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Dynamic implications of fiscal policy on NPLs: theoretical analysis and panel-regression empirics

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ABSTRACT

This paper examines the interplay between fiscal policy and non-performing loans (NPLs), a topic which is not widely considered in the existing literature. Using Guyanese bank-level and quarterly data from 2009: Q4 to 2024: Q4, the paper finds an inverse relationship between the overall fiscal balance – defined as total government revenues minus total government expenditures – and NPLs (or bad loans), implying that an improvement in the fiscal balance reduces credit risk and a fiscal expansion increases the percentage of bad loans (credit risk). Expanding the industrial organization model of banking and drawing on liquidity preference theory, the paper proposes a generalized theoretical framework to explain why a fiscal contraction might decrease NPLs in a bank's portfolio. Panel-regression estimates also reveal several auxiliary results consistent with the existing literature: oil price and an oil production dummy variable are negatively associated with NPLs, while capital adequacy and inflation are positively related to NPLs. Other macroeconomic factors, such as economic growth, real effective exchange rate, inflation, as well as bank-specific variables that capture diversification, liquidity, and efficiency, are not important determinants of NPLs, according to our estimates.

Keywords: Fiscal policy, liquidity preference, credit risk, non-performing loans, panel regression

JEL classification: E43, E50, E44, G11, G18, H30

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I. Introduction

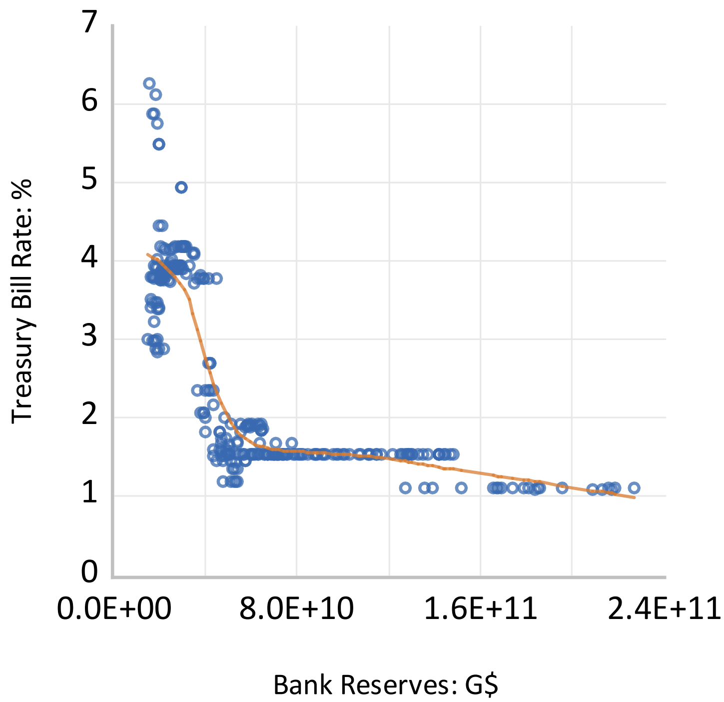
A large body of literature, all too numerous to mention here, on the determinants of non-performing loans (NPLs) has emerged over the years, especially after the 2007-08 Global Financial Crisis (Hakimi et al. 2023, Qian and Yang 2022, Vouldis and Louzis 2017, Chavan and Gambarcorta 2016, Skarica 2014, Louzis et al. 2010, Barseghyan 2010, Maggie and Guida 2009, Fofack 2005, Kane and Rice 2001). This can be attributed to the adverse effects of NPLs (or bad loans) on financial institutions, as well as financial systems and the broader economy. Indeed, NPLs have been associated with the insolvency of financial institutions, financial crises, inefficiency in the banking sector, and a reduction in lending and private investment that affect economic growth. While the existing literature encompasses various strands, econometric studies on NPLs can be broadly categorized into three main groups: those that employ macroeconomic variables only, those that employ bank-specific variables only, and those that use both macroeconomic and bank-specific variables (Umar and Sun 2016).

This paper investigates the interaction between fiscal policy and NPLs by applying a hierarchical panel regression model, and developing a theoretical model that augments the industrial organization (IO) theory of banking. The IO theory of banking is outlined in detail by Freixas and Rochet (1999) and applied for explaining financial outcomes such as excess bank liquidity in developing economies and beyond by Khemraj (2018, 2010) and Ghossoub (2023). We are not aware that the IO theory of banking was ever extended to make a connection between fiscal policy and NPLs of banks, especially in a developing country context. Our paper is also positioned in a broader literature focusing on the nexus between fiscal policy and financial stability (credit risk), such as the works by Borio et al. (2023), Okano and Eguchi (2020), and Yu (2017, 2016). Furthermore, the paper is related to the literature exploring how fiscal policy influences credit interest rates (Miranda-Pinto et al. 2023, Murphy and Walsh 2022, Gevorkyan and Kvangraven 2016).

A relatively small empirical literature explores the impact of fiscal policy on commercial bank's NPLs. For example, Siakoulis (2017) shows that fiscal consolidation, as reflected by higher taxes and lower spending, reduces the debt service capacity of businesses and households and consequently leads to higher non-performing loans. Özen et al. (2022) find that value-added tax is positively related to NPLs, arguing that higher taxes reduce borrowers' ability to service their loans. A similar relationship was found between service taxes and NPLs by Tham et. al. (2021). Meanwhile, Rahman et al. (2023) discovered that weak and strong fiscal consolidation increase NPLs in highly indebted countries (HICs).

Therefore, this paper makes two contributions: (i) it develops a generalized theoretical framework motivated by the IO banking model and liquidity preference theory for exploring the fiscal policy-NPL nexus; and (ii) it uses bank-level data to study the fiscal-policy-NPL nexus as well as other auxiliary empirical relationships. The main finding is the inverse relationship between fiscal policy and commercial bank NPLs, a result that may seem counterintuitive at first glance in light of research which shows that government procurement can stimulate firms' employment (Ye et al. 2025) as well as small business survival (Pasha et al. 2018). In addition, oil price and oil production (a dummy variable accounting for Guyana's nascent oil production) are negatively associated with NPLs, while capital adequacy and inflation are positively related to NPLs. That oil price exerts statistically and economically significant effects on NPLs should not be a surprise since small open economies are often buffeted by oil shocks (Upadhyaya et al. 2025, Cornejo et al. 2025). Following Khemraj and Pasha (2016), we also control for the effect of the real effective exchange rate, which has an implication for the external competitiveness of highly open economies, on NPLs.

