Determinants of private sector credit in Papua New Guinea

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GRIFFITH UNIVERSITY–SOUTH PACIFIC CENTRAL BANKS JOINT POLICY RESEARCH WORKING PAPER SERIES

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Queensland, Australia

BANK OF PAPUA NEW GUINEA

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Griffith University–South Pacific Central Banks Joint Policy Research Working Paper Series

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'Determinants of private sector credit in Papua New Guinea', Griffith University–South Pacific Central Banks Joint Policy Research Working Paper No. 11, 2020.

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Contents

Abstract

This is among the first of studies to investigate the determinants of private sector credit in the case of Pacific Island Countries. Using PNG as a case, various demand and supply-side factors and an autoregressive distributed lag model, the study finds that deposits at the commercial banks, real gross domestic product, real effective exchange rate, and net foreign assets have significant positive influence on credit to the private sector in both the short and the long-run. Interestingly, lending rates have no significant influence on credit to the private sector. Policy implications are discussed.

Keywords: private sector credit, PNG, autoregressive distributed lag

1. Introduction

It is widely accepted that finance is sine qua non for start-up, establishment and expansion of a private sector enterprise; capital is indeed critical for operational as well as non-operational activities. Generally, the capital structure encompasses a mix of internal and external sources, with the latter financed primarily and commonly by financial institutions like commercial banks (White and Cestone, 2003; Galor and Zeira, 1993). Growth and expansion of the private sector then becomes almost invariably dependent on credit available and accessible from the financial institutions, begging the question—what might the determinants of such credit to the private sector be? This question is important because a well-functioning private sector is in turn sine qua non for economic growth and development and thereby alleviate poverty and income inequality, enhanced employment and well-being of a country and its citizens. Hence the purpose of this study—what indeed are the determinants of private sector credit in the case of Papua New Guinea (PNG), a Pacific island Country (PIC).

PNG is a small, open and natural rich developing economy with a strong tradeable sector exporting chiefly primary commodities (such as palm oil, coffee, cocoa, fish, gold, copper, crude oil and liquefied natural gas(LNG)); and is highly import dependent on manufactured items (such as fuel, rice, vehicle, machinery and equipment and other consumables). Among the PICs, PNG is relatively larger, in terms of population and economy. The latter is dominated by two broad sectors—agriculture, forestry and fisheries —the biggest sectoral employer; and the mineral sector which accounts for majority of export earnings and gross domestic product (GDP). The mineral sector is comprised mainly of foreign-owned mining and quarrying and petroleum companies funded predominantly by parent companies overseas. The other sectors and depend on the domestic financial institutions for investment and expansion. PNG has experienced a period of sustained economic growth attributed to the high international commodity prices from 2003 to 2008 and the construction phase of the multi-billion-kina PNG LNG project which commenced in 2009 and was completed in 2013.

PNG's financial sector remains shallow and underdeveloped like other PICs and some developing countries. The sector comprises of commercial banks, finance companies, merchant banks, savings and loans societies, superannuation funds, life insurance companies, and other licensed financial institutions. Commercial banks—Bank South Pacific (BSP) Limited; Australia and New Zealand Banking Group (ANZ) PNG Limited; Westpac Bank (PNG) Limited; and Kina Bank Limited make up more than 50 percent of the financial sector and is the largest lending group. As of 2017, BSP, the largest of these four banks, have over 40 branches across the country and subsidiaries in some PICs, whilst ANZ, Westpac and Kina Bank have 16, 14 and 1 branch, respectively.

Via-a-vis other PICs, PNG's domestic credit to the private sector as a percentage of GDP remains low. According to the World Bank's Development Indicator database, domestic credit to the private sector as percentage of GDP in PNG has been hovering between 13 percent and 20 percent since 1994. This ratio reached 20 percent in 2013 but dropped to 15 percent in 2017, far lower than the ratios elsewhere in the PICs. For instance, the ratio for Fiji was 40 percent in 1994 and had reached 60 percent in 2006 and since then has been maintained around that level. Vanuatu's ratio has also improved from 35 percent in 1994 to

68 percent in 2017. Thus, the greater relevance of the study's question—what might the determinants of private sector credit be in the case of PNG?

This research employed quarterly data for the period 2000 to 2017. The study adopted the methodology used by Baoko, Acheampong & Ibrahim (2017), which included both supply and demand variables. The dependent variable is private sector credit expressed as percentage of real GDP. The independent variables from the supply side are ratio of deposit to real GDP and the weighted average lending rate, whilst real GDP, real effective exchange rate and ratio of net foreign assets to GDP are from the demand side. From the results obtained from Autoregressive Distributed Lag (ARDL) model, all variables have positive and significant impact on private sector credit in the long run except lending rate. The results show that private sector credit in PNG is mainly influenced by demand factors.

The rest of the paper is organised as follows. Section 2 provides a context of the study. Section 3 briefly reviews the literature. Section 4 outlines the data and methods. Section 5 discussed the results. And section 6 concludes with some policy implications.

