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Investigating the determinants of commercial banks credit by the Business Sector in Namibia: A Co-integration Analysis

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Abstract
Economists have long recognised that several factors are usually at work, when it comes to the determinants of bank credits in modern economies. Indeed, this subject has recently been reawakened by various scholars in the context of both the developing and developed countries, and Namibia is not an exception to this discussion. This study aims at addressing two key questions. Firstly, the driving factors that push the business sector in Namibia to demand for credit facilities are identified and analysed. Secondly, the neoclassical theory that postulates that there is an inverse and significant relationship between the real interest rate and investment growth is tested for Namibia. The study relied upon co-integration and error correction procedures in carrying out the investigation. Additionally, annual time series data for the period running from 1993 to 2010 was used in the study. The key findings arising from this study are the following. Firstly, the demand for bank credit in Namibia responds more to factors other than real interest rate. Secondly, the neoclassical theory, which postulates that real interest rates have significant dampening impact on credit decisions, does not hold water in the case of Namibia. In light of these findings, specific recommendations are put forward. Finally, future direction regarding further research concerning the issue under investigation is highlighted.
Keywords: Co-integration procedures, Annual Time Series Data, Commercial Bank credit, Gross Domestic Product, Neoclassical Theory of Investment Behaviour

1. Introduction

Namibia's financial structure is dominated by financially sound banking industry (Steytler: 2005: 3). Further, Steytler maintained that, Namibia has a financially sound, as well as, a well-developed bank-based economy, since the various banks, especially the commercial banks still play a critical role in the country's financial system. Further strengthening this fact, Malikane and Nghixulifwa (2010: 5-6) and Uanguta and Ikhide (2002: 4 &16) in their various studies also alluded to the fact that, the bank lending channel is highly effective in Namibia. There are currently a number of commercial banks, as well as, highly specialised banks in Namibia. Specifically, this study considers only the commercial banks in Namibia.

According to the Bank of Namibia (2011), the country's real Gross Domestic Product growth based on constant 2004 prices from 1991 to 2009 is estimated at 4.6 percent. An exceptionally good real growth rate was recorded in 1991 and 2004 at 10.4 and 12.3 percent respectively, while real contraction was recorded in 1993 and 2009 at 1.6 and 0.7 percent in that order. The economic growth for 2010 was expected to accelerate as the first and second quarters of 2010 is estimated at 6.2 and 11.1 percent respectively compared to an estimated contraction of 8.2 and 0.7 percent respectively in the first quarters of 2009. Since 2010 to-date the figures relating to the GDP growth rate for Namibia has been swinging between 4 and 6 percent.

Furthermore, Namibia is rated as one of the African countries with high GDP per capita. However, despite the high GDP per capita, half of its population still lives below the poverty line. According to the World Bank, this situation is mainly due to an uneven distribution of income. The unemployment rate has also gone up from 36.7 percent (2004) to 51.2 percent according to the Namibia labour survey (2008). However, the recent Namibia labour survey that took place in 2013 resulted in a dramatic fall of the country's unemployment rate figure from 51.2 to about 36.8 percent or so due principally to the inclusion of subsistence farmers and those belonging to the informal sector to be part and parcel of the labour force.

It is generally envisaged that credit applications on the part of the business sector in Namibia will continue to increase over time, due to the burning urge of this sector for more funds for business expansion purposes.

Accordingly, this study seeks to identify, and subsequently investigate key factors, based on a priori knowledge cum literature review, that are perceived to influence the demand for commercial banks' credits in Namibia on the part of the business sector. We relied heavily upon the use of co-integration and error correction procedures and techniques to further probe into the issue under consideration. The following two hypotheses were tested in the course of the study:

HYPOTHESIS 1

H0: The demand for commercial banks credit in Namibia by the business sector is not strongly influenced by the real interest rate

H1: The demand for commercial banks credit in Namibia by the business sector is strongly influenced by the real interest rate

HYPOTHESIS 2

H0: The Neoclassical theory of investment behaviour is not applicable to Namibia

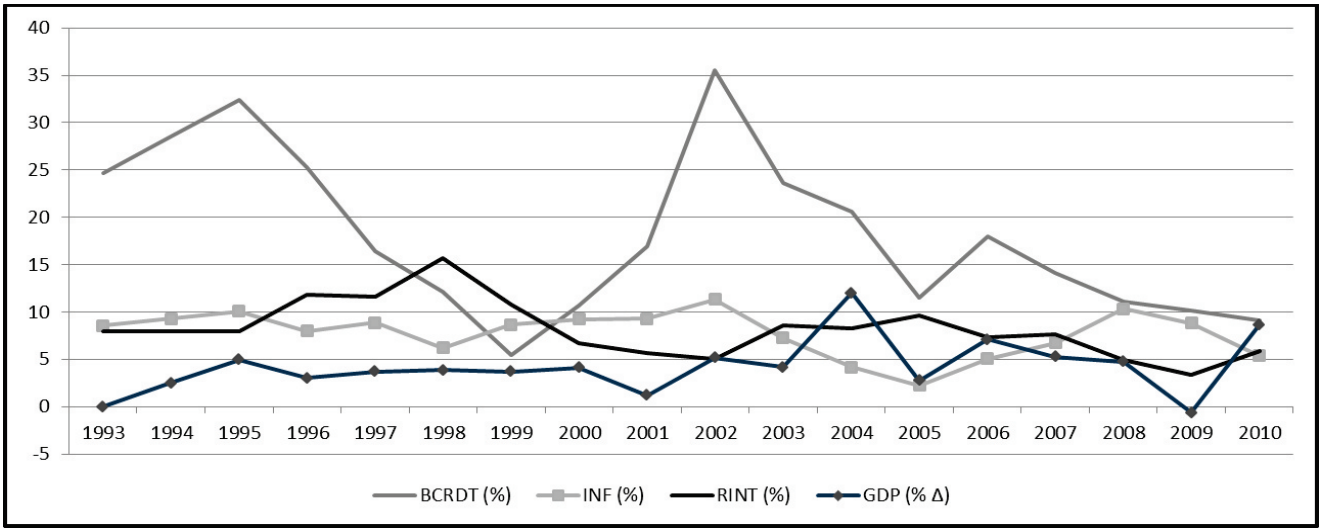
H1: The Neoclassical theory of investment behaviour is applicable to Namibia

