance sheet Items

An analysis of the Baseline Scenario in Table 4 shows the stress test conducted on aggregate data by shocks to the Non Performing Loan (NPL). The aggregate data of the six commercial banks in Guyana reflected a strong balance sheet position. Overall the banks are well capitalized with a capital adequacy ratio of 19 % and comfortable NPL ratio of 6.5 %. The provisioning for the writing off of bad loans is adequate and fully covered in the balance sheet. However, when more granular data is available and analyzed it reflects a different scenario among banks and a wide variation with respect to the different categories of loan.

Table 4 shows that some of the banks exhibit varying degree of vulnerability. The NPL ratio rises to a high 13.9 % for banks compared to a low 1.83% for bank #1. If there are systemic risks involved with financial institutions then each bank will have to be closely monitored to prevent contagion effect that can lead to a full blown banking crisis from such spread. It is therefore critical to investigate the nature of dispersion under these comfortable aggregates and averages. A closer analysis of the individual bank and loans by classification will unveil vulnerability that can be hidden under the more benign aggregate data.

The analysis of the data in the banking system provides important benchmarks and threshold on the asset quality given the size and impact of any unforeseen shock. Depending on the reliability and quality of data, past due loans could only migrate from one classification downwards overtime. Therefore the impact of any shock would be limited to the loan amount that is in that pre-shock classification.

Table 4. Baseline: Selected Bank Balance Sheet Items of Commercial Banks as at End-2009
(In millions of Guyana dollar)

			(1)	(2)	(3)	(4)	(5)	(6)	(7)
Row Number and	Item	Provisioning	All	Bank 1	Bank 2	Bank 3	Bank 4	Bank 5	Bank 6
Formula		Rate	Banks						
(1)	Capital		22430	6360	5165	3155	3375	3190	1195
(2)	RWA		118660	37955	24833	25160	13630	14935	2145
(3)=(1)/(2)*100	CAR (in percent)		19	17	21	13	25	21	56
(4)=(5)+(8)	Total Loans		109690	30520	21310	31160	11055	13615	2030
(5)=(6)+(7)	Performing Loans		102540	29960	19645	26800	10755	13350	2030
(6)	Normal and pass loans		97190	29360	18755	24260	10525	1240	1890
(7)	Special mention loans		5350	600	890	2540	230	950	140
(8)=(9)+(10)+(11)	NPLs		7150	560	1665	4360	300	260	0
(9)	substandard loans		3000	200	650	2000	160	200	0
(10)	Doubtful loans		3000	200	650	2000	100	150	0
(11)	Loss loans		1150	160	365	360	50	10	0
(12)=(8)/(4)*100	NPL ratio (in percent)		6.5	1.83	7.81	13.9	2.7	1.9	0
(13)	Total provisions currently held 1/		4520	730	2625	720	270	170	2
(14)=(15)+(17)	Total provisions that should be held		4520	730	2625	720	270	170	2
(15)=(16)	General provision								
(16)=(60)*Rate	against normal and pass loans	0.01	30	7.5	5	7.5	2.5	2.5	0
(17)=(18)+(19)+(20)+(21)	Specific provision								
(18)=(7)*Rate	against special mention loans	0.05	150	37.5	25	37.5	12.5	12.5	12.5
(19)=(9)*Rate	against substandard loans	0.20	600	150	100	150	50		
(20)=(10)*Rate	against doubtful loans	0.50	1500	375	250	375	125	125	250
(21)=(11)*Rate	against loss loans	1.00	3000	750	500	750	250	250	500
(22)=(13)-(14)	under/over-provisioning	0.00							

Source: Authors' calculations with Data from Commercial Banks

1/ It is assumed that NPLs are fully provisioned for initially

SHOCKS TO THE NPL BY 200 PERCENT VS LOAN BY CLASSIFICATION

Regulators can shock the aggregate NPL and compare the results with shock to loan by classification. Table 5 provides the evidence on the impact of such shocks.

