

CENTRAL BANK OF BELIZE¹

Research Department

DETERMINANTS OF INTEREST RATE SPREADS IN BELIZE

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Abstract

This paper examines the components of interest rate spreads in Belize using accounting data and then seeks to identify the factors that affect interest rate spreads using a panel dynamic least squares model. The study concludes that market share and adversely classified loans are two main determinants of the spread. Based on these findings, the study suggests policy recommendations to reduce information asymmetries and increase competition in the Belizean financial sector.

JEL codes: E43, C33

Keyword: Belize, interest rate spreads, panel dynamic least squares

¹The views expressed are those of the author and do not necessarily represent those of the Central Bank of Belize.

1.0 Introduction

In the latter part of 2008, the first wave of the global financial economic crisis was manifested through a slowdown in the real economy, with vulnerable sectors such as tourism being severely affected. These external shocks led to a rise in unemployment from 8.2% in 2008 to 13.1% in 2009 as businesses tried to compensate for the loss in revenue by reducing business hours and maintaining minimal staff. Eventually, adversely classified loans in the commercial banking system spiked from 6.83% at the end of 2007 to 12.69% in 2008. Notwithstanding the external macroeconomic environment, public sentiment identified exorbitant lending rates as the major obstacle hampering private sector growth and inhibiting their ability to recover.

Lending rates are made up of two components: deposit rates and the interest rate spread. While high interest rates have been suggested as a significant deterrent to a thriving entrepreneurial sector in Belize, empirical work on interest rate spreads is limited. The purpose of this paper is to identify the factors which sustain the interest rate spread in Belize and quantify the effects of these determinants using accounting and econometric techniques.

This paper is the first to decompose interest rate spreads using banking data at the consolidated country level for Belize and to provide an analogous econometric model using panel data. This approach recognizes that consolidated data can provide a general sense of the risk premium and minimum required returns placed on lending

activities, while panel techniques are able to capture the market dynamics faced by individual banks at the country level.

Definitions of interest rate spreads and margins vary among authors and offer no consensus on the best measure for interest rate spreads. By employing the wide interest margin definition in the analysis of the interest rate spread, the model seeks to accurately capture actual rates paid to depositors and actual interest incomes earned from loans, which includes the effects of fees and commissions, net of non-performing loans (see Section 4).

The paper is organized as follows: section 2 outlines the historical behaviour of interest rate movements from the 1970's to present, while section 3 reviews the economic literature pertaining to interest rate spreads. Section 4 provides an overview of the methodologies employed in the study, while sections 5 and 6 present the respective findings of the accounting and econometric framework applied in the study. Finally, the analysis and conclusions are presented in section 7.

2.0 Stylized Facts

Belize is a small, developing economy with a land mass of 8,866 square miles and has a population of 312,971 persons². Belize's maintains a fixed exchange rate, pegged at \$2BZ to \$1US, and the Central Bank is required to maintain external assets amounting to at

²Based on Belize Housing & Population Census 2010.

least 40.0% of the monetary base³. As of December 2010, Belize's domestic financial sector was comprised of five commercial banks, thirteen credit unions, fourteen insurance companies, two financial institutions and one development bank. In 2010, the sector's total asset size amounted to \$3.4bn, of which commercial banks and credit unions accounted for 73.8% and 15.9% respectively. In the commercial banking sector, market share is highly concentrated with two banks accounting for an average of 68.4% of total loans. Some financial deepening was evidenced in the last four years as the growth in branches and ATM machines⁴ underpinned an increase in the ratio of broad money to GDP from 59.7% in 2005 to 77.3% in 2009.

Tillet(1989) identifies the minimum lending and deposit rates as tools that influenced monetary policy in 1980s. The spike in interest rates in the early 1980's (as indicated in Figure 1) reflects the authorities' response to the drain on reserves experienced in 1978. Their efforts to curb private sector credit growth led to an increase in the discount window from 7% in 1978 to 14.5% in 1981, and the imposition of credit restrictions on commercial banks⁵. Consequently, commercial banks' prime lending rate rose from 9.5% in 1978 to 19.5% in 1981, while rates on time deposits increased to 15.0% at the end of 1980. In another instance, in an effort to limit credit expansion, reduce pressure on the balance of payments and increase domestic savings: the Central Bank increased the minimum lending rate from 12% to 14% in January 1984, while the minimum deposit

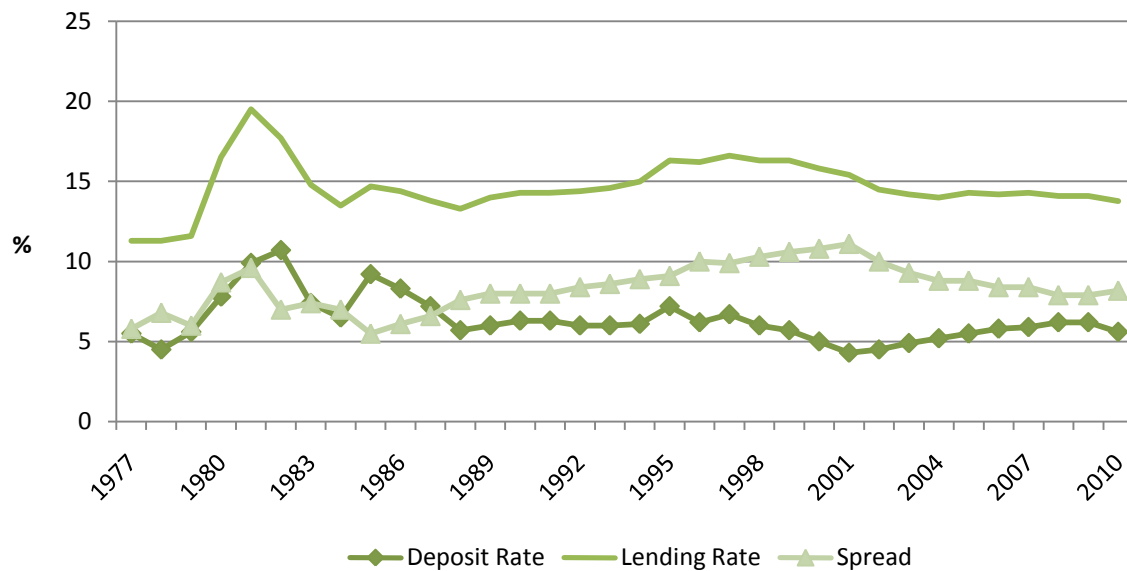
³This includes notes and coins in circulation and the Central Bank's liabilities to other depository corporations.

⁴The number of branches increased from 39 in 2005 to 47 in 2009, and the number of ATM machines increased from 51 in 2005 to 71 in 2009.

⁵In December 1979, Monetary Authorities issued directives to commercial banks to reduce their level of outstanding loans and advances by 5%.

rate was increased by 3 percentage points from existing levels. In the reverse case, relaxing of monetary policy led Central Bank to reduce the minimum lending and deposit rates December 1986 and March 1989.

