International Monetary Fund
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The Impact of Non-performing Loans on Loan growth

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Abstract

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The paper assesses the impact of Non-performing loans (NPLs) on loan growth. In making lending decisions, banks are assumed to react differently to NPL ratios above or below a threshold, with NPLs above the threshold having an adverse effect on lending. This is also contingent on the level of CAR banks hold for regulatory standards or own internal capital ratio requirements. We estimate the Loan-NPL relationship using a threshold model for a sample of Caribbean countries. The results suggest threshold range for the ratio of NPL/Total Loans as determining differential loan behavior of banks. An implication is that bank lending behavior could restrain economic activity, especially in periods of stress when NPLs are high.

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I. INTRODUCTION

The objective of the paper is to examine the impact of NPLs on loan creation in three Caribbean countries namely Jamaica, and Trinidad and Tobago. The paper in addressing the relationship of rising NPLS on loans will highlight how risk aversion impacts the sector's core function of financial intermediation.[2] The deterioration in the asset quality of banks is a characteristic of banking system failures in both developed and developing countries. As such the global financial sector crisis in 2008 has stimulated renewed interest in the impact of credit deterioration on financial stability. Once loan quality deteriorates banks become risk adverse and reduce the potential for the economy to be bolstered by financial intermediation.

The basis of sound credit risk management is the identification of the existing and potential risks inherent in lending activities. According to Estrella etal (2000) NPLs are the most common causes of bank failures. Measures to counteract these risks normally comprise clearly defined policies that express the bank's credit risk management philosophy and the parameters within which credit risk is to be controlled. Ideally a starting point for improving the prudential efficiency of monitoring of the banking system in the region must involve the identification of credit crunch.

The empirical work done on NPLs indicates that NPLs are procyclical in nature. O'Brien (1992) noted that a marked reduction in bank lending can be caused partially by a cyclical decline in the demand for credit. In upturns NPLs tend to be low and loan loss provisioning tend to be subdued. The loosening of lending standards during upswings depends on the supervisory environment and existing rules of conduct. In time of a downturn higher than expected NPLs engenders greater caution among lenders and as a consequence a tightening of lending standards which results in a tightening of lending, which has an adverse impact on economic growth. Heid and Krüger (2011) noted that a reduction in bank lending could be due to banks unwillingness to disburse loans as a result of two factors, deterioration in asset quality and stricter rules by regulators mainly from more stringent capital standards.

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[2] loan creation through deposit intake

Against this background NPLs determinants fall within the category of those associated with demand side factors and supply side factors all within the context of influence emanating from the macroeconomic environment. On the supply side, given the post global crisis period, banks have become more risk adverse and as a result have retooled the way in which it carries out its mandate of financial intermediation. Borio etal (2008) in focusing on the supply side, found that loan creation is negatively impacted by bank's perception of an increase in the relative risk on their portfolios.[3] Heid and Krüger (2011) noted that a sudden rise in credit risk may have a serious impact on loan supply. In the case of expected changes, the effect hinges on the size of the interest margin. If it is low, volatility in lending might be high. They also noted that even in the absence of capital regulation, banks hold a significant amount of capital. In the restricted cases, the bank holds capital well above the minimum capital requirements. Banks have a genuine incentive to hold capital cushion (buffer) well above the prudential requirement in order to avoid default through breaking regulatory capital requirements.

We observed that there are three strands of literature on NPLs. The first focuses on explain NPLs across banks focusing on the role of macroeconomic performance and the management quality and policy choices. The second strand of literature examines the impact of NPLs and microfinancial conditions by highlighting the positive impact of NPLs on the probability of crisis. Kaminsky and Reinhart (1999) suggest that a large increase in NPLs could be used to predict a crisis. The third branch of literature focuses on predicting NPL at the macroeconomic level from aggregate NPL ratios. Marco (2008) modeled consumer credit and mortgage debt from a sample of 11 euro area countries. The study found that a higher ratio of debt-to-income is associated with a higher level of NPL in subsequent periods.

Empirical literature on the impact of NPLs on loan creation from our observation is limited. Hou and Dickinson (2007) used the threshold regression technique and found some evidence that non-performing loans have non-linear negative effect on banks' lending behaviour.

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[3] For financial instrument, portfolio or institution Loan A is riskier than Loan B if the probability of default is higher.

Threshold methods are used in many papers when researchers are trying to solve for changes in the pattern of interaction between variables.

The paper contributes to the empirical literature by estimating the impact of NPLs on bank behavior. Existing literature that examines the relationship between NPLs and loans focuses on diverse countries and geographical location (Hou and Dickinson (2007), O'Brein and Browne (1992)). The collapse of the Standford International Bank in Antigua has been contained and the failure and impact of CLICO on the financial sector of Trinidad and Tobago as well as the region is still being ascertained. The resilience of the Caribbean financial sector was due mainly to the very conservative lending policies and the practice of having credit expansion based on deposit mobilization rather than on inter-bank or overseas borrowing. Notwithstanding this, the crisis has impaired the functions of banks in the region through a rapid increase in NPLs and a decline in loan portfolios.

Through the combined investigation of the three variables we can determine a threshold for banks' risk aversion. According low supply of loans relative to demand leads to credit rationing which distorts the market mechanism for loan dispersal. Increased risk aversion exhibited by banks has had a serious impact on the flow of credit which as a result has impacted monetary expansion negatively and by extension retard global economic growth.

The findings indicate that a continuous increase in NPLs causes a credit crunch above a NPL threshold. In times of downturn banks become less aggressive in operations and as a result financial intermediation is compromised. The broad policy implication for our analysis is that, while NPLs will always be a line item on the balance sheets of banks, steps must be taken to constantly ensure that sharp increases in NPLs does not result in NPLS going above the sectors threshold.