2. Context of the study

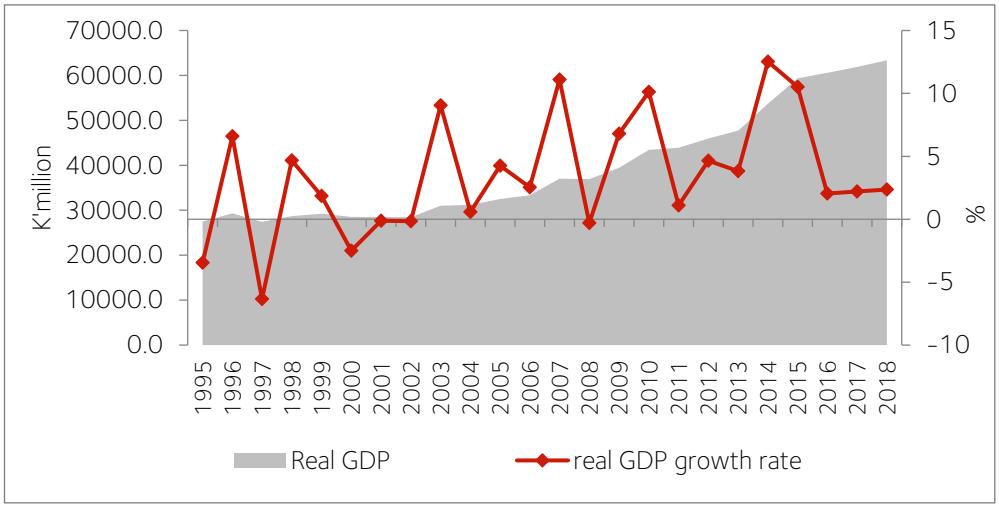
2.1 Macroeconomy

PNG's small open economy, depends heavily on trade which makes the external sector crucial in the development and growth of the country's economy. As is common in countries that export of primary commodities, developments such as high international commodity prices or establishment of new resource projects are favourable to PNG in terms of boosting economic activities and growth. Foreign direct investment (FDI), especially in the extractive sector, has also contributed significantly in the development and growth of the domestic economy. On the other hand, the country depends heavily on manufactured imports given its human and technological capacity constrains (Aipi and Sabok, 2016). Commodity export earnings and capital inflows from FDI are the main sources of foreign exchange which is needed for importing whilst the inflows play an essential role in supporting the national currency (Kina) in the floating exchange rate regime. In light of these structural underpinnings, economic activity in PNG is strongly influenced by factors such as FDIs, foreign exchange availability, exchange rate movements and developments in global economy and international commodity prices.

PNG experienced a period of rapid economic growth reflected by significant increase in GDP from early 2000's to 2014 (Figure 1). The period of growth between 2003 and 2008 was attributed to high international commodity prices which eventually ended as a result of the Global Financial Crisis (GFC). Domestic economic activity, however, remained resilient during the GFC, supported by expansionary fiscal policy. Whilst external conditions slowly recovered in the years following the GFC, the commencement of the construction phase of the PNG LNG project propped up domestic demand as economic growth gained momentum and peaked in 2010. There was increased FDI inflows related to the project, which led to increased supply of foreign currency in the economy with the country's foreign exchange reserve at Central Bank recording historic highs in that period. The construction phase of the project was completed in 2013.

In 2014, GDP growth reached an unprecedented high level attributed to the commencement of production and export of natural gas from the PNG LNG project. However, export earnings were lower than anticipated, which reflected the provisions given to PNG LNG project developers under the PDA to keep most of the export proceeds offshore to service their external liabilities, apart from meeting its operational costs, royalty payments and others. Furthermore, the international commodity prices dropped in the second quarter of 2014 precipitated by the significant plunge in international oil prices, resulting in further decline in export receipts. Foreign currency inflows were adversely affected, which led to build-up of backlog of foreign exchange orders for imports and other payments, and decline in the country's foreign exchange reserve as the Central Bank intervenes in supplying foreign exchange to the market. The shortage of supply of foreign currency against a persistent high demand in the market exerted downward pressure on the kina exchange rate. Consequently, import activities were hampered; affecting overall business activities and sentiments and led to subdued economic growth since 2014.

Figure 1: Real GDP growth in PNG, 1995-2018



2.2 Private sector credit

The growth in private sector credit between 2003 and 2014 was not in par with the strong economic growth in that period. However, this period of economic growth was characterised by significant increase in deposits at the commercial banks from both the private and government sectors (Figure 2). The high primary commodity export revenues earned in foreign currency by the private sector channelled via the commercial banks and were converted to kina. This led to a build-up of private sector deposits at the commercial banks. Meanwhile, the government deposits and converts most of its revenue earned, especially from trade and income tax, at the commercial banks and then draws them when needed for expenditure purposes. This resulted in increase in deposits with the commercial banks (Figures 2 and 3), which contributed to the high level of deposits at the commercial banks. However, this supply of credit did not translate to increase in private sector credit as there were other demand factors that could have affected the demand for credit.

