An Analysis of the Relationship between NPLs and Macroeconomic Indicators in Selected Caribbean Economies: A Panel-Vector Autoregressive Approach

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Abstract

The persistent high level of non-performing loans (NPLs) in the Caribbean has been a drag on economic growth, due to the strong macro-financial links. Therefore, this study investigates the dynamic relationship between NPLs, economic growth, private sector credit, unemployment and inflation, for select countries in the region. Specifically, using annual data for the period 2000-2017, the panel-Vector Autoregressive (PVAR) approach was employed to assess the feedback relationship among the variables. The results indicated that there are strong feedback links among the selected variables. The impulse response functions signal that the past behaviour of all variables are linear dependent and interdependent. Further, evidence suggests that economic growth, private sector credit, unemployment and inflation are important determinants of NPLs. Consequently, pursuing policies to boost economic growth, along with targeting lower unemployment, should translate into lower NPLs.

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I. Introduction

In the Caribbean non-performing loans (NPLs) refer to loan that have been in arrears in excess of 90 days and on which banks have stop accruing interest. Prior to the 2008 global financial crisis, the Bahamas, like its Caribbean counterparts had registered NPL ratios within the single digit range. However, following the financial crisis and subsequent recession, the level of NPLs remained stubbornly high for countries in the region. As the crisis deepened in 2009, the majority of Caribbean economies witnessed a significant portion of total credit not being repaid on schedule, with a resultant elevation in NPLs, due to weak economic fundamentals. Specifically, at end-2009, the rate stood above 12.0% for all of countries in the region, and the ratio ranged between 2.6% and 23.5% at end-2017.

Importantly, NPLs are a burden for both the lender and borrower. For the lender, which is the bank, it has to meet the cost of the NPLs by increasing its provisioning and the high capital requirements limit the creation of new credit. Thus, high NPL ratios weigh on banks' balance sheets and adversely impact their profitability. For the borrower, the burden is the loss of the asset, whether it is a home or a business. Moreover, NPLs have influenced banks' lending stance, with them being overly cautious in their lending posture. Hence, a deterioration in asset quality hinders bank lending and dampens economic activity. Therefore, the *domino effect* of elevated NPLs is that it curtails credit supply, distorts allocation of credit, worsens market confidence and slows economic growth. NLPs are a major problem for the banking sector in the Caribbean and the impact on economic growth cannot be isolated. Importantly, the persistent level of NPLs is influenced mainly by macroeconomic factors, more than bank-level factors. It is evident that NPLs themselves are often a reflection of an economic downturn, while accelerated economic expansion can result in a faster decline in the NPL ratio.

Given the elevated levels of NPLs in the Caribbean, the aim of this study it to conduct an empirical analysis of the impact of high NPLs on economic growth in the region and proposed policy options for reducing the level of NPLs. Hence, following the introduction, section 2 reviews the literature, examining the complex relationship between NPLs and the economy. Section 3 presents a trend analysis of the NPLs for selected Caribbean countries, while the methodology used for the empirical analysis is described in section 4. An analysis

of the empirical findings are conducted in section 5 and recommended policy options are explored in section 6. The paper is concluded in section 7.

II. Literature Review

A wealth of research has been done on the effect of NPLs on economic growth. While many economists agree that NPLs have a detrimental effect on economic growth, the literature differs on what instruments or institutional frameworks are best to negate the effects on the economy. A review of the literature has shown that a wide variety of methodologies are used to estimate the economic effects. Specifically, ordinary least squares (OLS) models and panel regressions are most commonly utilized.

Muthami (2016) investigated the relationship between economic growth and loan quality. His research utilized time series data from all the commercial banks in Kenya to estimate an OLS model to explain the determinants of NPLs without bias. The results of the model found that a number of independent variables like GDP, domestic credit, budget deficit, average lending and savings rates, inflation rate and the real exchange rate significantly influence NPLs. Muthami further found that GDP and exchange rate negatively affect NPL growth while domestic credit, budget deficit, average lending and savings rate, and the inflation rate positively affect NPL growth. Thus, Muthami concluded that an unfavourable macro-economic environment, poor economic performance, and a rise in the inflation rates, budget deficit, and lending rates contributed to the increase of NPLs in Kenyan commercial banks.

Similarly, Erdoğdu (2016) attempted to determine the effects of NPLs in the Turkish banking sector on the country's economic growth. Erdoğdu used time series data from the government and financial institutions and estimated an OLS model to determine whether there is a correlation between growth in a set of macro-economic variables and change in the NPL ratio in the Turkish banking sector. Erdoğdu, like Muthami (2016) concluded that Real GDP is in fact a positive driver of NPLs as an increase in economic growth reduces the growth in NPLs. He also found that NPLs within the Turkish banking sector affected private credit negatively and exposed the major lending activity of financial institutions to credit risk.

Likewise, Balgova et al (2016) analysed the problem of NPLs and the burden they impose on the economy. Using data on NPL loan reduction episodes and policies, the researchers took an episodes based approach composed of narrative and historical evidence. They also used propensity score matching to control for selection biases and conducted robustness checks. This enabled them to compare three different scenarios corresponding with the different strategies used to reduce NPLs. The results indicated that reducing NPLs has an unambiguously positive medium-term impact on the economy. The researchers found that countries who actively seek to resolve their NPL problems performed better across all scenarios, though there appears to be no systemic differences in economic outcomes between active and passive episodes. The researchers thus concluded that as economies manage to reduce their NPLs, they experience gains in both the economy and investments.