Section II of the paper reviews the nature of the commercial banking sector for Jamaica, Trinidad and Tobago, as well as perspective on the impact of the global financial crisis on the banking system. Section III describes the empirical specifications of the model and stylized

facts. Section IV examines and analyses the model results, Section V concludes and VI makes reference to future work.

II.   THE BACKDROP

NPLs in Jamaica, and Trinidad have increased significantly and rate of growth in loans have declined since the global financial sector crisis. The prudential minimum requirement for the Capital Adequacy Ratio (CAR) for Trinidad and Tobago is 8 percent while for Jamaica it is 10 percent. CARs have remained above the prudential minimum requirement, exception for Jamaica between the periods 1996 to 2011 during the country's financial sector crisis in the late 1990s.

Since the liberalization of the Jamaican economy in the late 1980's, there have been significant changes in the structure of the banking sector. In the 1990s following liberalization of the financial sector there was a credit boom in which loans were issued without proper risk assessment or appropriate valued collateral.[4] As a tightening of monetary policy to curtail high bouts of inflation during the period there was a reduction in aggregate demand which caused a slowdown in economic activity. The reduction in economic activity resulted in the poor servicing of loans which caused a spike in NPLs. NPLs/Loans ratio peaked to levels never seen before. In 1998 at the crescendo of the Jamaican financial crisis many commercial banks became insolvent. By end December1998 NPLs reached a staggering 28.9 percent. The dramatic expansion of the banking sector in the early 1990's culminated with the financial sector crisis. During the crisis almost all indigenous banks were deemed insolvent. These banks were subsequently closed liquidation being guided by the formation of the Financial Sector Adjustment Company (FINSAC) in 1997.[5] Through FINSAC four of the failed indigenous banks were merged bringing to six the number of banks in the sector. Commercial banks are the dominant institutions in the financial market, holding about three quarter of assets as well as liabilities.

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[4] Bank of Jamaica The first 40 years. pg: 64.
[5] BOJ first 40 years pg: 66.

Since the Jamaican financial crisis, the banking sector has remained robust due largely to the implementation by the Bank of Jamaica (BOJ) of a strong supervisory and regulatory framework. NPLs/Loans ratio has remained above the 10 percent prudential minimum standard since 2000. Banks have been very profitable and according to IMF 2006 Financial Sector Assessment Programme (FSAP) report, commercial bank profitability is perhaps helped by low competition and the perceived safe-haven of some banks. At present there are seven commercial banks in the industry. There is an active primary and secondary market for government bonds, an automated stock exchange for equities, a thin repo-based money market, an active market for short-term commercial paper and a spot market for foreign exchange.

Since the global financial crisis deposits have been increasing at a sluggish pace with an average growth of 2.4 percent over the review period (see table 1). As at the December quarter of 2010 deposits grew by a small margin of 1.6 percent and 6.2 percent relative to the September 2010 quarter and December 2009 quarter, respectively (see Panel 1.). Capital which recorded a noticeable decline during the late 1990s has been trending upwards. There was also another noticeable decline during the December 2007 quarter synonymous with the global financial crisis. Investments and loans have also increased steadily over the period. However there has been a fall of in loan disbursement which began during the first quarter of 2009. There was a decline in investments during the crisis period with some improvement since the start of 2011.

Table 1- Basic Data Description-The basic mean value and the standard deviation for each of the quarterly growth rates for the variables

Jamaica	Mean	Standard Deviation
Loan Growth Rate (%)	3.0	6.6
Investment Growth Rate (%)	4.0	8.9
Deposits Growth Rate (%)	2.4	3.2
Capital Growth Rate (%)	7.8	32.7
NPLS/Loans Growth Rate (%)	0.5	15.4
Trinidad and Tobago		
Loan Growth Rate (%)	3.0	3.3
Investment Growth Rate (%)	3.8	11.3
Deposits Growth Rate (%)	3.0	4.0
Capital Growth Rate (%)	4.1	6.6
NPLS/Loans Growth Rate (%)	2.8	32.0

The Commercial banking sector in Trinidad and Tobago has performed credibly in a dynamic economic, legislative and regulatory environment. Trinidad and Tobago's banking sector has undergone significant and complex changes since 1996 with mergers and conglomerate activities dominating the landscape. RBC Royal Bank which acquired RBTT Financial Holdings for US$2.2 billion in 2008 is the largest bank in Trinidad in relation to asset structure. There are presently eight commercial banks operating in Trinidad and Tobago with most of the banks increasing its financial services and expanding their operations to other countries in the Caribbean region. According to 2010 Article IV consultation, Trinidad and Tobago conducted the first ever Financial Stability Module (FSM) assessment under the Financial Sector Assessment Program (FSAP). The assessment sited that the banking system is strongly capitalized and is very conservative in lending practices. The report went on to note that notwithstanding the increase in NPLs, banks recorded strong profitability as the spread between the average lending and deposit rates has remained high. Stress tests suggest that the banking system has adequate buffers to withstand further deterioration in the macroeconomic environment, owing to the high capital cushion and slower credit growth, but the high degree of credit concentration risk is a concern.

The banking sector in Trinidad and Tobago has been described as oligopolistic (Forde etal 2008), with the top four of eight retail banks accounting for 90 percent of commercial bank assets. Each firm is aware of the actions of the others as well as the likely responses of other firms in the industry to any strategic plans on their part; some analysts argue that the industry is highly susceptible to collusive activity. On the other hand, competition between such firms to win or retain market share can be intense, offering customers a wider range of services at competitive prices.

NPLs increased sharply at the start of 2009 due to the slowdown in economic activity which resulted in a reduction in the ability of individuals being able to honour debt commitments. Investments, capital and deposits have been increasing over the period. Loans registered a sharp uptick since 2003. However since the start of 2009 loans have been relatively constant.

