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A COMPARATIVE ANALYSIS OF COMMERCIAL BANKING ACTIVITY IN DOMINICA, ST. LUCIA & ST. VINCENT

by

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1. Introduction

In any economy, commercial bank behaviour exerts a significant influence on economic activity. This influence is especially pronounced in economies such as Dominica, St. Lucia and St. Vincent, where commercial banks are the main suppliers of credit. Hence, knowledge of commercial banking behaviour is strategic to an understanding of economic processes in Dominica, St. Lucia and St. Vincent.

These three countries have had similar macroeconomic experiences. The agricultural sector has been the leading sector in these economies, and bananas have been the chief export in all three economies. These islands share a common monetary experience. In all three cases, the commercial banking system is regulated by the Eastern Caribbean Central Bank (ECCB), which was established in 1984.

In this paper, we undertake a comparative analysis of commercial banking behaviour in Dominica, St. Lucia and St. Vincent. The paper is organised as follows: In Section 2, the theoretical framework underpinning the analysis is presented. In Section 3, the data sources and properties are discussed. In Section 4, the empirical results are analysed and compared for the three islands , and in Section 5 concluding remarks are presented.

2. The Theoretical Framework

Portfolio selection and the theory of the firm are two categories of analysis which have been widely adopted as approaches to the theoretical explanation of commercial banking behaviour. The portfolio approach has been questioned in the literature on a number of grounds. Sealey (1980) looks at the applicability of the quantity setting assumption to the deposit markets, and expresses the view that deposit markets are virtually always highly concentrated and that, under such conditions, it is normal for commercial banks to set interest rates. Klein (1970) and (1971) questioned the portfolio approach on the grounds that financial intermediaries operated in imperfectly competitive market structures. Sealey and Lindley (1971) have asserted that the inadequacy of the portfolio approach "stems from the total omission of production and cost constraints in determining the equilibrium output mix and scale size of the financial firm.". Hart and Jaffee (1974) have acknowledged that rate-setting behaviour cannot be adequately treated within a portfolio model.

It should especially be noted that portfolio theory is centred on the assumption that the assets and deposits markets, in which the commercial banks operate, are competitive. This assumption is not valid in a Caribbean context, where markets are under-developed. Hence, the portfolio approach to the theory of commercial banking behaviour is not applicable to Caribbean economies. Accordingly, this study is based on a "theory of the firm" approach.

Pesek (1970), Klein (1970), Benston (1973), Sealey and Lindley (1977), and King (1986) have all used this approach to develop a framework to examine different aspects of commercial banking behaviour. In the Caribbean context, Worrell (1985) presents a simple model of bank behaviour utilising the concept of the theory of the firm, however, he does not go on to test the model empirically.

Although either a static, or dynamic framework can be presented, the two approaches result in similar inferences, however the differences arise in the mathematical presentation of the model, and the optimization process. Since the purpose of this paper is to compare results of the model for the three islands, and for simplification, the model presented here is set in a static framework.

As previously mentioned, the basic assumption is that commercial bank behaviour is based on the need to maximise profit. Since the banks are privately owned companies, by achieving this goal, they succeed in maximising owners wealth.

Model Presentation

The following model specification is based upon preliminary analysis of the data, and information about the regulation and operations of commercial banks in the three islands.

The main regulations which have affected the operations of the commercial banks in the three countries are:

1. A floor of 4% on the nominal interest rate paid on savings deposits, effective January 1985, and
2. A cash reserve requirement equal to 6% of the total deposits in the bank.

It is therefore necessary that any proposed theory of commercial banking behaviour in the three countries include the existence of these regulations in order to capture their effect on the banks' achievement of their objective.

The basic representation of the banks' profit function is

$$\Pi = r_L L + \overline{r_b}\overline{B} + \overline{r_f} NFA - \overline{r_s} D_s - r_t D_t \qquad (1)$$

Where Π is profit.