Figure 2: Deposit composition at commercial banks

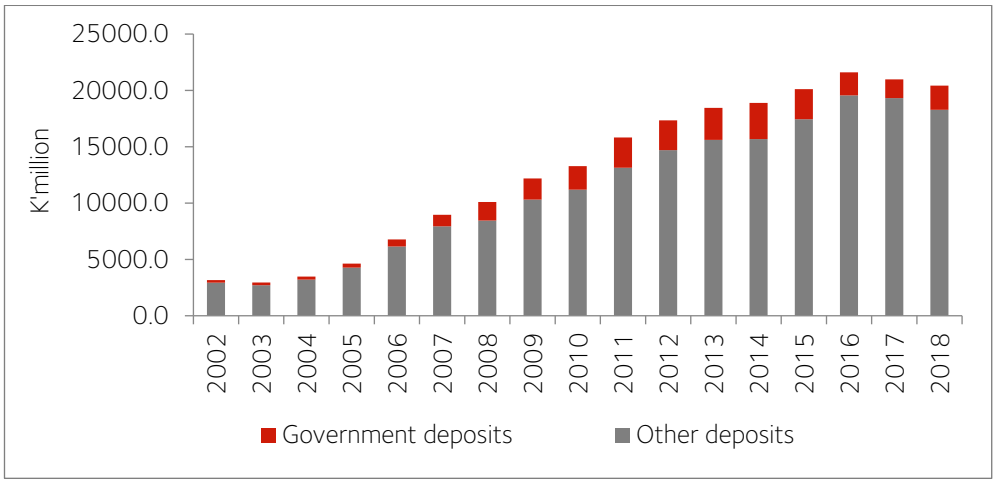
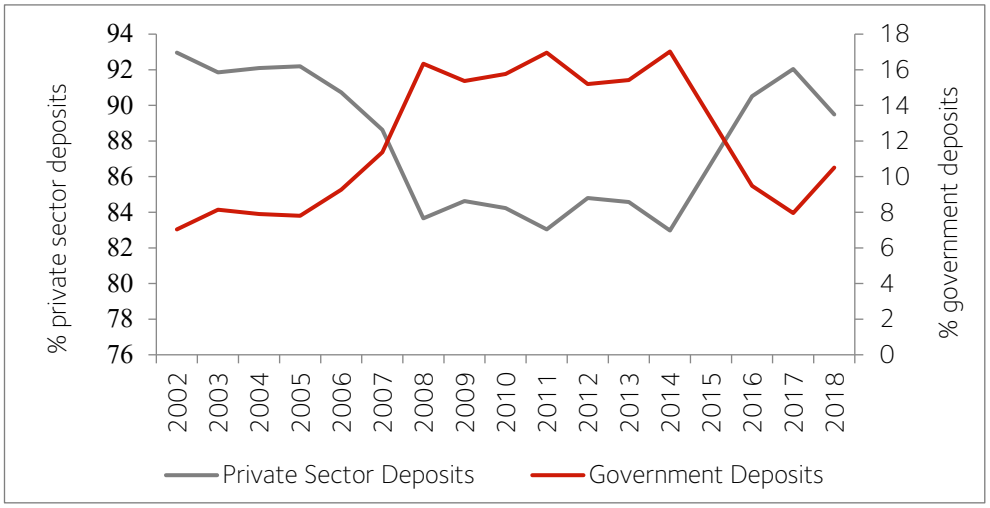
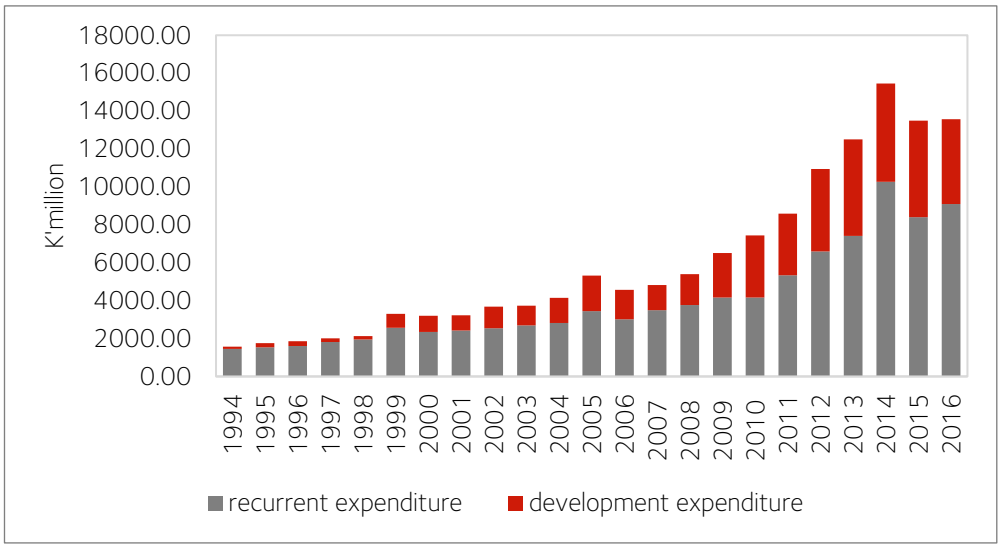


Figure 3: Deposit composition



The government and private sector had accumulated sufficient funds and were using their own cash stock to fund their investment and operations during the period of economic boom and as a result did not see the need to seek financial assistance form financial institutions. The government maintained expansionary budgets over the economic boom period and much of the spending was on development projects from which the private sector benefited through being subcontractors to the government for the various projects (Figure 4). The government, in that manner, injected more liquidity into the domestic economy. In addition, during the LNG PNG project's construction phase, the extractive company brought in its own funds and machinery and did not rely on the domestic financial sector to fund its operations and investment. The non-mineral private sector also benefited from subcontracts from the PNG LNG project. The private sector largely benefited from the favourable international commodity prices, consecutive expansionary government spending and subcontracts from the PNG LNG project's construction.