Figure I. Weighted Average Interest Rates⁶, 1977- 2010



Mendoza(1997) noted that during the 1985 to 1996 period, increases in government borrowing were accompanied by a decline in the rate of private sector credit growth and vice versa. Her study noted that some level of crowding out of private sector investments would have contributed to higher interest rate levels during this period. She identified that a significant structural change which contributed to the upward pressure on loan rates was the transformation of a Canadian bank subsidiary into a locally incorporated bank, and the later introduction of the International Business Company (IBC) Act with its Public Investment Company section that enabled this bank to enjoy considerable tax

⁶As reported by commercial banks to the Central Bank of Belize at the end of year.

benefits. Coupled with aggressive management, the advantages conferred by its PIC status paved the way for a sizeable increase in its deposit and loan growth. The remaining commercial banks were forced to increase their competition for customer's long term deposits by bidding up interest rates, which reflected an increase in the weighted average deposit rate from 8.6% in 1995 to 10.0% in 1996.

Another significant change in the interest rate structure took place in the mid-nineties when efforts were made to reduce commercial banks' reliance on Central Government's deposits for financing private sector credit. The liberalization of interest rates was brought about when Central Government shifted deposits from commercial banks to the Central Bank, and Central Bank simultaneously removed several floors on deposit rates to foster a more competitive environment. The only floor maintained was a rate of 4.5% on savings deposits, which was retained to protect small savers. Table I provides details on changes to interest rate floors set by the Central Bank of Belize in March 1989 and March 1994.

Table I. Comparative Interest Rates Floor Set by the Central Bank of Belize

	Mar-89 (%)	Mar-94 (%)
Deposit Rates		
Ordinary Passbook Savings	5.0	4.5
Premium Savings or other special savings account	6.0	-
Fixed deposits for periods of up to three months	7.0	-

Fixed deposits for periods over three months and up to six months	8.0	-
Fixed deposits for periods over six months and up to one year	8.5	-
Lending Rate		
Minimum Lending Rate	10.0	9.0
Central Bank's Lending Rate	12.0	11.0

Source: Central Bank of Belize Annual Report 1994

During the period 2000 to 2009, marginal declines in weighted average lending rates and simultaneous increase in deposit rates caused the weighted average interest rate spread (IRS) to fall from 11.1% to 7.8%. The Central Bank of Belize 2006 Annual Report identifies three factors that heightened the level of competition in the financial system and consequently reduced the interest rate spread, as follows: (i) in 2001, the number of domestic commercial banks increased from four to five; (ii) changes in the Offshore Banking Act in 2002 allowed EPZ and CFZ companies to bank with offshore banks licensed in Belize; and (iii) higher reserve requirements increased the level of competition among banks and prompted them to compete for market share by offering more attractive rates.

Despite these recent declines, figures 2&3 indicate that Belize has the second highest lending rates in the Caribbean and has been able to offer some of the highest deposit rates in the region over the last three years.

Figure II. Weighted Average Lending Rate

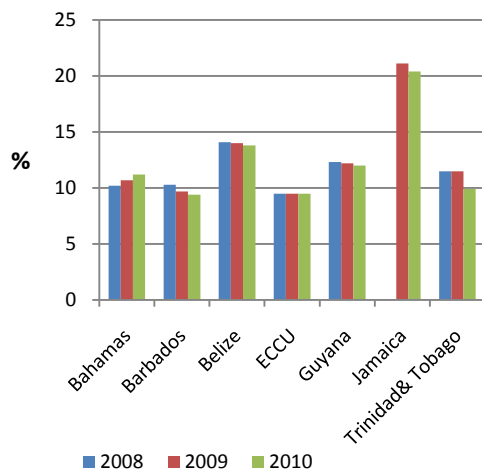
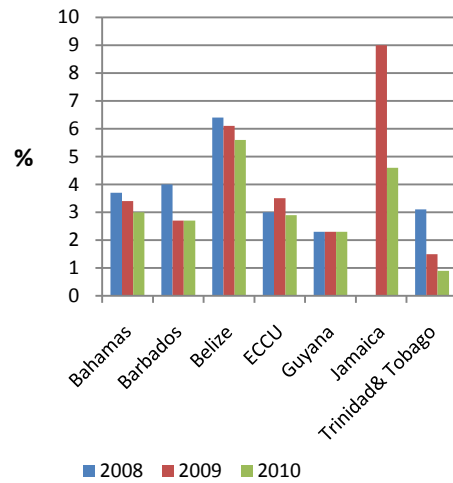


Figure III. Average 3-month Deposit



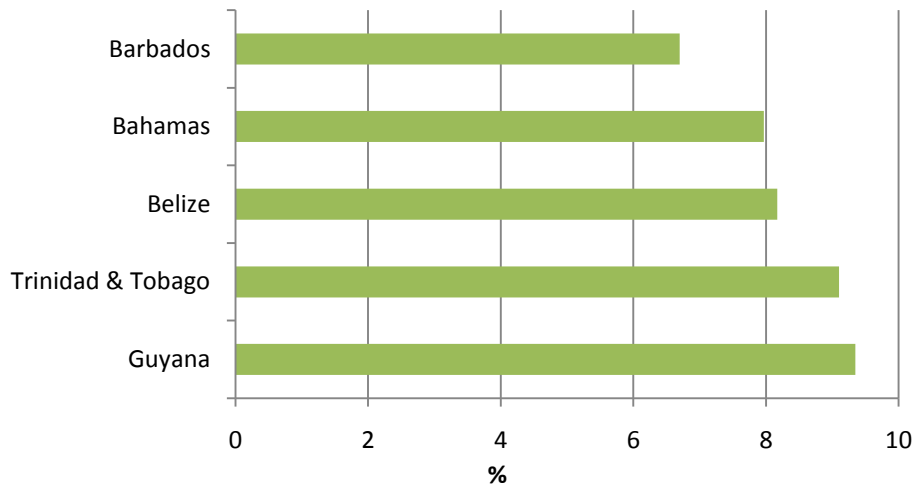
Source: Caribbean Centre for Monetary & Finance

Interest rate spreads in Belize are high relative to economies such as the United States (2.95%) and China (3.06%)⁷, while they remain in the vicinity of countries such as Guatemala (7.94%)⁶ and Mexico (4.2%)⁶. A regional comparison of spreads in 2009⁸ places Belize in the middle range. Figure 4 shows weighted average spreads in Belize are higher than rates in the OECS economies and Barbados, but lower than those in Guyana, Trinidad & Tobago and Jamaica.

⁷As at December 2010, calculated using lending rate minus deposit rate, as per International Financial Statistics.

⁸Spreads measure weighted average lending rate minus weighted average deposit rate. These were extracted from 2009 Annual Report Publications of the relevant Central Bank/Monetary Authorities.