In light of this, the study is structured in the following fashion. It begins with an introductory statement. In the next section, we made use of line graphs to show the trend in respect of selected macroeconomic variables in Namibia, bearing in mind the issue under consideration. This is closely followed by the relevant literature concerning the study. Further, a discussion on data sources and the various methodologies and procedures used in the study are presented. Next, we analysed the econometric results obtained from the estimation of the models used in the study. Finally, concluding remarks, policy implications, and future direction for further research regarding the issue under investigation are presented.

2. Selected macroeconomic variables' trends in Namibia

The graph 2.1 below depicts the movement trends in respect of some selected macroeconomic variables for Namibia, bearing in mind the driving objective of the study.

Graph 2.1: Gross Domestic Product, Real Interest Rate, Inflation rate, Bank Credit Growth Rate in Namibia: 1993 – 2010



Source: Authors' Construct through the application of Microsoft Excel facility

It is apparent from graph 2.1 that the four variables under consideration have experienced ups and downs over the period covered by the study. It is, however, pertinent to note that the real interest rate variable in particular, did experience greater perturbations compared to the other three variables under scrutiny during the period covered by the study. In general, combinations of domestic and international developments have contributed

significantly to the swinging in respect of the variables appearing in graph 2.1. Further, such developments are usually driven by
economic, political, psychological, as well as, social contemplations.

3. Theoretical Literature

Related theories in the literature concerning the issue under investigation are quite extensive. For purposes of this particular study, we consider the following theories: Rigid accelerator theory, flexible accelerator theory, neoclassical theory, liquidity theory, Q theory, as well as, the neoclassical theory.

3.1 Rigid accelerator theory

The simplest theory of investment demand is the rigid accelerator theory, which was highlighted upon by early writers of investment theories, such as, (Clark, 1917). According to the proponents of this theory, Investment is simply proportional to changes in output, i.e. It =a(Q_t-Qt-t), (Antonikis 1987: 3). Where a represents a numerical constant, while Q is the level of output. In this model t is the time factor. Additionally, the proponent of this theory further maintained that this form of investment behaviour does not come necessarily from a profit maximisation objective. Hence, in the accelerator model, expectations, profitability and capital costs play no role. It could be argued that this model considers only demand or changes in demand as a determinant of investment behaviour, although output is not a very good proxy of demand, since, it is restricted by capacity. The accelerator theory further assumes that firms are always in equilibrium, i.e. there is no excess capacity. To argue that investment is proportional to changes in output requires the assumption that capital is optimally adjusted in each period. This is really a comparative static analysis of an essentially dynamic phenomenon, namely investment. This approach has been characterised as a caricature of the arguments of the acceleration theorists according to Junankar (1972), and it has been rejected in tests by Kuznets (1935), Tinbergen (1938), Chenery (1952), Koyck (1954) and Hickman (1957), (Antonikis 1987: 3). Keynesians have traditionally favoured the accelerator theory of investment, while disregarding the role of factor costs.

3.2 Flexible accelerator theory

A more general form of the accelerator model is the flexible accelerator theory, which was pioneered by the works of Chenery (1952), Koyck (1954), (Antonikis 1987: 3). It overcomes one of the major shortcomings of the naive accelerator, namely that capital stock is always optimally adjusted. The basic notion behind this model is that the larger the gap between the existing capital stock and the desired capital stock, the greater is a firm's rate of investment. The idea behind this theory is that firms plan to close a fraction of the gap between the desired capital stock, K*, and the actual capital stock, K, in each period. This gives rise to a net investment equation of the following form:
$I = \delta (K^* - K\text{-}1)$ where; I = net investment, K* = desired capital stock, K-1 = last period's capital stock, and δ = partial adjustment coefficient.
The theory does not take explicit account of factor prices, and, therefore, this theory does not consider the effect of investment incentives. This has been considered as one of the main shortcomings of the flexible accelerator theory.

3.3 Neoclassical theory of Investment Behaviour

The neoclassical theory of investment behaviour was considered as a better alternative to the much rigid accelerator theory, when it comes to the explanation concerning investment. Its origins are found in the works of Roos and Von Sjeliski (1943) and Roos (1958). The theory is based on an optimal path for capital accumulation. It states that, the desired level of capital services at every period is derived from a maximisation of the present value of future expected net revenue, over an infinite number of years. The desired level of capital services subsequently derived is a function of relative prices and not output. The desired capital stock is also directly related to output and inversely related to the cost of capital. A decrease in the real interest rate will, therefore, lowers the opportunity cost of capital and increases the desired capital stock and investment spending.