- L is loans in the banking system.
- D_s is savings deposit in the banking system.
- D_t is time deposits in the banking system.
- NFA is the banks foreign assets less its foreign liabilities ie. the banks' net foreign assets.
- r_L is the rate of interest on loans.
- r_t is the rate of interest on time deposits.

r_b	is the rate of interest on government securities.
r_f	is the rate of return on the commercial banks' holdings of net foreign assets.
r_s	is the rate of interest paid on savings deposits.
B	the nominal value of government securities held by a commercial bank.

The bars over the variables indicate that they are not determined as part of the commercial banks' optimization process. The floor on the savings deposit rate is considered to be binding on the banks, hence the rate is assumed to be determined by the banks prior to the optimization process.

We assume that the banks obtain funds solely from deposits, this is a reasonable assumption considering the size of deposits relative to total assets. Deposits are in reality the main source of funds utilised by the banks in the three countries. Profit maximization is therefore constrained by the Balance Sheet Identity

$$L = (1 - \bar{\rho})D - \bar{B} - NFA - ER \qquad \textbf{(2)}$$

Where ρ is the required cash reserve ratio.

In the three islands, it is customary for the banks to accept all deposits, after fixing the level of interest rates. The level of deposits are therefore supply side determined. The deposit relationships are

$$D = D(\bar{Y}); \quad D_Y > 0 \qquad \textbf{(3)}$$

$$D_s = D_s(r_t, \bar{r}_s, D); \quad D_{s_{r_t}} < 0, \; D_{s_{r_s}}, D_{s_D} > 0 \qquad \textbf{(4)}$$

$$D_d = D_d(r_t, \bar{r}_s, D), \quad D_{d_D} > 0, \; D_{d_{r_t}}, \; D_{d_{r_s}} < 0 \qquad \textbf{(5)}$$

Where D is total deposits in the banking system.

Y is trended nominal income

D_d is the level of demand deposits.

Equations 3, 4, and 5 are the functional relationships for total deposits, savings deposits, and time deposits respectively. The level of time deposits is residually determined and represented as follows

$$D_t = D - D_s - D_d \tag{6}$$

The loan demand function captures effective demand, ie, the demand for loans which is actually backed by ability to repay. Assuming that the banks extend loans to all creditworthy customers, we have

$$L = L(r_L, \overline{Y}); \quad L_{r_L} < 0, \; L_Y > 0 \tag{7}$$

That is, the actual supply of loans by the banks is equal to the loan demand.

The final function is that for excess reserves

$$ER = ER(D_s, D_t, D_d, \overline{r_f}); \quad ER_{D_s}, ER_{D_t}, ER_{D_d}, ER_{r_f} > 0 \tag{8}$$

The actual level of excess reserves is related in this model to the banks' desire to hold excess reserves, represented as a function of demand deposits, time deposits, and savings deposits. The underlying principle is that the banks' expectations about the drain from the system results from their expectations about changes in the level of time, savings and demand deposits. These expectations are assumed to vary with the type of deposit, hence, the separation of the three types of deposits in equation 8.

Making the necessary substitutions for the variables defined in equations 3 to 8, we obtain the Lagrangean equation,

$$\begin{aligned} \mathfrak{L} = {} & r_L(r_L, \overline{Y}) + \overline{r_b}\overline{B} + \overline{r_f}NFA - \overline{r_s}D_s(r_t, \overline{r_s}, D(\overline{Y})) + \lambda[L(r_L, \overline{Y}) - (1 - \overline{\rho})D(\overline{Y}) \\ & + \overline{B} + NFA + ER(D_s(r_t, \overline{r_s}, D(\overline{Y})), D_d(r_t, \overline{r_s}, D(\overline{Y})), D(\overline{Y}) \\ & - D_d(r_t, \overline{r_s}, D(\overline{Y})) - D_s(r_t, \overline{r_s}, D(\overline{Y}))] \end{aligned} \tag{9}$$