Figure 4: Government budget component

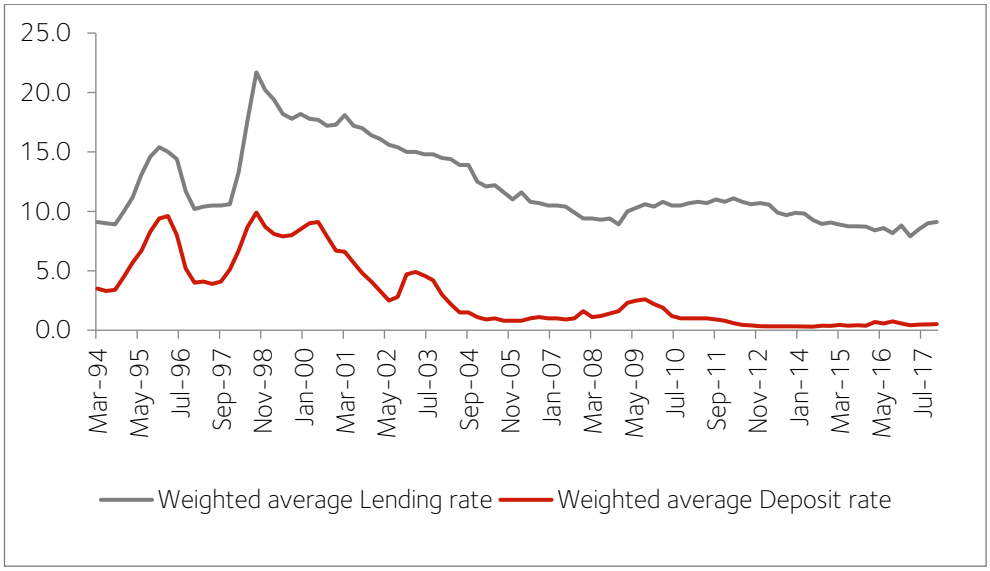


The issue on the shortage of foreign exchange in the domestic foreign exchange market evolved in 2014 and this affected growth in private sector which also had an impact on

private sector's demand for credit. Soon after the completion of the construction phase of PNG LNG project at the end of 2013, the international commodity prices significantly dropped resulting in decline in export earnings and foreign exchange. In addition, much of the PNG LNG export proceeds were not realised due to the PDA's, which contributed to the shortage of foreign exchange in the market. The lack of foreign currency also exerted additional downward pressure on the kina exchange rate. The foreign exchange situation and the depreciation of kina affected the private sector's ability to import resulting in subdued demand and lack of appetite for credit.

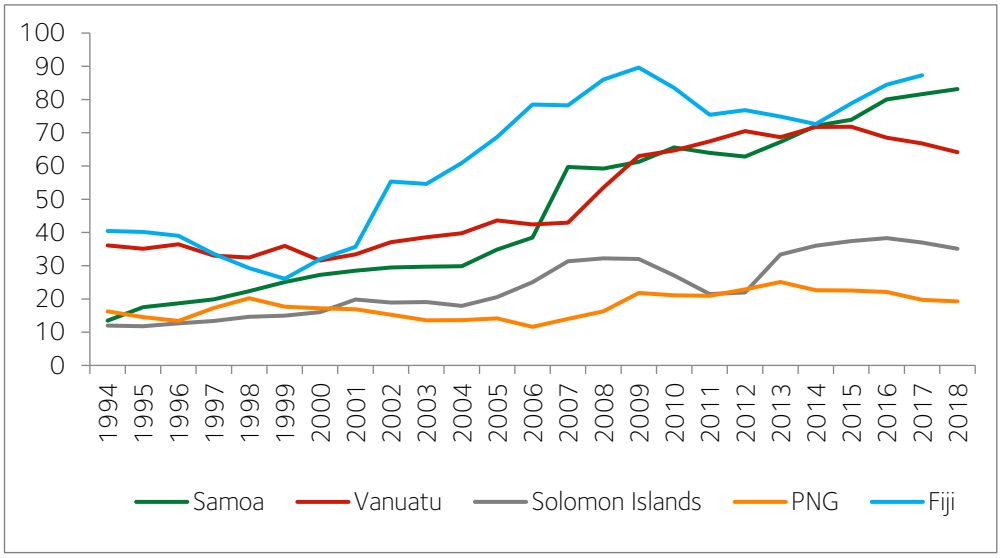
There is also the risk factor faced by the banking sector in PNG which could have affected the commercial banks' willingness to lend to the private sector. Ordinarily, the considerable increase in deposit in the banking system suggests an increase in loanable funds that should have encouraged a decline in lending rates and therefore encouraged an increase in lending to the private sector. However, this did not occur in the case of PNG in that period. This may be attributed to the oligopolistic nature of the banking sector and the risk factor. The absence of secondary debt market in trading or retailing government debt and other debt securities means that government debt cannot be easily liquidated or offloaded, especially in times of stress. The majority of deposits are from companies and government trust accounts which could be easily withdrawn or converted to foreign currency, whilst retail deposits comprises a smaller portion of the total deposits. These factors suggest that it may be prudent for commercial banks to hold capital ratios in excess of regulatory requirements. In addition, the margin between the weighted average lending and deposit rates remains relatively flat and barely respond to the changes in liquidity levels in the banking system (Figure 5).

Figure 5: Weighted average lending and deposit rates



Generally, the growth of private sector credit in PNG is comparably lower to other PIC's. According to the World Bank Development Indicators, the ratio of private sector credit to GDP in PNG has hovered between 13 percent and 18 percent between 1994 and 2008. During the construction phase of the PNG LNG project, the ratio increased to 21 percent in 2009 and peaked in 2013 at 25.1 percent. It had receded to 19 percent in 2016 and 2017. However, the ratio of private sector credit to GDP for PNG has not been in par with the considerable improvements in the domestic economy and still trails those of other PICs (Figure 6).