Figure 1 Bank Liquidity Preference Curve Derived from Locally Weighted Regression



Our theoretical model explains how fiscal contraction might reduce NPL by solving for three endogenous variables: the percentage of NPLs, bank liquidity, and the interest rate on government Treasury bills. Central to our approach is the idea of Keynesian bank liquidity preference as was discovered by Poghosyan (2014) and Khemraj (2010) for developing economies, and Eggertsson and Ostry (2005) for Japan. In order to motivate our theoretical framework, we replicate the bank liquidity curve for Guyana using data from 2001: Dec to 2025: June (Figure 1)[1]. The curve is fitted using the method of locally weighted regression. The vertical axis shows the Treasury bill rate (the banks' opportunity cost of holding non-remunerated reserves) and the horizontal axis indicates the total reserves. The curve follows a similar pattern found by the above-mentioned authors, first by being steep at high Treasury bill rates and becoming close to horizontal at low rates, thereby indicating that non-remunerated bank reserves and the short-term interest rate have a tendency to become perfect substitutes at low rates.

The supply of bank liquidity is reduced following a contractionary fiscal shock, *ceteris paribus*, resulting in an upward movement along the liquidity preference curve, thereby increasing the interest rate on the government security as well as bank profit. The higher profit from government securities, relative to the riskier commercial and household loans, induces banks to contract lending and thereby reducing the percentage of NPLs in their portfolios. A fiscal expansion, *ceteris paribus*, has the opposite effect, increasing bank liquidity and reducing interest on Treasury bills (a movement down the liquidity preference curve, Figure 1); therefore, prompting banks to expand loans and accumulate a higher percentage of bad loans.

Moreover, fiscal policy has been found to determine bank liquidity in Trinidad and Tobago (Primus et al. 2014), and changes in the government's central bank account balance have often been reflected in expansionary non-remunerated excess bank reserves in Guyana, because most funds from Treasury bill sales are no longer deposited in the central bank's sterilization account but in the Fiscal Consolidated Fund (Khemraj 2024). A parallel mechanism in which fiscal dominance determines bank interest rate spread in resource-rich economies – resulting in the financial paradox of plenty – was discovered by Constantine (2025).

Our approach is based on the notion of liquidity preference instead of loanable funds as a theory of interest rate determination at the short end of the term structure. In addition to the evidence provided by Figure 1, we argue that liquidity preference captures interest rate determination in developing economies in which finance is bank dominated, which is still the case for the majority of economies despite some gains in the development of secondary markets (Meh and Schmukler 2025). Moreover, liquidity preference theory is a good workhorse when the banking system is persistently saturated with non-remunerated excess reserves. The decision banks

[1] The data were downloaded from the IMF's International Financial Statistics (accessed, September 25, 2025). Total bank reserves were calculated by subtracting currency in circulation from the monetary base.

face is to rid themselves of the excess reserves, which often involves purchasing Treasury bills or extending new loans[2]. Loanable funds theory of interest rate assumes there are deep and liquid secondary markets for government securities across the maturity structure, a feature that is absent from Guyana and most economies in the Caribbean Region.

One supposed paradox in our analysis is the question of Treasury bill sales in times of fiscal contraction or even a surplus. Why would the government sell Treasury bills (a debt instrument) when there is an overall fiscal surplus? Tax and oil revenues are lumpy and often require legislative support before they can be spent. Therefore, the government still needs to conduct short-term cash flow management, like a profitable corporation raises short-term funds in the commercial paper market in the United States. In addition to cash flow management, a government would still sell short-term securities when there is a surplus for the purpose of assisting monetary policy and supporting financial market development (Tymoigne 2000, Nywata 2012).

The rest of the paper is organized as follows. Section 2 spells out a theoretical framework that connects NPLs and the government's fiscal balance. Section 3 discusses the empirical methodology and data matters, as well as presents descriptive statistical measures. Section 4 presents the panel-data econometric estimates and analysis. Section 5 concludes.

2. Theoretical Analysis

Consider the following bank profit function

$$\pi = r_L L + r_B B + R - r_D D - c(L), \qquad (1)$$

where r_L , r_B and r_D are interest rates on loans, government securities, and deposits, respectively. The quantities of loans, government securities, total reserves, and deposits are represented, respectively, by L, B, R, and D; and $c(L)$ represents the cost of NPLs relative to the total cost of banking. In other words, we will treat $c(L)$ and its derivative as a value between 0 and 1 for the rest of the analysis.

Total reserves – which includes required and excess reserves – is a fraction of deposits

$$R = zD, (0 < z < 1). \qquad (2)$$

The fraction z is endogenous because the required reserve ratio is non-binding owing to the non-remunerated excess reserves that often saturate the banking system in many developing economies

[2] For the rest of this paper, we will omit the foreign exchange market. When we control for foreign exchange variables, we do not obtain significant effects, as for example the insignificance of the real effective exchange rate. However, when we include the foreign exchange market in the model, it confirms our explanation of why a fiscal contraction might reduce NPLs.

(Ansari 2025, Khemraj 2018). Moreover, the notion that fiscal policy is a source of supply of excess bank liquidity was explored by Primus et al. (2014). The balance sheet constraint is $L + R + B = D$. Considering equation 2, the constraint can be written as

$$B = (1 - z)D - L. \tag{3}$$

Substituting equations 2 and 3 into 1 allows us to rewrite profit as

$$\pi = (r_L - r_B)L + [r_B - r_D + (1 - r_B)z]D - c(L). \tag{4}$$

<u>Deriving the interest-marginal cost curve (RM curve)</u>

The loan market first-order condition is

$$\frac{\partial\pi}{\partial L} = r_L - r_B - c'(L) = 0, \tag{5}$$

resulting in the bank's inverse supply of loans

$$r_L = r_B + m, \tag{6}$$

where $m = c'(L)$ is the marginal cost of NPLs ($0 < m < 1$). This is the ratio of total marginal cost accounted for by non-performing loans. We assume that the fraction of m is positively and linearly related to the ratio of NPLs to the quantity of total loans: $m = f\left(\frac{NPL}{L}\right)$ and $f'\left(\frac{NPL}{L}\right) > 0$.