Beaton et al. (2016) utilized panel data along with a dynamic panel regression model to identify the determinants of NPLs in the Eastern Caribbean Currency Union (ECCU). Additionally, through the use of a panel VAR approach, the researchers wanted to determine whether the deterioration in asset quality would result in negative feedback effects from the banking system to economic activity. They used the Helmert procedure to account for the correlation of fixed effects with the regressors so as to remove the mean of all forward future observations. To assess the level of integration, the researchers used the Fisher-ADF and PP unit root tests. The researchers also utilized the Johansen's co-integration test on the panel VAR to avoid interference based on spurious relationships. As a result, they found that the deterioration of assets in the ECCU was caused by both macro-economic and bank specific factors. They also concluded that asset quality is directly impacted by domestic and global macro-economic conditions, similar to Muthami (2016), Erdoğdu (2016) and Balgova et al. (2016). Further, their study suggests that foreign owned banks systematically have lower NPLs, while more profitable banks tend to have lower NPLs. They believe that further consolidation in the domestic banking sector can aid in the improvement of asset quality. Thus leading to the conclusion that strengthened asset quality will be of the utmost importance in regard to reversing the negative macro-economic feedback loops at play in the ECCU.

Examining the Caribbean region, Beaton et al. (2017) used three different research techniques to determine the impact of NPLs. The researchers used panel vector auto-

regression analysis, paired with country-level data to examine macro-financial links between NPLs, credit growth, and economic activities in Caribbean economy. Through this technique, researchers confirmed the presence of strong macro-financial links between NPLs, credit growth and economic activity. Their findings indicate that deteriorating asset quality reduced private credit growth. In addition, the researchers utilized dynamic panel regressions to analyse the determinants of NPLs using country data and detailed bank-level data. The results of the regression indicate that deteriorating asset quality can be attributed to both macro-economic and bank specific factors. They also indicate that NPLs are affected by the business cycle. In a qualitative analysis, researchers issued a survey to regional authorities and commercial banks to explore obstacles to NPL resolution in the Caribbean. The survey highlighted low growth and high unemployment, as well as weaknesses in regional real-estate markets, as contributing factors to high and persistent NPLs. The survey also found structural obstacles such as a lack of markets for distressed assets, gaps in information systems, deficiencies in the legal system, and insolvency and debt-enforcement regimes to be major hurdles obstructing NPL resolution.

Based on the papers researched, it is evident that the macro-economic environment within a country plays a major role in developments with NPLs. Economic growth leads to a reduction in NPLs in both the short-term and the long-term.

III. Trend Analysis of Non-performing Loans and The Economy

(A). Trend Analysis

The first wave of the financial crisis included reduced tourist arrivals and a slowdown in Foreign Direct Investment which affected government and private sector revenue. This led to increased deficits and an acceleration in the debt to GDP ratios of the countries. The second wave triggered a slowdown in credit and affected both the borrowers' ability to service and access loans. On the demand side, a reduction in economic activity coupled with elevated unemployment led to a decline in the number of persons who were able to qualify for loans, thereby causing a significant reduction in loans demanded. On the supply side, asset quality deteriorated as more persons were unable to service their loans which ultimately led to the expansion in non-performing loans.

Given the increase in risk since the crisis, many banks in the region have tightened their lending standards, which resulted in a falloff in credit growth. Further, as a sign of best practices, many financial institutions maintained a conservative lending standard. Generally, that standard should be met until their economies show signs of long-term improvement.


Graph 1:
Non-Performing Loan Rates 2017
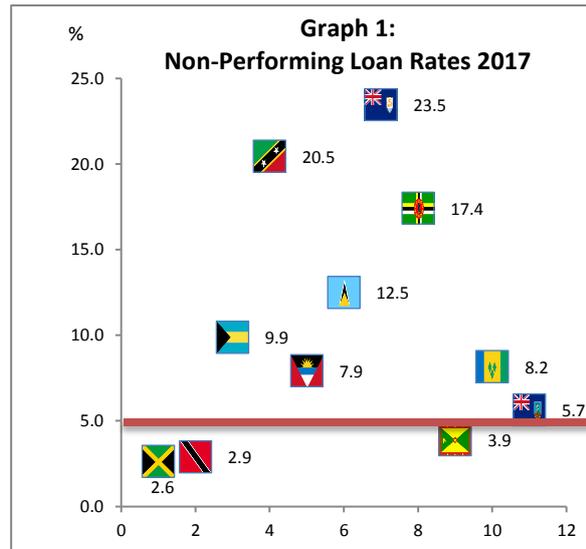
As at end-December, 2017, three Caribbean nations (Jamaica at 2.6%; Trinidad at 2.9%; Grenada at 3.9%) were under the region's prudential guideline of 5.0% as is indicated in Graph 1.

(B) Regional Trends

(b1). Bahamas

Over the last 16 years, non-performing loans in the Bahamas have largely trended upward due to the turbulent nature of the economic environment. Prior to the recession in 2007, NPLs stood at 4.4% of total loans; however, it peaked at 16.2% in 2014. Since then, NPLs have declined from their apex to 9.9% at end-December, 2017 (see Graph 2). This is the result of sustained loan write-offs by

