The determinants of non-performing loans: an econometric case study of Guyana

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ABSTRACT

The study attempts to ascertain the determinants of non-performing loans in the Guyanese banking sector using a panel dataset and a fixed effect model similar to Jimenez and Saurina (2005). Consistent with international evidence we find that the real effective exchange rate has a significant positive impact on non-performing loans. This indicates that whenever there is an appreciation in the local currency the non-performing loan portfolios of commercial banks are likely to be higher. Our empirical results show that GDP growth is inversely related to non-performing loans, suggesting that an improvement in the real economy translates into lower non-performing loans. We also find that banks which charge relatively higher interest rates and lend excessively are likely to incur higher levels of non-performing loans. However, contrary to previous studies, our evidence does not support the view that large banks are more effective in screening loan customers when compared to their smaller counterparts.

Key Words: Non-performing loans, Panel regression model, Guyana.

I. INTRODUCTION

It is widely accepted that the quantity or percentage of non-performing loans (NPLs) is often associated with bank failures and financial crises in both developing and developed countries. In fact, there is abundant evidence that the financial/banking crises in East Asia and Sub-Saharan African countries were preceded by high non-performing loans. The current global financial crisis, which originated in the US, was also attributed

[1] This paper was done when Sukrishnalall Pasha was an Economist in the Financial Stability Unit of the Bank of Guyana and is currently being updated by the authors. It has also benefitted from the invaluable research assistance provided by Ms. A Singh and Mr. A. Dorris.

to the rapid default of sub-prime loans/mortgages. In view of this reality it is therefore understandable why much emphasis is placed on non-performing loans when examining financial vulnerabilities.[2]

The aim of this study is to analyse the sensitivity of non-performing loans to macroeconomic and bank specific factors in Guyana. In particular, it employs regression analysis and a panel dataset covering 10 years (1994 to 2004) to examine the relationship between non-performing loans and several key macroeconomic and bank specific variables. To the authors' knowledge this is the first study to examine the determinants of non-performing loans in Guyana. As such, it will contribute to the existing literature by providing evidence on the causes of impaired loans in a small developing country. The study employs firm-level data which are rarely used by analysts who study non-performing loans. Therefore, the paper extends the literature on non-performing loans and utilizes both macroeconomic and bank specific variables. Apart from contributing to the literature, the paper may also have important practical implications for commercial bankers and bank regulators/supervisors in the Guyanese banking system. For instance, the findings may be used to develop a framework for measuring and assessing credit risk – an important element of study for the financial stability unit of a central bank.

The article finds that both bank specific and macroeconomic factors impacts on the loan portfolios of commercial banks in Guyana. In particular, we find a significant positive relationship between non-performing loans and the real effective exchange rate. This means that deterioration in international competitiveness of the local economy (as reflected by an appreciation in the real effective exchange rate) may result in higher

[2] Sorge (2004), for instance, reports that the stress testing literature makes extensive use of non-performing loans and loan loss provisions to assess the vulnerability of the financial system.

levels of non-performing loans. Our evidence shows that changes in real income – as reflected by growth in real GDP – exert a significant negative effect on NPLs. We also find that commercial banks that are aggressive and charge relatively higher interest rates incur greater NPLs. However, contrary to expectations, the evidence reveals that large banks are not necessarily more effective in screening loan customers when compared to their smaller counterparts as there is no significant relationship between the size of a banking institution and the level of NPLs it reports.

The remainder of the study is organised as follows. Section II provides a comprehensive review of the empirical literature on non-performing loans. Section III describes our panel dataset and econometric methodology. In this section special attention is given to the motivation for selecting each variable included in our econometric model. Section IV presents the empirical analysis, and Section V concludes with several policy implications.

II. LITERATURE REVIEW

Over the last few years the literature that examines non-performing loans has expanded in line with the interest afforded to understanding the factors responsible for financial vulnerability. This situation may be attributed to the fact that impaired assets plays a critical role in financial vulnerability as evidenced by the strong association between NPLs and banking/financial crises in Argentina, East Asia and Sub-Saharan African Countries during the 1990s. In this section we review the existing literature so as to formulate a theoretical framework to investigate the determinants of non-performing loans in Guyana.

Keeton and Morris (1987) present one of the earliest studies to examine the causes of loan losses. In the latter paper the authors examined the losses by 2,470 insured commercial banks in the United States (US) over the 1979-85. Using NPLs net of charge-offs as the primary measure of loan losses Keeton and Morris (1987) shows that local economic conditions along with the poor performance of certain sectors explain the variation in loan losses recorded by the banks. The study also reports that commercial banks with greater risk appetite tend to record higher losses.

Several studies which followed the publication of Keeton and Morris (1987) have since proposed similar and other explanations for problem loans in the US. Sinkey and Greenwalt (1991), for instance, investigate the loan loss-experience of large commercial banks in the US; they argue that both internal and external factors explain the loan-loss rate (defined as net loan charge offs plus NPLs divided by total loans plus net charge-offs) of these banks. These authors find a significant positive relationship between the loan-loss rate and internal factors such as high interest rates, excessive lending, and volatile funds. Similar to the previous study, Sinkey and Greenwalt (1991) report that depressed regional economic conditions also explain the loss-rate of the commercial banks. The study employs a simple log-linear regression model and data of large commercial banks in the United States from 1984 to 1987.