3.4 Liquidity theory

The liquidity theory sometimes referred to as the residual funds theory was pioneered by the works of Dusenberry (1958), Meyer and Kuh (1957), Kuh (1963), Meyer and Glauber (1964), Meyer and Strong (1990), as well as, the writings of (Samuel 1996: 4). According to the liquidity theory, investment depends primarily on

cash flows or internal finance, including the sum of retained earnings and depreciation. In other words, investment may be constrained by the availability of internal funds. Past profitability levels may also be an adequate proxy for future levels, hence they might be relevant for capital expenditure decisions. In part, the liquidity theory can be viewed as an attempt to explain the existence of financing hierarchy, which constitutes one of the most well documented facts in the field of corporate finance, Koch (1943) and Donaldson (1961). This theory further maintained that firms generally prefers to source finance from the following ways: Internal finance, external debt, as well as, equity financing (Samuel 1996: 4).

3.5 The Q theory

The Q theory of investment, attributed to three highly celebrated scholars, Brainard and Tobin (1968) and Tobin (1969) attempted to explain investment on a financial basis in terms of portfolio balance. More specifically, investment is based on the ratio of the market value of capital to its replacement cost (Samuel 1996: 4). Further, if managers seek to maximise the market value of firms, they will be able to add to their capital stock, whenever, the marginal addition to the firm's market value exceeds the replacement cost of its capital stock. Strengthening this theory, Bischoff (1971) proposed an important extension to the standard Jorgensonian neoclassical model with the putty-clay approach. Further, he pointed out that, it was often easier to modify factor proportions (Samuel 1996: 6). If this is the case, we do expect investment to be more responsive to changes in output compared to changes in the cost of capital.

3.6 Neoliberal theory

The neoliberal theory according to Galbis (1979: 423) emphasises the importance of financial deepening and high interest rates, when it comes to stimulating growth. This theory was popularised through the writings of McKinnon and Shaw (1973), and that of (Asante 2000: 4). The core of their argument rests on the preposition that developing countries suffers from financial repression which is generally equated with controls on interest rates in a downward direction, and that, if these countries were liberated from these restrictive conditions, it would induce savings, investment and growth. Not only will liberalisation increase savings and loanable funds, it will also result in a more efficient allocation of these funds, both contributing to a higher economic growth rate. In the neoliberal view, investment is positively related to the real rate of interest in contrast with the neoclassical theory (Asante 2000: 4). The reason for this is well explained in McKinnon (1973) work through the "conduit effect" phenomenon.

4 Empirical Literature

Asante (2000) carried out a study on behalf of the African Economic Research Consortium (AERC). The primary objective of the study was to analyse the determinants of private investment in Ghana between the periods 1970 and 1992. The study combined both primary and secondary sources of data for the analysis. A number of trials were made and the outcome found the coefficient of real interest rate variable to be positively signed in most of the trials; thus, reinforcing the McKinnon –Shaw hypothesis that investment is positively related to real interest rate. This is in sharp contrast with the neoclassical philosophy.

Lugo (2001) conducted a study in order to determine the differential impact of real interest rates and credit availability on private investment in Venezuela using quarterly macroeconomic data for the period running from 1983 to 2000. The variables used in this study, besides private investment, are bank lending real interest rates, bank loans to the private sector as an indicator of credit availability, public investment, and the contribution of the private sector to GDP. The results of the study show no clear evidence of a positive connection between real interest rates and private investment.

Hofmann (2001) explored the relation between credit to private non-bank sector and economic activity, real interest rates and property prices in 16 industrialised countries between 1980 and 1998, using quarterly data. The study stated that, during this period, there have been a number of business cycles sweeping across the credit markets in the industrialised countries. The researcher pointed out that economic activity, interest rate and property prices indeed, do affect credit through both supply and demand channels. The study shows that the long run development of credit cannot be explained by standard credit demand factors such as real GDP and the real interest rate alone. The study suggested that real property prices should also be included in the model in order to explain credit behaviour in those countries under investigation in a more robust fashion.

Michaelides, Roboli, Economakis and Milios (2005) analyzed the determinants of investment activity in Greece

over the period 1960 – 1999, using annual time series data. The study relied upon multiple linear regression model that incorporates various factors that are perceived to influence investment activity in Greece. The objective of the study was to identify the significance of specific factors in explaining investment behaviour in Greece. The results of the study indicate no evidence of multicollinearity among the independent variables. The results further confirm a positive relationship between investment and output. Furthermore, investment and profitability were observed to be positively connected. Additionally, the study found a negative association between investment and interest rate.

Söğüt (2008) made an inquiry into the determinants of financial development and private sector credits for a panel of 85 developing and industrial countries, using annual data from 1980 to 2006. The results from the panel cross-sectional fixed effects procedure suggests that an increase in the public sector credits and central government debt leads to a decrease in private sector credits in low income and lower middle income countries. For these groups of countries, public sector credits, notwithstanding will lead to a financial crowding out, that is, detrimental to financial development. For the upper middle income and high income countries, private sector credits are found to increase with public sector credits and financial development, as well as, a decrease in central government debts. Financial development is affected adversely by inflation and positively by real GDP, as well as, the public sector credits in high income countries. In upper middle income countries, both real GDP and credits to public sector do impact on financial development positively on one hand. In low income countries, on the other hand, public sector credits and inflation are positively associated with financial development.

Malikane and Nghixulifwa (2010) constructed a macroeconomic projection model for Namibia. The model combined the Phillips curve, the income and savings curve, as well as, the exchange rate adjustment equation. The model was estimated using annual macroeconomic data running from 1991 to 2008. The major finding of this paper is that, it is, indeed, the nominal, rather than the real interest rate that determines aggregate demand and real exchange rate perturbations.

