The Impact of Non-performing Loans on Loan Growth: an econometric case study of Jamaica and Trinidad and Tobago

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Abstract

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 Capital Adequacy Ratio (CAR) banks hold for regulatory standards or own internal capital ratio requirements. I estimate the threshold range for the Loan-NPL relationship using regression analysis for two Caribbean countries. The results suggest a threshold range for NPLs 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 financial crisis in the 2007 has caused a slowdown in monetary expansion. O’Brien and Browne (1992) sited that one factor that can contribute to the slowdown in monetary transaction is a reduction in bank lending. It is understood that a slowdown in loans reflects influences on both the demand and the supply side. On the demand side a slowdown in economic activity and the subsequent loss of purchasing power by many individuals has disqualified them from being able to qualify for access to loans. This has resulted in dramatic fall in loans demanded. According to O’Brien and Browne (1992), on the supply side, the decline in credit is exacerbated by two channels on the supply side i) a deterioration in asset quality and ii) stricter attitudes of regulators, especially through more stringent capital standard. Given the magnitude and nature of the recent financial crisis, the greatest financial and economic crisis since the Great Depression of the 1930s, the industry was to some extent spared a direct blow and has managed to remain resilient. In most Caribbean countries, the stress placed on the regional banking system has not resulted in any major runs on commercial banks or large failures. The failures that have occurred, the collapse of the Standford International Bank in Antigua and CLICO in Trinidad and Tobago, have largely been contained. The region was spared major direct contagion effect, due in large part to its very conservative lending policies and because credit expansion practices is principally based on deposit mobilization rather than inter-bank or overseas borrowing.

In the wake of the crisis, banks have come to the realization that retail operations forms an important source of funding for the asset side of the balance sheet. Loan products and increasing deposit size becomes the go to mark. On the flip side of the aggressive push to increase client base, the crisis highlighted that fundamentally what can be gained by aggressively pushing credit policies, can be lost in turbulent market conditions. The cost of financial intermediation has increased as evidenced by an increase in the cost resulting from higher capital costs and loan losses.

This study employs an Ordinary Least Square (OLS) model to ascertain the minimum and maximum threshold points for NPLs at which commercial banks become risk adverse in the dispersal of loans.

Section II of the paper reviews the nature of the commercial banking sector for Jamaica and Trinidad and Tobago, as well as perspective on the impact of the global financial crisis on the banking system for both jurisdictions. Section III reviews academic literature on the topic of NPLs. Section IV describes the empirical specifications of the model. Section V examines the data to be used in the study, section VI examines and analyses the empirical results, Section VII concludes and section VIII makes mention of future work to be conducted.

II. THE BACKDROP

The Commercial banking sector in Trinidad and Tobago has performed credibly in a dynamic economic, legislative and regulatory environment. There are presently eight commercial banks operating in Trinidad and Tobago with most of the banks expanding their operations to other countries in the Caribbean region. The banking sector in Trinidad and Tobago has often
been described as oligopolistic given that the industry is dominated by a small number of firms. On average a snapshot of the sector reveals of the eight participants, the top four retail banks account for 90.1 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 in an oligopoly can be intense, offering customers a wider range of services at competitive prices.

Since the liberalization of the Jamaican economy in the late 1980’s, there have been significant changes in the structure of the banking sector. The dramatic expansion of the banking sector in the early 1990’s cumulated with the financial sector crisis. During the crisis almost all indigenous banks were deemed insolvent. These banks were subsequently closed in an effort to curtail the problems in the financial sector during the period with the process of closure and liquidation being guided by the formation of the Financial Sector Adjustment Company (FINSAC) in 1997. Through FINSAC four of the failed indigenous banks were merged bringing to six the number of banks in the sector. Since then according to a study by Duncan (2002) competition in the banking sector has declined. Commercial banks are the dominant institutions in the financial market, holding around three quarter of assets as well as liabilities. Since the Jamaican financial crisis the banking sector has remained robust due largely in part to the implementation by the Bank of Jamaica (BOJ) of various prudential regulatory rules and mechanism to ensure operations of the banking system occur in a prudent manner. 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 deep repo-based money market, an active market for short-term commercial paper and a spot market for foreign exchange.