Keeton (1999) uses data from 1982 to 1996 and a vector autoregression model to analyse the impact of credit growth and loan delinquencies in the US. It reports evidence of a strong relationship between credit growth and impaired assets. Specifically, Keeton (1999) shows that rapid credit growth, which was associated with lower credit standards, contributed to higher loan losses in certain states in the US. In this study loan

delinquency was defined as loans which are overdue for more than 90 days or does not accrue interest.

Studies that examined other financial systems also provide similar results to those in the US. For instance, Bercoff et al (2002) examine the fragility of the Argentinean Banking system over the 1993-1996 period; they argue that NPLs are affected by both bank specific factors and macroeconomic factors. To separate the impact of bank specific and macroeconomic factors, the authors employ survival analysis.

Using a dynamic model and a panel dataset covering the period 1985-1997 to investigate the determinants of problem loans of Spanish commercial and saving banks, Salas and Saurina (2002) reveal that real growth in GDP, rapid credit expansion, bank size, capital ratio and market power explain variation in NPLs. Furthermore, Jimenez and Saurina (2005) examine the Spanish banking sector from 1984 to 2003; they provide evidence that NPLs are determined by GDP growth, high real interest rates and lenient credit terms. This study attributes the latter to disaster myopia, herd behaviour and agency problems that may entice bank managers to lend excessively during boom periods.

Meanwhile, Rajan and Dhal (2003) utilise panel regression analysis to report that favourable macroeconomic conditions (measured by GDP growth) and financial factors such as maturity, cost and terms of credit, banks size, and credit orientation impact significantly on the NPLs of commercial banks in India.

Using a pseudo panel-based model for several Sub-Saharan African countries, Fofack (2005) finds evidence that economic growth, real exchange rate appreciation, the real interest rate, net interest margins, and inter-bank loans are significant determinants of

NPLs in these countries. The author attributes the strong association between the macroeconomic factors and non-performing loans to the undiversified nature of some African economies.

More recently Hu et al (2006) analyse the relationship between NPLs and ownership structure of commercial banks in Taiwan with a panel dataset covering the period 1996-1999. The study shows that banks with higher government ownership recorded lower non-performing loans. Hu et al (2006) also show that bank size is negatively related to NPLs while diversification may not be a determinant.

III. ECONOMETRIC MODEL AND ESTIMATION PROCEDURE

Based on our review of the literature it is clear that there is extensive international evidence which suggests that NPLs may be explained by both macroeconomic and bank specific factors. In this study we employ a reduced form econometric model that is similar to Jimenez and Saurina (2005) to ascertain the determinants of NPLs in the Guyanese banking sector. The model is a simple linear regression function that links the ratio of NPLs to total loans and key macroeconomic and bank specific variables. The general regression equation is of the form:

$$lnNPL\_A_{i,t} = \beta_{0i} + \beta_1 lnNPL\_A_{i,t-1} + \beta_2 lnL\_A_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 \Delta LOANS_{i,t} + \beta_5 \Delta LOANS_{i,,t-1} + \beta_6 \Delta LOANS_{i,,t-2} + \beta_7 lnRIR_t + \beta_8 lnRIR_{t-1} + \beta_9 lnINF_t + \beta_{10} lnINF_{t-1} + \beta_{11} \Delta GDP_t + \beta_{12} \Delta GDP_{t-1} + \beta_{13} lnREER_t + \beta_{14} lnREER_{t-1} + \eta + \varepsilon_{i,t}$$

$$i = 1,...N,\ t = 1,...T$$

where: $lnNPL_{i,t}$ and $lnNPL_{i,t}$ represent the natural log of the ratio of NPLs to total loans for bank i in year t and $t-1$; ΔGDP_t and ΔGDP_{t-1} represent the annual growth in real GDP at time t and $t-1$ respectively; $lnRIR_t$ and $lnRIR_{t-1}$ denote the natural log of the real

interest rates (measured as the difference between the weighted average lending rate and the annual inflation rate) at time *t* and *t-1*; $lnREER_t$ and $lnREER_{t-1}$ indicates the natural log of the real effective exchange rate at time *t* and *t-1*; $lnINF_t$ and $lnINF_{t-1}$ indicate the natural log of the annual inflation rate at time *t* and *t-1*; $SIZE_{i,t}$ is the ratio of the relative market share of each bank's assets that capture the size of the institution at time *t*; $lnL\ A_{i,t}$ is the natural log of the loans to total asset ratio for bank *i* in year *t;* $\Delta LOANS_{i,t}$, $\Delta LOANS_{i,,t-1}$ and $\Delta LOANS_{i,,t-2}$ represent the growth in loans for bank *i* in year *t, t-1,and t-2* respectively; and $\varepsilon_{i,t}$ is the white noise error term. In the model, the coefficient β_{0i} captures the idiosyncratic behaviour of commercial banks. The fixed effect coefficient allows for detecting those factors affecting NPLs that do not change over time.