**Table 5: Ad Hoc Shock to Agregate NPLs using a 100 percent
Provisioning Rate vs. to Loans by Classification
(in millions of domestic currency units unless stated otherwise)**

Item	Provisioning	All Banks	Provisioning	All Banks
	Rate		Rate	
<u>Pre-shock</u>				
Capital		22,440		22,440
RWA		118,660		118,661
CAR (in percent)		19		19
Total Loans		109,690		109,690
Performing Loans		102,540		102,540
Normal and pass loans		97,190		97,190
Special mention loans		5,350		5,350
NPLs		7,150		7,150
substandard loans		3,000		3,000
Doubtful loans		3,000		3,000
Loss loans		1,150		1,150
NPL ratio (in percent)		7		7
Total provisions currently held 1/		4,520		4,520
Total provisions that should be held		4,520		4,520
General provision				
<u>Post-shock</u>				
Shock: NPLs increase by 200 percent				
Total loans		109,690		109,690
Performing loans		78,220		78,220
Normal and pass loans				50,000
special mention loans			0.01	28,220
NPLs 2/		21,470	0.05	21,470
Substandard loans			0.20	10,000
Doubtful loans			0.50	10,000
Loss loans		4,520	1.00	1,470
Total provisions currently held		21,470		4,520
Total provisions that should be held				14,880
General provisions				
against normal and pass loans				
Specific provision				5,000
against special mention loans				1,410
against substandard loans				2,000
against doubtful loans				5,000
against loss loans				1,470
under/over provisioning		16,950		10,360
<u>Assume full provisioning after shock</u>				
New capital		5,490		12,080
New CAR (in percent) 3/		4.6		10.1
Impact on CAR (in percent)		14.4		8.9

Source: Authors' Calculation

The NPL is shocked by 200 percent with full provisioning the bank capital declined by 75.8 %. This forced CAR in the Banking system to fall to 4.6 percent way below the Basel threshold.

However, when the shock is applied to the loans by classification utilizing the percentage range the impact is less devastating. The CAR falls to 10.1 percent a decline of 8.9 in comparison to a 14.4% decline when the shock is applied to the entire banking system.

In other words, the estimated impact will be 28 percent less when more granular data is available to supervisors.

Shock to Performing Loan: Maximum Migration Down Classification

The construction in Table 6 shows that the maximum amount by which a loan can increase in the short term is equivalent to the balance in the category above it (row 6). Therefore any shock to both the performing and non performing loans (row 5 & 8) in Table 6 should result in the total deterioration moving only one step downward. In this shock, even with the maximum possible migration down classification the Banking system still remain well capitalized at 15.4%. However two Banks, Bank #3 falls below the minimum threshold while Bank #5 capital becomes impaired.

A hypothetical ad hoc hot spot shock is tested on the whole banking system compared to shocks on individual bank is mapped out in Table 9. This scenario is applied in three phases of shocks at 100, 200 and 400 percent respectively to the Non Performing Loans. In addition there is also a 10, 20 and 40 percent shocks applied to the performing loans category. These three phases of shock forced capital in the six banks to become negligible as indicated in table 9. The possibility exists in this hypothetical case that after the first round shocks the second and third could be followed in rapid succession. Row 14 in Table 9 then becomes a reality with most Banks becoming impaired after these successive shocks. These idiosyncratic shocks are randomly applied to “plausible but improbable” event in a financial system.