Guo and Stepanyan (2011) investigated the determinants of Bank Credit in Emerging Market Economies, using quarterly time series data for the period, 2001 to 2010 covering 38 countries. The study examined changes in bank credit across a wide range of emerging market economies during the last decade. The results of the study show that domestic and foreign funding contributes positively and symmetrically to credit growth. The results also indicate that stronger economic growth leads to higher credit growth, and high inflation; while increasing nominal credit, was seen to be detrimental to real credit expansion. The study also found that loose monetary conditions, be it domestic or global, results in more credit. Finally, the health of the banking sector in any modern economy cannot be over-exaggerated, as far as, this study is concerned.

The various literatures reviewed, so far, assisted in various ways, in terms of the methodologies relied upon in the study.

5. Data, Empirical Model and Methodology

5.1 Data

The study relied upon quarterly data covering a period of 72 quarters from 1993 to 2010. All the data used in this study were sourced from the Bank of Namibia (BoN) and the Central Bureau of Statistic. Reference can be made to appendix 1.1 displayed at the end of the paper.
Notwithstanding the fact that there are various measures of business investments, this study has used the bank credit from commercial banks as a proxy for business investment. The bank credit excludes bank overdraft due to the understanding that businesses mainly use overdraft to cover for operational expenses and not for investment purposes. The business credit consists of leasing, loans and advances, as well as, instalments on credits.

The independent variables used in this study are real interest rate, inflation and Gross Domestic Product (GDP). The real interest rate represents the real price that the businesses would most probably have to pay on borrowed funds. The dominant measure used as indicator of inflation in Namibia is the consumer price index (CPI). The CPI represents the prices of a representative "basket" of goods and services, and it is used as the official measure of inflation in Namibia. The changes in the CPI inflation rate of Namibia were used. The gross domestic product (GDP) is measured as a percentage change over the quarters.

5.2 Empirical model

The model used in this study is adopted from Guo and Stepanyan (2011) seven-variable model. Further, the development of the model was based on Emerging Market Economies (EME).
In this study, the model is modified to accommodate one dependent and three independent variables. It is expressed in the following way:

$$BCRDT = a_0 + a_1RINT_1 + a_2INF_2 + a_3GDP_3 + \mu$$

Where:

BCRDT =		Bank credit growth rate excluding overdraft
a	=	Intercept
RINT	=	Real interest rate measured in ex post terms as the nominal interest rate less Inflation rate
INF	=	Inflation rate
GDP	=	Gross Domestic Product
μ	=	Shock term

5.3 Methodology

Financial and macroeconomic models involving time series data are mostly characterised by non-stationarity, leading to unreliable and spurious regression results. In such cases, regression results appear to be statistically significant, when indeed, all that is obtained is evidence of accidental correlations rather than meaningful casual relationships (Harris and Sollis, 2003:32). Therefore, in order to remove the problem of spurious regression, time series data must first be transformed so that it becomes stationary by differencing to remove the trend in the variance.
If a variable can be made approximately stationary by differencing it *d* times, it is called integrated of order *d, or I(d),* (Kungl Vetenskapsakademien, 2003:6). If two variables are integrated of order *d* and *b* or I(*d, b)*, then the two series are said to be co-integrated, that is, if their linear combination is stationary (Harris and Sollis, 2003:34). Thus, co-integration between variables would imply that, there is a long-run equilibrium relationship among the concerned variables, such that, they will converge over time. In order to model the stationarity properties of the data used in this study, we invoked and applied the Engle-Granger Co-integration Methodology. Engle and Granger (1987) suggested estimating the co-integration relationship in the first step with a static OLS regression. The resulting residuals are then tested for the presence of a unit root. If they are found to be stationary, they are, in the second step, included as a regressor in order to formulate the error correction model, and subsequently determine the long-run equilibrium relationships amongst the variables used in the study.

5.4 Unit Root Tests

Data points are often non-stationary or have means, variances and co-variances that change over time. Non-stationary behaviours can be trends, cycles, random walks or combinations of the three. Non-stationary data, as a rule, are unpredictable and cannot be modelled or predicted. The results obtained by using non-stationary time series may be spurious in that they may indicate a relationship between two variables, when in fact, no relationship do exist among them. In order to receive consistent, reliable results, the non-stationary data needs to be transformed into stationary data. In contrast to the non-stationary process that has a variable variance and a mean that does not remain, or returns to a long-run mean over time, the stationary process reverts around a constant long-term mean and has a constant variance independent of time. The data used in this study is tested for stationarity; when $\rho < 1$, where ρ is the coefficient, then, we have what is called stationary time series. But if $\rho > 1$, then, we have, what is called non-stationary time series and, further if $\rho = 1$, then we have a random walk situation.