One of the major indicators of distress in the banking sectors that has been closely monitored across the world since the global crisis is the sharp increase in non-performing loans/Loans (NPLs/Loans). A Non-performing loan under Basel II is any loan that is past due for more than 90 days, but subject to national variation. According to Bank of International Supervision (BIS), the standard loan classifications are defined as follows:

(1) **Passed**: Solvent loans;
(2) **Special Mention**: Loans to enterprises which may pose some collection difficulties, for instance, because of continuing business losses;
(3) **Substandard**: Loans whose interest or principal payments are longer than three months in arrears of lending conditions are eased. The banks make 10% provision for the unsecured portion of the loans classified as substandard;
(4) **Doubtful**: Full liquidation of outstanding debts appears doubtful and the accounts suggest that there will be a loss, the exact amount of which cannot be determined as yet. Banks make 50% provision for doubtful loans;

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1 Forde et.al (2008).
2 BOJ first 40 years pg:66.
(5) **Virtual Loss and Loss (Unrecoverable):** Outstanding debts are regarded as not collectable, usually loans to firms which applied for legal resolution and protection under bankruptcy laws. Banks make 100 percent provision for loss loans.³

Non-performing loans comprise the loans in the latter three categories, and are further differentiated according to the degree of collection difficulties.

Given the slowdown in economic activity experienced in most Caribbean countries the quantum of NPLs on commercial banks’ portfolios has been rising. In Jamaica, for example, NPLs of the financial sector had grown by 57.6 percent in 2008 and 60.6 percent in 2009.⁴ In the Second Review under the IMF Stand-By Arrangement, it sited that 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.⁵ An IMF Mission to Trinidad and Tobago in 2010 in their Article IV report signaled that the banking system remained robust, with strong profitability and capital despite increases in non-performing loans which must be monitored carefully.⁶

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 increased scantily by 1.9 percent in Jamaica, while in Trinidad credit growth was also sluggish growing by just 0.9 percent year on year for February 2011.⁷ Most financial institutions are likely to maintain relatively prudent lending standards until signs of an end mark for the turbulent period are within sight.

### III. A REVIEW OF THE LITERATURE

The efficiency of the banking sector can be severely compromised by NPLs. In a study by Maggi and Guida (2009) which modeled the effect of NPLs on the cost structure of the commercial banking system it was found that probability of an uncertain loan becoming non-performing is extremely costly to the banking system effectively impacting the efficiency of the banking sector. A number of studies found that failing banks tend to be located far from the most-efficient frontier (Berger and Humphrey (1992), Barr and Siems (1994), DeYoung and Whalen (1994), Wheelock and Wilson (1994)), because banks do not optimize their portfolio decisions by lending less than demanded. There is a host of studies which reveals that even among banks that do not fail, there is a negative relationship between the non-performing loans and performance efficiency (Kwan and Eisenbeis (1994), Hughes and Moon (1995), Resti (1995)).

The idea that banks are reluctant to take new risks and commit to loan supply is called “credit crunch” according to Hou and Dickinson (2007). According to the United States Council of Economic Advisors (1991), credit crunch is “a situation in which the supply of credit is

³ The details of the loan classifications are collected from various BIS documents.
⁴ 2010 IMF First Review under the Stand-By Arrangement report pg 12.
⁵ Second Review under the IMF Stand-By Arrangement pg 4.
⁶ Trinidad and Tobago: 2010 Article IV Consultation Public Information-Notice on the Executive Board Discussion pg 2.
⁷ Central Bank of Trinidad and Tobago Quarterly summary of economic indicators March 2011.
restricted below the range usually identified with prevailing market interest rates and the profitability of investment projects”. A “credit crunch” is a disequilibrium phenomenon. The low supply of loans relative to demand leads to credit rationing which distorts the market mechanism for loan dispersal. This as a result retards monetary policy which filters into a slowdown in economic growth.

In evaluating the impact of NPLs on the loan supply by banks, there are studies that suggest that credit creation is impacted by both macroeconomic variables that impact loan uptake as well as internal structures such as the composition of a bank’s balance sheet and the demand for loans. Baum et al (2002) investigated empirically the link between bank lending and macroeconomic uncertainty using annual and quarterly U.S. bank level data. They concluded that in the presence of greater macroeconomic uncertainty, banks collectively become more conservative, and this concerted action will lead to a narrowing of the cross-sectional distribution of banks’ loan-to-asset (LTA) ratios. Calza et al (2001) using the Johansen methodology, identified in their study one cointegrating relationship linking real loans, GDP and interest rates. This relationship implies that in the long-run real loans are positively related to real GDP and negatively to real short-term and long-term interest rates.