Figure 6: Domestic bank credit to private sector (%) in PICs, 1994–2018



3. Data and methodology

3.1 Data

This study adopts the framework used by Baoko et al. (2017) where the baseline model has both supply and demand factors that determine credit to the private sector. The dependent variable is private sector credit, defined as total credit to the private sector by Other Depository Corporations (ODCs) which comprises of all commercial banks, finance companies, savings and loans societies and merchant banks. The independent variables were selected based on the structural underpinnings of the economy. The supply side variables include ratio of deposits to real GDP and weighted average lending rate whilst real GDP, real effective exchange rate and ratio of NFA to GDP are from the demand side. GDP data was sourced from World Bank, while deposits, net foreign asset and weighted average lending rate were sourced from the Bank of PNG Quarterly Economic Bulletin (QEB). The Real Effective Exchange Rate (REER) is calculated quarterly by the Bank of PNG and is weighted by the trading countries' shares of PNG's total merchandise trade value. All variables in the model are expressed in log (ln).

Accordingly, the baseline model used in this research is specified below.

$$lnPSC=F(lnD_t, lnY_t, LR_t, lnREER_t, lnNFA_t) \quad (1)$$

where:
PSC = private sector credit; D = ratio of deposits to real GDP; Y = real GDP; LR = weighted average lending rate; REER = real effective exchange rate; NFA = ratio of NFA to real GDP

Normally, an increase in deposits at the commercial banks implies an increase in loanable funds hence increase in credit to the private sector. An increase in GDP implies an increase in the level of demand in the economy which put pressure on available resource and creating the need for the private sector to borrow. Lending rate is the cost of borrowing, therefore an increase in lending rate results in decline in credit to the private sector. An increase in NFA should result in an increase in PSC. REER should have a positive relationship with PSC in the case of PNG because an increase in REER makes imports cheaper resulting in increase in import demand which boost economic activity in the private sector, hence increase in private sector credit. An increase in NFA should result in an increase in PSC. These theoretical relationships between PSC and each explanatory variable are summarised in the Table 1.

Table 1: Short-Run and Long-Run Relationships between

PSC and Independent Variables	
Variable	Expected relationship
lnD	Positive
lnY	Positive
lnLR	Negative
lnREER	Positive
lnNFA	Positive

3.2 Unit root and breakpoint unit root tests

The test for unit root and stationarity for each variable was done using the Augmented Dicker Fuller (ADF) and Phillips Perron (PP), and the Kwiatkowski Phillips Schmidt Shin (KPSS) tests, respectively. According to the results obtained from the ADF test, lnY is I(0), lnD, lnLR, lnREER and lnNFA are I(1), whilst lnPSC is I(2). The ADF test has lower power, while PP test results show that all variables do not have unit root and are stationary at first difference or I(1). The KPSS test results show that lnY is stationary at level or I(0) whilst all the variables are stationary at first difference or I(1). The results of the unit root and stationarity tests are presented in Table 2.

Table 2: Unit root and stationary test results

Variable	ADF	PP	KPSS
lnPSC	I(2)	I(1)	I(1)
lnD	I(1)	I(1)	I(1)
lnY	I(0)	I(1)	I(0)
lnLR	I(1)	I(1)	I(1)
lnREER	I(1)	I(1)	I(1)
lnNFA	I(1)	I(1)	I(1)

Time series variables that have structural breaks may produce spurious results. Therefore, the 'Break point unit root test' was used to test for structural breaks in the time series of the variables. The break dates are reported in the Table 3. The dummy variables were created each break.

Table 3: Break point unit root test results and dummy variables

Variable	Unit Root Test	Break Date	Possible reason for the structural break
lnPSC	I(1)	Quarter 4, 2004	The lag impact of the removal of restriction on lending to residents foreign owned businesses in September 2004 under the Central Banking Act 2000.
lnY	I(1)	Quarter 1, 2014	GDP fell due to fall in the international commodity prices and the completion of PNG LNG project construction phase.
lnLR	I(1)	Quarter 4, 2007	Inflation increased, fuelled by government expansionary fiscal policy, hence lending rate significantly increased.

From the unit root test results, the ARDL model was selected as the appropriate model as it can model a mixture of I(0) and I(1) variables. When variables are not stationary at level, a cointegration test must be carried out to establish a long-run relationship among the variables. The cointegration test methods based on Johansen and Juselius (1990) requires all variables to be of the same degree of integration, that is, I(1). However, the variables used in this study are a mixture of I(0) and I(1) series. The ARDL model is the appropriate model to be used in this study as it has the 'Bounds Test', developed by Pesaran and Shin (1999) and Pesaran, Shin, and Smith (2001), to test for cointegration among I(0) and I(1) variables.