The model is estimated using pooled least squares with a fixed effect estimator. Researchers who utilise this estimation technique argue that it is more efficient than the ordinary pooled least squares since it accounts for heterogeneity that is often present in panel datasets.[3] In order to minimise the effect of heteroskedasticity, the White robust standard errors are computed. We also estimate our model with the dependent variable on the right-hand side with a lag of one year. This is done to overcome the persistence exhibited by the ratio of NPLs to total loans over our sample period (Figure 1). Additionally, we follow the general to specific approach to arrive at the parsimonious model. The rationale for considering each variable is provided in the ensuing section of the paper.

3 See Hu et al. (2006) and Wooldridge (2009).

Motivation and description of variables

Macroeconomic variables

The existing literature provides evidence that suggests a strong association between NPLs and several macroeconomic factors. Several macroeconomic factors which the literature proposes as important determinants are: annual growth in *GDP*, credit growth, real interest rates, the annual inflation rate, real effective exchange rate (*REER*), annual unemployment rate, broad money supply (*M2*) and GDP per capital etc. This study only considers the growth in real GDP (ΔGDP), annual inflation (INF) and the real effective exchange rate (REER).

There is significant empirical evidence of a negative relationship between the growth in real GDP and NPLs (Salas and Suarina, 2002; Rajan & Dhal, 2003; Fofack, 2005; and Jimenez and Saurina, 2005). The explanation provided by the literature for this relationship is that strong positive growth in real GDP usually translates into more income which improves the debt servicing capacity of borrower which in turn contributes to lower non-performing loans. Conversely, when there is a slowdown in the economy (low or negative GDP growth) the level of NPLs should increase.

The literature also provides evidence of a positive relationship between the inflation rate and non-performing loans. Fofack (2005), for instance, shows that inflationary pressures contribute to the high level of impaired loans in a number of Sub-Saharan African countries with flexible exchange rate regimes. According to this author, inflation is responsible for the rapid erosion of commercial banks' equity and consequently higher credit risk in the banking sectors of these African countries.

There is also evidence in the literature of a positive association between NPLs and real effective exchange rate. Fofack (2005) reveals that changes in the real effective exchange rate have a positive impact on NPLs of commercial banks that operate in some Sub-Saharan African countries with fixed exchange rate regimes. The author argues that this result is due to the large concentration of loans to the export-oriented agriculture sector, which was adversely affected by the appreciation in the currency of these countries during the 80s and early 90s.

The macroeconomic variables are included in our econometric model both contemporaneously and with one year lag since adverse shocks from the economy may not impact immediately on the loan portfolios of banks. Except for ΔGDP, the natural logarithms of the macro variables are used to estimate our model. We were unable to take the log of GDP since there were negative growth rates during our sample period. Additionally, while we allow the macroeconomic variables to vary over time they are the same across institutions.

Bank Specific Variables

Apart from macroeconomic variables, there is abundant empirical evidence that suggests that several bank specific factors (such as, size of the institution, profit margins, efficiency, the terms of credit (size, maturity and interest rate), risk profile of banks (measured by several proxies including total capital to asset ratio and loans to asset ratio) are important determinants of NPLs. This study only considers four bank specific variables owing to data availability. These are: real interest rate (*RIR*), bank size (*SIZE*), annual growth in loans (Δ*LOAN*) and the ratio of loans to total asset (*L_A*).

The impact of real interest rates on NPLs is extensively documented in the literature. In fact, several studies report that high real interest rate is positively related to this variable (see for example, Jimenez and Saurina, 2005 and Fofack, 2005). We construct this variable by subtracting the annual inflation rate from the weighted average lending rate of each bank. The variable is included contemporaneously ($RIR_{i,t}$) and with a lag of one year ($RIR_{i,t-1}$).

Excessive lending by commercial banks is often identified as an important determinant of NPLs (Salas and Saurina, 2002; and Jimenez and Saurina, 2005; Keeton and Morris, 1987; and Sinkey and Greenwalt, 1991; and Keeton, 1999). The variable to capture credit growth is constructed by finding the annual percentage change in the loan portfolio for each bank (ΔLOANS). This variable is introduced into our model contemporaneously and with up to two lags. Like the growth in real GDP, we were unable to take the natural logarithm of (ΔLOANS) since there were periods when some commercial banks provided lower credit to the private sector. We expect this variable to have a significant positive relationship with NPLs since the literature shows that rapid credit growth is often associated with higher NPLs.

The empirical evidence relating to the impact of bank size on NPLs appears to be mixed. For instance, some studies report a negative association between NPLs and bank size (see Rajan and Dhal, 2003; Salas and Saurina, 2002; Hu et al, 2006). According to these studies, the inverse relationship means that large banks have better risk management strategies that usually translate into more superior loan portfolios vis-à-vis their smaller counterparts. There are also studies which provide evidence of a positive association between NPLs and bank size (see Rajan and Dhal, 2003). In this study the

SIZE variable is constructed by computing the relative market share of the asset of each commercial bank.