The next step is to obtain the bank's direct supply of loans in terms of r_B and m. The direct supply can be expressed as

$$L_S = L_S(r_B, m),$$

with the following derivatives: $\partial L_S/\partial r_B < 0$ and $\partial L_S/\partial m < 0$. The latter derivatives allow us to rewrite the direct loan supply as

$$L_S = -\alpha_1 r_B - \alpha_2 m. \tag{7}$$

The intuition is that banks will reduce their lending if it is relatively more profitable to hold the government security; and a rise in the marginal cost will shift the supply curve inward.

Firms demand bank loans by maximizing the net present value (NPV) of revenues:

$$maxNPV^{firm} = max\sum_{t=0}^{T}\frac{f(\beta g, E\Omega_1)}{(1+r_B)},$$

where g = the percentage of the overall fiscal balance calculated as $\frac{T-G}{Y}$, and $E\Omega_1$represents other exogenous determinants of the firm's cash flow (E represents the expectation operator since future cash flows are uncertain), such as net revenue. A fiscal tightening is indicated by a greater value of g, while an expansion is signaled by a smaller value of g. The symbol β indicates a linking factor from the macro (fiscal balance) to the micro (firm or bank).

The following partial derivative holds, $\partial f/\partial g < 0$ (hence a decrease of NPV), because a fiscal tightening contracts business revenue, *vice versa*. It is clear that an increase in r_B increases the rate of discount of the NPV, thereby resulting in the partial derivative: $\partial NPV^{firm}/\partial r_B < 0$. Therefore, we can express the firm's demand for loans as

$$L_D = -\beta_1 r_B - \beta_2 g. \qquad (8)$$

The loan market equilibrium, $L_D = L_S$, produces the RM curve, which expresses the government security rate (r_B) in terms of the relative marginal cost of NPL (m) and the fiscal balance relative to GDP (g).

$$r_B = \frac{-\beta_2 g}{\beta_1 - \alpha_1} + \frac{\alpha_2 m}{\beta_1 - \alpha_1} \qquad (9)$$

Deriving the interest-reserve curve (RZ-curve)

The deposit market first-order condition is given as

$$\frac{\partial \pi}{\partial D} = r_B - r_D + (1 - r_B)z = 0, \qquad (10)$$

from which the bank's inverse demand for deposits is obtained

$$r_D = r_B + (1 - r_B)z. \qquad (11)$$

Holding z constant, an increase in r_B will increase the deposit rate, causing the bank to reduce its demand for deposits. Therefore, we expect an inverse relationship between r_B and deposit demand. Similarly, an increase in z, which is non-remunerated, will increase r_D, causing the bank to demand less deposits. It follows that the bank's direct demand for deposits is

$$D_D = -\gamma_1 r_B - \gamma_2 z. \qquad (12)$$

Households are expected to supply deposits by maximizing the NPV of future returns on deposits,

$$maxNPV^{hs} = max \sum_{t=0}^{T} \frac{h(\alpha g, s, E\Omega_2)}{(1 + r_B)},$$

where $s = (y^h - c)/y^h$ and s indicates the household's savings rate ($0 < s < 1$), y^h = household income, and c represents consumption. g is the same as defined earlier and the symbol α represents a conversion factor from the macro (fiscal balance) to the micro agent (household). Ω_2 includes other exogenous factors determining household cashflow. The expectation operator (E) indicates that future household cashflows are uncertain.

The following partial derivatives are assumed to exist: $h'(s) > 0$ and $h'(g) < 0$. The former result indicates that higher household savings will increase the NPV while fiscal tightening reduces household cashflow. As in the case of firm behavior, an increase in r_B decreases household's NPV, $\partial NPV^{hs}/\partial r_B < 0$, holding everything else constant. It follows that households' supply of deposits is given by

$$D_S = -\varphi_1 r_B - \varphi_2 g + \varphi_3 s. \tag{13}$$

The deposit market equilibrium, $D_D = D_S$, produces the RZ curve, which expresses the government security rate (r_B) in terms of z, g and s,

$$r_B = \frac{-\varphi_2 g + \varphi_3 s}{\varphi_1 - \gamma_1} + \frac{\gamma_2 z}{\varphi_1 - \gamma_1}. \tag{14}$$

It is clear from equations 9 and 14 that the model has three endogenous variables: r_B, m and z. Note that when the equilibrium interest rate is reached, $m = z$. When the latter condition holds, the percentage of NPLs (n) is determined ($m = z = n$). As NPL costs rise, we expect the bank to hold a higher share of bad loans in its portfolio, and *vice versa*. Moreover, the model has two explicit exogenous variables (g and s) and other implicit exogenous variables embedded in Ω_1 and Ω_2. Therefore, we have at least as many exogenous variables as there are endogenous variables. Our primary interest, however, is to analyze the impact of fiscal policy (g) on the relative NPL cost (m).