Given the slowdown in economic activity experienced in most Caribbean countries, NPLs on commercial banks' portfolios have been rising. In Jamaica, NPLs of the financial sector had grown by 57.6 percent in 2008 and 60.6 percent in 2009.[6] Non-performing loans continued to increase reaching 5.9 percent of total loans in June 2010 compared with 5.5 percent in March 2010 and that the rise in NPLs contributed to risk aversion by banks.[7] The banking system in Trinidad for 2010 was robust, with strong profitability and capital despite increases in non-performing loans.[8]

Given the rise in expected risk, most banks within the region appear to have tightened their lending standards thereby resulting in a slowdown in credit growth. Most recent figures, June 2011, suggest that bank credit to the private sector rose by a mere 1.9 percent in Jamaica, while in Trinidad credit grew by just 0.9 percent year on year for February 2011.[9] Most financial institutions are likely to maintain relatively prudent lending standards until signs of an end mark for the turbulent period are within clear view.

[6] 2010 IMF First Review under the Stand-By Arrangement report pg 12.
[7] Second Review under the IMF Stand-By Arrangement pg 4.
[8] Trinidad and Tobago: 2010 Article IV Consultation Public Information-Notice on the Executive Board Discussion pg 2.
[9] Central Bank of Trinidad and Tobago Quarterly summary of economic indicators March 2011.

Panel 1. Loans and variables that impact loan creation. Loan growth has been flat since the financial crisis while has been a sharp increase in non-performing loans and a constant growth in capital for all three countries since the financial crisis in 2008.
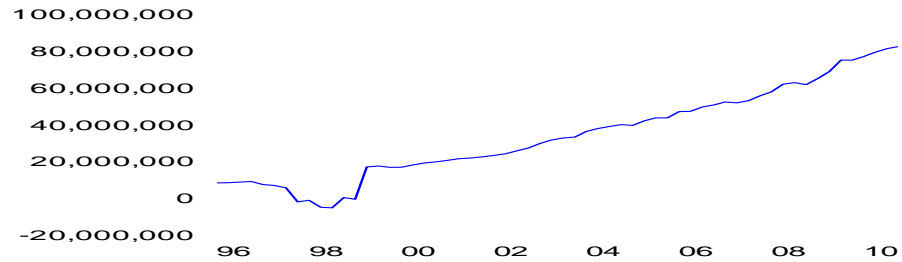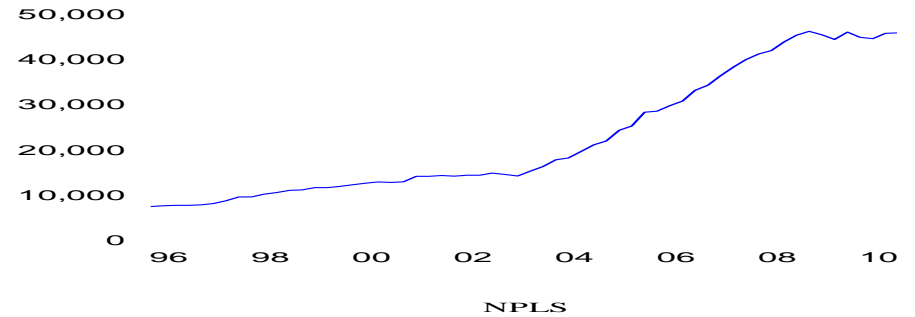
Jamaica (J$'000)

LOANS
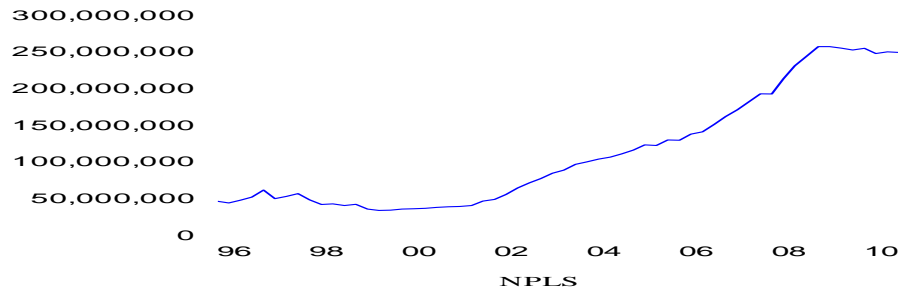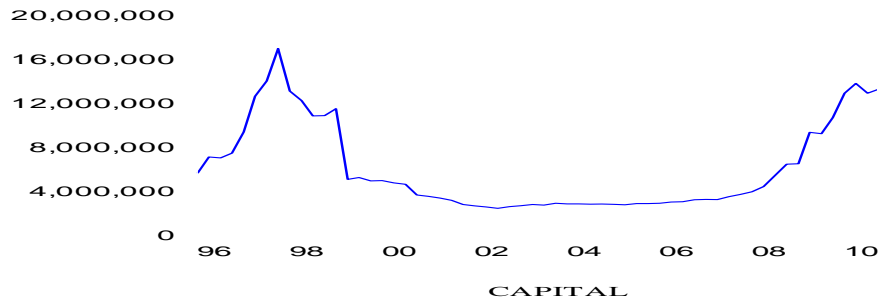
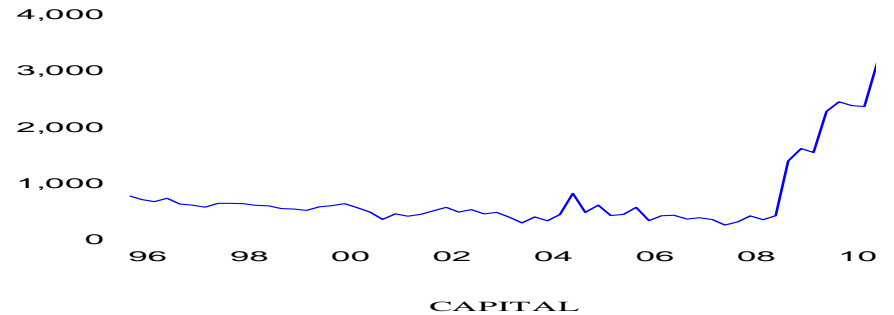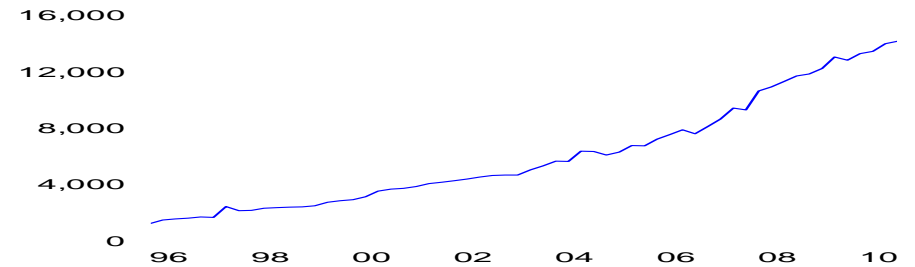**Trinidad and Tobago (TT$'000)**