FigureIV. Regional Comparison of Interest Rate Spreads for 2010



Source: Relevant Monetary Authorities

3.0 Literature Review

Interest rate spread consists of several components: operating cost, profits, reserves and provisions for bad debts based on the accounting perspective. These components are a reflection of micro and macro variables which impact the spread, such as efficiency, type of ownership, concentration of market power and the regulatory framework under which banks operate. A review of the literature provides an extensive list of variables that affect the spreads and categorises these determinants into five main groups: bank-specific variables, system-wide measures of market structure, regulatory environment, legal and institutional environment and macro-economic variables.

Bank-specific variables refer to those factors which characterise individual banks and affects the interest rate spreads accruing to the respective institution. This category includes features such as efficiency, credit risk levels, bank profitability and excess

liquidity. Higher operational costs have been positively correlated with higher interest rate spreads as banks increase mark up on loans to cover operating expenditure. Various studies supporting this relationship included: an international cross-country comparison of OECD, developing and transitioning economies by Demirguc-Kunt & Huizinga (1999); a regional study on the Caribbean by Craigwell and Moore (2002); and individual country analyses of the Ugandan economy by Beck and Hesse (2006) and Central Bank of Solomon Islands (2007). Further, larger operating costs have been associated with greater levels of inefficiency in the financial system of developing countries established by respective studies by Randall (1998) and Ngugi (2001) on the OECS and Kenya. A recent study by IADB (2010) found that Belize's high interest rate spreads are indicative of high operating costs or inefficiencies in financial intermediation.

Increases in loan loss provisions has been cited as another factor which increases interest rate spreads as additional resources must be committed to dealing with bad loans (Barajas, Steiner and Salazar 1998, Randall 1998 and Craigwell and Moore 2002). Additionally, country-specific studies by Central Bank of Solomon Islands (2007) and Ghosh (2008) on India states that holdings of excess liquidity also drives spreads upwards as higher levels of excess liquidity represents a greater penalty for unused funds on which banks must pay interest to depositors.

Demirguc-Kunt, Laeven & Levine (2003) concluded that individual bank characteristics can also explain a substantial part of within-country variations in financial intermediation cost, as high net interest margins tend to be associated with (i) small banks, (ii) banks

without substantial income from fee-based activity, (iii) banks that hold a low amount of capital and (iv) those with a large market share.

System-wide measures of market structure highlight those attributes that define the industry and which cause interest rates to change over time. These factors include the level of bank concentration, market power and competition, as well as the effect of foreign ownership and state ownership. In the late nineties, the relationship between market structure and interest rate margins was re-visited, as the push for financial liberalization among several countries in the 1990s failed to bring about the convergence of spreads between developing and industrial economies. Cross-national and regional studies were able to establish that the structure of the financial markets can affect variations in spreads. However, results produced were sometimes contradictory and differed across regions.

Martin (2010) noted that inefficient and uncompetitive financial intermediation processes partially contributed to Belize's high cost of financing. Similarly, Mendoza (1997) identifies the low level of competition in the Belizean banking system as a primary reason for interest rate spreads being higher than in Barbados, a Caribbean country with a similar exchange rate regime and higher reserve requirements. Mendoza identified that Barbados' financial system was of a larger size and had a variety of non-bank financial institutions which facilitated lower spreads when compared to Belize.

Demirguc-Kunt and Huizinga (1999) noted that in relatively poor countries foreign ownership of banks is associated with higher interest spreads as foreign banks were frequently exempted from unfavourable domestic regulations and their application of superior banking techniques would allow them to earn higher margins than domestic-owned banks. In contrast, Martinez Peria and Mody's (2004) study on Latin America concluded that foreign banks were able to charge lower spreads relative to domestic banks and indirectly influence intermediation through lowering costs of operation.

Martinez Peria and Mody (2004) also established a positive correlation between bank concentration and interest rate spreads, as industries with a high market concentration had less pressure to reduce intermediation costs. On the other hand, Crowley (2007) provided evidence of a negative relationship between concentration and spreads suggesting that a country with a small number of powerful banks are able to restrict the level of competition by keeping spreads artificially low.

Chirwa and Mlachila (2002) found that interest rate spreads in Malawi increased significantly after implementing financial liberalization reforms due partially to high monopoly power within the industry coupled with the high incidence of interlocking ownership and directorship in the Malawian banking system which effectively stifled competition. Their study strongly concluded that high interest rate spreads in developing countries will persist if financial sector reforms do not alter the structure within which banks operate.

Regulatory environment specifically includes both explicit taxation via corporate income tax or profit tax and implicit taxation via reserve requirements. The **legal and institutional environment** refers to the overarching ethos under which all national institutions operate. This impacts perceptions of risk including credit risk and loan loss provisioning. Commercial laws, adequate institutional enforcement, index of corruption and level of institutional development are variables studied under this category.

Increases in reserve requirements are associated with a growth in interest rate spreads since banks pass on the cost of holding unloanable funds to consumers via an increase in lending rates or a reduction in deposit rates (Demiguc-Kunt and Huizinga 1999, Demigruc-Kunt, Laeven and Levine 2003 and Tennant and Folawewo 2009). However, reserve requirements relative to the size of the spread were small for the OECS (Randall 1998) accounting for less than 10% of the average spread between the period 1991 to 1996. In the case of Belize, Martin (2010) estimated that 50% of the spread is attributable to reserve requirements, based on the zero-profit methodology.

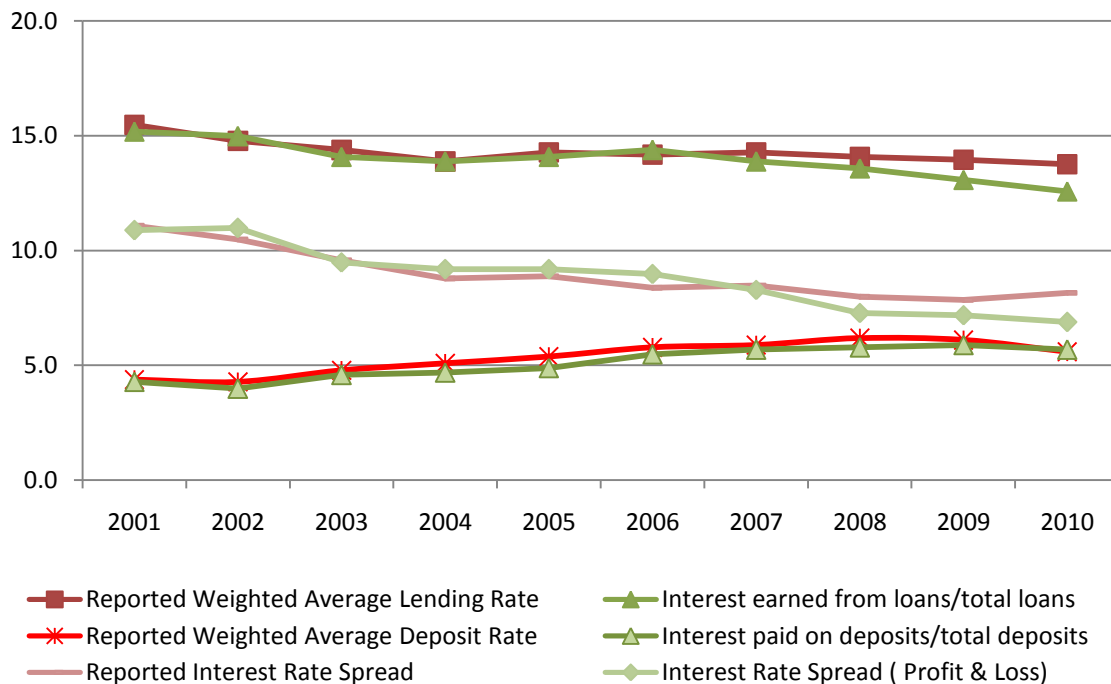
Macro-economic factors such as inflation, GDP growth, interest rates on alternative financial instruments and exchange rates were employed as control variables across most studies. However, Birchwood (2004) explicitly examined the impact of macroeconomic influences on nominal and real interest spreads in the Caribbean region. He concluded that differences in interest rate spreads across the region may be due to differences in economic cycles, inflation and liquidity conditions, while the differences in the exchange