3.3 Methodology

The ARDL model is a combination of the Ordinary Least Square (OLS) model and the Error Correction Model (ECM). The OLS specification for the ARDL model employed in this research is:

$$\ln PSC_t = \beta_0 + \beta_1 \ln D_t + \beta_2 \ln Y_t + \beta_3 \ln LR_t + \beta_4 \ln REER_t + \beta_5 \ln NFA_t + \tau\ Dummy_t + \varepsilon_t \quad (2)$$

Where $\mathbf{t}$ is the time period and $\boldsymbol{\beta_1, \dots, \beta_5}$ are the coefficients representing the elasticity of the explanatory variables in the long-run. The error correction model (ECM) derived from the equation 2 is:

$$\Delta \ln PSC_t = \alpha_0 + \alpha_1 \ln PSC_{t-1} + \alpha_2 \ln D_{t-1} + \alpha_3 \ln Y_{t-1} + \alpha_4 \ln LR_{t-1} + \alpha_5 \ln REER_{t-1} + \alpha_6 \ln NFA_{t-1} +$$
$$\sum_{i=1}^{p_1} \pi_1 \Delta \ln D_{t-i} + \sum_{i=1}^{p_2} \pi_2 \Delta \ln PSC_{t-i} + \sum_{i=1}^{p_3} \pi_3 \Delta \ln Y_{t-i} + \sum_{i=1}^{p_4} \pi_4 \Delta \ln LR_{t-i} + \sum_{i=1}^{p_5} \pi_5 \Delta \ln REER_{t-i} +$$
$$\sum_{i=1}^{p_6} \pi_6 \Delta \ln NFA_{t-i} + \tau\ Dummy_t + \varepsilon_t \quad (3)$$

Where t is the time period and $\boldsymbol{\pi_1, \dots, \pi_6}$ are the coefficients representing the elasticity of the explanatory variables in the short-run. The error correction, $\mathbf{ecm,}$ is the OLS residual series from the long-run 'cointegration regression', equation 2. The ARDL model is formed by combining equations 2 and 3. Therefore, the specification of the ARDL model used in this research is:

$$\Delta \ln PSC_t = \alpha_0 + \theta ECM_{t-1} + \sum_{i=1}^{p_1} \pi_1 \Delta \ln D_{t-i} + \sum_{i=1}^{p_2} \pi_2 \Delta \ln PSC_{t-i} + \sum_{i=1}^{p_3} \pi_3 \Delta \ln Y_{t-i} +$$
$$\sum_{i=1}^{p_4} \pi_4 \Delta \ln LR_{t-i} + \sum_{i=1}^{p_5} \pi_5 \Delta \ln REER_{t-i} + \sum_{i=1}^{p_6} \pi_6 \Delta \ln NFA_{t-i} + \tau\ Dummy_t + \varepsilon_t \quad (4)$$

In the above equation, the terms without summation sign represent the long-term dynamics whilst the second part with summation sign corresponds to the short-run relationship.

The ARDL model was regressed using the specification in equation 4. The lag structure of the model was identified using the Akaike Information Criterion (AIC). The model with 4 lags had the minimum AIC. Therefore, 4 lags were employed in this model and this is also reflective of the quarterly data frequency used in this research work. The residual diagnostics tests indicated no serial correlation and the stability diagnostics tests ensured the model is dynamically stable.

Given that the ARDL model can calibrate a group of variables that has a mixture of I(1) and I(0), the regression results are only valid if there exist a long-run relationship between these variables. In the ARDL model, the bounds test procedure, developed by Pesaran and Shin (1999) and Pesaran et al. (2001), is used to test for the presence of a long-run relationship among the variables. The bounds test, in this case, was done on equation 3 using an 'F test' of the hypothesis, $\mathbf{H_0}: \boldsymbol{\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_4 = \alpha_5 = \alpha_6 = 0}$ against the alternative that $\mathbf{H_0}$ is not true. As in conventional cointegration testing, this test assumes the absence of a long-run equilibrium relationship between the variables in question. This absence coincides with zero coefficients for $\boldsymbol{\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6,}$ in equation 3. A rejection of $\mathbf{H_0}$ implies that there is a long-run relationship. Pesaran et al. (2001) have lower and upper bounds for respective critical values for the asymptotic distribution of the F-statistic.

The lower bound is based on the assumption that all variables are I(0), and the upper bound is based on the assumption that all of the variables are I(1). When the computed F-statistic falls below the lower bound, the variables are I(0), so no cointegration is possible, by

definition. If the F-statistic exceeds the upper bound, the variables are cointegrated I(1). However, if the F-statistic falls between the bounds, the test is inconclusive. The bounds test was conducted for the equation 4 and the results are presented in the Table 4. The result showed that the critical value or the critical F statistic is 5.65 and exceeds the upper bound of 3, 3.38, 3.73 and 4.15 respectively, which implies that there is cointegration among the variables. The bounds test proved that the variables move together in the long run, hence, the results for the short-run and long-run generated from the ARDL model are sound.

Table 4: Bounds Test Results

Test Statistic	Value	K
F-statistic	5.6562	5
Critical Value Bounds		
Significance	I(0) Bound	I(1) Bound
10%	2.08	3
5%	2.39	3.38
2.50%	2.7	3.73
1%	3.06	4.15

4. Empirical results

The long-run and short-run output for the ARDL model are presented in Tables 5 and 6.

Table 5: ARDL model long run coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
lnD	0.55118	0.10863	5.07386	0.00000
lnY	0.30326	0.14615	2.07508	0.04360
lnNFA	0.27144	0.06250	4.34314	0.00010
lnREER	0.37437	0.17129	2.18563	0.03400
lnLR	0.06713	0.12691	0.52893	0.59940
DUMMYQ12014	0.01553	0.03464	0.44834	0.65600
DUMMYQ42004	-0.11290	0.05808	-1.94390	0.05800
DUMMYQ32007	-0.13087	0.06223	-2.10289	0.04100
C	-4.29696	1.31337	-3.27172	0.00200