**Table 6. Ad Hoc Shock Stress Test: Maximum Possible Migration Down
Classifications
(In Millions GYD)**

Row Number and Formula	Item	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		All Banks	Bank 1	Bank 2	Bank 3	Bank 4	Bank 5	Bank 6
	Pre-shock							
(1)	Capital	22430	6360	5165	3155	3375	3190	1195
(2)	RWA	118660	37955	24833	25160	13630	14935	2145
(3)=(1)/(2)*100	CAR (in percent)	19	17	21	13	25	21	56
(4)=(5)+(8)	Total Loans	109690	30520	21310	31160	11055	13615	2030
(5)=(6)+(7)	Performing Loans	102540	29960	19645	26800	10755	13350	2030
(6)	Normal and pass loans	97190	29360	18755	24260	10525	1240	1890
(7)	Special mention loans	5350	600	890	2540	230	750	140
(8)=(9)+(10)+(11)	NPLs	7150	560	1665	4360	300	260	0
(9)	substandard loans	3000	200	650	2000	150	200	0
(10)	Doubtful loans	3000	200	650	2000	100	150	0
(11)	Loss loans	1150	160	365	360	50	10	0
(12)=(8)/(4)*100	NPL ratio (in percent)	6.5	1.83	7.81	13.9	2.9	1.9	0
(13)	Total provisions currently held 1/	4520	730	2625	720	270	170	2
(14)=(15)+(17)	Total provisions that should be held	4520	730	2625	720	270	170	2
(15)=(16)	General provision							
(16)=(60)*Rate	against normal and pass loans	30	7.5	5	7.5	2.5	2.5	
(17)=(18)+(19)+(20)+(21)	Specific provision							
(18)=(7)*Rate	against special mention loans	150	37.5	25	37.5	12.5	12.5	12.5
(19)=(9)*Rate	against substandard loans	600	150	100	150	50		
(20)=(10)*Rate	against doubtful loans	1500	375	250	375	125	125	250
(21)=(11)*Rate	against loss loans	3000	750	500	750	250	250	500
(22)=(13)-(14)	under/over-provisioning							
	Post-shock							
	Shock: All loans migrate from one classification down to the next							
=(4)	Total loans	109690	30520	21310	31160	11055	13615	2030
(23)=(4)-(26)	Performing loans	102540	29960	19645	26800	10755	13350	2030
(24)=0	Normal and pass loans	0	0	0	0	0	0	0
(25)=(6)	special mention loans	97190	29360	18755	24260	10525	1240	1890
(26)=(27)+(28)+(29)	NPLs 2/	12500	1160	2555	6900	530	12375	140
(27)=(7)	Substandard loans	5350	600	890	2540	230	750	140
(28)=(9)	Doubtful loans	3000	200	650	2000	150	200	0
(29)=(11)+(10)	Loss loans	4150	360	1015	2360	150	11225	0
=(13)	Total provisions currently held	4520	730	2625	720	270	170	2
(38)=(13)-(30)	under/over provisioning	370	370	1610	1640	120	1105	-138
	<u>Assume full provisioning after shock</u>							
(39)=(1)+(38)	New capital	18280	5970	4150	795	3225	IMP	1195
(40)=(39)/(2)	New CAR (in percent) 3/	15.4	15.7	16.7	0.31	23.7	IMP	56
(41)=(40)-(3)	Impact on CAR (in percent)	4.6	1.3	4.3	12.7	1.3	IMP	0

Source: Authors' calculations

- 1/ It is assumed that NPLs are fully provisioned for initially
- 2/ It is assumed that NPLs increase proportionately across all categories
- 3/ It is assumed that RWA remains the same

Table 7: Nonperforming Loan Migration Matrix

	Pass	OLEM	Substandard	Doubtful	Loss
Pass		0.01	0.00	0.00	0.00
OLEM			0.01	0.00	0.00
Substandard				0.01	0.00
Doubtful					0.01

Source: Worrel (2008)

C. Breaking Point Scenario

Worrel's (2008) illustration of credit deterioration and examination of its impact on CAR overtime utilized five classes of loan used by bank regulators. The Nonperforming Loan Migration Matrix in Table 7 above provides the useful indicators. The probability of loss increases with each category increasing up to 100 percent in category 5 as stated in the Table above. Banks are therefore required to make higher provision for losses in each successive category that range from 1%, 5%, 20%, 50% and 100% respectively for each of the five successive categories of loan. The figure in Table 3 shows the deterioration of CAR with the successive migration pattern. This gradual migration rate is capable of bringing CAR down below its statutory level in a very short pace of time. This analysis provides a useful benchmark for necessary remedial action to prevent a crisis situation.

The 'breaking point' method is essentially stressing while it breaks exercise is also known as reverse stress testing exercise. This method is appealing especially when data can be considered unreliable and does not provide an indication as to the size of the overall NPL shocks. It estimates the amount of classified loans that would reduce a bank's CAR to "breaking point" for example 12% below which recapitalization would be necessary.

The Loan Portfolio Distribution is analyzed in Table 8 and examines the implication of credit expansion in housing. This is a historically a vulnerable category that could easily stress the banking system to the point of breaking. There are two large categories of loan

housing and business totaling some \$92,928 million or equivalent to 56.8 % of the loan portfolio in Table 8.