rate regime affected the magnitude of the spreads. The study also found that countries with fixed exchange rates exhibited lower inflation rates and the highest real spreads.

4.0 Methodology

Based on the literature, use of the net interest margin is a commonly used measure which is calculated by subtracting interest expense from interest income and then dividing by total assets. A variation of this measure is wide interest margin, which subtracts interest payments divided by total deposits from interest earnings divided by total loans. Figure 1 shows that the reported rates in the Belizean system are a close proxy of the actual interest rate spread calculated from the profit and loss statements.

Figure V. Comparison of Various Interest Rates (%) in Belize, 2001-2010



Source: Central Bank of Belize

Figure 5 shows that disparities exist between rates reported by commercial banks and actual rates paid to depositors since actual interest payments on deposits are based on the minimum holdings during the period. Similarly, the weighted average lending rate exceeds actual interest income when a rise in non-performing loans reduces the average earnings realised by the commercial bank. Sections 5 of the paper will focus on the wide interest margin as this is a more accurate measure of spreads accrued by commercial banks in comparison to reported interest rates⁹.

A review of the literature uses specific accounting and econometric techniques to examine interest rate margins. For the purpose of this analysis, the accounting method is used to decompose the spread and identify its most significant components. Building on these results, the econometric model is then used to analyse those behavioural factors that sustain the spread. The consistency of the findings in these two models will then be used as a check and balance to corroborate the accuracy of the study.

The accounting method used by various studies analyses the factors that make up the interest rate spread using information from the profit and loss statement and the balance sheet. This method attempts to quantify the contribution of specific accounting factors such as return on assets, operating expenses and cash reserve requirements to the overall spread. Although it offers preliminary insights on the impact of these determinants on the size of the spread, it is unable to provide an explanation for causation or behavioural patterns (Central Bank of Solomon Islands 2007). This model cannot be used to ascertain

⁹Commercial banks are required to submit their lending and deposit rates on a monthly basis to the Central Bank of Belize.

the underlying causes for the magnitude of each factor's contribution to the spread. Hence, it is ineffective for predictive purposes and cannot adequately assess the impact of non-accounting factors to the spread, such as competitiveness, risk and bank size, among others.

To overcome these deficiencies, econometric techniques will be used to model interest rate spreads. A review of the literature shows that various econometric studies (including Ghosh (2008), Martinez Peria and Mody (2004), Tennant and Folawewo (2009) and Craigwell and Moore(2002)) employ panel regression techniques and use the appropriate fixed or random effects model, based on the suitability of the data. Taking into account the main factors that affect interest rate spreads(bank-specific, industry-specific, and macro-economic variables), a panel regression was used to model the determinants of the spread, as shown in Section 6.

5.0 Accounting Methodology

5.1 Accounting Model &Data Sources

The accounting model taken from Randall (1998) is based on the premise that total income earned by banks must cover interest expenses, operational cost, provisioning cost and profits or losses. On the other side of the equation, total income is the sum of interest income and non-interest income. Hence, the equation is represented as follows:

$$II + NII \equiv IP + OC + Prov + P + T \dots \dots \dots (1)$$

Where II represents interest income, NII represents non-interest income, IP represents interest expense, OC represents operational cost, Prov represents provision for loan losses, P represents profit or losses after taxes and T represents taxes.

By rearranging identity (1), and normalizing certain variables using loans and deposits, we reduce the equation to make interest rate spreads the subject of the formula, as follows:

$$i_L - i_D \equiv \rho i_L + OC/D + Prov/D + ROA * A/D - NII/D + T/D + \epsilon \dots \dots \dots (2)$$

Based on equation 2 above, i_L represents II/L or interest income divided by loans and is a proxy for the effective lending rate. i_D represents interest expenses divided by deposits which is a proxy for effective deposit rate. ρ represents the required reserved ratio, and ρ multiplied by i_L represents that fraction of interest earnings that is lost by holding cash reserves. $ROA * A/D$ is a normalised variable representing the proportion of the spread that makes up the return on assets after taxes. $Prov/D$ and T/D represents that portion of the spread attributable to provisioning and taxation. NII/D represents a reduction from the spread which has a negative effect on the spread as non-interest income earning increase. ϵ represents the residual. Appendix 1 contains a detailed derivation of the formula.

The residual reflects errors that result from combining flow data from income statements and stock data from the consolidated balance sheet. The residual also accounts for errors

as well as simplifying the assumption that loanable funds are comprised of deposits net of required reserves.

Balance sheet and profit and loss data of the five commercial banks for the time period 2001 to 2010 were used for individual banks and were consolidated for the system.

5.2 Empirical Results

According to the accounting model described above, variables from the profit and loss statement would have a direct impact on the interest rate spread, as follows:

- (i) Factors increasing the spread: reserve requirements, operating costs, loan loss provisioning, tax payments and after tax profits; and
- (ii) Factors decreasing the spread: non-interest income.

Table II shows the contribution of the various factors to the interest rate spread over the period 2001 to 2010. Notwithstanding gradual increases in the reserve requirements, the actual interest rate spread has narrowed over time from 10.9% in 2001 to 6.9% in 2010, as the average lending rates have declined (from 15.2% to 13.1%) and average rate on deposits have increased (from 4.3% to 5.9%). For the ten-year average, the interest rate spread represents almost two-thirds (63.5%) of the lending rate (i.e. 8.9% out of 14.0%).