Graph 2:
NPLs in the Bahamas
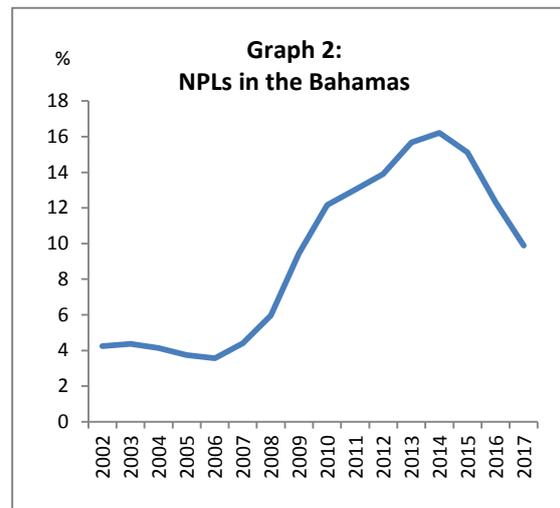
commercial banks, particularly the Government bailout of Bank of the Bahamas, positive contributions from the initial results of the Government's mortgage relief plan and NPL (mortgage) sales.
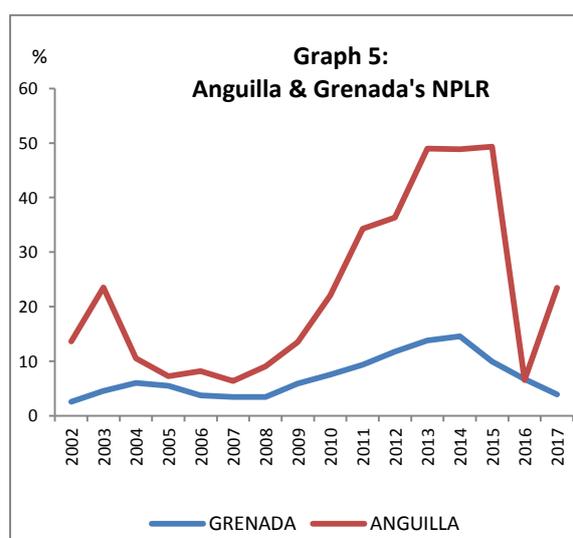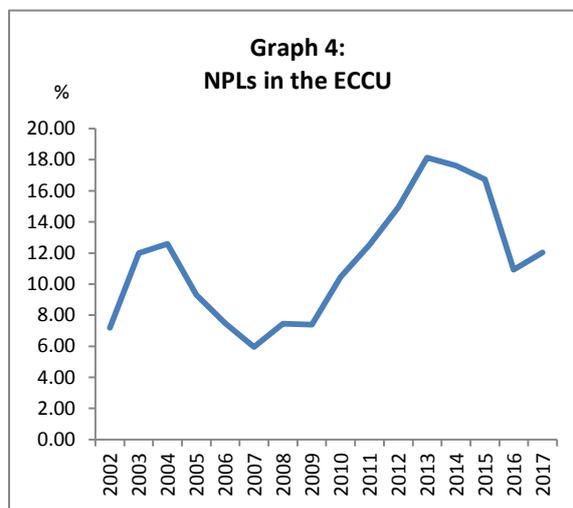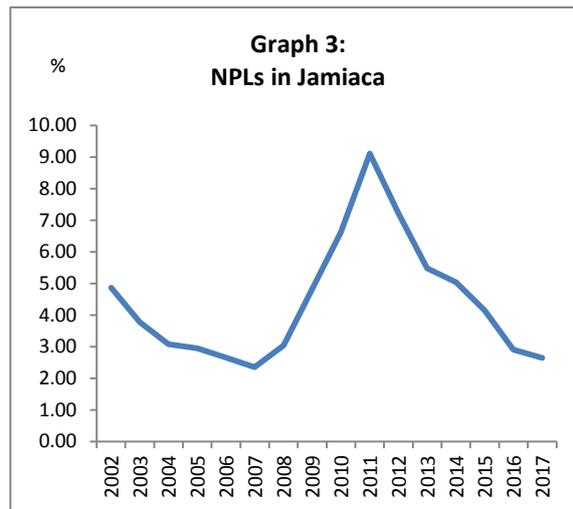
(b2). Jamaica

Jamaica's NPL trends differ slightly, peaking at 9.1% in 2011, before declining to a low of 2.6% as at December, 2017 (see Graph 3). The reasons behind this are linked to tighter risk

management policies, corporate sector improvement in their performance, coupled with a decline in the interest rate along with sustained write-offs in bade debt. Further, the introduction of a credit bureau contributed to its more permanent decline. The private sector spearheaded the exercise and in 2012, obtained the license from the Ministry of Finance to operate a credit bureau. By September 2013, the CRIF Credit Bureau Jamaica, which specializes in drafting credit reports and providing ratings to approved agencies, was fully functional.

## (b3). Eastern Caribbean Currency Union

Of all the islands in the Caribbean, the Eastern Caribbean Currency Union (ECCU) has struggled the most with controlling the growth in their non-performing loans. On average, NPLs have grown significantly since 2002's rate of 7.4% and peaked at 14.7% in 2014 before slowing to 8.8% as at end-December 2016 (see Graph 4). Across the region, NPLs have continued to climb with Anguilla at the forefront with 23.5% NPL-to-total loans, while St. Kitts & Nevis follow with 20.5% NPLs as at end-December, 2017. On the other hand, Grenada and Montserrat have been able to reduce their NPLs over time to 3.9% (see Graph 5) and 5.7%, respectively.

Graph 3:
NPLs in Jamaica

Graph 4:
NPLs in the ECCU

Graph 5:
Anguilla & Grenada's NPLR

GRENADA   ANGUILLA

The IMF's regional resident representative in the ECCU cited inadequate bank supervision as well as macroeconomic factors as the leading reasons behind the high rate of NPLs in the Eastern Caribbean. On the part of supervision, weak asset quality led to the falloff in banks' overall profitability. As a result, three banks (Antigua and Barbuda Investment Bank, Caribbean Commercial Bank, and National Bank of Anguilla) in the region became insolvent and an eventual intervention was made by the Eastern Caribbean Central Bank.

(c). Comparative Trends

Graph 6 presents the average NPL ratios and Real GDP growth rates of the 11 countries[2] studied. Between 2002 and 2006, on average the countries saw RGDP expansion coupled with a decline in NPLs, which is in line with economic theory that NPLs and economic growth share an inverse relationship where as the economy grows, NPLs contract, because more persons are employed and able to service their debts. However, after the financial crisis of 2007, the reverse was true where NPLs began to increase while economic growth trended downward. This outturn is largely attributed to these islands' heavy dependency on US tourists. The effect was not immediate, but by 2009, both NPLs and economic growth were working in opposite directions, detrimental to the economic vitality of the countries.