Should the data in this study happen to be non-stationary, then co-integration and error correction model (ECM) will be introduced. Co-integration and error correction means that if a stationary linear combination of non-stationary random variables exists, the variables combined are said to be co-integrated. The term 'error correction models' applies to any model that directly estimates the rate at which changes in Y_t return to equilibrium after a change in X_t. The ECM behavioural justification implies that the behaviour of Y_t is tied to X_t in the long run and that short run changes in Y_t respond to deviations from that long run equilibrium. Below is an ECM:

$\Delta Y_t = \beta_0 \Delta X_t + \gamma[Y_{t-1} - \beta_3 X_{t-1}] + \mu_t$

Where Δ refers to a first difference i.e. $\Delta Y_t = Y_t - Y_{t-1}$. It is clear that the model uses differences in both the dependent variables and the independent variables. The inclusion of the second term $Y_{t-1} - \beta_3 X_{t-1}$ is the explicit formulation of the fact that the study assumed that X and Y have a long-term equilibrium relationship. More specifically, we know that any change in Y_t is a sum of two effects: (i) the short-run impact of the change in X_t on Y_t and (ii) the long-run impact of the deviation from the equilibrium value in period t adjusted at each period at the rate γ. Thus,

- β_0 captures the short-run relationship between X and Y. It indicates how Y and ΔY immediately change if X goes up one period. In other words, if X goes up by one unit in period 5, then Y and ΔY go up β_0 units in period 5.

- γ gives the rate at which the model re-equilibrates i.e. the speed at which it returns to its equilibrium level. It formally, tells us the proportion of the disequilibrium which is corrected with each passing period. This coefficient should be negative and less than the absolute value of one indicating its re-equilibrating properties. If $\gamma = 0$, then the process never re-equilibrates and if $\gamma = -1$, then re-equilibration occurs in one period.

5.5 Co-integration

If two series follow unit root processes, but are not co-integrated, the problem of spurious regression can occur, i.e. the estimated relationship is statistically highly significant due to incorrect inference, but is not reasonably interpretable. Instead, co-integration implies that there exists a linear combination of the respective variables which is stationary. Such a stationary linear combination can then be interpreted as long-run relation.

A widely used method to test for co-integration is Engle-Granger two-step procedure. Engle and Granger (1987) suggested estimating the co-integration relationship in the first step with a static OLS regression. The resulting residuals are then tested for the presence of a unit root. Secondly, we test for the presence of a long-run equilibrium among the variables used in the study. The problem of small-sample bias in the Engle-Granger first step led to Banerjee, Dolado, Galbraith and Hendy (1986) to suggest that it may be preferable to carry out the estimation of long-run and short-run parameter in a single step, with the lag structure on the differenced variables being determined by experimentation, and that is the approach that this study adopted.

Following the representation theorem by Granger (1986) each existing linear co-integration relationship can be represented as error correction model (ECM). The advantage thereof is that long-run and short-run properties can be estimated jointly and it is possible to make statements concerning the direction of the causality, again for the long and the short run situations. Furthermore, if co-integration exists, the variables included in the ECM will all be stationary, which allows the application of standard test procedures.

A bivariate ECM for two variables, for example, x_t *and* y_t, if both are integrated of order 1, I(1), will form the following co-integration relation $Y_t - \gamma X_t = \epsilon_t$, where ϵ_t is I(0).

Co-integration can also be tested for in a multivariate framework. This allows the simultaneous co-integration analysis of more than two non-stationary variables, and the formulation of the respective multivariate ECM.

6. Empirical Results

6.1 Unit root tests

In almost all cases, time series data do manifest non-stationarity properties. It is, therefore, recommended that the first step in our analysis should be to test for unit roots or order of integration. The Augmented-Dickey-Fuller (ADF) tests have been applied in order to test for the order of integration in respect of the variables appearing in equation 1 below. The results obtained are displayed in tables 6.1, 6.2 and graph 2.2. The results show that BCRDT and GDP were stationary after first differencing; that is, they are integrated of order one, denoted as, I(1), while RINT was also stationary at 1 percent significance level as suggested by the shape of the line graph presented in graph 2.2 below.

$$BCRDT = \alpha + \beta_1 GDP + \beta_2 RINT \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Table 6.1: Augumented Dickey-Fuller Unit Root Test (Business Credit)

Null Hypothesis (H_0) : ρ^*= 0 (non-stationary)
Alternative Hypothesis (H_1): ρ* < 0 (stationary)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.336526	0.4088
Test critical values:	1% level	-4.103198	
	5% level	-3.479367	
	10% level	-3.167404	

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LBCRDT,2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LBCRDT(-1))	-0.531328	0.227401	-2.336526	0.0229
D(LBCRDT(-1),2)	-0.496613	0.221468	-2.242369	0.0287
C	0.024778	0.015336	1.615692	0.1115
@TREND(1993Q1)	-0.000182	0.000240	-0.758278	0.4513

R-squared	0.621494	Mean dependent var	-0.000632
Adjusted R-squared	0.583002	S.D. dependent var	0.054320
S.E. of regression	0.035077	Akaike info criterion	-3.762515
Sum squared resid	0.072595	Schwarz criterion	-3.530278
Log likelihood	131.1630	F-statistic	16.14603
Durbin-Watson stat	1.990330	Prob(F-statistic)	0.000000

Table 6.2: Augumented Dickey-Fuller Unit Root Test (LGDP)

Null Hypothesis (H_0) : ρ^*= 0 (non-stationary)
Alternative Hypothesis (H_1): ρ* < 0 (stationary)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.694325	0.0017
Test critical values:	1% level	-4.098741	
	5% level	-3.477275	
	10% level	-3.166190	

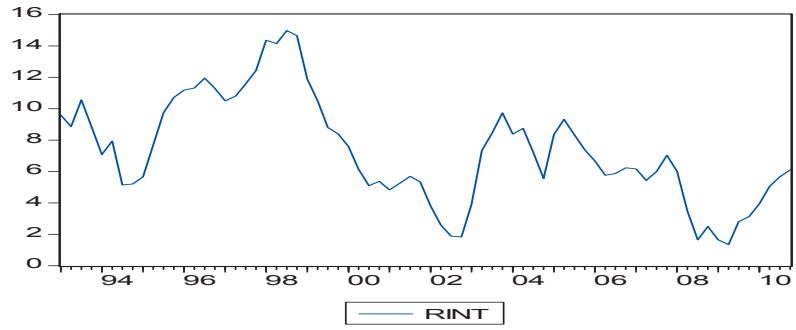
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP(-1)	-0.521794	0.111154	-4.694325	0.0000