The impact of NPLs/Total Loans (a balance sheet variable) on loan supply will be the mechanism used to identify a threshold range within which there is a clear distinction between mood swings as it relates to banks decision making process in loan dispersal. Using the study by Hou and Dickinson (2007) as the launching pad, I will look at the risk aversion of banks in supplying loans through the modeling of loan supply on balance sheet variables. Hou et al in their study concluded that higher level of nonperforming loans reduces a banks’ aspiration to increase lending.

IV. **Empirical Specification**

I will seek to ascertain a threshold range for NPLs by employing a methodology which estimates the confidence interval for the threshold for NPLS/Loans ratio for both Jamaica and Trinidad and Tobago. I have specified a model to capture the credit supply side factors. The supply of loans is determined by two factors mainly, banks willingness to supply credit and the factors influencing a banks willingness to supply loans. Following the views regarding Credit Crunch, NPLs should have a negative effect on loans, which would imply that the higher NPLs in a bank’s portfolio, the less credit that the bank can and is willing to supply.8

For a simple commercial bank balance sheet, assets are mainly composed of commercial loans and other earning assets; while on the liability side, deposits and capital are the main components. Thus, we can conjecture that the loan growth is affected by deposit growth, capital growth and other earning assets growth. In addition, we take the non-performing loan growth into consideration.

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8 Hou and Dickinson (2007)
As financial intermediates, commercial banks’ main function is to receive deposits and make loans to facilitate the flow of capital. For most of the commercial banks, deposits are the main funding sources for commercial banks’ assets. 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.

a. Regression Approach

There are a number of factors that impact banks willingness to issue loans. I have modeled in an equation those factors from a bank’s balance sheet that determine how much credit is extended to customers to ascertain their relationship with the amount of loans issued. The specification undertaken to model the relationship between these balance sheet items and credit creation is a regression analysis.

A regression equation is derived from the variables of interest:

\[ \text{Loans}_t = \beta_0 + \beta_1 \text{NPL}/L_{t-1} + \beta_2 \text{NPL}/L^2_{t-1} + \beta_3 D_{t-1} + \beta_4 \text{Inves}_{t-1} + \beta_5 \text{Cap}_{t-1} + \epsilon_t \]

where \( t \) is the index for time period in this instance quarterly. \( \text{Loans} \) is the loan growth rate, \( \text{NPL}/L_{t-1} \) is non-performing loan growth rate of the previous quarter, \( D_{t-1} \) is the deposit growth rate of the previous quarter, \( \text{Inves}_{t-1} \) is the other income earning assets growth rate of the previous quarter, and \( \text{Cap}_{t-1} \) is the capital growth rate for the previous quarter. It must be noted that \( \text{NPL}/L^2_{t-1} \) 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:

\[ f(x) = ax^2 + bx + c \]

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 \( \text{NPL}/L^2_{t-1} \) variable, its threshold range would be large and have a low minimum value.
In Graph 2 the coefficient a is smaller. Therefore, the parabola is wider and minimum threshold begins much further down the spectrum.

b. Confidence Interval

I also have employed the use of the theorem of Confidence interval to ascertain the confidence interval range for the regression coefficient of the $NPL_{t-1}^2$ 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 $\beta_2$ is obtained as follows:

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

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

**Diagram 1. - Risk Aversion Spectrum of Banks** – A represents lower bond of threshold and B represents the upper bound.

V. DATA

The commercial banking system balance sheet data was obtained from the BOJ and the Central Bank of Trinidad and Tobago. The data sets are quarterly in nature and span the time period 1996Q1 to 2011Q2 and 1995Q3 to 2010Q4 for Jamaica and Trinidad and Tobago, respectively.

In Jamaica during 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. With a tightening of monetary policy to curtail high bouts of inflation during the period came 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. During the late 1990s NPLs/Loans ratio in Jamaica peaked to levels never seen before. In 1998 at the crescendo of the Jamaican financial crisis many commercial banks became insolvent. By end December 1998 nonperforming loans reached a staggering 28.9 percent. Since then with the tightening of regulations by the BOJ, NPLs/Loans ratio has remained below 8.0 percent since 2000.