Table II. Components of Interest Rate Spread for the Banking System

	2001	2006	2007	2008	2009	2010	Average 2001-
	(%)	(%)	(%)	(%)	(%)	(%)	2010 (%)
i_L	15.2	14.4	13.9	13.6	13.1	12.6	14.0
i_D	4.3	5.5	5.7	5.8	5.9	5.7	5.1
Spread	10.9	9.0	8.3	7.8	7.2	6.9	8.9
<i>Factors increasing interest rate spread</i>							
Res. Req.							
(cash)	0.5	1.3	1.4	1.4	1.3	1.1	1.0
OC/D	6.0	6.2	6.0	6.2	5.5	5.2	5.8
Prov/D	0.3	0.5	0.5	1.0	0.6	1.3	0.6
Taxes/D	0.5	0.9	0.9	1.0	1.1	1.1	0.7
ROA *(A/D)	6.6	4.8	4.1	2.6	2.1	1.3	4.3
<i>Factors decreasing interest rate spread</i>							
NII/D	3.0	3.8	3.5	3.5	3.5	2.7	3.3
Residual	0.1	0.9	1.2	0.8	0.0	0.4	0.3

Figure 6 displays a regional comparison on the interest rate spread to lending rates for a few selected Caribbean countries for the time period 2001 to 2009. While Belize has the largest interest rate spread to lending rate ratio in 2001, this ratio has consistently declined and interest rate spreads accounts for less than 60% of the lending rate in 2009. In contrast, Trinidad & Tobago had the lowest spread to lending ratio in 2001, but their ratio rose significantly in 2009 with their spread accounting for almost 90% of their lending rate.¹⁰

¹⁰This lending rate refers to local currency lending only.

Figure VI. Comparative Ratios of Interest Rate Spreads to Lending Rates¹¹ among Selected Caribbean Economies

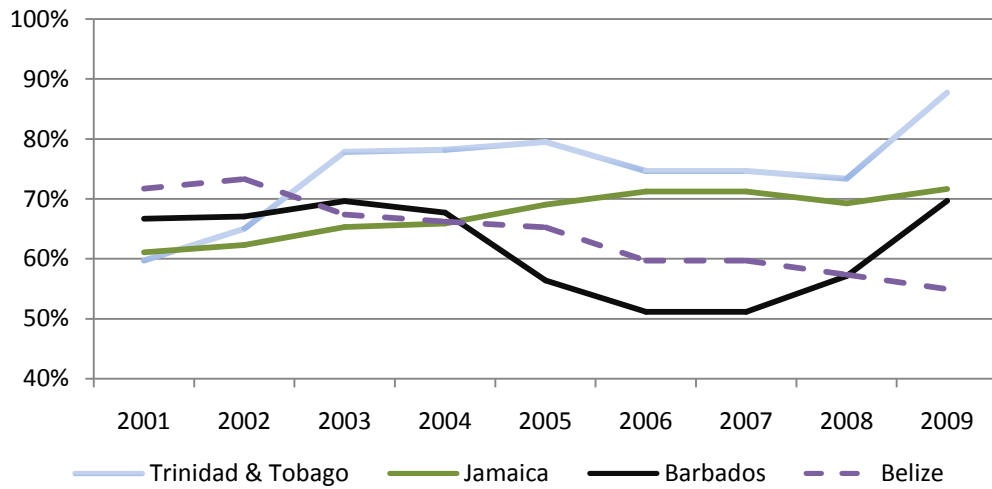
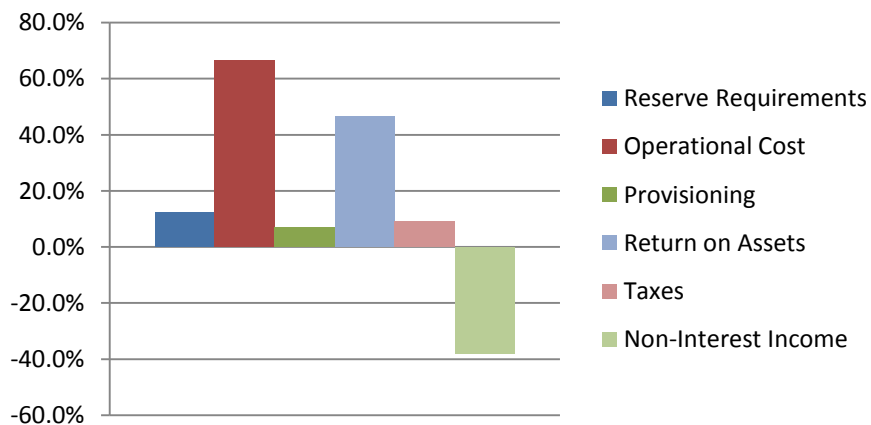


Figure 7 shows that on average, operating cost and after-tax profits are the largest components of the spread, while non-interest income is a significant factor that reduces the spread.

Figure VII. Components of Average Interest Rate Spread: 2001 – 2010



¹¹Lending rates and spreads for Trinidad & Tobago, Barbados and Jamaica represent reported interest rates, while calculations for Belize uses actual average loan income and wide interest margin.

Table III. Factors affecting the various components of Interest Rate Spreads

	Variable	Range	Mean	Calculation	Factors Affecting Changes in Variables
Reserve Requirement	ρ^*i_L	5.0%(2001) - 18.3%(2009)	12.4%	Cash Reserve Requirement x (Interest Earnings on Loan/Average Loans)	Cash reserve requirements were increased 6 times as measures to curb credit and foreign exchange demand were necessary after sizeable fiscal expansion in the four years prior to 2002. (See Table A.2)
Operating Cost	OC/D	51.2%(2002) – 79.2%(2008)	66.6%	Annual Operating Cost/ Average Deposits	- Salaries and operating costs contributed to the largest increase in operating cost followed by net expenses on bank premises and equipment. (See Table A.3) -The Burden ratio fluctuated around 2.0% during the period, but the efficiency ratio rose from 44.8% in 2001 to 56.7% in 2009 indicating that although inefficiency levels rose for the entire banking system, commercial banks were able to recoup these costs via non-interest income (fee-based) activities. Two main factors accounting for the decline in net interest income which caused the disparity between the two variables are (i) reduction in interest earnings attributable to increased non-performing loans and (ii) increases in the cost of deposits.
Loan Loss Provisioning	Prov/D	1.1%(2004) – 18.2%(2010)	7.0%	Total Annual Loan Loss Provision/ Average Deposits	The rapid acceleration in the growth of non-performing loans between 2007 (at 6.83%) to 2010 (16.1%). Table A.4 provides definitions and requirements for different categories of non-performing loans.
Tax Payments	T/D	3.0%(2003) - 15.9%(2010)	9.0%	Annual Tax Payments/ Average Deposits	Commercial Banks tax rates increased twice during the period. In February 2005, commercial banks tax rates increased from 4% to 8% for Public Investment Companies (PICs) and from 10% to 15% for non-PICs. The second was effective January 2009, when taxation for PICs rose from 8% to 12%. (Table A.5)
After Tax Profits	ROA*A/D	18.9%(2010) - 60.7%(2001)	46.5%	Annual Net Income After Tax x Average Assets/Average Deposits	After tax profits declined sharply in 2008 with the increase in non-performing loan levels, as noted above, and the increase in operating costs.
Non-Interest Income	NII/D	-25.5%(2002) - -48.2%(2009)	37.9%	Annual Non Interest Income/ Average Deposits	Banks increasing dependence on non-interest-based activities. Foreign exchange transactions were the most significant source of non-interest income for commercial banks between 2005 and 2009. (See Table A.6)

In summary, an examination of financial data reveals that profits and operating costs are the main components of interest spreads in the commercial banking system. Simultaneously, non-interest income is equally important in reducing the pressure on commercial banks to raise revenue from interest-based activities. On the other hand, reserve requirements account for an average of 12.4% of the interest rate spread, considerably lower than the 50% estimate derived from the zero-profit methodology applied by Martin (2010) for the year 2006. However, the accounting model fails to identify the behavioural factors that may sustain these profits and operating costs such as the level of competition for deposits and loans in the banking system, inefficiency and macro-economic factors. The econometric model attempts to identify those behavioural factors which impact interest rate spreads in the Belizean system.