C	4.570297	0.971375	4.704979	0.0000
@TREND(1993Q1)	0.005727	0.001242	4.611173	0.0000

R-squared	0.253392	Mean dependent var	0.009382
Adjusted R-squared	0.230420	S.D. dependent var	0.036161
S.E. of regression	0.031723	Akaike info criterion	-4.020447
Sum squared resid	0.065412	Schwarz criterion	-3.922528
Log likelihood	139.6952	F-statistic	11.03022
Durbin-Watson stat	2.119550	Prob(F-statistic)	0.000075

Graph 2.2: Real Interest Rate (RINT)



6.2 Co-integration

The variables in this study displayed non-stationary behaviours and as a result, the co-integration methodology is used to analyze the data. Assuming that most of the variables entered in equation 1 above are I(1), the study estimated a probable long-run co-integration equation based on equation 1 and subsequently generated the residuals. The results of a probable long-run co-integration equation are presented in table 6.3.

Table 6.3: Results of the long-run co-integration equation

Dependent variable: LBCRDT

Variable	Coefficient	t-Statistic
LGDP	*3.368557*	*44.24177*
RINT	*0.013338*	*2.653091*
C	*-21.62313*	*-30.13067*

$R^2 = 97 \quad S.E = 0.117 \quad DW = 1.24 \quad T = 69\ (1993Q4 - 2010Q4) Prob(F - statistics) = 0.00$

The results in table 6.3 above suggest that an improvement in output (expansion in economic activity) will lead to a rise in demand for private sector credit. The high R-squared, which is close to unity, indicates the degree to which the bank credit or credit extended to private sector is explained by the explanatory variables taken together. The F-statistic indicates the joint significance of the explanatory, as well as, the dependent variables. The null hypothesis of no serial correlation is rejected considering the value of the D-W statistic. Upon subjecting the residuals to check whether they are stationary or not; we indeed, observed them to exhibit a stationary series. Therefore, it is reasonable to expect that the estimated linear combination of the variables will have a co-integrating relationship.

Table 6.4: Augumented Dickey-Fuller Unit Root Test on RESID01

ADF Test Statistic	-4.924897	1% Critical Value*	-3.5312
		5% Critical Value	-2.9055
		10% Critical Value	-2.5899

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID01)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID01(-1)	-0.784657	0.159325	-4.924897	0.0000
D(RESID01(-1))	0.064955	0.153909	0.422031	0.6745
D(RESID01(-2))	0.184378	0.125775	1.465932	0.1477
C	0.008851	0.012691	0.697473	0.4881

R-squared	0.400229	Mean dependent var	0.004292
Adjusted R-squared	0.371208	S.D. dependent var	0.129684
S.E. of regression	0.102835	Akaike info criterion	-1.652692
Sum squared resid	0.655651	Schwarz criterion	-1.519986
Log likelihood	58.53883	F-statistic	13.79093
Durbin-Watson stat	1.990102	Prob(F-statistic)	0.000001

Further, the stationarity of the residual from the long-run equation is thus tested using the ADF testing procedure. The results obtained are presented in table 6.4 above. The variables are co-integrated at a 1 percent level of significance, since –4.92 is smaller than the critical value of –3.53 at a 1 percent level of significance. In other words, the study can reasonably infer that the residuals are stationary, and that, these variables are, therefore, co-integrated. The above results provide a prima facie justification for the estimation of ECM. Thus, a long-run relationship really does exist in the case of Namibia, as far as the determinants of bank credit are concerned.

6.3 Error Correction Model (ECM)

The existence of at least one co-integration vector among the variables implies that an ECM can be estimated. The ECM is useful in the derivation of the short run impacts on the bank credit in Namibia. The results from ECM estimation are displayed in table 6.5 below.

Table 6.5: Error Correction Model (ECM)

DLOG(BCRDT) = -1.9963 + 0.1037DLOG(GDP) + 0.0101DRINT – 0.1182LOG(BCRDT)

(-1.8035) (0.7229) (1.8236) (-2.5612)

+0.3435LOG(GDP(-1))-0.0007RINT-0.0018D(INF)-0.0008INF(-1)

(2.0900) (-0.2892) (-0.3272) (-0.3102)

$R^2 = 27$ $S.E = 0.03$ $DW = 2.36$ $T = 68\ (1994Q1 - 2010Q4)$

Note: The values above in parentheses are the t-statistics

The results presented in table 6.5 show that developments in the economy in previous years could have a significant positive effect on credit extension to private sector in the long-run, while real interest rates was also observed to have similar impact on credit extension to private sector on the short-run. The coefficient of inflation was both negative and statistically insignificant an indication that inflation has no influence on the demand for bank credit in Namibia. We, therefore, inevitably re-specified and re-estimated the ECM upon dropping inflation. The results are displayed in tables 6.6 and 6.7 below.

Table 6.6: Error Correction Model (ECM) without inflation

DLOG(BCRDT) = -1.7366 + 0.0109DRINT -0.1013LOG(BCRDT(-1)) + LOG(GDP(-1))

(-2.4617) (3.3835) (-3.0217) (2.6870)

$R^2 = 26$ $S.E = 0.03$ $DW = 2.35$ $T = 68\ (1994Q1 - 2010Q4)$

Note: The values above in parentheses are the t-statistics.