Since the 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 second quarter of 2011 quarter deposits grew by a small margin of 1.3 percent and 0.3 percent relative to the March 2011 quarter and December 2010 quarter, respectively. Capital for the period has been trending upwards with a noticeable decline during the late 1990s synonymous with the Jamaica financial crisis. There was also another noticeable decline during the December 2007 quarter.

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9 Bank of Jamaica The first 40 years. pg: 64.
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. Investments saw some decline during the crisis period but has picked up pace since then.

The Trinidad and Tobago 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. The commercial banks not only increased their financial services offer domestically they have also expanded their reach to the rest of the Caribbean. 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 nonperforming loans, 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 a further significant 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.

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.

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

<table>
<thead>
<tr>
<th>Jamaica</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loan Growth Rate (%)</td>
<td>3.0</td>
<td>6.6</td>
</tr>
<tr>
<td>Investment Growth Rate (%)</td>
<td>4.0</td>
<td>8.9</td>
</tr>
<tr>
<td>Deposits Growth Rate (%)</td>
<td>2.4</td>
<td>3.2</td>
</tr>
<tr>
<td>Capital Growth Rate (%)</td>
<td>7.8</td>
<td>32.7</td>
</tr>
<tr>
<td>NPLS/Loans Growth Rate (%)</td>
<td>0.5</td>
<td>15.4</td>
</tr>
</tbody>
</table>

**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 |
VI. **EMPIRICAL RESULTS AND ANALYSIS**

a. **A Priori Expectation**

According to the theoretical and empirical literature, the following relationships are expected to be reflected in the empirical results: (i) Loans should be pro-cyclical;\(^\text{10}\) (ii) There should be a negative relationship between loans and the variables Nonperforming loans and income earning assets; (iii) there should be a positive relationship between loans and the two variables deposits and capital.

b. **Empirical Results for Jamaica**

i. ** Regression outcome**

For both sets of data the variables were integrated at order 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 lagged by 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 undertaken 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 which 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 \(Invest_{t-1}\) (which represents other income earning assets) is negative and significant. This evidence is consistent with previous studies. The inference can therefore be made 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 which 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 by increasing the loan stock.

\(^{10}\) What is being posited from this is that during periods of economic booms economic activity increases and as a result economic agents’ require more credit to carry out consumption and vice versa.
ii. **Confidence Interval Outturn**

Using the confidence interval theorem on the coefficient estimated for \((NPL/L)_{t-1}\) 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 the crisis period of the late 1990s in Jamaica when rates were higher than the threshold maximum the growth in loans declined. 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.

c. **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 interact in 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 regarding Trinidad and Tobago would indicate that there are other underlining variables that seem to have a greater impact on loan dispersal than the balance sheet variables for banks in Trinidad and Tobago. This is evidenced by the low \(R^2\) obtained from the regression process. However the model is valid and has some predictive capability as the F-statistic is significant at the 5.0 percent level. 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

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11 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.
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 \((\frac{NPL/L}{L})^2\), the range found for Jamaica is 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, respectively. However one would suspect going forward that the maximum range will decline (and as a result the range) as players in the banking sector would have fully evaluated and adjusted the market post the lag effect from the collapse of CLICO.

**VII. CONCLUSION**

I have studied how non-performing loans impact bank’s lending behavior for both Jamaica and Trinidad and Tobago. To my expectation, I have detected some level of evidence that at higher level of NPLs/Loan ratio banks become more risk adverse 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. They ensure that they operate within a range that does not carry them to the NPLs/loans ratios that prevailed during that time period. 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 bureau act paves the way for a credit bureau 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 has 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 that is used to ascertain 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.

VIII. FUTURE WORK

Since my 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; I 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 I will change the model specifications. I will estimate the threshold level using a Smooth Transition Autoregressive (STAR) model. This will allow for the estimation of the Loan-NPL-CAR relationship.
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### Table 2. 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.

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

Inverted AR Roots: 0.59, -0.59
Inverted MA Roots: 0.81 - 0.59i, 0.81 + 0.59i, 0.31 + 0.95i, 0.31 - 0.95i
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.

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

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

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

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.
Panel Chart 1- Original data series for Jamaican (J$'000). It is easy to ascertain that all variables are non-stationary.
Panel Chart 2. Trinidad and Tobago Variables (TT$mn). It is easy to see that all variables were non-stationary.