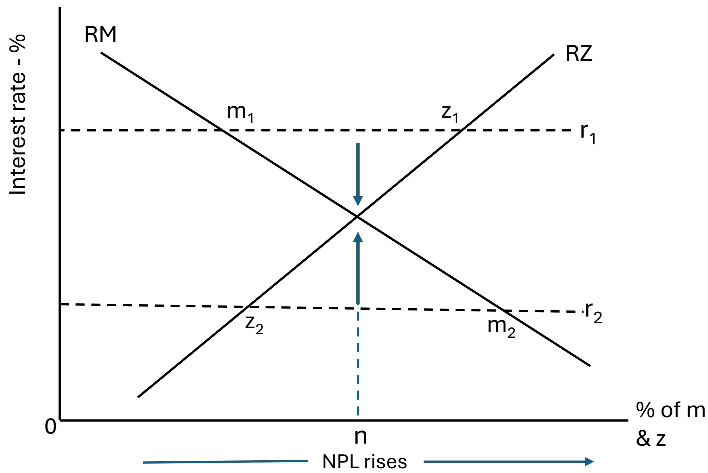
Model stability

Stability can be assessed using diagrams and institutional knowledge of developing economies. For example, we know that despite substantial gains in capital market financing, banks are still the dominant source of business financing in developing countries (Meh and Schmukler 2025). The implication is that banks are more likely to be active managers of Treasury bills and bonds in their portfolio relative to firms and households. Therefore, we expect that banks' supply of loans is more responsive to r_B than households' and firms' demand for loans with respect to r_B, implying that the following condition relating to the RM curve holds: $|-\alpha_1| > \beta_1$. It follows that the RM curve is downward sloping.

Following a similar institutional understanding, banks' demand for deposits is likely to be more responsive to r_B compared with the responsiveness of households' (and firms') supply of deposits to the same interest rate. It follows that banks are more likely to actively manage a financial portfolio of assets and liabilities given a change in r_B, compared with the interest-sensitivity of households and firms. Therefore, the following condition is the more likely outcome, $|-\gamma_1| > \varphi_1$, making the RZ curve upward sloping.

Figure 2 sketches the essential features of the model to underscore stability. First, consider the interest rate at r_1, at which point the percentage of bank reserves is greater than the percentage of NPL marginal cost relative to total cost ($z_1 > m_1$). In this case, the banking system is inundated with reserves, most likely excess reserves. Through a liquidity effect, the interest rate will adjust downward until $z = m$, at which point an equilibrium outcome is reached, determining the fraction of NPLs (n). The opposite occurs when $m_2 < z_2$. In this regime, the fraction of reserves is lower than the fraction of NPL marginal cost, resulting in the opposite liquidity effect, whereby the interest rate adjusts upward until the equilibrium is reached $z = m = n$.

Figure 2 Stability Analysis involving NPLs, Bank Liquidity, and Interest Rate



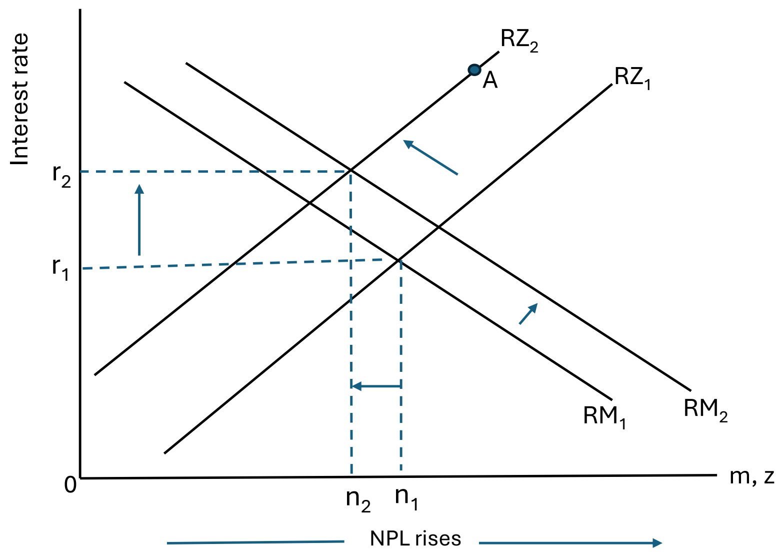
<u>Comparative statics</u>

First, we analyze how a tightening of fiscal policy – an increase in the percentage, g – affects NPLs and bank liquidity. Given Equation 9 and the previously mentioned condition, $|-\alpha_1| > \beta_1$, we expect that the increase in g will unambiguously shift outward the RM curve, initially increasing the percentage of NPLs (Figure 3). However, according to Equation 14 and the condition, $|-\gamma_1| > \varphi_1$, we expect the fiscal tightening to shift inward the RZ curve.

Given that the empirical estimates later in the paper find that there is a negative relationship between NPL and fiscal tightening, the inward shift of RZ has to be larger than the outward shift in the RM. Overall, the percentage of NPLs falls from n_1 to n_2, and the interest rate rises from r_1 to r_2. However, if the outward shift of the RM curve is larger, then the percentage of NPLs could rise following the fiscal tightening, as well as the interest rate (point A).

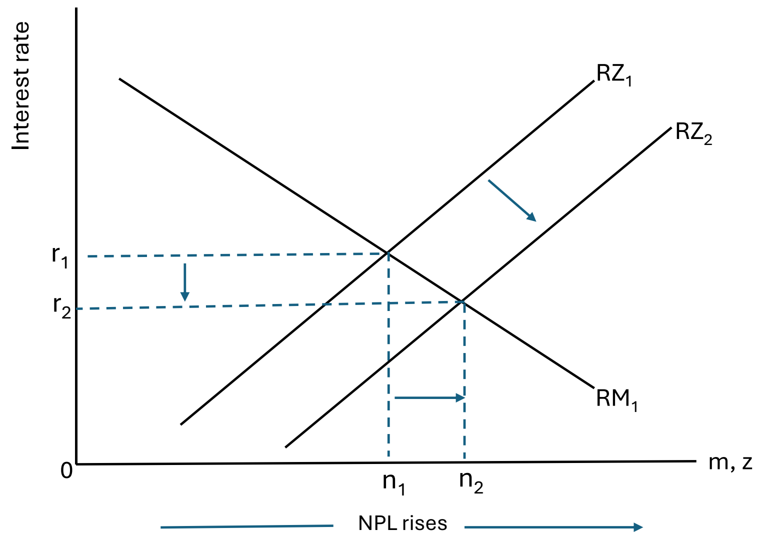
While we do not find the fiscal effect on NPLs controversial, the final effect on interest rate might be counterintuitive to some, given that it appears to contravene the loanable funds theory. *We argue that the loanable funds theory is more relevant to advanced financial systems with liquid secondary bond markets. In that world, the fiscal tightening will reduce the secondary supply of bonds and increase their prices, causing the secondary market interest rate to fall*. However, in a world of bank liquidity preference, we can expect a fiscal tightening to reduce bank liquidity, *ceteris paribus*, requiring the government to pay a higher interest rate to induce banks to part with their scarce reserves. On the other hand, a fiscal expansion, *ceteris paribus*, will produce a higher level of bank liquidity and a lower interest rate on the government security.