There is also evidence in the literature that shows a strong positive relationship between NPLs and the ratio of loans to asset (*L_A*), which captures the risk appetite of banks (see Sinkey and Greenwalt, 1991). The supporting rationale is that banks that value profitability more than the cost of higher risk (represented by a high loan to asset ratio) are likely to incur higher levels of NPLs during periods of economic downturn. In this paper, *SIZE* and *L_A* variables are included contemporaneously. In addition, our bank specific variables vary with time and across institutions. The methodology for calculating each variable and the a priori coefficient signs are given by Table 1.

Table 1: Summary of variables used in regression model

Variables	Definition	Expected Sign
$lnNPL\_A_{i,t}$	The natural logarithm of the ratio of non-performing loans to total loans for bank i in year t. $NPL\_A_{i,t} = \frac{NPL_{i,t}}{TOTALLOANS_{i,t}} \times 100\%$	
ΔGDP_t	The annual growth in real GDP at time t computed as follows: $\Delta GDP_t = \frac{GDP_t - GDP_{t-1}}{GDP_t} \times 100\%$	(-)
$lnRIR_{i,t}$	The natural logarithm of the real interest rate (measured as the difference between the weighted average lending rate and the annual inflation rate) of bank i at time t. $\ln RIR_{i,t} = WALR_{i,t} - INF_t$	(+)
$lnINF_t$	The natural logarithm of the annual inflation rate at time t. $InINF_t = \frac{CPI_t - CPI_{t-1}}{CPI_{t-1}}$	(+)
$lnREER_t$	The natural logarithm of the real effective exchange rate at time t.	(+)
$lnL\_A_{i,t}$	The natural logarithm of the ratio of loans to total asset of bank i at time t. $\ln L\_A_{i,t} = \frac{LOANS_{i,t}}{ASSETS_{i,t}} \times 100\%$	(-)
$SIZE_{i,t}$	Is the relative market share of bank i at time t. $SIZE_{i,t} = \frac{Asset_{i,t}}{\sum Asset_{i,t}} \times 100\,\%$	(+)/(-)
$\Delta LOANS_{i.t}$	The growth in loans of bank i at time t computed as follows: $\Delta LOANS_{i,t} = \frac{LOANS_{i.t} - LOANS_{i.t-1}}{LOANS_{i.t-1}}$	(+)

Data issues

In this study we use a panel dataset that consists of firm-level data for six commercial banks that operated during the 1994 to 2004 period.[4] The dataset also includes macroeconomic variables such as the annual inflation rate, real effective exchange rate (REER), and annual growth in real GDP over the period of analysis. The firm-level data were obtained from the Annual Reports of Commercial Banks while the macroeconomic variables were obtained form the Bank of Guyana Annual Reports and the International Financial Statistics (IFS).

The time period covered by our panel is selected for two primary reasons. Firstly, data for NPLs before 1994 were not available. Secondly, several local commercial banks (in collaboration with the government) embarked on an exercise to restructure their NPLs to the rice producing sector during 2005. This initiative saw a sharp contraction in the impaired assets of the banks and can therefore distort the econometric analysis.

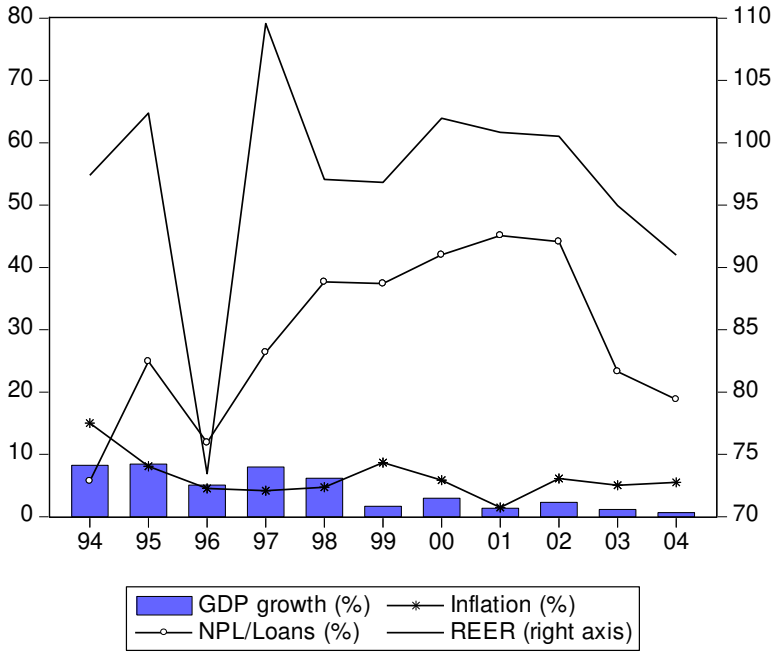
Stylized facts

The adoption of the Economic Recovery Programme (ERP) in 1989 saw the liberalisation of the Guyanese banking sector and the expansion of the real economy which in turn encouraged many commercial banks to extend credit rapidly to the private sector. The average real GDP growth rate during the 1991-97 was 7.1 percent. The ratio of credit to GDP rose from 19.8 percent in 1991 to approximately 50 percent in 1997. However, these trends were reversed after 1997 due to political instability, a slow down