From equation 9, we obtain the following first order conditions for profit maximization

$$\frac{\delta \mathcal{L}}{\delta r_t} = r_t(D_{s_{r_t}} + D_{d_{r_t}}) - D(\overline{Y}) + D_s(r_t, \overline{r_s}, D(\overline{Y})) + D_d(r_t, \overline{r_s}, D(\overline{Y})) + \overline{r_s} D_{s_{r_t}} = 0 \qquad \textbf{(10)}$$

$$\frac{\delta \mathcal{L}}{\delta r_L} = L(r_L, \overline{Y}) + r_L L_{r_L} + \lambda L_{r_L} = 0 \qquad \textbf{(11)}$$

$$\frac{\delta \mathcal{L}}{\delta NFA} = \overline{r_f} + \lambda = 0 \qquad \textbf{(12)}$$

$$\begin{aligned}\frac{\delta \mathcal{L}}{\delta \lambda} = L(r_L, \overline{Y}) - (1 - \overline{\rho}) D(\overline{Y}) + \overline{B} + NFA + ER(\ & D_s(r_t, \overline{r_s}, D(\overline{Y})), D_d(r_t, \overline{r_s}, D(\overline{Y})), \\ & D(\overline{Y}) - D_d(r_t, \overline{r_s}, D(\overline{Y})) - D_s(r_t, \overline{r_s}, D(\overline{Y}))\ ) = 0\end{aligned} \qquad \textbf{(13)}$$

Equation 11 implies that

$$\lambda = -\, r_f$$

substituting this into equation 12 for λ and differentiating equations 10, 11, and 13 totally, we obtain

$$dr_t = \frac{D_Y(1 - D_{s_D} - D_{d_D}) d\overline{Y} - (D_{s_{r_t}} + D_{s_{r_s}} + D_{d_{r_s}}) d\overline{r_s}}{2(D_{s_{r_t}} + D_{d_{r_t}})} \qquad \textbf{(14)}$$

$$dNFA = -L_{r_L} dr_L - [L_Y + D_Y(ER_D - (1 - \overline{\rho}))]\, d\overline{Y} - d\overline{B} - D(\overline{Y})d\overline{\rho} \tag{15}$$

$$dr_L = \frac{L_{r_L} d\overline{r_f} - L_Y d\overline{Y}}{2L_{r_L}} \tag{16}$$

Equations 14, 15 and 16 constitute the structural form of the model. The reduced form is obtained by substituting equation 16 into equation 15 for dr_L, to obtain the following equation for dNFA

$$dNFA = -\frac{1}{2} L_{r_L} d\overline{r_f} - [\frac{1}{2} L_Y + D_Y(ER_D - (1 - \overline{\rho}))]\, d\overline{Y} - d\overline{B} - D(\overline{Y})d\overline{\rho} \tag{17}$$

hence, equations 14, 16 and 17 are the reduced form of the model.

Given that;

$$(D_{sD} + D_{dD}) < 1$$

that is, the percentage changes in savings deposits and demand deposits which result from a change in total deposits in the banking system, is less than the overall change in deposits;

the structural and reduced forms of the model can be expressed in general functional form as [1]:

$$r_t = r_t(\overline{Y}, \overline{r_s}); \quad r_{t_Y} < 0, \quad r_{t_{r_s}} = (?) \tag{18}$$

$$r_L = r_L(\overline{r_f}, \overline{Y}); \quad r_{L_{rf}}, r_{L_Y} > 0 \tag{19}$$

[1]Please note that (?) indicates that the direction of change is not determined apriori in the theoretical framework.

$$NFA + \bar{B} = NFAB(r_L, \bar{Y}, \bar{\rho}); \quad NFAB_{r_L} > 0, \ NFAB\rho < 0, \ NFAB_Y = (?) \qquad \textbf{(20)}$$

Equations 18, 19 and 20 are the structural forms, and the reduced form comprise equations 18 and 19, and the following equation for NFAB,

$$NFA + \bar{B} = NFAB(\bar{r}_f, \bar{Y}, \bar{\rho}); \quad NFAB_{r_f} > 0, \ NFAB\rho < 0, \ NFAB_Y = (?) \qquad \textbf{(21)}$$

Equations 15 and 17 suggest that the coefficient of 'B' should be restricted to '-1' in the estimation of NFA, hence the reason for restructuring the structural and reduced forms in equations 20 and 21.