The table 6.6 above shows that the developments in economic activities in the previous year also have a positive effect on bank credit. The equation further shows that changes in real interest rate is statistically significant and in fact do positively affect bank credit contrary to the neoclassical philosophy. The Adjusted Coefficient of Determination (Adjusted R-squared), which measures the goodness-of-fit of the equation, is highly unsatisfactory. Only about 26 percent of the systematic variations in the Namibian bank credit growth is explained by the explanatory variables taken together. The F-test statistic of 7.35 appearing in table 6.7 below suggests that the entire model is statistically significant. Indeed, it tells us that both the explanatory and dependent variables taken together passes the significance test. In which case, we can reasonably rely on the estimated model for various purposes, including forecasting.

Table 6.7: Regression Results of the ECM without inflation

Dependent Variable: DLOG(BCRDT)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.736576	0.705443	-2.461680	0.0165
D(RINT)	0.010911	0.003225	3.383507	0.0012
LOG(BCRDT(-1))	-0.101316	0.033529	-3.021760	0.0036
LOG(GDP(-1))	0.296826	0.110469	2.686960	0.0092
R-squared	0.256343	Mean dependent var		0.037182
Adjusted R-squared	0.221484	S.D. dependent var		0.037737
S.E. of regression	0.033297	Akaike info criterion		-3.909691
Sum squared resid	0.070955	Schwarz criterion		-3.779131
Log likelihood	136.9295	F-statistic		7.353718
Durbin-Watson stat	2.351634	Prob(F-statistic)		0.000261

7. Conclusion, Policy Implications and Future Direction for Further Research

This study tested whether the neoclassical theory of investment behaviour, which postulates that real interest rates have significant dampening impact on credit decisions is applicable to Namibia. The study was carry out, using quarterly macroeconomic time series data running from the period 1993 to 2010, as well as, through the application of co-integration and error correction model (ECM) techniques. The two null hypotheses that we tested in the course of the study were accepted and, we indeed, also rejected the two alternative hypotheses for apparent reasons. In other words, the real interest rate is not a good predictor of credit demands on the part of the business sector in Namibia. Also, the neoclassical theory of investment behaviour is not applicable to Namibia. Indeed, the demand for bank credit in Namibia responds more to factors other than the real interest rate. Additionally, the study relied upon Coefficient of Determination as a way of determining the extent to which the explanatory variables taken together accounted for the systematic variation in the regressand. In all, we observed that the regressors combined together were only able to account for approximately 26 percent of the demand for bank credit that occurred during the period under investigation, that is, 1993 to 2010.

One obvious implication arising from the study is that, in the case of Namibia the real interest rate is not a good predictor of the demand for bank credits on the part of the business sector in Namibia. This is rather strange, and indeed, do contradict the neoclassical theory of investment behaviour, the empirical literature that we reviewed, as well as, conventional wisdom. Another implication drawn from the findings of this study is that, there is an extent to which the monetary authority (the Bank of Namibia) can rely upon the bank rate (REPO rate) as an instrument of either encouraging or discouraging businesses from soliciting for credits from the commercial

banks. The need for policy makers to explore other approaches of encouraging the business sector in order to promote investments in the economy of Namibia through the mobilization of finance, especially credits cannot be overstated.

In future, it would be advisable, for other researchers to accommodate other factors that could explain further the issue under investigation in their model, besides those factors, that we have considered in this study. Secondly, there is also the need to extend the time series data used in this study to cover a longer period of time. Additionally, other relevant techniques besides the ones that, we have used in this particular study should be invoked and applied in future studies. Additionally, competing theories to the particular one that, we have used in this study should also be tested in further research investigations concerning the issue under discussion.

Finally, despite the fact that the results arising from this study failed to validate the relevance of the neoclassical theory of investment behaviour in the context of Namibia; we nevertheless, think that, the study has contributed significantly to the literature in various ways in respect of the issue under investigation.

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Appendix 1.1: Macroeconomic Time Series Data for Namibia, 1993 to 2010