The fastest growth category recently has been housing. Housing loan accounts for \$38,960 million or 24 % of the loan portfolio of the banking sector. The lessons of the past experiences on financial crisis required that housing loans be carefully monitored.

This study further analyses the data in Table 10 to find out the extent that impaired housing loan can force the bank to fall below the CAP 12% threshold. In the event that some 10% percent of the mortgage portfolio becoming impaired, the CAP falls to 15.0%. In the improbable but likely event that some 20 % of the mortgage portfolio becomes impaired, overall the CAR falls to 6.3 percent in the Banking System.

A closer look at the disaggregated data for the banks indicates that one bank has a high level of Non Performing Loan and exposure in housing in the banking system. Deterioration could force its capital adequacy ratio below the statutory minimum. It is also important to separate speculative commercial property loan from residential loan. It is also necessary to make adequate provisioning for losses and search out vulnerabilities and emerging signals to ensure adequate mechanisms are put in place in the improbable but likely event that a large percentage of the mortgage loan becoming impaired.

An estimation of the aggregate NPL ratio for the banking system which would bring the CAR below 12% using the average rates for performing and non performing loan shows that the breaking point NPL ratio for the banking system as a whole is around 400 percent in Table 9. This along with the 40 percent migration of performing loan to NPL presented in row 13 and compared to the level in row 7 showed deterioration. The aggregate breaking point information is used to provide analysis of the data with regard to individual banks with different migration rate.

With more granular data available, the breaking point method would require some basic assumption with regards to the magnitude of shocks to loan in each category in an effort to estimate the NPL ratio that would yield breaking point. In this regard, the percentage of performing loans that migrates to the NPL in each of the six banks will follow a new NPL amount being calculated for each bank.

The credit risk assessment concentrates mainly on the rapid growth in housing loans. Past experience has shown that the financial crises in Asia and USA began with real estate

loans easily becoming toxic. Worrel (2008) pointed out that a 5 percent growth in mortgage is capable of bringing CAR below the statutory 8% level in less than twelve months. Table 10 indicates that when a 10% shock is applied to the housing loan most of the banks in Guyana except bank # 3 will remain viable despite some balance sheet deteriorations. However, an ad hoc shock of 20 % on housing loans forces the three banks below the 12% threshold along with one borderline case. Housing loan is difficult to renegotiate especially in crises. The collateral value of loans falls with the decline in property price as loans become impaired. This is followed by a cycle of pricing crises that impact negatively on the financial system.

BIS (2009) pointed out that the financial crises has under scored the importance of giving appropriate weight to expert judgment in defining relevant scenarios with a forward looking perspective in stress test. The impact of mortgage growth on CAR depends on its rate of growth and the initial NPL ratio. Regulators will have to carefully monitor these ratios as a rise in mortgage credit in the portfolio being more risky especially in period of real estate boom.

Conclusion

This study analyzed granular financial data and conducted randomized shocks to the main income earning assets credit which has provided useful information on the health of a banking system. These trends may not be captured by analysis of the larger macro or aggregate data or Econometric analysis. An important caveat is that the results and interpretation of this stress test exercise will be dependant on the economic conditions in the country and reliability or classification of the data on the analysis of individual institution. The ability to utilize “improbable but pausable events” and its impact on the financial system is guided by this analysis in predicting early signs of vulnerability. It is necessary to monitor certain benchmark for weakness. This work focused on shocking loans and examining its impact on bank solvency. It also utilized the breaking point scenario to estimate its impact on CAR falling below its statutory minimum. However, the main thrust of this work is to compliment the different analytical perspective using the results as cross checks. An important point is that no single methodology can be adopted as a stand alone best practice. Incorporating liquidity effect and contagion spread have to be factored in to make this stress test a fully meaningful exercise.

Credit risk has been the main focus of the shocks since it is the main source of overall risk in the banking system. In this simple test it is possible to shock the banks balance sheet directly by targeting the Non Performing Loans even if there is a lag in the data. The analysis of the result should be done in conjunction with on- site supervision and other qualitative and subjective analysis of the financial system.