6.0 Econometric Model

6.1 Model Specification

Based on the model by Ghosh (2008), an assessment of the factors that affect interest rate spreads can be decomposed into bank-specific variables (B), industry specific variables (Z) and macro-economic variables (M).

The general model takes the following form:

$$WIM_{it} = \varphi_0 + \varphi_1 B_{it} + \varphi_2 Z_t + \varphi_3 M_t + \varepsilon_{it}$$

where i indexes banks and t denotes year;

WIM measures wide interest margin;

For the purpose of this analysis, bank specific variables include adversely classified loans (acl), operating cost (ovcost), liquidity (xslq) and non-interest income (non_int_yoi) and actual holdings of liquid assets as a ratio to liquidity requirements (holdings_req). *Holdings_req* is a scalar variable used in this model which measures holdings of excess liquidity beyond statutory requirements and attempts to quantify the effect of banks' liquidity management practices on interest rate spread. Industry specific time-varying determinants are measured by cash reserve requirements (cashreq), marketshare (mktshare) and concentration of deposits (dep_concen). The latter two variables are a proxy for market power: (i) market share (measured by the relative size of a commercial banks' loan portfolio) is a common indicator across several countries, and (ii) the concentration of deposits variable has been devised for the Belizean context where limited investment alternatives permit large institutional depositors to negotiate for higher deposit rates among banks with tight liquidity. Macroeconomic variables include GDP growth (dgdp) and inflation (dcpi).

A priori expectations from the literature review suggest a positive correlation with adversely classified loans, cash reserve requirements, operating cost, the ratio of actual holdings to required holdings, excess liquidity, market share and GDP growth; while concentration of deposits, inflation and non-interest income should be negatively correlated with the interest rate margin. Appendix 7 provides a description and summary statistics of the variables used in the model.

6.2 Econometric Methodology

All variables were converted to log form to interpret the elasticity effect of the variable, except for GDP growth rates and inflation which already represented growth rates. Based on the correlation matrix shown in Appendix 8, liquidity and operating costs were removed from the equation on the basis of its strong correlation with cash reserve requirements and market share.

6.2.1 Unit Root Testing

Baltagi (2008) describes several panel unit root tests that examine the stationarity properties of the variables. The panel unit root tests by Levin, Lin and Chu (LLC) assumes cross sectional independence and its null hypothesis states that the time series has a common unit root process. Im, Pesaran and Shin (IPS) proposes a testing procedure based on averaging individual unit root test statistics and allows for different serial correlation properties across cross sectional units. Tests for the Augmented Dickey Fuller (ADF) – Fisher Chi square and Phillips-Perron (PP)-Fisher Chi square assume that the time series has an individual unit root process in the null hypothesis.

Appendix 9 shows the results of the unit root tests. Wide interest margin, adversely classified loans, cash reserve requirements, concentration of deposits, non-interest income and market share were found to be integrated of order one [I(1)], while the remaining variables, inflation, gdp growth and liquid asset holdings above required holdings were stationary.

6.2.2 Panel Cointegration Tests

Panel cointegration techniques allow researchers to pool information regarding common long-run relationships from across the panel while allowing the associated short run dynamics and fixed effects to be heterogenous across different panel members.(Pedroni 1999).

The Pedroni tests allow for considerable heterogeneity among individual members of the panel, including heterogeneity in both the long-run cointegrating vectors as well as heterogeneity in the dynamics associated with short-run deviations from these cointegrating vectors. Pedroni (1999) proposes two types of tests, with both having no cointegration in the null hypothesis. The first series of tests refers to within dimension tests (or panel cointegration statistics test) and is obtained by summing both the numerator and the denominator terms over the N dimensions separately. The second set of tests is based on pooling between dimension (or group mean panel cointegration statistics) and is constructed by dividing the numerator by the denominator before summing over the N dimensions. An additional cointegration test developed by Kao (1999), as cited in Baltagi (2008), was also used to test cointegration. This test proposes an ADF-type unit root test for the residual as a test for the null of no cointegration.

Appendix 10 reports the results of these tests, with most tests rejecting the null hypothesis of no cointegration, thus implying there is a long run relationship between the wide interest margin and adversely classified loans, cash reserve requirements, concentration of deposits, market share and non-interest income.

6.2.3 DOLS Estimation

Long run estimates are derived using a panel dynamic least squares (DOLS) estimator proposed by Kao and Chiang (2000). In the DOLS framework, the regression model includes lags and leads of the first difference of the I(1) variable to correct for possible autocorrelation and endogeneity of the regressors, thus yielding unbiased estimates. In particular, the equation is given by:

$$y_{it} = \alpha_{it} + x'_{it}\beta_i + \sum_{j=-k}^k \lambda'_{ij} \Delta x^1_{it-j} + \xi_{it}$$

where x^1 denotes the subset of I(1) variables of x , β_i is the vector of long run coefficients and ξ is the residual. The equation is estimated with 5 lags and leads since the model uses quarterly data. The model is then reduced using a 'general to specific' approach, retaining only variables at the 5% level of significance. To take care of bank heteroskedasticity, the model is estimated with fixed effects using cross section weights; and the white cross section method was used to deal with cross equation correlation. The long run multipliers are presented in Table IV shown below.

Table IV. Dynamic OLS Estimation Results

Number of banks included: 5

Total panel (balanced) observations:115

Linear estimation after one-step weighting matrix

White cross-section standard errors and covariance

	LONG RUN MULTIPLIERS	
Variable	Co-efficient	t-statistics (prob)¹²
log_acl	0.0189	2.6935***
log_dep_concen	-0.0280	-7.3408***
log_mkt_share	0.0143	8.7064***
log_non_int_yoi	-0.0184	-4.6347***
log_holdings_req	0.0071	5.3741***
R-squared	0.9602	
Adjusted R-squared	0.9473	
S.E. of regression	0.0014	

The results show that in the long run, increases in adversely classified loans, market share and holdings of liquid assets above required levels are the main factors which have a significant positive impact on interest rate spreads. On the other hand, increases in the concentration of deposits and non-interest income will reduce spreads. Additionally, macroeconomic factors (gdp growth and inflation) and cash reserve requirements were not significant to the model and were removed during the reduction process.