Period			Credit Growth rate	Inflation	Real interest rate	Nominal interest rate	GDP Constant 2004 prices
Year		**Quarter**	**BCRDT**	**INF**	**RINT**	**NINT**	**GDP**
1993	31/03/1993	Q1	23.795718	9.287881	7.878786	17.166667	0.000000
	30/06/1993	Q2	20.820302	8.687202	7.812798	16.500000	0.000000
	30/09/1993	Q3	23.995652	7.852035	8.647965	16.500000	0.000000
	31/12/1993	Q4	30.122162	8.367667	7.465666	15.833333	0.000000
1994	31/03/1994	Q1	26.997650	10.592929	6.490404	17.083333	3.531508
	30/06/1994	Q2	25.208574	9.621349	7.628651	17.250000	2.764474
	30/09/1994	Q3	29.726885	8.603465	8.646535	17.250000	1.253012
	31/12/1994	Q4	32.196427	8.393440	9.023227	17.416667	2.349392
1995	31/03/1995	Q1	30.199581	11.897978	5.102022	17.000000	7.063016
	30/06/1995	Q2	29.596846	10.555497	7.444503	18.000000	5.528947
	30/09/1995	Q3	35.458118	9.354895	8.645105	18.000000	2.506023
	31/12/1995	Q4	34.270691	8.419213	10.580787	19.000000	4.698784
1996	31/03/1996	Q1	33.991337	7.621811	11.378189	19.000000	1.096580
	30/06/1996	Q2	26.505343	7.913670	12.086330	20.000000	2.198884
	30/09/1996	Q3	20.782013	7.954290	12.045710	20.000000	4.740360
	31/12/1996	Q4	19.810540	8.509553	11.723780	20.233333	3.970640
1997	31/03/1997	Q1	16.441800	9.812906	10.887094	20.700000	4.897934
	30/06/1997	Q2	16.850172	9.885159	10.814841	20.700000	0.019650
	30/09/1997	Q3	17.064092	8.642402	12.007598	20.650000	3.772000
	31/12/1997	Q4	15.234836	7.069984	12.930016	20.000000	6.032197
1998	31/03/1998	Q1	13.050189	5.183222	14.683445	19.866667	4.443263
	30/06/1998	Q2	14.154716	4.796982	14.569685	19.366667	5.488361
	30/09/1998	Q3	11.574107	6.850825	17.349175	24.200000	2.252769
	31/12/1998	Q4	9.879910	7.932680	15.933987	23.866667	3.204146
1999	31/03/1999	Q1	8.877274	9.100000	13.300000	22.400000	2.308551
	30/06/1999	Q2	4.665965	8.825554	11.591112	20.416667	3.138590
	30/09/1999	Q3	4.232326	8.182138	9.967862	18.150000	3.679666
	31/12/1999	Q4	4.175260	8.489464	8.277202	16.766667	5.761303
2000	31/03/2000	Q1	5.162659	7.774999	8.325001	16.100000	7.070144
	30/06/2000	Q2	10.408782	9.296037	6.603963	15.900000	1.035628
	30/09/2000	Q3	11.985507	9.969919	5.930081	15.900000	4.008761
	31/12/2000	Q4	14.969434	9.955014	5.944986	15.900000	4.396121
2001	31/03/2001	Q1	16.421978	10.750000	5.150000	15.900000	-1.279970
	30/06/2001	Q2	15.971575	10.050000	5.383333	15.433333	3.938892
	30/09/2001	Q3	18.280129	8.110000	6.456667	14.566667	0.443963
	31/12/2001	Q4	17.099000	8.270000	5.730000	14.000000	1.665963
2002	31/03/2002	Q1	14.781311	8.860000	5.973333	14.833333	7.416061
	30/06/2002	Q2	41.834207	10.540000	5.543333	16.083333	4.791826
	30/09/2002	Q3	40.077906	12.260000	4.740000	17.000000	3.572237
	31/12/2002	Q4	45.535071	13.550000	3.950000	17.500000	4.863390
2003	31/03/2003	Q1	39.163112	11.566667	5.933333	17.500000	4.268802
	30/06/2003	Q2	18.696088	8.333333	9.166667	17.500000	5.297129
	30/09/2003	Q3	20.199281	6.100000	9.383333	15.483333	4.726740
	31/12/2003	Q4	16.352290	3.100000	9.866667	12.966667	2.338443
2004	31/03/2004	Q1	24.439554	4.166667	8.333333	12.500000	7.931172
	30/06/2004	Q2	19.785028	4.266667	8.233333	12.500000	8.084671
	30/09/2004	Q3	19.301492	4.066667	8.350000	12.416667	21.041708
	31/12/2004	Q4	18.651313	4.200000	8.050000	12.250000	10.982761
2005	31/03/2005	Q1	11.687464	2.266667	9.983333	12.250000	5.170028
	30/06/2005	Q2	10.474913	1.266667	10.483333	11.750000	3.881051
	30/09/2005	Q3	12.551703	2.266667	9.483333	11.750000	-5.171375
	31/12/2005	Q4	11.476611	3.233333	8.516667	11.750000	7.058150
2006	31/03/2006	Q1	18.404897	3.966667	7.783333	11.750000	4.477493
	30/06/2006	Q2	18.782109	4.933333	6.983333	11.916667	7.690733
	30/09/2006	Q3	17.847234	5.333333	7.250000	12.583333	10.242574
	31/12/2006	Q4	17.015569	6.000000	7.416667	13.416667	5.883086
2007	31/03/2007	Q1	16.506372	6.100000	7.650000	13.750000	1.937089
	30/06/2007	Q2	14.057307	7.000000	6.916667	13.916667	0.497342
	30/09/2007	Q3	12.422220	6.900000	7.683333	14.583333	11.289251
	31/12/2007	Q4	13.634951	6.866667	8.383333	15.250000	7.420168
2008	31/03/2008	Q1	11.868916	8.033333	7.216667	15.250000	15.577057
	30/06/2008	Q2	11.435056	9.766667	5.483333	15.250000	7.935154
	30/09/2008	Q3	10.880677	11.966667	3.283333	15.250000	-5.210122
	31/12/2008	Q4	10.221027	11.533333	3.550000	15.083333	0.657123
2009	31/03/2009	Q1	10.366250	11.466667	2.616667	14.083333	-8.160495
	30/06/2009	Q2	10.186071	9.566667	2.579167	12.145833	-0.743083
	30/09/2009	Q3	9.804414	7.400000	4.016667	11.416667	0.582723
	31/12/2009	Q4	10.200388	6.933333	4.337500	11.270833	5.704515
2010	31/03/2010	Q1	8.781553	6.066667	5.183333	11.250000	6.200214
	30/06/2010	Q2	9.504604	4.666667	6.583333	11.250000	11.118191

Sources: Bank of Namibia Annual Reports and Namibia Statistics Agency

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