Stress test should consider also unthinkable developments since financial sector is prone to crises. Basic stress test using appropriate assumptions and shocks could reveal important vulnerability and key areas of risks to inform contingency planning (Ong and Cihak 2010). Lessons of past experience with the most recent being Iceland Banking collapse a slight oversight in this case being liquidity crunch can bring a whole financial system down. Further analysis of the data and information with a regression model will be a good exercise for future research.

Table 8
Loan Portfolio Analysis of Commercial Banks
as at December 31, 2010

	G\$ MILLIONS						
	Bank 1	Bank 2	Bank 3	Bank 4	Bank 5	Bank 6	Total
Business Enterprises	13,726	15,996	6,621	8,788	7,372	1,465	53,968
Agriculture	3,000	912	548	2,736	257	169	7,622
Mining and Quarrying	190	1,388	605	30	337	35	2,585
Manufacture	3,407	4,895	2,312	1,856	2,363	240	15,073
Services	7,129	8,801	3,156	4,166	4,415	1,021	28,688
Households	6,415	1,256	3,620	1,055	955	312	13,620
Home-Improvement	2,305	375	980	0	125	253	4,040
Real Estate Mortgages	7,173	3,344	18,132	1,110	5,161	0	34,920
Non-Residents	839	326	65	103	0	0	1,333
Government	46	0	9	0	0	0	55
Other	7	15	1,731	0	0	0	1,753
Total Loans	44,237	37,308	37,779	19,844	20,985	3,495	163,657

Source: Central Bank of Guyana

Table 9. : Ad Hoc Shock to the Banking System vs. to Individual Banks
(In millions of Guyana Dollars)

Row Number and Formula	Item	Shock	(1) All Banks	(2) Bank 1	(3) Bank 2	(4) Bank 3	(5) Bank 4	(6) Bank 5	(7) Bank 6
	Pre-shock								
(1)	Capital		22,430	6,360	5,165	3,155	3,375	3,190	1,195
(2)	RWA		118,660	37,955	24,833	25,160	13,630	14,935	2,145
(3)=(1)/(2)*100	CAR (in percent)		19	17	21	13	25	21	56
(4)	Total Loans		109,690	30,520	21,310	31,160	11,055	13,615	2,030
(5)	Performing Loans		102,540	29,960	19,645	26,800	10,755	13,350	2,030
(6)	NPLs		9,150	560	1,665	5,360	300	260	
(7)=(6)/(4)*100	NPL ratio (in percent)		7	2	8	14	3	19	0
(8)	Total provisions currently held 1/		4,520	730	2,625	720	270	170	2
(9)	Total provisions that should be held		4,520	730	2,625	720	270	170	2
(10)=(8)-(9)	Under/over provisioning								
	Post-shock								
=(4)	Total loans		109,690	30,520	21,310	31,160	11,055	13,615	2,030
(11)	Total NPLs								
=(6)*(1+Shock)	NPLs increase by 100 percent		14,300	1,120	5,330	8,720	600	520	
=(6)*(1+Shock)	NPLs increase by 200 percent		21,450	1,680	4,995	13,080	900	780	
=(6)*(1+Shock)	NPLs increase by 400 percent		28,600	2,240	6,660	17,440	1,200	1,040	
=(6)*{(5)*Shock}	10 percent of performing loans become NPLs		17,404	3,052	2,630	7,440	1,375	1,395	203
=(6)*{(5)*Shock}	20 percent of performing loans become NPLs		27,658	6,552	5,594	9,720	2,450	2,930	406
=(6)*{(5)*Shock}	40 percent of performing loans become NPLs								
=(8)	Total provisions currently held		48,165	12,545	9,525	11,440	11,120	4,600	812
(12)=(11)-(8)	under/over provisioning								
	NPLs increase by 100 percent		-9,780	-390	705	-8,000	-330	-350	2
	NPLs increase by 200 percent		-16,930	-950	2,370	12,360	630	660	2
	NPLs increase by 400 percent		24,080	1,510	4,035	16,720	930	870	2
	10 percent of performing loans become NPLs		12,884	2,322	5	6,720	1,105	1,425	201
	20 percent of performing loans become NPLs		23,138	5,820	2,970	9,000	835	1,255	404
	40 percent of performing loans become NPLs		41,016	11,255	4,035	10,000	4,030	5,170	810
	Assume full provisioning post shock								
(13)=(1)+(12)	New capital								
	NPLs increase by 100 percent		12,650	5,970	4,160	-4,855	3,045	2,670	1,195
	NPLs increase by 200 percent		5,500	5,410	2,795	-9,005	-2,745	2,580	1,195
	NPLs increase by 400 percent		-1,650	4,750	1,130	-13,565	2,445	2,150	-
	10 percent of performing loans become NPLs		9,546	4,035	5,160	-3,565	2,270	1,765	990
	20 percent of performing loans become NPLs		-708	-540	2,195	-5,945	2,540	2,935	790
	40 percent of performing loans become NPLs		18,585	-4,895	1,130	-6,845	655	-1,980	385
(14)=(13)/(2)*100	New CAR (in percent) 2/								
	NPLs increase by 100 percent		9	16	17	NEG	22	18	56
	NPLs increase by 200 percent		5	14	11	NEG	20	17	-
	NPLs increase by 400 percent		0	13	13	NEG	18	14	-
	10 percent of performing loans become NPLs		8	11	21	NEG	17	12	46
	20 percent of performing loans become NPLs		NEG	NEG	9	NEG	19	20	37
	40 percent of performing loans become NPLs		NEG	NEG	NEG	NEG	NEG	NEG	NEG