Graph 6: Average NPL ratio and RGDP growth

Graph 7: Average NPL Ratio & Unemployment
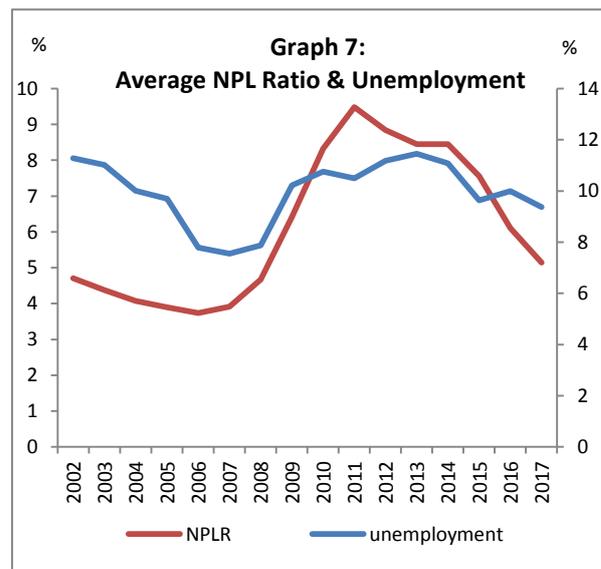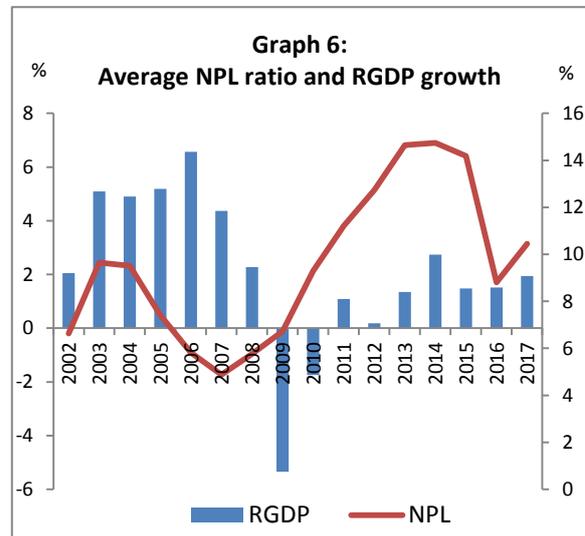
On the other hand, unemployment and NPLs tend to move in the same direction. Looking at graph 7, it is evident that, as unemployment increases or decreases, so does the NPL rate. This is because as more persons leave the workforce, they do not have sufficient funds to

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[2] Bahamas, Jamaica, Trinidad & Tobago, St. Kitts & Nevis, Antigua & Barbuda, St. Lucia, Anguilla, Dominica, Grenada, St. Vincent & the Grenadines and Montserrat

service their debts. As a result, the loans go into arrears and by the 90 day period of non-payment, the loans become non-performing. The reverse is also true, that as more persons enter the workforce and the unemployment rate decreases, then non-performing loans will also decline because now they are able to pay their debts.

IV. Assessing The Impact of NPLs on Economic Growth

It is evident, high levels of NPLs affect bank lending, thereby reducing banks profitability. As a result banks are required to hold more capital because of higher risk weights on these impaired assets. This increases banks' funding costs because of lower expected revenue streams and investors' heightened risk perceptions. The decline in credit supply thereby translates into weaker economic activity, with adverse implications for NPLs.

Country level data suggests that the NPL ratios are negatively correlated with bank profitability and private sector credit expansion, indicating that banks with higher NPL ratios have lower profitability and lending. Further, private sector credit growth is positively correlated with economic activity, signalling that elevated NPLs are related to subdued economic growth and rising unemployment.

(a) Data and Methodology

Panel vector autoregression (PVAR) models have been increasingly used for macroeconomic and financial analysis, since it combines the traditional VAR approach, which treats all variables in the system as endogenous and interdependent, with the panel-data approach, which allows for unobserved heterogeneity across countries. Accordingly, the panel VAR model is used in this study to assess feedback effects between non-performing loans in the banking sector and the real economy. The study uses annual data for the period 2002 to 2017 for selected countries in the Caribbean[3]. All of the variables used are in percentage form. In examining the relationship, the fixed effects model, which assumes that the individual-specific effects are correlated with the independent variables, was appropriate. The panel-specific fixed effects are represented by the following system of linear equations:

$$Y_{it} = Y_{it-1}A_1 + Y_{it-2}A_2 + \cdots + Y_{it-p+1}A_{p-1} + Y_{it-p}A_p + X_{it}XB + u_i + e_{it} \qquad (1)$$

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[3] Countries used in the study are Bahamas, Trinidad & Tobago and Jamaica.

$$Y_{i,t} = [NPLR_{i,t}, \Delta PRIVSEC_{i,t}, UNEMPL_{i,t}, \Delta RGDP_{i,t}, INFL_{i,t}]$$

(2)

Where $Y_{i,t}$ is a vector of five endogenous variables: *NPLR* is the ratio of NPLs to total loans in country *i* banking sector in year *t*; $\Delta PRIVSEC_{i,t}$ denotes the annual change in private sector credit in country *i* in year *t*; $UNEMPL_{i,t}$ refers to the unemployment rate in country *i* in year *t*; $\Delta RGDP_{i,t}$ signifies change in real GDP in country *i* in year *t*; and $INFL_{i,t}$ denotes the average annual inflation rate. Important to note is that in assessing the strength of the feedback effects from the banking system to the real economy, no distinction was made between the tourism-dependent economy (The Bahamas) and the commodity exporting economies (Trinidad & Tobago and Jamaica).