¹²*** indicates significance at the 1% level

7.0 Comparison of Accounting & Econometric models

For the accounting model, operating cost, after-tax profits and non-interest income has the largest impact on the spreads, accounting for a respective 5.9%, 4.6% and -3.4%¹³, of the total spread of 9.1%. Similarly, the econometric model establishes a positive relationship between market share and the wide interest margin which translates to a market structure which allows commercial banks to pass on increasing costs directly to consumers via higher spreads.

In addition, the ability to pass on the costs of non-performing loans (NPLs) to borrowers via increased margins allows commercial banks to maintain positive returns despite spikes in NPLs. This is corroborated in the accounting model, with non-performing loans increasing from 6.8% in 2006 to 16.1%¹⁴ in 2010, while after tax profits still accounted for almost 20% of the spread in 2010.

Both models also confirm that non-interest income is a significant factor in reducing spreads, as the reliance on fee-based activities to generate income has been necessary to match the spiralling growth in operating cost within recent years. Based on the accounting data in Appendix 3, the diverging results between a steady and improving burden ratio versus a deteriorating efficiency ratio implies that those increases in income from fee-based activities has far outpaced the growth in income from interest-bearing activities.

¹³Represents the ten year average from 2001 to 2009.

¹⁴Source: Central Bank of Belize 2010 Annual Report

On the other hand, the accounting model shows that despite their increased contribution to the spread over the last ten years, reserve requirements represents a little more than one-tenth of the total. Similarly, the impact of cash reserve requirements was an insignificant long run factor in the econometric model and was not retained in the final model.

Other economic factors included in the econometric model but not directly assessed in the accounting model were the concentration of time deposits and the holding of liquid assets in excess of the required reserves. On its own, a higher concentration of time deposits reduces the spread accruing to commercial banks, as depositors with a large deposit base are able to negotiate higher than average deposit rates which cut into bankers' margins. In the case of increases in excess liquid holdings above requirements, the cost of holding excess deposits represents a cost to commercial banks. The extent to which the commercial bank minimizes these excess holdings above the required level depends on the adeptness of their liquidity management function. The common element which affects these two variables is the availability of a range of alternative investments which will provide flexibility for investors with different maturity needs.

8.0 Policy Implications & Recommendations

8.1 Market power, efficiency and competition

Commercial banks' ability to raise interest rates based on increased market share implies that limited incentives exist to reduce costs, as these are passed onto consumers by raising spreads. In addition, the negative relationship between non-interest income and interest

rate spreads suggests that increases in fee-based activities have been compensating for increasing inefficiency.

These two issues point to the need for increased competition among banks supported by increased transparency on interest rates and other charges. This will allow consumers to effectively evaluate their lending and borrowing options on sound and comparable criteria. Consumers must be able to compare the respective earnings and cost of interest, fees, late charges and penalties which are incurred in depositing and borrowing. Furthermore, addressing the need for a comprehensive, consumer protection policy for financial services is a cornerstone for a vibrant financial market as consumers are encouraged to take greater responsibility in their financial decision making process.

8.2 Reduction in Non-Performing Loans

When interest rates are increased to compensate for non-performing loans, this suggests that good customers pay the penalty for non-performing loans. Reductions in non-performing loans would require commercial banks to accurately assess the credit worthiness of their clients and therefore charge different lending rates to consumers based on their credit risk. The introduction of a credit bureau coupled with increased reporting standards for commercial clients would facilitate the loan adjudication process for all commercial banks across the board.

8.3 Large Institutional Deposits & Liquidity Management Issues

High-concentration deposits from large depositors are also able to distort spreads based on their leverage with the individual bank. This suggests that limited investment alternatives for large depositors facilitate the distortion of interest rate spreads, as institutional investors are highly motivated to negotiate the highest deposit rates from the commercial banking system given the perceived dearth of other viable investment options. Due to the thinness of the domestic financial market, increases in holdings of liquid assets in excess of requirements also contribute to the widening of interest rate spreads. Further, the level of excess liquid asset holdings varies widely among commercial banks, warranting an investigation on commercial banks' treasury management practices to identify the underlying factors that would induce them to hold these excess balances. Increasing the range of alternative investments available to institutional investors would improve their flexibility in managing both long term and short term investments.

9.0 Conclusions

The study reveals that increases in market share and adversely classified loans have been two main determinants of interest rate spreads in Belize. Other factors which affect the spread include increased concentration of deposits, the increased reliance on non-interest income and to a lesser extent growth in excess liquidity. The fundamental issues driving these factors are few market participants, the presence of information asymmetries in the credit markets and the limited investment instruments available to financial institutions. For commercial banks, the creation of formal networks for sharing customers' credit history via a credit bureau and requiring mandatory audited financial statements for

commercial clients are imperative for the reduction of adversely classified loans. For borrowers, greater transparency of commercial banks' effective interest rates, fees, commissions and other charges will support increased competitiveness in the financial sector.

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Appendices

Appendix 1. Derivation of Accounting Model

In the model, II represents interest income, NII represents non-interest income, IP represents interest expense, OC represents operational cost, Prov represents provision for loan losses, P represents profit or losses after taxes and T represents taxes.

$$II + NII \equiv IP + OC + Prov + P + T \dots\dots\dots(1)$$

Rearranging equation (1)

$$II - IP \equiv OC + Prov + P + T - NII$$

Dividing both sides by D

$$II/D - IP/D \equiv OC/D + Prov/D + P/D + T/D - NII/D$$

Assuming that the level of lending is restricted by the level of deposits and reserve requirements (ρ), then $1 - L/D = \rho$. Hence multiply II/D by L/L to introduce ρ in the model.

$$II/D * L/L - IP/D \equiv OC/D + Prov/D + P/D + T/D - NII/D$$

$$II/L * L/D - IP/D \equiv OC/D + Prov/D + P/D + T/D - NII/D$$

$$II/L * (1 - \rho) - IP/D \equiv OC/D + Prov/D + P/D + T/D - NII/D$$

$$II/L - IP/D \equiv II/L * \rho + OC/D + Prov/D + P/D + T/D - NII/D$$

$$i_L - i_D \equiv \rho i_L + OC/D + Prov/D + P/D + T/D - NII/D$$

Since P/A represents return on assets (ROA), we multiply P/D by A/A to introduce ROA into the model.

$$i_L - i_D \equiv \rho i_L + OC/D + Prov/D + P/D * A/A + T/D - NII/D$$

$$i_L - i_D \equiv \rho i_L + OC/D + Prov/D + ROA * A/D + T/D - NII/D$$

Appendix 2

Table A.2 Changes in Cash Reserve Requirements: 2001- 2009

Year	Policy Changes in Cash Reserve Requirements (CRR)
2002	September 28: Reserve requirements on average savings and time deposits increased from 3% to 5% and demand deposits increased from 5% to 7% November 1: CRR on demand, savings and time deposits were harmonized at 6%
2004	December 1: CRR increased from 6% to 7%
2005	May 1: CRR increased from 7% to 8%
2006	January 1: CRR increased from 8% to 9% September 1: CRR increased 9% to 10%