[4] The data for GNCB are excluded from the panel. In 2002 GNCB was merged with GUYBANK, where the former took over the non-performing loans of the latter. The merger of these financial institutions therefore resulted in a significant growth in the aggregate NPLs of the banking sector which was not related to the performance of the domestic economy or credit policy of GNCB. Since the aim of this exercise is to determine the relationship between the growth in non-performing loans and key macro-economic and bank specific variables, GNCB was excluded to avoid the distortion that may be caused by the inclusion of this financial institution in our analysis.

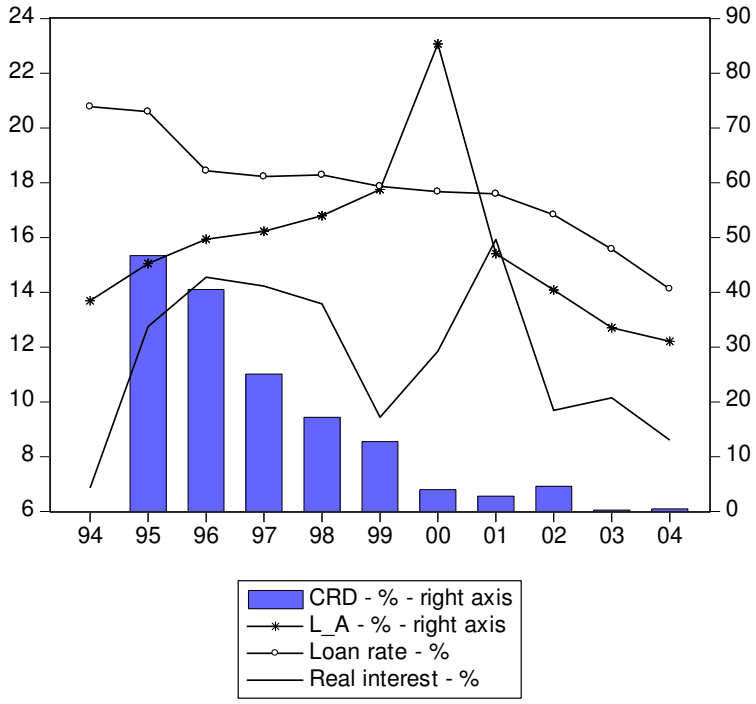
in the real economy, and unfavourable external circumstances which contributed to a sharp increase in NPLs. The total NPLs of the banking system which amounted to G$786 million in 1994 expanded to reach G$21 billion (or 45 percent of total loans and advances) at end-2001. The strong co-movement between the ratio of NPLs/total loans and our macroeconomic variables (*ΔGDP* and *REER*) depicted in Figure 1 clearly reflects the sensitivity of impaired loans to the real economy and adverse external shocks.

Figure 1: Trend of growth in real economy (GDP), real effective exchange rate (REER), inflation and the ratio of NPLs to total loans



Source: Bank of Guyana Annual Report (various years) and International Financial Statistics (IFS)

Figure 2: Trend of growth in loans and advance, loan-to-asset ratio, real interest rate the ratio non-performing loans-to-total loans



Source: Annual Reports of Commercial Banks (various years).

Given the widespread default on loans during the mid-1990s several commercial bank adopted a cautious lending stance. As a consequence, credit growth slowed significantly after 1998 as commercial banks shifted to safer investments, mainly treasury bills. These trends in the lending policies of local commercial banks are reflected in Figure 2, which shows a contraction in credit growth and the ratio of loans to total assets. Based on Figure 2, credit growth reduced continually from 47 percent during 1995 to below 1 percent in 2004. The ratio of loans to asset also reduced from 45 percent to 31 percent over the corresponding period. The strong co-movements between NPLs and the various bank specific and macroeconomic factors are not only clearly visible from the Figures above

but are confirmed by our correlation analysis reported in Table 2, which presents the correlation coefficient between NPLs/total loan ratio and the bank specific and macroeconomic variables for our panel dataset from 1994 to 2004.

Table 2: Correlation Analysis

Variables	Small Bank	Large Banks	All Banks
Bank specific variables			
Loan to asset ratio	0.21	0.19	0.20
Credit growth	-0.33	-0.28	-0.33
Real interest rate	0.06	0.07	0.07
Macroeconomic variables			
Real GDP growth	-0.40	-0.39	-0.41
Inflation rate	-0.26	-0.27	-0.28
Real effective exchange rate	0.10	0.09	0.09

Source: Bank of Guyana Annual Report (various years) and the Annual Reports of Commercial Banks (various years).