Similar to the study conducted by Beaton, et.al. (2017), the baseline specification was computed, in which the NPLR appears first in the ordering, followed by change in private sector credit, unemployment rate, real GDP growth and inflation. The result is in line with the assumption that unemployment, GDP growth and inflation affect NPLs with a lag, while delinquent loans have a contemporaneous effect on economic activity through the credit channel. However, the initial step was conducting the unit root test for stationarity for all panel VAR variables, while the Kao residual test for cointegration was computed. The estimates for the models with fixed effects were computed using the panel least squares method. The impulse response functions, which explains the behaviour of one variable in response to shocks in another variable, keeping all the other variables constant, was also used to assess the macro-financial feedback effects. The Granger causality test for the VAR model was computed as a further robustness check.

(b) Estimation Results

(b1) Panel Unit Root Test

The panel unit root test was performed on the level and on the first difference of each variable in the sample. Based on the p-values, the critical values and the t-statistics results all panel VAR variables, except unemployment, are stationary of order I(0). This suggests that a time trend is present in all of the variables in the first differences, except the

unemployment. However, the result for the unemployment rate is perhaps due to the fact the unemployment rate was not seasonally adjusted in the model.

Further, according to the VAR lag order selection criteria the appropriate number of lag lengths is two based on the Akaike Information Criterion (see Appendix Table 1).

(b2) Kao Residual Cointegration Test

Based on the Kao cointegration test there is a long run relationship among NPL, private sector credit, unemployment, real GDP and inflation at the 5% level of significance (see Appendix Table 2). It also implies that even if there are shocks in the short-run, which may affect movements in the individual series, they would converge in the long run.

(b3) Baseline Specifications

In the study the baseline specification indicated that the NPL ratio is negatively correlated with real GDP, credit growth and inflation, but positively correlated with the unemployment rate (see Table 1). The model also suggest that a one percent increase in private sector credit, *cetrius paribus*, results in a 0.11 percentage point reduction in the NPL ratio. Similarly, a one percent firming in the unemployment rate contributes to a 0.38 percentage point widening in the NPL ratio. Further, a one percent rise in real GDP growth and the inflation rate leads to a 0.23 and 0.02 percentage point falloff in the NPL ratio.

Table 1: Correlation Matrix for Macro-Financial Variables

|	NPLR	CHPRIVSEC	UNEMPL	RGDP	INFL
NPLR	1				
CHPRIVSEC	-0.109379	1			
UNEMPL	0.375031	-0.15434	1		
RGDP	-0.22694	0.223703	-0.46352	1	
INFL	-0.01476	-0.04747	-0.00797	-0.01067	1

(b4) PVAR Results

The stability condition of the estimated PVAR was conducted. The results revealed that all the eigenvalues lie inside the unit circle, indicating that the PVAR satisfies the stability condition[4] (see Figure 1). In addition, as shown in appendix table 2, five models estimating the short-run relationship between the variables were derived from the PVAR results. The

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[4] Stability condition of the estimates panel VAR states that, when all roots like within the unit circle it suggest that VAR is stationary.

PVAR results suggested that there is a positive and significant feedback relationship between NPLs and unemployment. The results also indicated that there exist an inverse relationship between NPLs and real GDP growth, changes in private sector credit and inflation (see Appendix Table 3).

Figure 1

Inverse Roots of AR Characteristic Polynomial
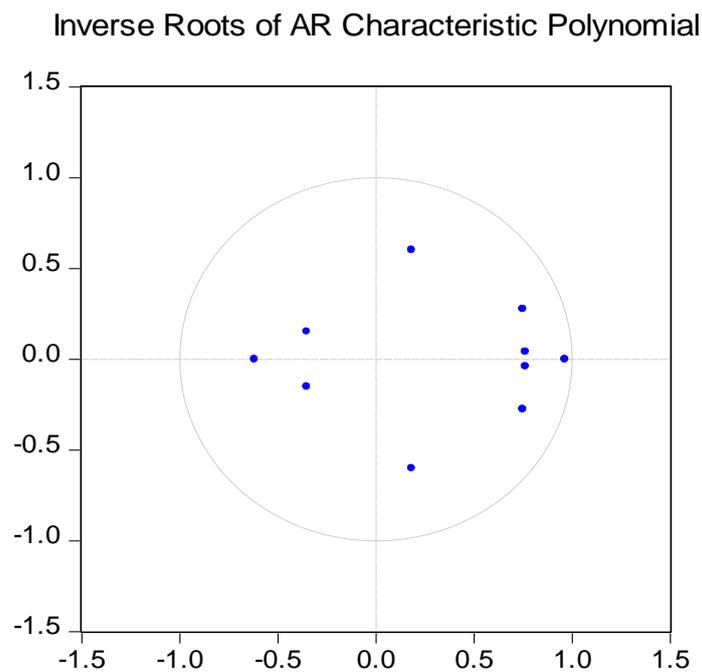
(b5) Impulse Responses

Using the PVAR model, the impulse response function was computed to see how changes in changes in NPL are affected by shocks to the other variables. The impulse response functions were estimated from a five-variable vector autoregression (VAR), and with the identifications achieved through Cholesky decomposition. A shock is defined as a Cholesky one-standard deviation. The horizon is measured in years and the dotted lines display the plus or minus two-standard error bands. As shown in figure 1 of the appendix a one standard deviation positive shock (increase) to unemployment will trigger a rise in the NPL ratio for The Bahamas, Trinidad & Tobago and Jamaica, with the effect progressively increasing, before starting to smooth out over the 10-year time horizon (see Appendix Figure 1).