LOANS

NPLS

NPLS

CAPITAL

CAPITAL

Modeling Loan growth: Linear model

In this paper, we use data from the balance sheet of the commercial banking system to assess empirically whether non-performing loans adversely affect bank's lending behaviour. Quarterly commercial banking system balance sheet data was obtained from the Bank of Jamaica (BOJ), and the Central Bank of Trinidad and Tobago. The time period 1996Q1 to 2011Q2 and 1995Q3 to 2010Q4 for Jamaica and Trinidad and Tobago, respectively.

For a typical commercial bank balance sheet, assets mainly comprise loans and other earning assets, while, deposits and capital are the main liabilities. Thus, the counterparts to loan growth are increases in deposits, capital and other earning assets. In addition, we take the non-performing loan growth into consideration. Further, NPLs are expected to adversely impact loan growth. The basic model we consider is:

$$Loans_t = \beta_0 + \beta_1 NPL/L_{t-1} + \beta_2 (NPL/L)^2_{t-1} + \beta_{3+} D_{t-1} + \beta_4 Inves_{t-1} + \beta_5 Cap_{t-1} + \varepsilon_t$$

where t is the index for time period in this instance quarterly. $Loans_t$ is the loan growth rate, NPL/L_{t-1} is non-performing loan growth rate of the previous quarter, D_{t-1} is the deposit growth rate of the previous quarter, $Inves_{t-1}$ is the other income earning assets growth rate of the previous quarter, and Cap_{t-1} is the capital growth rate for the previous quarter. It must be noted that $(NPL/L)^2_{t-1}$ is a nonlinear variable but linear in its parameter.

The characteristics of a quadratic equation allows for its usage in determining a threshold range for the impact of NPLs on loans. This can be seen as follows:

$$f(x) = a(x)^2 + b(x) + c$$

where $a(x)^2$ is the quadratic term, $b(x)$ is the linear term and c is the constant. The coefficient of the quadratic term, a, determines how wide or narrow the graph is, and whether the graph turns upward or downward. A positive quadratic coefficient causes the ends of the parabola to point upward and vice versa.

In Graph 1, coefficient a is large therefore the parabola is narrow. For any country that has a relatively high coefficient for the $(NPL/L)^2_{t-1}$ variable, its threshold range would be large and have a low minimum value.
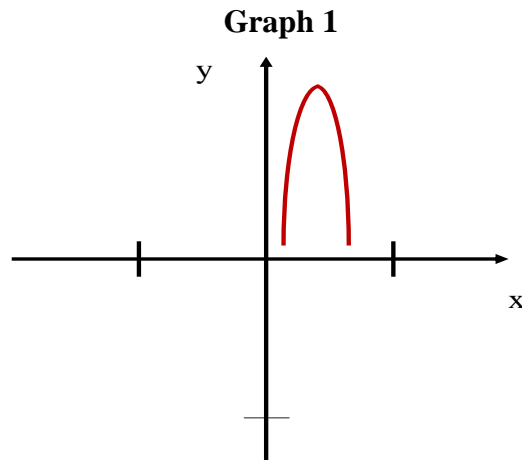
Graph 1

In Graph 2 the coefficient a is smaller. Therefore, the parabola is wider and minimum threshold is closer to zero.

Graph 2
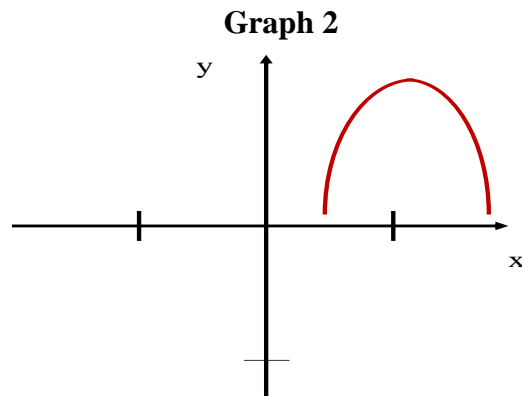
    a.   Confidence Interval

We also employed the use of the theorem of Confidence interval to ascertain the confidence interval range for the regression coefficient of the NPL^2_{t-1} variable. The interval obtained will represent the threshold range for the behavioral pattern of banks risk aversion in the issuance of credit. The confidence interval represents a closed interval where a certain percentage of the population is likely to lie. For this study a confidence of 95% confidence interval is used.

A 95% confidence interval with a lower limit of A and an upper limit of B implies that 95% of the population lies between the values of A and B. Out of the remaining 5% of the population, 2.5% is less than A and 2.5% is greater than B.