Equation 18 indicates that the rate of interest paid by the bank on time deposits is a function of the rate of interest on savings deposits, a decreasing function of the level of trended nominal income, and an increasing function of the level of prices. The loan rate of interest, represented in equation 19, is an increasing function of both the foreign rate of interest, and the level of trended nominal income.

The level of net foreign assets and bonds (NFAB) is determined in the structural form by the interest rate on loans at the banks, the level of trended nominal income, prices, and the required reserve ratio. Changes in the loan rate cause same direction changes in NFAB while changes in the required reserve ratio causes opposite effects. In the reduced form of NFAB the foreign rate of interest replaces the loan rate as an explanatory variable, and all the other explanatory variables remain the same. The effect of a change in the loan rate on the level of NFAB is the same as was for the loan rate in the structural form. In both forms of the equation the effect of changes in trended nominal income and the price level are not determined a priori.

3. Data Definition, Sources and Properties

The data utilised in this study are quarterly series which have been obtained from the Eastern Caribbean Central Bank Commercial Banking Statistics Publication, the International Monetary Funds' International Financial Statistics (IMF IFS), and from the Research Department of the ECCB. With the exception of the data obtained from the IMF the data set extends from the last quarter of 1985 to the 2nd quarter of 1996, hence, the empirical analysis is limited to that period.

For each of the countries being studied, we include three endogenous variables in our data set, namely the interest rate on loans, represented by the prime rate of interest (PR_..), the interest rate on fixed deposits (TR_..), which is a weighted average, and the level of net foreign assets combined with the banks' holdings of government bonds (NFAB), where net foreign assets is derived from the foreign assets less foreign liabilities which are reported in tables 2 and 1 respectively of the ECCB Commercial Banking Statistics.

The prime rate of interest is the business loan rate that banks charge their most creditworthy customers. Since non-prime rates are typically set by tying them either formally or informally to the prime, the prime rate is considered to be a prominent measure of credit market conditions, hence the reason for choice of the prime rate as representative of the loan rate of interest for estimation purposes. All of the endogenous variables are integrated of order 1, I(1), at the 1% level, utilising the Augmented Dickey Fuller (ADF) test for a unit root.

The exogenous variables utilised comprise; the level of trended nominal income in the countries (Y_D, Y_L, Y_V)[2], the average savings deposit rate (SR_..), the overnight London Inter-bank Offer Rate (LI_ON) used to represent the foreign interest rates, the commercial banks' holdings of Government Bonds (B_..), and the required cash reserve ratio (RHO).

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[2] Throughout this paper, D, L, and V extended to the first letter indicates Dominica, St. Lucia, and ST. Vincent variables respectively, eg. Y_D indicates trended nominal income variable for Dominica.

Since income is not recorded on a quarterly basis in the islands, the annual income series was obtained from the IMF IFS , and divided by four. This series was then smoothed using the Hodrick and Prescott Filter, to obtain a trended nominal income series for each of the islands. B_.. includes both the commercial banks holdings of government securities and of treasury bills, as recorded in table 2 of the ECCB Commercial Banking Statistics. The required cash reserve ratio has been in effect for the entire period of our study, and has remained at 6% throughout, ρ is therefore a constant, hence, its inclusion or exclusion in the empirical analysis will make no difference to the inferences to be drawn. ρ is not included in the estimation process. All the exogenous variables proved to be I(1) at the 5% level of significance.

Cointegration testing was performed on each of the groups of explanatory and dependent variables in each equation. The results indicate that these variables are all cointegrated. Hence, enabling us to proceed to the next stage of analysis, the empirical estimation of the model.

4. Empirical Results and Comparative Analysis

In tables 1, 2, and 3, we report the results of the estimation of the system of reduced form equations. A partial adjustment model is used and estimated in logarithmic form. The statistical package used is Eviews Version 2.0, and the method of estimation is the Iterative Seemingly Unrelated Regression. In the three tables, we report the results of both the theorised (UM) and the modified system of equations (M).