Source: Authors' calculations

1/ It is assumed that loans are fully provisioned for initially

2/ It is assumed that RWA remains the same

Table 10: Breaking Point Analysis: Ad Hoc Shock to the Banking System vs. to Individual Banks
(In millions of Guyana dollars)

Row Number and Item	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Formula	All Banks	Bank 1	Bank 2	Bank 3	Bank 4	Bank 5	Bank 6
Pre-shock							
(1)	Capital	22,430	6,360	5,165	3,155	3,375	1,195
(2)	RWA	118,660	37,955	24,833	25,160	13,630	2,145
(3)=(1)/(2)*100	CAR (in percent)	19	17	21	13	25	56
(4)=(5)+(8)	Total Loans	109,690	30,520	21,310	31,160	11,055	2,030
(5)=(6)+(7)	Performing Loans	102,540	29,960	19,645	26,800	10,755	2,030
(6)	Normal and pass loans	97,190	29,360	18,755	24,260	10,525	1,890
(7)	Special mention loans	5,350	600	890	2,440	230	140
(8)=(9)+(10)+(11)	NPLs	7,150	560	1,665	4,360	300	0
(9)	substandard loans	3,000	200	650	2,000	160	0
(10)	Doubtful loans	3,000	200	650	2,000	100	0
(11)	Loss loans	1,150	100	365	360	50	0
(12)=(8)/(4)*100	NPL ratio (in percent)	6.5	1.83	7.81	13.9	2.7	0
(13)	Total provisions currently held 1/	4,520	730	2,625	720	270	2
(14)	Total provisions that should be held	4,520	730	2,625	720	270	2
High Loan Categories							
(15)	Housing	38,960	9,480	3,720	19,110	1,110	253
(16)	Business	53,968	13,725	15,995	6,620	8,790	1,465
Post-shock							
10% of Housing Loan Migrate to N.P.L							
(17)	Housing NPL	3,895	950	370	1,910	110	25
(18)	NPL	11,045	1,510	2,035	6,270	410	25
(19)	Under Provisioning	-6,525	-780	590	-5,550	-140	-20
(20)	New Capital	15,905	5,580	5,165	-2,395	3,235	1,175
(21)	CAR %	13.4	14.7	21	N.A	23.7	54.8
(22)	Impact on CAR	5.6	2.3	0	N.A	1.3	1.2
20% Housing Loans Migrate to NPL							
(23)	20% Housing to NPL	7,790	1,900	740	3,820	220	50
(24)	Under Provisioning	14,940	2,460	2,405	8,180	520	50
	New Capital	7,490	3,900	2,760	-N.A	2,855	1,145
Assume full provisioning after shock							
(25)	CAR	6.3	10.3	11.1		20.9	53.4
	Impact on CAR (in percent)	12.7	6.7	10.9	N.A	4.1	2.6

Source: Authors' calculations

1/ It is assumed that NPLs are fully provisioned for initially

2/ It is assumed that NPLs increase proportionately across all categories

3/ It is assumed that RWA remains the same

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