A 100(1-α) percent confidence interval on β_2 is obtained as follows:

$$\hat{\beta}_2 \pm t_{\frac{\alpha}{2}, n-2} \cdot se(\hat{\beta}_2)$$

where $\hat{\beta}_2$ is the coefficient of the squared variable of interest in this case $(NPL/L)^2_{t-1}$, $t_{\frac{\alpha}{2}, n-2}$ is the confidence interval and $se(\hat{\beta}_2)$ is the standard error of $\hat{\beta}_2$.

Diagram 1 below shows the spectrum of risk aversion by banks in its disbursement of credit. In the green quadrant loan creation is more dominated by demand side forces. As the level of NPLs/Loans ratio increases risk aversion by banks travel up the quadrant, from point A, which is the minimum point of the threshold range, signaling that loan supply is impacted by the NPLs/Loan ratio. After point B banks become almost unwilling to disburse loans due to the level of NPLs/Loans.

Diagram1. - Risk Aversion Spectrum of Banks – A represents lower bond of threshold and B represents the upper bound.
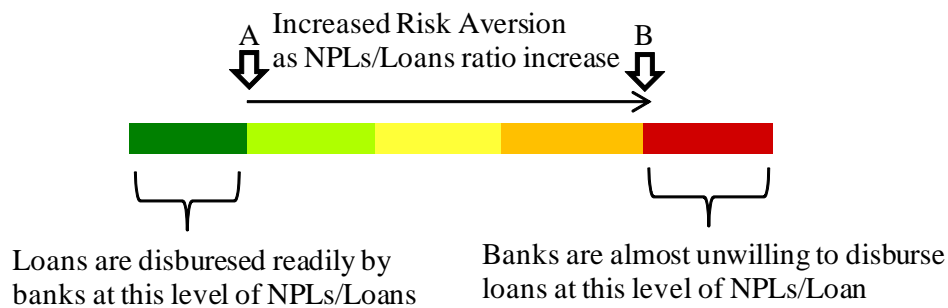
Stylized facts

The empirical model is specified to capture the credit supply side factors. Normally, the supply of loans is determined by banks' lending capacity and factors that influence banks' willingness to provide credit. Based on Credit Crunch view, the NPLs has a negative

relationship to loans, implying that the higher NPLs in a bank's portfolio, the less credit banks are willing to supply.

As financial intermediations, commercial banks' main function is to receive deposits and make loans to facilitate the flow of capitals. For most of the commercial banks, deposits are the main funding sources for commercial banks' assets. And loans take up the biggest proportion in the asset portfolio. With the expansion of the asset size, banks will expand the volume of the loans to re-balance the asset portfolio. Under the normal situation, loan growth rate is expected to move in the same direction as the growth of deposits. The sign in front of DGR_t, thus, is expected to be positive. But according to the non-performing loan hypothesis, when banks are in poor condition ridden by high level of NPLs, the willingness for the banks to expand loans is decreased, which implies that loan growth will not be consistent with the expansion of deposits.

Capital is the part of the long-term funds that banks can use with fewer restrictions than other kinds of funds from outside sources. In addition, capital acts as the safety cushion for bank's lending. With a higher capital level, banks will feel more confident and less constrained to extend loans. In order to maximise profits, which is the primary objective for most of the commercial banks, banks are supposed to increase lending with the growth of capitals, which implies a positive sign in front of CGR_t. However, under our hypothesis, such relationship between the lending and capital is distorted, which suggests the possibility of the negative sign. According to Basle Accord II, the target ratio of capital to risk weighted assets is set at 8%. However, using capital as the proxy for banks' holding of capital against risky assets we will show that banks have an internal quality control is more rigid. In response to different characteristics and situations, different jurisdictions may have different levels of effective capital ratio constraints.

The sign in front of $OEAGR_t$ is expected to be negative as other earning assets are the substitute for loans for a given amount of total assets. When the banks are heavily ridden by the non-performing loan problem, they are unwilling to make loans for fear of the generation

of new non-performing loans; instead, they switch for securer assets, such as government bonds or treasury bills, thus, the substitute effect will be greater. As a result of such greater substitution effect, the other earning asset growth will have larger negative effects on loan growth. On the other hand, higher credit risk may impede the growth of other earning asset. With higher credit risk in portfolio, banks may have to retain more capital rather than investing in other earning assets to improve the safety position. In addition, higher credit risk will reduce banks' credit ranking on the financial markets, which will also reduce their ability to engage in various investments.

Under the non-performing loan hypothesis, the relationship between the loans and non-performing loan conditions are negative, indicating negative sign associated with non-performing loan growth rate. In our model, we use the lagged term of the non-performing loan growth. It is because that the amount of non-performing loans is not normally known until the end of period; however, the loan decisions are always made at the beginning of the period. Banks make decision according to their existing non-performing loan situation, which can be roughly represented by the situation of non-performing loans at the end of last period.

Nonlinear relationship: the threshold effect of NPLs and Capital

So far, we have emphasised the negative aspects of NPLs, i.e., they reduce the efficiency of resource allocation of the financial system. But in reality, bad loans exist as a natural consequence of lending behaviour when banks re-balance their portfolio. Banks decide the degree of risk they will tolerate for a given level of expected return according to their risk preference. When the level of non-performing loans goes beyond a certain level that banks can accept, the re-balancing actions will be affected. It implies that the coefficient might change in reference to the amount of NPLs; and hence, we conjecture that negative effect on lending is non-linear, i.e., there is a critical threshold level decided by the rate of NPLs to total loans. Banks make lending decision differently reacting to non-performing loans rate under or above a certain level; when NPLs increase above the threshold, they start to cause negative effect on lending. Therefore the estimation of the threshold range will isolate change in behavioral patterns of the banking sector below and above the threshold. As a consequence of this realization that the relationship between NPLs and loans will cause a non-linear effect.