Table 1 contains the estimation results for the time deposit rate equations for all three countries. The results for St. Lucia and St. Vincent are similar, where both the level of trended nominal income, and the interest rate on savings deposits have a significant in the determination of the level of the interest rate on time deposits. However the effect of changes in the interest rate on savings deposit differs in the two countries. In St. Lucia, changes in the interest rate on savings deposits causes a direct change in the interest rate on time deposits, while in St. Vincent the effect is opposite. In all three countries, changes in the level of nominal income cause opposite changes in the interest rate on time deposits.

The results outlined above conform with the theory, which postulates changes in income will have a negative effect on the interest rate on time deposits, and does not propose the type of effect changes in the interest rates on savings deposits will exert. In Dominica, the interest rate on savings deposits does not play a significant role in the determination of the interest rate on savings deposits.

TABLE 1

ESTIMATION OUTPUT REDUCED FORM OF 'TR'

Estimation Method: Iterative Seemingly Unrelated Regression

Column Entries are the Dependent Variables, and Row Entries are the Explanatory Variables

DEPENDENT VARIABLE	TR_D UM	TR_D M	TR_L UM	TR_L M	TR_V UM	TR_V M
LOG(Y_. .)	0.221877 (0.935146)	-0.042579 (-0.043508)	-0.241268 (-1.925764)	-0.24227 (-1.934751)	-0.171659 (-1.56603)	-0.177257 (-1.61503)
LOG(SR_..)	-0.221731 (-1.196006)		0.403038 (1.931414)	0.390268 (1.870181)	-0.670849 (-2.17346)	-0.694163 (-2.24648)
SELF (-1)	1.057197 (7.293018)	0.908323 (11.1288)	0.628137 (4.90448)	0.628058 (4.903311)	0.709781 (16.13213)	0.700175 (6.03317)
CONSTANT	-2.339412 (-0.865782)	0.6245449 (0.515175)	2.957675 (1.88189)	2.990018 (1.904118)	3.481329 (2.19215)	3.597861 (2.26084)
R-squared	0.850945	0.845715	0.751776	0.751941	0.923450	0.923467
Adj. R-squ.	0.837395	0.836639	0.728505	0.728685	0.916491	0.916510
S.E. of Regre.	0.051170	0.051289	0.104684	0.104649	0.047729	0.047723
D-W Statistic	2.138113	2.052130	2.105987	2.101301	2.238879	2.221401
Sum Sq. Res.	0.086406	0.089437	0.350680	0.350447	0.075175	0.075158

The estimates summarised in table 2 are those for the interest rate on loans. The Dominica and St. Vincent results are similar. In both cases, the Libor is a significant explanatory variable, and the sign of its coefficient in both equations are as predicted by theory. In all three countries, the level of income proved to be insignificant in the determination of the interest rate on loans. Further, the results for St. Lucia it appears that the interest rate on loans follows a purely auto-regressive process.

TABLE 2

ESTIMATION OUTPUT FOR REDUCED FORM OF 'PR'

Estimation Method: Iterative Seemingly Unrelated Regression

Column Entries are the Dependent Variables, and Row Entries are the Explanatory Variables

DEPENDENT VARIABLE	PR_D UM	PR_D M	PR_L UM	PR_L M	PR_V UM	PR_V M
LOG(Y_D)	-0.039843 -1.063593		-0.029710 (-0.367786)		-0.028263 (-0.561822)	
LOG(LI_ON)	0.03433 (2.732366)	0.037464 (3.29022)	-0.001724 (-0.06577)		0.042402 (2.224641)	0.040864 (2.487676)
SELF(-1)	0.461716 (3.623619)	0.526541 (4.513915)	0.853507 (6.905027)	0.900766 (22.0368)	0.715127 (7.080559)	0.790637 (9.598368)
CONSTANT	1.651743 (2.885419)	1.036140 (3.99759)	0.712865 (0.541560)	0.228859 (2.343241)	0.964413 (1.414221)	0.445147 (2.303883)
R SQUARED	0.679726	0.659654	0.913354	0.920574	0.739889	0.780643
ADJ. RSQUARED	0.650611	0.642201	0.905231	0.918588	0.716243	0.769394
S.E. REGRESS.	0.020437	0.019962	0.033919	0.030410	0.035111	0.033124
D.W.STATISTIC	1.848425	1.800943	2.118464	2.122583	1.598810	1.633156
SUM SQU. RESID.	0.013783	0.015540	0.036816	0.036990	0.040681	0.042791