(b6) Granger Causality Tests

Further, the Granger causality test was conducted as an additional robustness test check. Results of the Granger causality test show NPLs cause changes in private sector credit at the usual 5% level of significance. The results also revealed that change in private sector credit Granger causes inflation. Further, the Granger test show that real GDP causes changes in private sector credit and changes in the NPLs Granger causes unemployment. However, unemployment lagged 1 and 2 do not cause NPLs at the 5% level of confidence, but at the 10% level. The results also showed that real GDP lagged 1 and 2 years cannot cause NPLs and vice versa.

V.   Policy Options for Reducing The Non-Performing Loans (NPLs) in The Caribbean

Policies geared towards reducing the stubbornly high level of NPLs in the Caribbean are necessary, owing to its ability to destabilize the financial sector. However, the policy options need to be multifaceted, involving both macroeconomic and prudential policies, so as to encourage economic growth and ensure financial stability.

In terms of policy options, implementing strong macroeconomic policies and appropriate structural reforms that stimulate robust and sustainable growth is a main policy option. It is imperative to note that numerous studies have revealed that a recovery in economic growth, which translates into lower unemployment, higher household income and an increase in corporate profits usually assist in resolving problem loans through the increased ability of firms and households to service their debts.

Another policy option that can be employed to address the elevated levels of NPLs is to focus on strengthening prudential and supervisory frameworks where necessary. In this context, authorities could set up a toolkit of well-targeted prudential policies geared towards lowering excessive risk taking at the initial stage of granting the loan and to mitigate risks subsequently identified. In so doing, this would help to prevent a build-up of problem loans in the future. Further, the supervisory regime should ensure that banks follow prudent loss-recognition and provisioning practices in line with international standards. The authorities should also ensure that banks apply appropriate real estate

valuation standards to improve collateral valuation and liquidation in the process of debt enforcement.

Further, write-offs which are a common and simple way of disposing of NPLs are another policy option which should be encouraged. Appropriate incentives pertaining to the write-off of bad loans and provisioning to facilitate recognition of losses should be in place (see Figure 2). Nevertheless, banks are usually reluctant to write-off NPLs from their balance sheet, because of the implications for profits and capital. Banks generally prefer to keep the full value of the loan on their balance sheet, with the hope that improving economic conditions turn around the loan or that it will eventually be restructured. Nonetheless, resolution strategy based on write-offs is contingent on banks' capital buffers and provisions being adequately high to absorb these losses, since capital buffers that are too thin will serve as a barrier to write-offs. Therefore, a prerequisite for sizeable write-offs is strict provisioning practices. In this context, countries in the region could either intensify their regulatory provisioning regime or introduce mandatory write-off regimes.

Direct sales are another simple way of addressing the NPLs backlog. In this case the bank could sell the asset to an asset management company (AMC), who would then in turn provide perspective buyers with the information needed to conduct their due diligence. However, in the Caribbean there are impediments, such as gaps in the information framework and culture, as well as social factors that hinder the development of a well-functioning domestic market for distressed assets to facilitate the disposal of NPLs. In the region the experience with AMCs is limited, with only the Eastern Caribbean Currency Union and the Bahamas establishing such facilities. The Eastern Caribbean Central Bank created the Eastern Caribbean Asset Management Company (ECAMC) to resolve problem loans. Further, in The Bahamas, both public and private ACMs have been established to remove bad loans from banks balance sheets. The Government of the Bahamas created a special purpose vehicle (Bahamas Resolve) to manage the non-performing loans of mainly the state-owned Bank of The Bahamas. In addition, the privately-owned Gateway, a specialised mortgage servicing company, was established. Thus far reaching indications are that these AMCs have yielded positive results without any significant consumer protection complaints associated with the loan restructuring. Hence, unless banks are in a position to move NPLs off their books at market price, given their prevailing capital and provisioning levels, then

the market for distress assets will remain underdeveloped. Further, critical to the development of an active NPL market for distressed assets is access to timely information on distressed borrowers, collateral valuations and recent NPL sales.

Figure 2: Policy Options for Resolving NPLs
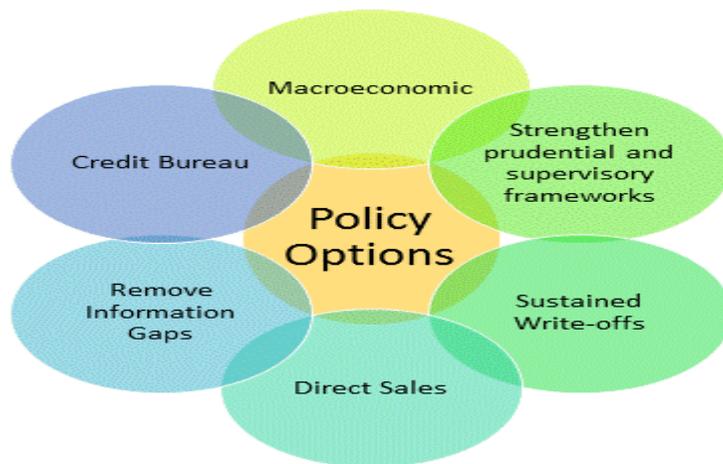
In addition, polices geared towards removing information gaps should be pursued. These policies should focus on the elimination of information gaps that impede the pricing of risk, collateral valuation and reduction of large pricing gaps between buyers and sellers of properties that serve as a barrier to the development of NPL markets. Efforts should focus on establishing well-functioning public registries and credit bureaus in counties where they are non-existent, so as to narrow information asymmetries and improve management of credit risk. In cases were such registries exist, the quality of data may also need improving. Therefore, enhancing data quality and closing information gaps are critical to resolving the high NPL dilemma and fostering market development.