IV. EMPIRICAL RESULTS AND ANALYSIS

a. Empirical Results for Jamaica

    i. Regression outturn

For both data sets the variables were integrated in order to remove unit root. Granger causality test was conducted and revealed that loans granger caused all the independent variables. This was corrected by having all the independent variables lag one period. The model was then estimated using ordinary least squares. An Autoregressive Moving average (ARMA) term was introduced in order to correct for autocorrelation. Diagnostics tests on residuals were conducted and the model was found to be significant.

The variable NPL/L_{t-1} (which represents the nonperforming loans to total Loans ratio) of the commercial banks was negative and significant at the 5.0 percent level in the model. It can be inferred that banks will reduce their loans supply at greater levels of NPLs/Loans ratio (see Hou and Dickinson (2007)).

The variable D_{t-1} (which represents deposits) is positive and significant. This evidence is consistent with previous studies and the inference can be drawn that as deposits increase banks will have more funds available to supply credit.

The variable $Inves_{t-1}$ (which represents other income earning assets) is negative and significant. This evidence is consistent with previous studies. We can therefore conclude that loans can be substituted by banks for other tools on the balance sheet that have the capability of earning an income.

The variable Cap_{t-1} (which represents capital) is positive and significant. This evidence is consistent with previous studies can be interpreted as an increase in loan disbursement by banks is accompanied by an increase in the stock of capital to back the risk undertaken due to an increase in the loan stock.

ii.   Confidence Interval Outturn

Using the confidence interval theorem on the coefficient estimated for $(NPL/L)^2_{t-1}$ the range found for Jamaica is threshold with a minimum value of 5.6 percent and a maximum limit of 15.6 percent. The maximum and minimum results are consistent with our initial hypotheses that as banks move to higher levels in the range they will become more risk averse. During Jamaica's financial crisis episode in the late 1990s rates were higher than the threshold maximum and growth in loans declined during the period. Once NPLs are below the minimum threshold of 5.6 percent there tend to be an increase in loans supplied. The concentration of loan output at that lower level would be more influenced by the demand side variables for loans.

b. Empirical Results for Trinidad and Tobago

i.   Regression outturn

The variable NPL/L_{t-1}(which represents the nonperforming loans to Loans ratio) of the commercial banks was negative and significant at the 5.0 percent level of significance. It can therefore be inferred that banks in Trinidad like Jamaica will reduce their loans supply at greater levels of NPLs/Loans Ratio.

The variable D_{t-1} (which represents deposits) is positive and insignificant at the 10.0 percent level. The variable however was kept as it added to the predictive power of the model. The variable did not follow priori explanatory power of the equation. This evidence is inconsistent with previous studies.

The variable $Inves_{t-1}$ (which represents other income earning assets) is negative and insignificant. This may be due to other dynamics which may be interacting with the decision making process of banks in Trinidad regarding a substitute for not increasing loan supply. The variable however was kept as it added to the predictive power of the model.

The variable Cap_{t-1} (which represents capital) is positive and significant at the 10.0 percent level. As the level of loans increase banks ensure that there is adequate buffer for the added risk undertaken when loans supply increases.

Results for Trinidad and Tobago would indicate that there are other underlining variables outside of balance sheet variables that play an important role in the decision process by banks in Trinidad and Tobago in supplying loans. This is evidenced by the low R^2 obtained. However the model is valid and has some predictive capability as the F-statistic is significant at the 5.0 percent level.[10] Of all the balance sheet line items used in the model, NPLs/Loans and capital were the only two variables that had a significant relationship with loans. This would indicate that banks with the exception of NPLs/loans ratio and capital are highly dependent on other influences outside the model in the decision process for loan disbursal. One such set of factors could be macroeconomic variables.

ii.   Confidence Interval Outturn

Using the confidence interval theorem on the coefficient estimated for $(NPL/L)^2_{t-1}$ the range found for Trinidad and Tobago is a threshold with a minimum value of 2.7 percent and a maximum limit of 30.2 percent. The IMF FSAP evaluation done on Trinidad did underscore that banks in Trinidad were very cautious in loan disbursal. This is justified by the very low floor for the threshold range for Trinidad and Tobago. The high ceiling indicates that the banks risk aversion band is more widely placed when compared to Jamaica. This may be due to Trinidad and Tobago not having the experience of a financial crisis. One of the most stressful periods for the banking sector in Trinidad according to Wai (2009) was during the bust period in the Trinidadian economy during the late 1980s. Over the period, specifically 1986 to 1989, the ratio of non-performing loans to total loans for the entire commercial banking industry rose from 11.7 percent to 24.6 percent. However one would suspect going forward that the maximum range will decline (and as a result the range) as players in the

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[10] The model returned a R^2 of 0.3833. However the F-statistic was significant at the 5 percent level which indicates the model was significant.

banking sector would have fully evaluated and adjusted the market post the lag effect from the collapse of CLICO.

V. CONCLUSION

Having examined the impact of non-performing loans on bank's lending behavior for both Jamaica and Trinidad and Tobago we have detected some evidence that at higher levels of NPLs/Loan ratio banks become more risk averse in loan disbursal. It is also observed that the two countries used had varying level of risk aversion behavioral patterns.

For Jamaica the threshold range indicates that banks operate within a tight band of risk aversion. The relatively low maximum range indicates that banks are still cognizant of Jamaica's financial crisis in the late 1990's, ensuring that they operate within a range that does not carry the NPLs/loans ratios that prevailed during the late 1990s. The range may expand in the future given two facts; i) the more time passes the more the crisis of the late 1990s become a distant past, ii) the recent passing of the credit bueauru act paves the way for a credit bueauru in Jamaica. Banks will have a lower cost and more efficient mechanism to assess the riskiness of loan customers.