Figure 3: The Effect of Fiscal Policy on NPLs and Interest Rate



The next task is to analyze the effect of an increase in savings on NPL and interest rate. This is outlined in Figure 4. It is clear from Equation 14 and from the condition $|-\gamma_1| > \varphi_1$ that an increase in the savings rate will shift outward the RZ curve, causing the interest rate to fall from r_1 to r_2 and the percentage of NPL to increase from n_1 to n_2. Higher savings would mean a rise in excess bank liquidity, thereby incentivizing banks to bid a lower interest rate for government securities. Meanwhile, the lower interest rate on government securities implies that banks have to make up for the loss of profit by expanding loans at a higher loan rate, resulting in an increase in cost associated with bad loans and, therefore, the percentage of NPLs. A somewhat similar mechanism was explored by Constantine (2025), in which he showed that an increase in excess liquidity owing to fiscal dominance will widen the loan-deposit rate spread.

Figure 4: The effect of Savings on Interest Rate and NPLs.



3. Empirical Strategy and Data Matters

In order to examine the nexus between fiscal policy and NPLs, the paper applies a hierarchical panel regression method using pooled Ordinary Least Squares (OLS), fixed effects (FEM), and random effects model (REM). The model selection is guided by standard diagnostics. The F-test is used to determine whether the fixed effect estimation technique is superior to the pooled OLS. The Breusch and Pagan Lagrange multiplier (LM) test is computed to evaluate the appropriateness of the random effect model (REM) relative to the OLS, while, the Hausman test is applied to determine if the random effect or fixed effect is appropriate. The pooled OLS model is specified as follows

$Y_{i,t} = \alpha + \rho Y_{i,t-1} + \beta X_{it} + \varepsilon_{it}$,

where i = 1, …, N, t = 1, …, T, and where i represents each bank, t represents each time period. Y_{it} is the dependent variable (non-performing loans); α is the intercept; and ρ is the autoregressive coefficient of the lagged endogenous variable, $Y_{i,t-1}$. X_{it} is a vector of time-varying regressors (macroeconomic and bank-specific variables); β is a row vector of coefficients that captures the relationship between the dependent variable and regressors; and ε_{it} is the random error term that is uncorrelated with the regressors and has a mean value of zero. The general form of the fixed effect model (FEM) is as follows:

$$Y_{it} = \alpha + c_i + \rho Y_{it-1} + \beta X_{it} + \mu_{it},$$

where c_i represents the unobserved bank-specific effect that is time-invariant and μ_{it} is the random error term that is uncorrelated with the regressors and the unobserved individual fixed effect.

The random effect model (REM) is defined as

$$Y_{it} = \alpha + \rho Y_{it-1} + \beta X_{it} + \epsilon_i + \varepsilon_{it},$$

where, like before, Y_{it} is the dependent variable, NPL for the *i*-th bank observed over time *t*. ρ is the autoregressive coefficient of the lagged endogenous variable, Y_{it-1}. X_{it} is a vector of time-varying regressors (macroeconomic and bank-specific variables); β is the row vector of coefficients that captures the relationship between the dependent variable and regressors; ϵ_i is the individual impact (or random variation) of each entity and is independent of the individual random error term, ε_{it}. Moreover, ε_{it} is the uncorrelated with the regressors.

The data used for the study were obtained from the International Monetary Fund (IMF), the Bank of Guyana (BOG), and the Bureau of Statistics, covering the period from 2009: Q4 to 2024: Q4. This timeframe was selected because the bank-specific data was only publicly available from the fourth quarter of 2009 to last quarter of 2024. All six commercial banks in Guyana were included in the analysis over the said time period, implying that we have covered the total population of banks. In order to control for the distortion caused by the COVID-19 pandemic and Guyana's transition to a Petro-State, dummy variables were included in our model. A detailed description of the variables and corresponding sources is shown in Table 1.

To ensure that the selected model does not suffer from potential heteroscedasticity, serial correlation, and correlation among error terms, a battery of diagnostic tests is performed, including the panel groupwise heteroskedasticity test, modified Wald test for groupwise heteroskedasticity for the fixed effect model, Wooldridge's test for autocorrelation, and Pesaran's test for cross-sectional dependence. Appropriate corrective measures are employed to overcome any of these challenges, depending on the estimation technique used. Should the estimated model be affected by both serial correlation and heteroscedasticity, the Feasible Least Squares method will be employed. If the fixed effect model is used but the model is affected only by heteroscedasticity, it will be estimated with robust standard errors.

Table 1: Description, Definition of Variables and Sources

Variable	Classification	Definition	Source
NPL	Dependent variable	Non-performing loans/gross loans	Bank of Guyana
Micro-variables			
LIQ1	Liquidity	Liquid assets/gross assets	Bank of Guyana
DIV	Diversification of income	Non-interest income/operating income	Bank of Guyana
CAR1	Capital adequacy	Capital/Risk-weighted Assets	Bank of Guyana
EFF	Operational efficiency	Non-interest expense/operating income	Bank of Guyana
ROA	Profitability	Net Profit/total assets	Bank of Guyana
Macroeconomic variables			
OFB	Overall fiscal balance	Overall Fiscal Balance/GDP	Authors' calculation
GDP	Economic growth	Percentage change in real GDP	Bureau of Statistics
INF	Inflation	Percentage change in Consumer Price Index	Bureau of Statistics
REER	Real Effective Exchange Rate		International Financial Statistics, IMF
COVID	COVID-19 dummy variable	1 for periods 2020: Q1 to 2022: Q1, 0 otherwise	Authors' calculation
PETRO	Petroleum production dummy	1 for periods 2019: Q4 to 2024: Q4, 0 otherwise	Authors' calculation
OIL	Oil Price	Brent crude price	Federal Reserve Economic Database

Table 2 reports several unit root tests in order to assess the stationarity of the variables. The various tests are performed on the dependent and independent variables using specifications with intercept only, as well as intercept and trend. Given the seasonal patterns inherent in production and government spending, the quarterly GDP growth rates and ratio of overall fiscal balance to GDP are de-seasonalized prior to the estimation of our models. Therefore, the symbol SA means that a variable is seasonally adjusted, as is the case for SA_GDP and SA_OFB. Based on the results presented in Table 2, DIV, EFF, ROA, LIQ, SA_GDP, INF, and SA_OFB are stationary in levels, that is, I (0), while NPL, REER, CAR, and OIL are stationary after differencing once, or integrated of order one, that is, I (1).