Table 6: ARDL short run cointegration coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(lnD)	0.11339	0.07161	1.58338	0.12020
D(lnD(-1))	-0.19696	0.07309	-2.69467	0.00980
D(lnD(-2))	0.01724	0.07069	0.24392	0.80840
D(lnD(-3))	0.15884	0.06431	2.47003	0.01730
D(lnY)	-0.62987	0.23412	-2.69038	0.00990
D(lnY(-1))	-0.44084	0.25693	-1.71578	0.09290
D(lnNFA)	0.06227	0.03370	1.84802	0.07100
D(lnNFA(-1))	-0.14149	0.03043	-4.64892	0.00000
D(lnNFA(-2))	-0.08234	0.03482	-2.36489	0.02230
D(lnREER)	-0.02428	0.06551	-0.37056	0.71270
D(lnREER(-1))	-0.18685	0.06813	-2.74260	0.00870
D(lnREER(-2))	-0.15649	0.07666	-2.04136	0.04700
D(lnLR)	0.04640	0.08087	0.57379	0.56890
D(DUMMYQ12014)	0.00752	0.02267	0.33178	0.74160
D(DUMMYQ42004)	-0.05415	0.01778	-3.04545	0.00380
D(DUMMYQ32007)	-0.06504	0.01865	-3.48860	0.00110
CointEq(-1)	-0.44942	0.07101	-6.32871	0.00000

$R^2 = 0.99$	Adjusted R^2=0.99	S.E of Regression=0.022
DW=2.09	F(6,68)=1438(0.000)	AIC=-4.51

The coefficient of the error correction term, ecm(-1), is rightfully negative and it is very significant. This is as expected when there is cointegration between the variables in question. The magnitude of the coefficient of the ecm implies that around 44 percent of the disequilibrium between the independent variables and PSC is corrected within one period (one quarter).

From the results generated from the ARDL model, almost all the variables are significant in influencing credit to the private sector in the long-run except lending rate.

Total deposit at the commercial banks in the long-run has a significant and positive relationship with private sector credit. A 1 percent increase in deposits results in 0.55 percent increase in credit to the private sector. However, in the short-run, a percentage increase in deposit cause PSC to fall by 0.19 percent in the first quarter, however PSC picks up by 0.15 percent in the third quarter. Deposit at the commercial bank is still the major source of loanable fund in both short and long run.

In the long run, a 1 percent increase in GDP results in a 0.30 percent increase in credit to the private sector. GDP is a proxy for aggregate demand in the economy, thus in the long-run increase in demand exerts pressure on the private sector's available resources hence creates the need for private sector to resort to borrow from available sources such as financial institutions. In the short-run, GDP has a significant negative relationship with PSC where a 1 percent increase in GDP results in an instant decline in borrowing by 0.62 percent. This may imply that, with the increase in GDP in the short-run, the private sector is cashed-up and may not see the need to borrow from financial institutions.

NFA has a significant positive relationship with PSC in the long run, whilst in the short run NFA has a negative relationship with PSC. The model result shows that a 1 percent increase in NFA in the long run results in a 0.27 percent increase in credit to the private sector which conforms to the expectation that foreign reserve is vital for growth in private sector activities, hence will increase borrowing to fund expenditure and investments. Sufficient foreign exchange supply is essential for private sector growth whilst a shortage of foreign exchange subdues economic activity in the private sector. In the short run, a 1 percent increase in NFA has a significant positive influence on PSC by 0.06 percent immediately but causes PSC to decline in the first and second quarters. The negative relationship between NFA and PSC in the first and second quarter may be attributed to increase in commodity export earnings and FDI from, especially the extractive sector. As a result, private sector cash flow improves and private sector does not need to borrow from financial institutions in the short-run.

The REER in the short-run has an inverse relationship with PSC whilst in the long run has a positive relationship with PSC. In the long-run, a 1 percent increase in REER results in a 0.37 percent increase in private sector credit. When REER increases due to appreciation of kina, imports become cheaper culminating to subsequent increase in economic activities. As a result of growth, private sector increases its investment and demand for credit therefore, credit to private sector also increases. On the other hand, increase in REER resulting from appreciation of kina makes PNG's commodity exports less competitive in the international market. This will result in decline in export earnings, hence less money circulates in the economy and creates the need for the private sector to borrow from commercial banks. In the short run, a 1 percent increase in REER causes PSC to decline in the first and second quarters because when REER increases, imports become cheaper and private sector is able to import without the need to borrow additional funds.

Lending rate has no significant impact on credit to the private sector in both the short and long run.

5. Conclusion and policy implications

From the empirical results private sector credit (PSC) in PNG is mainly driven by demand factors. Given the structural underpinnings of PNG where the domestic economy depends substantially on primary export commodities and imports, macroeconomic factors such as foreign exchange and exchange rate have important impact on the demand in the domestic economy, which in turn affects private sector's demand for credit. In addition, results show deposit is still the main source of credit in PNG whilst interest rate has no impact on credit.
NFA has a direct and profound impact on the level of demand in the economy. NFA comprises of PNG's foreign reserves which is essential for private sector growth and the economic wellbeing of the country. Therefore, in order to grow PSC there has to be ample foreign exchange in the market to meet demand from the private sector resulting in private sector growth. The government including relevant government agencies may continue to ensure and promote conducive environment to encourage foreign investment in the country. Secondly, the government may continue to pursue broad base growth in agriculture, fisheries and forestry in order to generate sustainable increase in export earnings and foreign exchange, apart from developing the extractive sector which has received much attention over the past two decades. Thirdly, the government may review the PDAs to allow export proceeds to be repatriated back into the country. In addition, the Central Bank must continually reinforce the foreign exchange directives in relation to remittance of e surplus export proceeds back into the country.