The results show a positive association between the loan to asset ratio and NPLs. The magnitude of this relationship is fairly strong suggesting that banks with a greater penchant for risk taking incurred higher NPLs. According to Table 2, real interest rates also have a positive relationship with non-performing loans. However, the association between real interest rate and the ratio of NPLs/total loans is weak as reflected in the low correlation coefficient.

Growth in loans and advances exhibits a fairly strong negative relationship with non-performing loans. While the literature suggest a positive association, our peculiar results probably reflects the conservative lending stance adopted by commercial banks after 1998 due to their bad lending experience with the rice sector and the general decline in the real economy. The social/political instability that characterised the late 1990s and

which continued during the early to mid 2000s may also explain the contraction in loans and advances extended by the banking sector.

Our correlation analysis reveals a fairly strong negative relationship between NPLs and growth in real GDP. Contrary to the existing literature Table 2 shows a negative association between inflation and the ratio of NPLs to total loans. This unique situation may be explained by the indexation of wages to inflation in Guyana.[5]

Table 2 shows that there are positive co-movements between the ratio of NPLs and real effective exchange rate. However, the magnitude of the correlation coefficient indicates that the co-movements between the real effective exchange rate and NPLs are not as strong as those between growth in real GDP and non-performing loans. This suggests that international competitiveness had a less pronounced impact on NPLs when compared to the slowdown in the real economy during our sample period.

IV. DISCUSSION OF RESULTS

In this study we employ a fixed effect panel model to identify the determinants of NPLs of local commercial banks. Tables 3 and 4 summarize the results of our regression model which is estimated using pooled least squares with a fixed effect estimator. Our model is estimated with a balanced panel dataset that consists of both macroeconomic and firm level data from 1994 to 2004.

The variable $L\_A_{i,t}$ which represents the risk appetite of the commercial banks is positive and significant at the 15 percent and 5 percent levels of significance in our general and parsimonious models (see Tables 3 and 4). This means that banks which are

[5] The labour unions in Guyana usually negotiate wage increases based on the inflation rate. During the sample period, the unions were able to successfully negotiate higher wages for their member that covered the rate of inflation.

high risk takers are likely to incur greater levels of NPLs(see Sinkey and Greenwalt, 1987).

The variable $SIZE_{i,t}$ (which represents the size of the bank) is positive but insignificant. This evidence which is inconsistent with previous studies (Rajan and Dhal, 2003; Salas and Saurina, 2002 and Hu et al, 2006) can be interpreted to mean that large banks are not necessarily more effective in screening loan customers when compared to their smaller counterparts.

Similar to previous studies, however, we find a significant positive contemporaneous association between the real interest rate variable ($RIR_{i,t}$) and NPLs (see Sinkey and Greenwalt, 1991; Fofack, 2005; Jimenez and Saurina, 2005). This indicates that when a commercial bank increases its real interest rates this may translate immediately into higher non-performing loans.

Table 3: Regression results

This table shows the results of the fixed effect regression model which is estimated with the ordinary least squares estimation technique and a balanced panel dataset from 1994 to 2004.

$$lnNPL\_A_{i,t} = \beta_{0i} + \beta_1 lnNPL\_A_{i,t-1} + \beta_2 lnL\_A_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 \Delta LOANS_{i,t} + \beta_5 \Delta LOANS_{i,,t-1} + \beta_6 \Delta LOANS_{i,,t-2}$$

$$+ \beta_7 lnRIR_t + \beta_8 lnRIR_{t-1} + \beta_9 lnINF_t + \beta_{10} lnINF_{t-1} + \beta_{11} \Delta GDP_t + \beta_{12} \Delta GDP_{t-1} + \beta_{13} lnREER_t + \beta_{14} lnREER_{t-1} +$$

$$\eta + \varepsilon_{i,t} \qquad i = 1,...N,\ t = 1,...T$$

where: $lnNPL_{i,t}$ and $lnNPL_{i,t}$ represents the natural log of the ratio of non-performing loans to total loans for bank *i* in year *t* and *t-1*; ΔGDP_t and ΔGDP_{t-1} represents the annual growth in real GDP at time *t* and *t-1* respectively; $lnRIR_t$ and $lnRIR_{t-1}$ denotes the natural log of the real interest rates (measured as the difference between the weighted average lending rate and the annual inflation rate) at time *t* and *t-1*; $lnREER_t$ and $lnREER_{t-1}$ indicates the natural log of the real effective exchange rate at time *t* and *t-1*; $lnINF_t$ and $lnINF_{t-1}$ is the natural log of the annual inflation rate at time *t* and *t-1*; $SIZE_{i,t}$ is the ratio of the relative market share of each bank's assets that capture the size of the institution at time *t*; $lnl\_A_{i,t}$ is the natural log of the loans to total asset ratio for bank *i* in year *t;* $\Delta LOANS_{i,t}$, $\Delta LOANS_{i,,t-1}$ and $\Delta LOANS_{i,,t-2}$ represent the growth in loans for bank *i* in year *t, t-1,and t-2* respectively; and $\varepsilon_{i,t}$ is the error term which should be normally distributed with zero mean and constant variance. In the model β_{0i} *is* fixed.