Table 2: Unit Root Tests

	Levin, Lin and Chu	Im, Pesaran, Shin	ADF-Fisher Type	PPP-Fisher Type	Order of Integration
Intercept					
Δ(NPL)	-5.02923*	-6.97118*	73.5967*	239.659*	I (1)
Δ(CAR1)	-6.30427*	-11.6365*	139.405*	266.892*	I (1)
DIV	-0.52430	-1.61451***	19.2200***	102.179*	I (0)
EFF	-1.28482***	-4.16553*	48.7068*	150.393*	I (0)
ROA	-2.29456*	-4.84719*	50.7482*	167.486*	I (0)
LIQ1	2.01364	-1.12914	23.0222**	58.6537*	I (0)
SA_GDP	10.7961	-6.07510*	60.2150*	197.512*	I (0)
Δ(REER)	-10.2134*	-10.9942*	129.030*	202.859*	I (1)
INF	-5.67269*	-7.06356*	72.8382*	200.867*	I (0)
SA_OFB	1.84715	-2.00713**	19.2024***	110.524*	I (0)
Δ(OIL)	-8.32413*	-6.17609*	61.4285*	139644*	I (1)
Intercept and Trend					
Δ(NPL)	-5.05340*	-6.70663*	64.8168*	221.711*	I (1)
Δ(CAR1)	-5.95243*	-11.4262*	123.129*	203.517*	I (1)
DIV	-1.77570**	-3.06488*	30.2337*	116.487*	I (0)
EFF	0.27511	-2.48034*	32.6900*	143.816*	I (0)
ROA	-1.94079*	-4.23971*	42.1986*	161.227*	I (0)
LIQ1	0.01228	-1.06250	22.9649**	56.2911*	I (0)
SA_GDP	16.7801	-7.39774*	71.1302*	206.782*	I (0)
Δ(REER)	-10.2257*	-7.13734*	105.118*	173.924*	I (1)
INF	-5.14134*	-6.16203*	57.0125*	175.484*	I (0)
SA_OFB	1.91970	-4.09705*	36.1103*	140.998*	I (0)
Δ(OIL)	-8.09331*	-4.71194*	41.8936*	112.626*	I (1)

* Refers to $p < 0.01$, ** refers to $p < 0.05$, *** refers to $p < 0.10$

The descriptive statistics for the quarterly data from 2009 to 2024 are presented in Table 3. Our dataset is strongly balanced, comprising a total of 366 observations. The mean values for NPL, capital adequacy (CAR1), income diversification (DIV), efficiency (EFF), profitability (ROA), and liquidity (LIQ1) are 8.3%, 27.4%, 22.9%, 38.4%, 0.6%, and 32.7%, respectively. Based on these averages, commercial banks can be regarded as adequately capitalized, highly liquid, and not overly reliant on traditional interest income; instead, they earn a fairly balanced share of non-interest income. Additionally, the average ratio of non-interest expenses to operating income suggests that commercial banks exercise reasonable control over their overhead expenses relative to their income. The average quarterly GDP growth rate during the review period is 1.9%, while the average quarterly inflation rate is 0.6%. Further, the average real effective exchange rate (REER), oil prices (OIL), and overall fiscal balance as a percentage of GDP are $105.03, $78.33, 2.27% and -3.88%, respectively.

Table 3: Descriptive Statistics

	Mean	Median	Maximum	Minimum	Std. Dev
NPL	8.31	5.76	33.79	0.00	7.94
CAR1	27.37	24.95	76.71	7.04	12.41
DIV	22.91	22.39	56.10	6.92	8.46
EFF	38.45	38.87	150.72	-10.75	15.88
ROA	0.60	0.55	1.51	-1.74	0.29
LIQ1	32.7	30.05	60.60	8.76	10.85
GDP	1.92	2.60	29.80	-25.70	12.83
SA_GDP	4.57	1.80	56.65	-8.90	10.01
REER	105.03	105.69	115.28	96.62	5.33
INF	0.60	0.61	3.47	-2.36	0.95
OFB	-3.88	-2.10	5.80	-22.50	7.01
SA_OFB	-3.70	-3.46	1.53	-11.78	2.38
OIL	78.33	76.67	118.43	33.38	23.54

We also checked for correlations among the independent variables, which are generally weak, indicating that there is no perfect or exact linear dependence between any two variables. Overall, with the exception of the correlation coefficient between EFF and ROA, the highest correlation between two the independent variables is 0.22. It therefore follows that the likelihood of multicollinearity is relatively low. However, we uncover a fairly strong correlation between EFF and ROA, amounting to -0.73. Therefore, we probe further into the variance inflation factor (VIF) of the regressors. It is clear from Table 4 that the VIF is substantially lower than the arbitrary cut-off value of 10, which is suggested by Wooldridge (2013, Chapter 3) as the threshold beyond which multicollinearity could be a ‘problem’ for estimating the slope coefficients.