Trinidad and Tobago's threshold range revealed that for Trinidad and Tobago's banking sector they are cautious in loan dispersal as revealed by the relatively low minimum value of the lower bound of the threshold but are willing to expand loan disbursement over a larger range of NPLs/Loan ratio growth. This speaks to the lack of experience of having a financial crisis and as such these banks are more willing to expand their risk horizon. The closest to a crisis was the recent CLICO failure which had no significant impact on the present statistical data.

Regulators can use the methodology as defined in this paper to monitor the NPLs/Loans ratio threshold in order to ascertain when the banking sector is coming under severe pressure. This in effect would add to the suite of predictive indicators available to regulators in ascertaining when the banking sector is coming close to turmoil and crisis. As well as to ascertain when

the market is in a credit crunch this ultimately has negative consequences for monetary expansion and ultimately economic growth.

Overall NPLs can have a negative impact on loan creation and as evidenced from the study is different in its degree of influence across Jurisdictions. It ultimately can slow down monetary expansion in the region and as a result stall economic growth and prosperity.

VI. FUTURE WORK

Since our results from Jamaica and Trinidad and Tobago are encouraging, the study will be improved upon. There will be two added features to the body of work; we will incorporate the impact of Capital adequacy (CAR) on loan growth; estimate a threshold level rather than a threshold range for both NPLs and CARs. In order to achieve these objectives we will change the model specifications. We will estimate the threshold level using a Smooth Transition Autoregressive (STAR) model. This will allow for the estimation of the Loan-NPL-CAR relationship.

VII. APPENDIX

A1.
Table 2. Summary of Unit Root test – With the exception of the loan variable for Jamaica, all variables were stationary when first differenced.

	levels		First difference	
	ADF Tests Statistic	PP test rho	ADF Tests Statistic	PP test rho
Jamaica				
Loans	-2.129(2)	-1.780(4)	-13.22(0)***	-5.600(4)*
Deposit	-1.697(3)	-2.858(58)	-7.741(2)*	-21.915(4)*
Capital	-2.657(0)	-2.704(2)	-7.893(0)*	-7.889(2)*
Income earning assets	-2.082(0)	-2.146(1)	-7.152(0)*	-7.139(4)*
NPLs	-0.452(0)	-0.755(3)	-7.131(0)*	-7.150(2)*
T & T				
Loans	-1.719(2)	-1.630(5)	-7.217(2)*	-6.089(4)*
Deposits	-0.709(0)	-0.494(3)	-8.541(0)*	-9.070(5)*
Capital	-0.239(1)	-0.362(4)	-11.035(0)*	-11.035(0)*
Income earning assets	-1.479(0)	-1.419(1)	-8.402(0)*	-8.550(4)*
NPLs	1.022(0)	1.922(2)	-7.563(0)*	-7.627(4)*

Results for the unit root test for each variable ** and * represents significance at the 5% and 1% level respectively. *** represents second difference. Lags are in brackets.

A2

Table 3. Jamaica OLS Regression - An OLS regression was done and the results indicate that all variables were significant at the 5.0 percent level. Note there is a negative relationship between Loans and NPls; as NPLs increase loan supply declines. The model had a sufficiently high R^2 term and the P value of the F-statistic indicates the model was significant.

Dependent Variable: DLOG(LOANS)
Method: Least Squares
Date: 09/23/11   Time: 15:46
Sample (adjusted): 1997Q1 2011Q2
Included observations: 58 after adjustments
Convergence achieved after 26 iterations
MA Backcast: 1995Q4 1996Q4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.030441	0.017064	1.783988	0.0805
D(NPLS_LOANS(-1))	-2.709298	0.946232	-2.863250	0.0061
D(NPLS_LOANS2(-1))	10.56569	2.547274	4.147842	0.0001
@PCH(CAPITAL(-1))	0.060794	0.017113	3.552587	0.0008
DLOG(INVESTMENT(-1))	-0.179364	0.066046	-2.715742	0.0091
DLOG(DEPOSITS(-1))	0.198683	0.088295	2.250213	0.0289
AR(2)	0.347331	0.132304	2.625256	0.0115
MA(5)	0.987483	0.026446	37.33899	0.0000

R-squared	0.606948	Mean dependent var	0.026474
Adjusted R-squared	0.551921	S.D. dependent var	0.067302
S.E. of regression	0.045051	Akaike info criterion	-3.234611
Sum squared resid	0.101479	Schwarz criterion	-2.950412
Log likelihood	101.8037	Hannan-Quinn criter.	-3.123910
F-statistic	11.02996	Durbin-Watson stat	1.948052
Prob(F-statistic)	0.000000		

Inverted AR Roots	.59	-.59		
Inverted MA Roots	.81-.59i	.81+.59i	-.31+.95i	-.31-.95i
	-1.00			

Table 3. - Trinidad and Tobago OLS regression- An OLS regression was done and the results indicate that only one variable was significant at the 5.0 percent and 10 percent level. Note there is a negative relationship between Loans and NPLs; as NPLs increase loan supply declines. The model had a low R^2 term indicating other variables were impacting loan supply. The P value of the F-statistic indicates the model was significant.