VI. Conclusion

The purpose of this study was to investigate the feedback relationship between NPLs and selected macroeconomic variables. In the analysis, it was found that economic growth, private sector credit, unemployment and inflation are important determinants of NPLs. Further, the study revealed that NPLs are a drag on economic growth owing to the strong macro-financial links. Weak macroeconomic conditions and high NPLs feed off of each

other. Adverse macroeconomic conditions contribute to elevated NPLs, and weighed down by the NPLs, banks in turn are reluctant to lend, which translates into a protracted recovery in economic growth.

Therefore, policies geared towards addressing the high NPLs epidemic in the Caribbean need to be vigorously pursued. Initiatives such as the establishment of AMCs, credit bureaus, enhancement of insolvency and debt-enforcement regimes, and the establishment of guidelines for collateral valuations are worth pursuing. Nevertheless, reforms need to be tailored based on the detailed institutional framework and should be coordinated across the relevant agencies, such as the Central Bank and Ministry of Finance. In addition, while cleaning up of banks' balance sheets can support the economic recovery, complementary macroeconomic policies are also necessary to jump-start that growth.

Appendix

Table 1: VAR Lag Order Selection Criteria Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-368.3676	NA	142.2700	19.14706	19.36033	19.22358
1	-265.6402	173.8463	2.675041	15.16104	16.44070*	15.62017*
2	-235.2665	43.61358*	2.169843*	14.88546*	17.23151	15.72720
3	-214.9120	24.00788	3.290161	15.12369	18.53613	16.34804

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 2: Kao Residual Cointegration Test

NPLR CHPRIVSEC INFL RGDP UNEMPL
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-1.983899	0.0236
Residual variance	1.743221	
HAC variance	1.466611	

Table 3: Estimates of PVAR Models

Equations	Model 1: NPLR	Model 2: RGDP	Model 3: CHPRIVSEC	Model 4: UNEMPL	Model 5: INFL
NPLR$_{t-1}$	1.3928 (0.1510) [9.2250] *__0.0000__	-0.2433 (0.3318) [-0.7332] *0.4688	-0.0107 (0.0070) [-1.5360] *0.1344	0.3579 (0.1647) [2.1729] *__0.0373__	-0.2246 (0.3590) [-0.6257] *0.5360
NPLR$_{t-2}$			0.00281 (0.0075) [0.3757] *0.7096		
RGDP$_{t-1}$			0.0131 (0.0032) [4.0320] *0.0003	-0.1583 (0.0767) [-2.0650] *__0.0471__	
RGDP$_{t-2}$			0.0017 (0.0034) [0.5060] *0.6163		0.1586 (0.1767) [0.8976] *0.3761
CHPRIVSEC$_{t-1}$	-3.1497 (3.4910) [-0.9022] *0.3737	7.6334 (7.6730) [0.9948] *0.3273		-0.7922 (3.8091) [-0.2080] *0.8366	8.3383 (8.3013) [1.0045] *0.3227
CHPRIVSEC$_{t-2}$					13.1032 (7.5460) [1.7364] *0.0921
UNEMPL$_{t-1}$	0.3579 (0.1647) [2.1729] *__0.0553__				-0.0288 (0.3912) [-0.0735] *0.9418
UNEMPL$_{t-2}$		-0.3766 (0.3941) [-0.9555] *0.3465	-0.0088 (0.0083) [-1.0678] *0.2936		
INFL$_{t-1}$					
INFL$_{t-2}$	-0.0657 (0.0598) [-1.0995] *0.2797	0.0561 (0.1313) [0.4271] *0.6722	0.0092 (0.0028) [3.3182] *__0.0023__	-0.0161 (0.0652) [-0.2468] *0.8066	

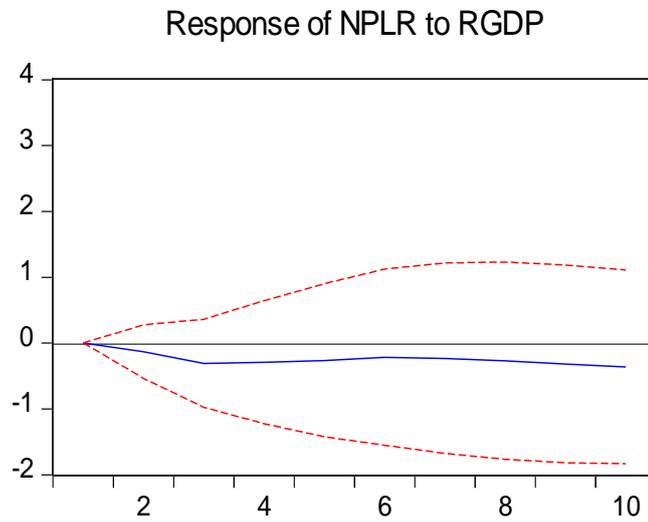**Asterisks (*) denotes p-values**
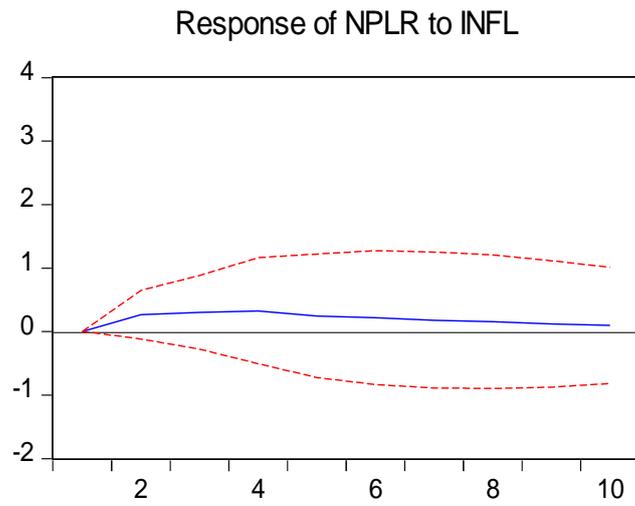**The variables that were significant at the 5.0% level are shown in bold**