The Central Bank may continue to closely monitor changes in REER since a prolonged declined in REER will hurt the import sector and subdue growth in the private sector and the economy as a whole. The government and relevant agencies should ensure there is sufficient foreign exchange in the economy by pursuing the policy recommendations for NFA growth which will intend support the kina exchange rate.

The growth in GDP in the recent past was mainly driven by the extractive sector which basically rely on external funding from parent sources. Therefore, in order for growth in GDP to translate to investment and expansion (which is mainly funded thought borrowing) of the private sector, particularly the non-mineral private sector, the government should continue to pursue its drive for broad-base growth by developing and expanding the broad-base sectors like agriculture, forestry and fisheries.

In light of the precautionary behaviour of the commercial banks with regards to government debt, the government and relevant agencies like the Central Bank should promptly develop secondary debt markets in PNG in order to encourage private sector credit growth.

Notes and references

Aba, LA, Aipi, B and Irau, T, 2012a, 'Supply response of coffee in Papua New Guinea', *Bank of Papua New Guinea Working Paper 2012/01*.

Aba, LA, Aipi, B and Irau, T, 2012b, 'Supply response of cocoa in Papua New Guinea', *Bank of Papua New Guinea Working Paper 2012/02*.

Aba, LA, Aipi, B and Irau, T, 2012c, 'Supply response of palm oil in Papua New Guinea', *Bank of Papua New Guinea Working Paper 2012/03*.

Adeleke, AM and Awodumi, OB, 2018, A bound testing analysis of bank credit supply determinants in Nigeria. *Review of Innovation and Competitiveness*, 4(1), pp. 5–26.

Aipi, B and Sabok, G, 2016, 'Estimating aggregate import demand function for Papua New Guinea', *Bank of Papua New Guinea Working Paper 2015/2*.

Bernanke, BS and Gertler, M, 1995, 'Inside the black box: The credit channel of monetary policy transmission', *The Journal of Economic Perspectives*, 9, pp. 27–48.

Baoko, G, Acheampong, IA and Ibrahim, M, 2017, Determinants of bank credit in Ghana: A bound-testing cointergration approach. *African Review of Economics and Finance*, 1(1), pp. 33–61.

Chebet, S and Muriu, PW, 2016, 'Factors influencing the demand for credit by the private sector in Kenya', *European Scientific Journal,* 12(16), pp. 390–411.

Friedman, M, 1957, The permanent income hypothesis', *American Economic Review*, 48, pp. 990–1.

Frimpong, JM and Oteng-Abayie, EF, 2006, 'Bounds testing approach: An examination of foreign direct investment, trade and growth relationships', *American Journal of Applied Sciences*.

Fritzer, F and Reiss, L, 2008, 'An analysis of credit to the household sector in Austria', *Austria Financial Stability Report*, 16, pp. 122–34.

Galor, O and Zeira, J, 1993, 'Income distribution and macroeconomics', *The Review of Economic Studies,* 60(1), pp. 35–52.

Guo, K and Stepanyan, V, 2011, 'Determinants of bank credit in emerging market economies', *International Monetary Fund Working Paper 11/51*.

Hall, RE, 1978, 'Stochastic implications of the life cycle-permanent income hypothesis: Theory and evidence', *Journal of Political Economy*, 87(6), pp. 971–87.

Haris, R and Sollis, R, 2003, *Applied Time Series Modelling and Forecasting*, Durham University.

Hulsewig, O, Winker, P and Worms, A, 2001, 'Bank lending and monetary policy transmission: A VECM analysis for Germany', *Journal of Economics and Statistics,* 224, pp. 511–29.

Imran, K and Nishat, M, 2013, 'Determinants of bank credits in Pakistan: A supply side approach', *Economomic Modelling*, 35, pp. 384–90.

Johansen, S and Juselius, K, 1990, 'Maximum likelihood estimation and inferences on cointegration: With applications to the demand for money', *Oxford Bulletin of Economics and Statistics,* 52, pp. 169–210.

Keynes, JM, 1936, *The General Theory of Employment, Interest and Money*, London: Macmllian.

Myers, SC and Majluf, NS, 1984, 'Corporate financing and investment decisions when firms have information that investors do not have', *Journal of Financial Economics,* 13(2), pp. 187–221.

Pesaran, MH, Shin, Y and Smith, RJ, 2001, 'Bounds testing approaches to analysis of level relationships', *Journal of Applied Econometrics,* 16, pp. 289–326.

Pesaran, MH and Shin, Y, (Eds), 1999, *An Autoregressive Distributed Lag Modelling Approach to Cointergration Analysis: Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium, Storms*, Cambridge, United Kingdom: Cambridge University Press.

Pham, THH, 2015, 'Determinants of bank lending', *Institut d'Economie et de Management de Nantes-IAE, Lemna, Universite de Nantes Working Paper EA 4272.*

Sharma, P and Gounder, N, 2012, 'Determinants of bank credit in small open economies: The case of six Pacific Island Countries. *Discussion Paper Finance, Griffith Business School, Griffith University, No. 2012-13.*

Shijaku, G and Kalluci, I, 2013, 'Determinants of bank credit to the private sector: The case of Alabania', *Bank of Alabania Working Paper,* 09(48).

White, L and Cestone, G, 2003, 'Anti-competitive financial contracting: the design of financial claims', *Journal of Finance* 58 (5), 2109–42.

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