Dependent Variable: DLOG(LOANS)
Method: Least Squares
Date: 09/23/11   Time: 15:58
Sample (adjusted): 1995Q3 2010Q4
Included observations: 62 after adjustments
Convergence achieved after 11 iterations
Newey-West HAC Standard Errors & Covariance (lag truncation=3)
MA Backcast: 1994Q3 1995Q2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.021769	0.005847	3.722869	0.0005
D(NPLS_LOANS(-1))	-3.184559	0.740662	-4.299610	0.0001
D(NPLS_LOANS2(-1))	16.42155	7.008000	2.343257	0.0228
@PCH(CAPITAL(-1))	0.068842	0.037896	1.816599	0.0747
DLOG(DEPOSITS(-1))	0.106186	0.066318	1.601164	0.1151
D(INVEST(-1))	-2.71E-07	4.02E-06	-0.067459	0.9465
MA(4)	0.518511	0.126412	4.101763	0.0001

R-squared	0.383365	Mean dependent var		0.028657
Adjusted R-squared	0.316096	S.D. dependent var		0.032389
S.E. of regression	0.026786	Akaike info criterion		-4.295903
Sum squared resid	0.039461	Schwarz criterion		-4.055743
Log likelihood	140.1730	Hannan-Quinn criter.		-4.201610
F-statistic	5.698968	Durbin-Watson stat		1.665856
Prob(F-statistic)	0.000116			

Inverted MA Roots	.60+.60i	.60+.60i	-.60-.60i	-.60-.60i

A2

Chart 1. - Jamaica-The Histogram below indicates that the model for Jamaica was normally distributed as noted by the value of the Jarque-Bera.

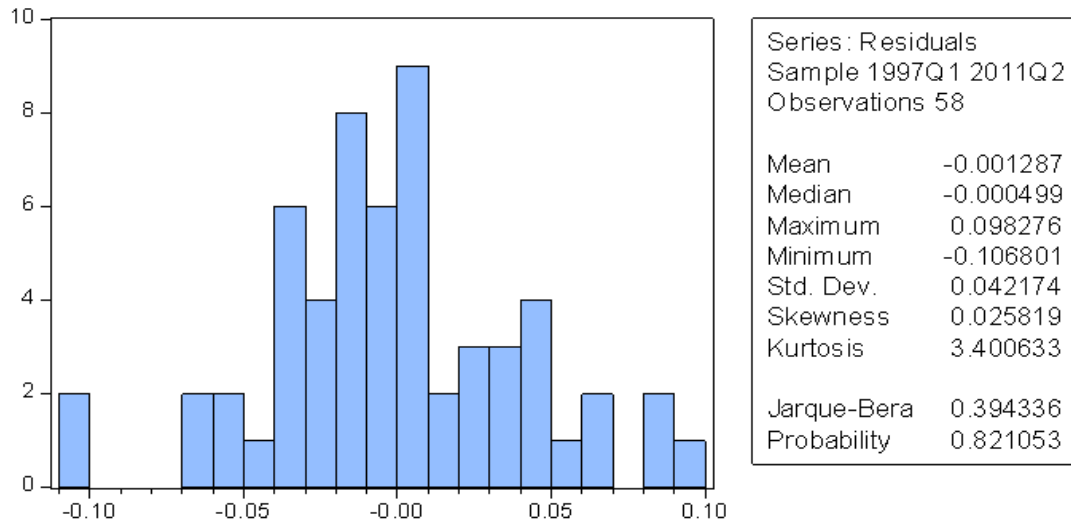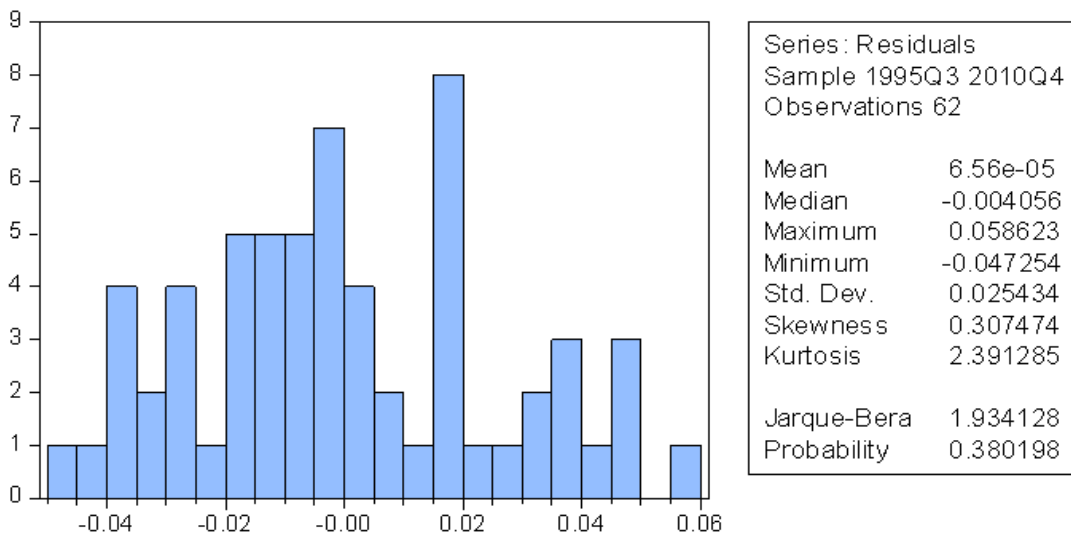| Series: Residuals Sample 1997Q1 2011Q2 Observations 58	
Mean	-0.001287
Median	-0.000499
Maximum	0.098276
Minimum	-0.106801
Std. Dev.	0.042174
Skewness	0.025819
Kurtosis	3.400633
Jarque-Bera	0.394336
Probability	0.821053

Chart 2. - Trinidad and Tobago - The Histogram below indicates that the model for Trinidad and Tobago was normally distributed as noted by the value of the Jarque-Bera.

Series: Residuals Sample 1995Q3 2010Q4 Observations 62	
Mean	6.56e-05
Median	-0.004056
Maximum	0.058623
Minimum	-0.047254
Std. Dev.	0.025434
Skewness	0.307474
Kurtosis	2.391285
Jarque-Bera	1.934128
Probability	0.380198

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