Table 4: Variance Inflation Factors (VIF)

Variable	VIF	1/VIF
PETRO	5.85	0.170869
EFF	2.67	0.373861
ROA	2.49	0.402396
∆(REER)	2.01	0.49687
COVID	1.98	0.506012
∆(OIL)	1.89	0.529437
SA_OFB1	1.88	0.531501
SA-GDP	1.84	0.544582
SA_OFB	1.74	0.574243
SA_OFB2	1.72	0.582838
SA_OFB3	1.71	0.585536
SA_GDP2	1.67	0.59752
INF	1.66	0.601795
SA_GDP3	1.64	0.609837
SA_GDP1	1.62	0.618866
DIV	1.32	0.756041
NPL (-1)	1.1	0.910014
∆(CAR1)	1.08	0.92991
∆(LIQ1)	1.04	0.963675

4. Regression Analysis

To evaluate the impact of the overall fiscal balance on NPLs of commercial banks, the pooled OLS, fixed-effect, and random-effect models are estimated using quarterly data from 2009 to 2024 and for all six commercial banks. As shown in Table 5, the results consistently reveal a statistically significant negative relationship between the overall fiscal balance, lagged by two quarters, and NPLs across all model specifications at the 5% significance level. The statistical significance of the lagged independent variable suggests a dynamic relationship between the fiscal balance and NPL. Specifically, the result indicates that an improvement in the fiscal balance is associated with reductions in NPLs in the banking sector. In effect, fiscal policy plays a meaningful role in lowering credit risk and enhancing the stability of the financial system.

Based on the results, oil price, as well as the COVID-19 dummy variable and oil production dummy variable (PETRO), are inversely related to NPLs at different levels of significance. While the negative relationship between oil prices and NPLs may appear counterintuitive, it is plausible given the tendency of the government to adjust taxes on fuel imports during periods of rising oil prices to cushion the impact of these price changes on consumers and businesses. The negative effect is conceivable if we consider the fact that Guyana is a massive crude oil exporter, but still needs to import processed fuels and other energy-based products.

The inverse relationship between oil production in Guyana and NPLs is also understandable. Since the commercial production of oil in Guyana, there has been a notable expansion in non-oil sectors as well as a general improvement in disposable income – factors that likely contributed to improved loan performance. Although the negative impact of the COVID-19 pandemic on NPLs may also appear unusual, it can be explained by the decision of commercial banks to offer their loan customers a moratorium on loan payments, which temporarily eased the repayment burden for borrowers.

The quarterly economic growth rates and real effective exchange rate, however, are not significantly related to NPLs. This finding conflicts with the results in Khemraj and Pasha (2016), which reported an inverse relationship between economic growth and NPLs and a positive relationship between NPLs and the real effective exchange rate. Additionally, while inflation is significantly associated with NPLs in the fixed effects model at the 5% level of significance, it does not exert any significant impact on NPLs in the pooled OLS and random effects models.

Regarding the bank-specific variables, the return on assets (ROA) exerts a significant negative impact on NPL across all model specifications, at both the 5% and 1% significance level. This may be interpreted to mean that more profitable banks are generally better equipped to manage risk and therefore less likely to engage in risky lending practices (Berger and DeYoung 1997). Conversely, the capital adequacy ratio (CAR1) has a positive association with NPLs in all models at the 5% level of significance, indicating that banks that maintain more capital relative to risk-weighted assets tend to report lower NPLs. In other words, banks that adopt more cautious lending practices incur lower NPLs. The operational efficiency ratio (EFF) also exhibits a significant positive relationship with NPLs in all the models. The positive association between the EFF and NPLs suggests that banks with lower operational efficiency (reporting higher operational efficiency ratios) are more susceptible to higher loan default or NPLs, possibly because of weaker internal controls and suboptimal resource allocation. However, the income diversification variable (DIV) is significantly associated with NPLs in the random-effects and OLS models, but not in the fixed-effects model. These mixed results indicate that the benefit of income diversification in mitigating credit risk is sensitive to model specification.

Table 5: Regression Estimates

Variable	FEM	REM	OLS
∆ (NPL (-1))	.03174533	.29451638	.01448753
∆ (CAR1)	**.04938941***	**.04858063***	**.04858063***
∆ (LIQ1)	-.02341286	-.02466617	-.02466617
DIV	-.03303432	**-.03898449****	-.03898449**
EFF	**.02872871***	**.03646169*****	**.03646169*****
ROA	**-2.9955599*****	**-1.1325045***	**-1.1325045***
SA_GDP	.00504592	.00408391	.00408391
SA_GDP(-1)	-.00889718	-.00633023	-.00633023
SA_GDP(-2)	-.00269831	-.0017408	-.0017408
SA_GDP(-3)	-.01123458	-.00961526	-.00961526
INF	**.26465551***	.21382273	**.21382273**
∆ (REER)	-.1667108	-.1291806	-.1291806
∆ (OIL)	**-.04970986*****	**-.04127595****	**-.04127595****
COVID	**-.88224312***	**-.74788289***	**-.74788289***
PETRO	**-1.1328124***	**-1.044975***	**-1.044975***
SA_OFB	-.08747162	-.0977464	-.0977464
SA_OFB(-1)	.00822181	.00347967	.00347967
SA_OFB(-2)	**-.13216299***	**-.11248363***	**-.11248363***
SA_OFB(-3)	.03843344	.04473515	.04473515
CON	1.2671285	-.02984608	-.02984608
R-squared	0.3426	0.2753	0.2753
AdjR-squared	0.2945		0.2340
Chi2	9	126.50	6.66
Prob>Chi2	0.000	0.000	0.000

Note: * p < 0.05, ** p < 0.01, *** p < 0.001

To identify the best model, we first compare the fixed-effect model with the pooled OLS using the Likelihood Ratio. The test yields a Chi-square statistic of 34.98 (p-value = 0.0000). This means that the fixed effect model offers a better fit than the pooled OLS model at the 1% level of significance. Next, we apply the Hausman Test, which yields a p-value less than 0.05. This suggests that the null hypothesis (H0: there is no systematic difference in coefficients) should be rejected (see Table 6). Accordingly, we accept the fixed effect model as superior to the random effect model.

Table 6: Hausman Test

Chi-square test value	42.81
P-value	0.0014

Finally, we apply the Breusch and Pagan Lagrangian multiplier test to compare the REM with the pooled OLS regression. The p-value of the test is greater than 0.05, indicating that the null hypothesis (Ho: there is no significant difference across units) should be rejected (see Table 7). Based on the test results, the pooled OLS model is superior to the REM. Since the fixed effect model is superior to both the random effect and the pooled OLS models, we select the fixed effect model to examine the interplay of fiscal policy on the NPLs.