Variables	Coefficient	Std. error [1)]	t-statistics	Prob.
Bank specific factors				
$LnNPL\_A_{i,t-1}$	0.231329	0.091067	2.540206	0.0171
$lnL\_A_{i,t}$	0.933447	0.608620	1.533711	0.1367
$lnSIZE_{i,t}$	0.157875	0.383693	0.411462	0.6840
$\Delta LOANS$	-0.010862	0.002624	-4.138843	0.0003
$\Delta LOANS_{i,t-1}$	-0.012695	0.002079	-6.106473	0.0000
$\Delta LOANS_{i,t-2}$	-0.008616	0.002497	-3.450496	0.0019
$RIR_{i,t}$	0.806953	0.502583	1.605612	0.1200
$RIR_{i,t-1}$	0.381330	0.426080	0.894975	0.3787
Macro-factors				
INF_t	-0.002097	0.086632	-0.024211	0.9809
INF_{t-1}	0.070132	0.128910	0.544040	0.5909
ΔGDP_t	-0.049554	0.036561	-1.355406	0.1865
ΔGDP_{t-1}	-0.006514	0.034384	-0.189455	0.8512
REER	1.591487	1.046019	1.521471	0.1398
$REER_{t-1}$	2.689959	0.840546	3.200254	0.0035
Fixed Effects				
Bank 1	-9.781574			
Bank 2	-9.920805			
Bank 3	-9.678762			
Bank 4	-12.54788			
Bank 5	-9.963629			
Bank 6	-10.88915			
Diagnostic test				
R-squared	0.956505			

[1)] Represent White's robust standard errors.

Table 4: Regression results: the parsimonious model

This table shows the results of the fixed effect regression model which is estimated with the ordinary least squares estimation technique and a balanced panel dataset from 1994 to 2004.

$$lnNPL\_A_{i,t} = \beta_{0i} + \beta_1 lnNPL\_A_{i,t-1} + \beta_2 lnL\_A_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 \Delta LOANS_{i,t} + \beta_5 \Delta LOANS_{i,,t-1} + \beta_6 \Delta LOANS_{i,,t-2} + \beta_7 lnRIR_t + \beta_8 lnRIR_{t-1} + \beta_9 lnINF_t + \beta_{10} lnINF_{t-1} + \beta_{11} \Delta GDP_t + \beta_{12} \Delta GDP_{t-1} + \beta_{13} lnREER_t + \beta_{14} lnREER_{t-1} + \eta + \varepsilon_{i,t} \qquad i = 1,...N,\ t = 1,...T$$

where: $lnNPL_{i,t}$ and $lnNPL_{i,t}$ represents the natural log of the ratio of non-performing loans to total loans for bank *i* in year *t* and *t-1*; ΔGDP_t and ΔGDP_{t-1} represents the annual growth in real GDP at time *t* and *t-1* respectively; $lnRIR_t$ and $lnRIR_{t-1}$ denotes the natural log of the real interest rates (measured as the difference between the weighted average lending rate and the annual inflation rate) at time *t* and *t-1*; $lnREER_t$ and $lnREER_{t-1}$ indicates the natural log of the real effective exchange rate at time *t* and *t-1*; $lnINF_t$ and $lnINF_{t-1}$ is the natural log of the annual inflation rate at time *t* and *t-1*; $SIZE_{i,t}$ is the ratio of the relative market share of each bank's assets that capture the size of the institution at time *t*; $lnl\_A_{i,t}$ is the natural log of the loans to total asset ratio for bank *i* in year *t;* $\Delta LOANS_{i,t}$, $\Delta LOANS_{i,,t-1}$ and $\Delta LOANS_{i,,t-2}$ represent the growth in loans for bank *i* in year *t, t-1,and t-2* respectively; and $\varepsilon_{i,t}$ is the error term which should be normally distributed with zero mean and constant variance. In the model β_{0i} *is* fixed.

Variables	Coefficient	Std. error [1)]	t-statistics	Prob.
Bank specific factors				
$LnNPL\_A_{i,t-1}$	0.253678	0.084641	2.997096	0.0052
$lnL\_A_{i,t}$	-0.927715	0.411203	-2.256099	0.0310
$lnSIZE_{i,t}$	-	-	-	-
$\Delta LOANS$	-0.010817	0.002462	-4.394326	0.0001
$\Delta LOANS_{i,t-1}$	-0.012556	0.001892	-6.636234	0.0000
$\Delta LOANS_{i,t-2}$	-0.008432	0.002234	-3.774699	0.0007
$RIR_{i,t}$	0.592864	0.389024	1.523979	0.1373
$RIR_{i,t-1}$	-	-	-	-
Macro-factors				
INF_t	-	-	-	-
INF_{t-1}	-	-	-	-
ΔGDP_t	-0.051873	0.029788	-1.741394	0.0912
ΔGDP_{t-1}	-	-	-	-
REER	1.413999	0.790145	1.789542	0.0830
$REER_{t-1}$	2.583651	0.747548	3.456166	0.0016
Fixed Effects				
Bank 1	-7.507684			
Bank 2	-7.574109			
Bank 3	-7.542794			
Bank 4	-10.57218			
Bank 5	-7.730316			
Bank 6	-8.824282			
Diagnostic test				
R-squared	0.9565052			

[1)] Represent White's robust standard errors.