Figure 1

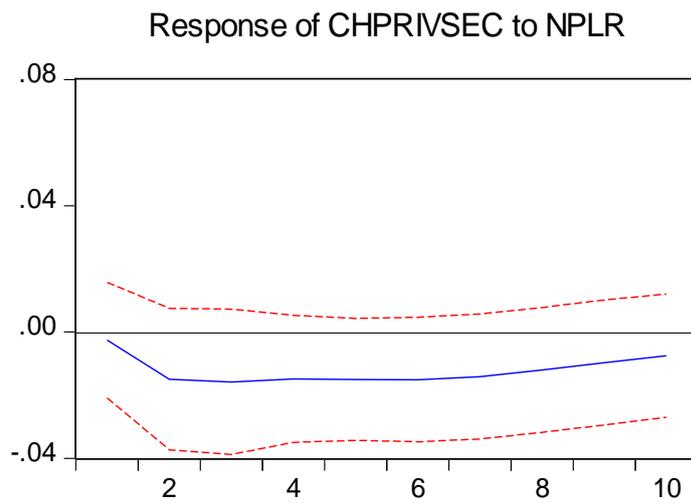## Response to Cholesky One S.D. Innovations ± 2 S.E.
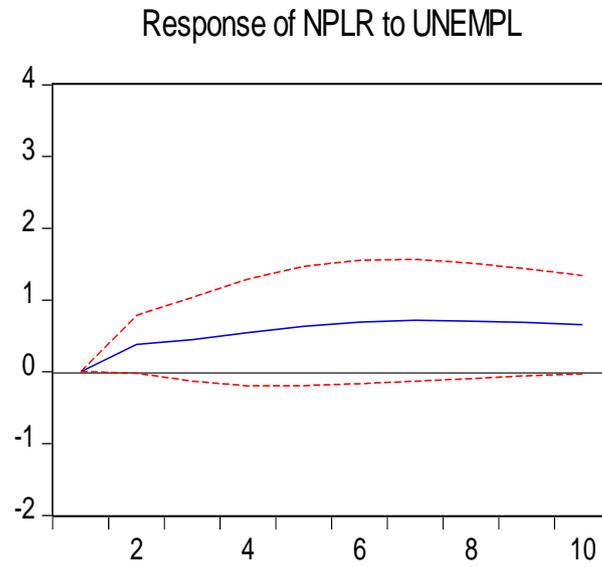
Response of NPLR to UNEMPL

Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of NPLR to RGDP

Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of NPLR to INFL

Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of CHPRIVSEC to NPLR

References

Abrigo, M.R.M., & Love, I., (2015), *Estimation of Panel Vector Auto Regression in Stata: a Package of Programs*, Working Paper 201602, University of Hawaii at Manoa, Department of Economics.

Alves da Silva, M. E., (2017,*) Does Inequality Benefit Growth? New Evidence Using a Panel VAR Approach,* Department of Economics and PIMES, Universidade Federal de Pernambuco, Brazil.

Baudino, P., & Yun, H., (2017), *Resolution of Non-Performing Loans—Policy Options*, Financial Stability Institute, FSI Insights on Policy Implementation, no. 3, Bank for International Settlements

Beaton, K., Dowling, T., Kovtum, D., Loyola F., Myrvoda, A., Okwuokei, J., Otker, I., & Turunen, J., (2017), *Problem Loans in the Caribbean: Determinants, Impact and Strategies for Resolution*, IMF Working Paper, no. WP/17/230.

Beaton, K., Myrvoda, A. & Thompson, S., (2016), *Non- Performing Loans in the ECCU: Determinants and Macroeconomic Impact*, IMF Working Paper, no. WP/16/229.

Bouvet, F., Brady, R., & King, S., (2013), *Debt Contagion in Europe: A panel- Vector Autoregressive (VAR*) Analysis, Social Science Journal, pp 319-340.

Claessens, S., (2009), *Policy Approaches to Corporate Restructuring Around the World: What Worked, What Failed?* World Bank WP, pp 281-328.

Fung, B., George, J, Hohl, S. & Guonan, M., (2004). *Public Asset Management Companies in East Asia, A comparative study*, Occasional Paper, No. 3, Financial Stability Institute, website: https://www.bis.org/fsi/fsipapers03.pdf

Hawkins, J., (1997). *Bank Restructuring in South-East Asia,* Bank for International Settlements, WP 197-221

Jha, S., Mallick, S., Park, D. & Quising, P., (2010), *Effectiveness of Countercyclical Fiscal Policy: Time-Series Evidence from Developing Asia,* ADB Economics Working Paper Series.

Krueger, A. & Tornell, A., (1999), *The Role of Bank Restructuring in Recovering From Crisis: Mexico 1995-1998,* National Bureau of Economic Research Working Paper Series, no.7042.

Mako, W. P., (2003), *Uses and Limitations of Out –of-Court Workouts*: *Lessons from East Asia*, World Bank Global Forum on Insolvency Risk Management, pg. 19, Washington DC.

Mountford, A., & Ulig, H., (2008), *What are the Effects of Fiscal Policy Shocks?* National Bureau of Research, Working Paper14551.

Vidangos, I., (2009), *Fluctuations in Individual Labor Income: A Panel (VAR) Analysis,* Finance and Economics Discussion Series, 2009-09, Board of Governors of the Federal Reserve System (U.S.).

Woo, D., (2000), *Two Approaches to Resolving Non perming Assets during Financial Crises,* Monetary and Exchange Affairs Department, IMF Working Paper, WP/00/33.