Table 7: Breusch and Pagan Lagrangian Multiplier Test for Random Effects

	Var	sd = sqrt(Var)
d_npl	4.161	2.039
E	2.931	1.712
U	0	0
chibar2(01)	=	0.000
Prob > chibar2	=	1.000

We conduct various diagnostic tests to validate the robustness of the fixed effect model. The Modified Wald test for groupwise heteroskedasticity reveals a p-value of less than 0.05, suggesting that the null hypothesis of homoskedasticity can be rejected (see Table 8). The Panel Data Heteroskedasticity Wald Test confirms the presence of heteroskedasticity.

Table 8: Modified Wald Test for Groupwise Heteroskedasticity in Fixed Effect Model

Chi-square (6)	221.66
Prob>chi-square	0.0000

The Wooldridge test for autocorrelation also provides strong statistical evidence against the null hypothesis of no first-order correlation. With a p-value of 0.0302, this test result confirms the presence of autocorrelation at the 5% significance level. In other words, the results suggest that the residuals are not independently distributed across time.

Table 9: Wooldridge Test for Autocorrelation in Panel Data

F (1, 5)	8.977
Prob > F	0.0302

We perform the Pesaran cross-sectional dependence test to determine whether the residuals are also correlated across entities. Based on the results shown in Table 10, the residuals are not correlated.

Table 10: Pesaran Cross-Sectional Dependence

Pesaran's test of cross-sectional independence	-1.347
p-value	0.1778
Average absolute value of the off-diagonal elements	0.120

The diagnostic tests reveal that the fixed effect model suffers from two problems, heteroskedasticity and autocorrelation. The standard errors and t-values for the coefficients are therefore likely to yield misleading inferences. To address these issues, we estimate the fixed effect model with cluster-robust standard errors. The results indicate that the overall fiscal balance with two lags, SA_OFB (-2), is also negatively associated with NPL at slightly above the 5% significance level (see Table 11). It therefore follows that fiscal tightening may coincide with lower credit risk.

Similarly, both oil prices (OIL) and the oil production (PETRO) dummy variable are inversely related to NPL at the 5% significance level and 10% significance level, respectively (see Table 11). These results highlight the sensitivity of the banking system to global commodity prices and the measures implemented by the government to dampen these shocks by appropriate fiscal policies, as well as the performance of the emerging oil and gas sector. Conversely, capital adequacy (CAR1) and inflation (INF) exert a positive impact on NPL at the 10% significance level. This implies that high capital buffers of commercial banks and rising prices are associated with a deterioration in the loan portfolios of commercial banks. All the other variables are statistically insignificant in the final model.

Table 11: Fixed Effect Model with Cluster-Robust Standard Errors

Variable	Coefficients	Robust Standard Errors	P > |t|
Δ (NPL (-1))	0.0317	0.0647	0.644
D(CAR1)	**0.0494**	**0.0203**	**0.059**
Δ (LIQ1)	-0.0234	0.0222	0.340
DIV	-0.0330	0.0244	0.234
EFF	0.0287	0.0314	0.402
ROA	-2.9956	1.6938	0.137
SA_GDP	0.0050	0.0063	0.461
SA_GDP (-1)	-0.0089	0.0085	0.346
SA_GDP (-2)	-0.0027	0.0100	0.798
SA_GDP (-3)	-0.0112	0.0125	0.410
INF	**0.2647**	**0.1164**	**0.072**
Δ (REER)	-0.1667	0.1295	0.254
D(OIL)	**-0.0497**	**0.0195**	**0.052**
COVID	-0.8822	0.6548	0.236
PETRO	**-1.1328**	**0.4701**	**0.061**
SA_OFB	-0.0875	0.0490	0.135
SA_OFB (-1)	0.0082	0.0487	0.873
SA_OFB (-2)	**-0.1322**	**0.0537**	**0.057**
SA_OFB (-3)	0.0384	0.0304	0.263
CON	1.2671	1.4777	0.430
R-squared	0.2753		

5. Conclusion

The primary aim of this paper was to analyze fiscal policy as a determinant of non-performing loans (NPLs) using panel regression models and a theoretical framework. The study covers all six banks in Guyana over the period 2009: Q4 to 2024: Q4. After estimating various econometric models – fixed effect, random effect, and pooled OLS – we find that a fiscal contraction results in a reduction of NPLs, results that somewhat contravene the very small literature that studied the fiscal-NPL nexus. Moreover, fiscal policy influences NPL with a lag of two quarters, making the effect dynamic in nature. Drawing from the literature on bank liquidity preference in developing economies and the industrial organization model of banking, we develop a theoretical framework to explain this seemingly contradictory finding. Central to our theoretical model is a bank-dominant financial system without very liquid secondary markets for government securities. In such a world, liquidity preference drives interest rate determination and banks' portfolio allocation, as well as the inadvertent accumulation or decumulation of NPLs. However, the model can easily be extended to economies with deep secondary markets for government securities – a world in which the loanable funds approach, instead of liquidity preference, may dominate.

Diagnostic tests reveal that the fixed effect model is better compared with the pooled OLS and random effect models. The fixed effect model, however, suffers from heteroskedasticity and serial correlation. To address these issues, the fixed effect model is estimated with robust standard errors. Based on the results from this model, the overall fiscal balance is inversely associated with the NPL of commercial banks, thereby confirming a robust relationship across various estimates.

As is customary, we control for other factors that may determine NPLs. The results indicate that oil production is inversely related to NPLs, highlighting the significant impact of this new sector on the performance of the loan portfolios of commercial banks. Conversely, capital adequacy and inflation exert a positive impact on NPL. This implies that high capital buffers of commercial banks tend to take on more risky loans and therefore record higher NPLs, and higher inflation erodes the capacity of borrowers to honor their loan obligations. Unlike previous studies, economic growth, real effective exchange rate, and inflation are not important determinants of NPLs. Additionally, bank-specific variables such as liquidity, efficiency, and income diversification do not exert any significant impact on NPLs.

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