The variable which captures the relative credit growth of commercial banks ($\Delta LOANS_{i,t}$) is negative and significantly related to NPLsat time *t*, *t-1* and *t-2* respectively. Based on our results, it therefore follows that commercial banks which extend relatively higher levels of credit are likely to incur lower non-performing loans. It is important to note that our results are contrary to the international evidence which suggest a positive relationship between credit growth and NPLs (see Salas and Saurina, 2002 and Jimenez and Saurina, 2005).

Based on Tables 3 and 4, the real effective exchange rate ($REER_t$) is positively and significantly related to NPLs suggesting that the international competitiveness of the domestic economy is an important determinant of credit risk. In other words, whenever there is the deterioration in the competitiveness in the local economy the level of NPLs emanating from the key export oriented economic sectors is likely to increase. This evidence is not only consistent with Fofack (2005) but highlights the high levels of NPLsthat were reported for the agriculture sector as a result of lower commodity prices in the late 1990s.

Consistent with previous studies we also find a significant negative contemporaneous relationship between ΔGDP_t and NPLs (see Salas and Suarina, 2002; Jajan and Dhal, 2003; Fofack, 2005; and Jimenez and Saurina, 2005). Similar to these studies we interpret our findings to mean that an improvement in the real economy is likely to see an instantaneous reduction in the non-performing loan portfolios of commercial banks.

Our results suggest a mixed relationship between inflation and non-performing loans. The variable has a negative relationship with NPLs at time *t* but a positive impact

at time *t-1*. This means that high inflation in the current period should see a reduction in the level of NPLsin the banking sector. However, high inflation from the previous period causes commercial banks to incur higher non-performing loans. Apart from the mixed effects that inflation appears to exert on NPLsthe coefficients of the inflation variables are not statistically significant in our regression model.

V. CONCLUSION AND POLICY IMPLICATIONS

This study attempted to ascertain the determinants of NPLs in the Guyanese banking sector using a panel dataset and a fixed effect model similar to Jimenez and Saurina (2005). Our empirical results support the view that macro-factors, such as, the real effective exchange rate and growth in real GDP impacts significantly on the level of NPLs. In particular, we found that the real effective exchange rate has a strong positive association with the levels of NPLs reported by commercial banks suggesting that whenever there is a deterioration in the international competitiveness of the domestic economy (as reflected by an appreciation in the real effective exchange rate) this translates into higher NPLs. We also find evidence of a significant inverse relationship between GDP and non-performing loans. This means that strong performance in the real economy results in lower non-performing loans. Our results show that the impact of growth in real GDP on NPLs is instantaneous. The empirical results, however, reveals that inflation is not an important determinant of NPLs in the Guyanese banking system.

With respect to the bank specific variables, we find that banks which charges relatively higher real interest rates and have a penchant for taking on risk tends to experience greater loan delinquencies (or non-performing loans). This is evident from the significant positive associations between NPLs and the $RIR_{i,t}$ and $L\_A_{i,t}$ variables.

However, contrary to international evidence our results show that large banks are not necessarily more effective in screening loan customers when compared to their smaller counterparts – since there is no significant relationship between the size of a banking institution and the level of NPLs. We also find that banks which are more aggressive in the credit market are likely to incur lower NPLs, which conflict with previous studies.

Based on our findings, it means that commercial banks should pay attention to several factors when providing loans in order to curtail the level of impaired loans. Specifically, commercial banks need to consider the international competitiveness of the domestic economy since this may impair the ability of borrowers from the key export oriented sectors to repay their loans which in turn would result in higher non-performing loans. These lending institutions should also take the performance of the real economy into account when extending loans given the reality that loan delinquencies are likely to be higher during periods of economic downturn. Finally, banks should constantly review the interest rates on loans since loan delinquencies are higher for banks which increase their real interest rates.

The Bank of Guyana should also expand its monitoring framework to include macroeconomic prudential indicators such as GDP and REER when assessing the stability and soundness of the banking system.

Future Research

Since our results for Guyana are encouraging, the authors will replicate this study for other countries in the Caribbean. In order to extend the literature on non-performing loans, the authors plan to incorporate corporate governance and the regulatory environment in our future research. This decision is motivated by two primary reasons:

(i) the financial crisis in the US was blamed on deregulation and the weak regulatory framework in this country; and (ii) ethics seem to at the heart of the financial crisis in the US. While there are reasons to suspect that other financial crises occurred because of these factors, they were ignored in previous studies.

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