Finally, in table 3 contains a summary of the results pertaining to the estimation of the equation for net foreign assets (NFAB). The results for Dominica and St. Lucia comparable. Y exerts an opposite effect on the level of NFAB in both countries. In St. Vincent, however, changes in the level of income cause direct changes in the banks' holdings of net foreign assets. In all three countries, the level of income is the only variable which impacts significantly on net foreign assets. In the theory, the type of effect changes in the level of income has on the banks' holdings of NFA is not determined.

TABLE 3

ESTIMATION OUTPUT FOR REDUCED FORM OF NFAB

Estimation Method: Iterative Seemingly Unrelated Regression

Column Entries are the Dependent Variables, and Row Entries are the Explanatory variables

DEPENDENT VARIABLE	NFAB_DUM	NFAB_DM	NFAB_LUM	NFAB_LM	NFAB_VUM	NFAB_VM
LOG(LI_ON)	-0.069419 -0.371520		-0.025140 -0.178107		0.120104 1.147091	
LOG(Y_. .)	-1.012505 -1.530292	-0.830797 -1.959146	-0.392255 -1.737327	-0.368080 -2.234138	0.796015 1.151701	0.202532 3.441697
SELF (-1)	0.943813 10.74325	0.927496 15.50801	1.25E-05 6.707118	1.23E-05 8.365986	0.689466 5.074213	0.789419 12.69961
CONSTANT	12.45889 1.705251	10.40107 2.187759	15.12486 5.196603	14.79077 7.260995	-6.070791 -0.883457	
R-squared	0.868443	0.866803	0.682071	0.680925	0.882635	0.879367
Adj. R-sq	0.856109	0.858730	0.650278	0.660339	0.871632	0.875819
S.E. of Regr	0.248075	0.245806	0.207789	0.204778	0.171442	0.168622
D-W Statistic	1.772153	1.724496	1.842284	1.830243	2.128649	2.219094
Sum Sq. Res	1.969320	1.993871	1.295284	1.299953	0.940556	0.966739

The estimation output summarised in tables 1, 2, and 3 above indicate that the theory explains the behaviour of commercial banks in Dominica and St. Vincent, much better than it does that of St. Lucia.

5. Conclusion

The opposite effect of changes in the level of income on the time deposit rate in all three countries implies that policy makers can effect changes in the time deposit rate by instituting policies which effectively change the nominal level of income. This is an especially important finding especially in the case of Dominica where the savings rate has proved to be insignificant as an explanatory variable in the time deposit rate function. This means that changes in the savings rate floor will not necessarily affect the interest rate on time deposits, since banks in Dominica do not allow the interest rate on savings deposits to affect their decisions about the interest rate to be paid on time deposits. This , however, is not the case in St. Lucia and St. Vincent.

The level of nominal income does not affect the loan rate of interest in any of the three countries. The results indicate that in the three islands, the prime lending rate is determined by factors external to the local environment. These results may be due to measurement error or error in the choice of the dependent variable and/or explanatory variables utilised. The determination of this variable definitely requires revisiting.

Finally, the level of net foreign assets are affected by changes in the level of income in Dominica and St. Lucia, this implies that fiscal policy aimed at increasing the level of nominal income should cause the banks to reduce the net flow of funds out of these countries. Based on our results, the previous conclusion would be more certain for Dominica than St. Lucia.

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