Appendix 3

Table A.3 Commercial Banks' Operating Costs (\$'000), 2005 – 2009

	2001	2005	2006	2007	2008	2009
Salaries and Employee Benefits	24,039	32,218	35,216	38,997	44,975	46,144
Net Expenses on Bank Premises and Equipment	11,539	15,909	19,324	21,767	20,532	23,500
Management Fees	5,728	5,194	5,441	6,713	10,271	9,536
Other Non-Interest Expenses	9,818	19,540	21,405	23,353	29,596	26,273
Total Non-Interest Expense (NIE)	51,124	72,861	81,386	90,830	107,474	105,453
Total Non-Interest Income (NII) (\$'000)	25,646	42,450	49,880	52,969	61,345	66,494
Burden (NIE - NII) (\$'000)	25,478	30,411	31,506	37,861	46,129	38,959
Burden Ratio [(NIE – NII)/ Avg. Total Assets]	2.2%	1.8%	1.8%	1.9%	2.0%	1.6%
Efficiency Ratio [NIE / (NII + Net Interest Income)]	44.8%	49.6%	50.6%	51.9%	58.8%	59.7%
Number of Branches		39	37	44	47	47
Number of ATM Machines		51	56	61	66	71
Number of Employees		795	857	942	1,017	1,039
Premises & Fixed Assets (\$'000)	37,425	57,165	56,782	54,936	56,838	56,838

Appendix 4

Table A.4 Loan Classification, Definitions & Provisioning Requirements

Loan Classification	Definition	Provision Requirement
Substandard	Loans that are: (i) Three to six months in arrears; (ii) overdraft with little or no activity for three to six months; (iii) non-performing loans to government or those fully secured by government; (iv) portion of debt that is fully secured by marketable security	Provisions equivalent to the unsecured portion of the loan.
Doubtful	Loans that are: (i) Six to twelve months in arrears unless fully secured by marketable security; (ii) overdraft has little or no activity for a period of six to twelve months; (iii) Collection of debt is highly unlikely.	Provisions equivalent to 50% of loans.
Loss	Loans that are: (i) Twelve months in arrears unless fully secured by marketable security; (ii) overdraft account shows little activity or no activity for more than twelve months; (iii) Considered uncollectible	Provisions equivalent to 100% of loans.

Appendix 5

Table A.5 Commercial Banks Taxation Rates

Year	Taxation Rates	
	PICs (%)	Non-PICs(%)
July 1998 – Jan. 2005	4	10
Feb. 2005 – Dec. 2008	8	15
Jan. 2009 – present	12	15

Appendix 6.

Table A.6 Commercial Banks' Non-Interest Income Earnings (\$'000), 2005 -2009

	2005	2006	2007	2008	2009	Average Contribution
4. Non-Interest Income:						
4.a Service Charges on Deposit Accounts	6,967	6,887	8,057	10,488	10,357	15.6%
4.b Other Service Charges, Commissions and Fees	7,364	6,232	4,999	10,394	12,683	15.1%
4.c Foreign Exchange	16,586	19,552	20,525	21,934	26,306	38.5%
4.d Other Non-Interest Income	11,533	17,209	19,388	18,529	17,148	30.9%
4.e Total Non-Interest Income	42,450	49,880	52,969	61,345	66,494	100.0%

Appendix 7

Table A.7 Summary Statistics

Variable	Empirical Definition	Unit	Mean	Standard Deviation	Data Source
Wide Interest Margin (wim)	(Interest earned from loans & commissions/ average loans) – (Interest paid on deposits/ average deposits)	percent	0.021529	0.006398	Profit & Loss Statement & Balance Sheet
Bank Specific Variables					
Operating Cost (opcost)	Non-Interest Expense	Bz\$	4210	2090.953	Profit & Loss Statement
Return on Assets (roa)	Return on Average Assets after taxes	numerical	0.023639	0.024661	FSSD Quarterly Indicators
Non-interest income (non_int_yoi)	Non-interest income divided by adjusted operating income	numerical	0.339976	0.163099	FSSD Quarterly Indicators
Adversely Classified Loans (acl)	Adversely Classified Loans/ Total Loans	numerical	0.066331	0.049864	FSSD Statistics
Excess liquid holdings above requirements (holdings_req)	(Excess Liquidity + Liquidity Requirements)/ Liquid Asset Requirements	scalar variable	1.345959	0.289444	FSSD Quarterly Indicators
Concentration of Deposits (dep_concen)	(Time deposits of Social Security Board + Credit Unions)/ Total Time deposits	numerical	0.155216	0.0944	FSSD Quarterly Indicators
Industry Specific Variables					
Market Share (mktshare)	Size of Bank's loan portfolio as a portion of total outstanding private sector loans held by commercial banks	numerical			FSSD Quarterly Indicators
Cash Reserve Requirements (cashreq)	Cash Reserve Requirements, based on changes in deposits and Central Bank's prudential requirements	Bz\$	24,934.68	17,468.87	Monthly Liquidity Reports
Tax (taxes)	Taxes/Total Assets	numerical	0.002006	0.0001652	Profit & Loss Statements
Macro Economic Variables					
Inflation	Quarterly percentage variation	numerical	0.64332	1.136421	SIB
GDP	Quarterly GDP growth	numerical	3.82081	4.35543	SIB

Appendix 8

Table A.8 Correlation Matrix

	LOG_WIM	LACL	LOG_CASHREQ	LOG_DEP_CONCEN	LOG_HOLDINGS_REQ	LOG_LIQUIDITY	.OG_MKT_SHARE	LOG_NON_INT_YOI	LOG_OVCOST	LOG_TAXES	GDP	CPI
LOG_WIM	1.000											
LACL	-0.365	1.000										
LOG_CASHREQ	0.056	0.192	1.000									
LOG_DEP_CONCEN	-0.539	0.374	-0.062	1.000								
LOG_HOLDINGS_REQ	0.103	-0.044	-0.286	0.212	1.000							
LOG_LIQUIDITY	0.160	0.137	0.929	-0.297	-0.340	1.000						
LOG_MKT_SHARE	0.224	0.067	0.747	-0.525	-0.440	0.904	1.000					
LOG_NON_INT_YOI	-0.367	0.249	-0.220	0.175	-0.125	-0.219	-0.235	1.000				
LOG_OVCOST	0.324	0.082	0.860	-0.312	-0.286	0.883	0.778	-0.221	1.000			
LOG_TAXES	0.237	-0.168	-0.057	-0.002	0.196	-0.179	-0.304	-0.234	-0.081	1.000		
GDP	0.136	-0.068	-0.268	-0.307	-0.097	-0.155	0.001	0.121	-0.166	-0.128	1.000	
CPI	0.097	-0.148	-0.062	-0.073	-0.106	-0.069	-0.002	-0.049	-0.064	-0.035	0.205	1.000

Appendix 9. Table A.9 Panel Unit Root Tests

Variables	Levels							
	L,L & C	Prob.	I,P & S	Prob.	ADF-F Chi-Sq	Prob.	PP-F Chi Sq.	Prob.
Wide Interest Margin	-1.479	0.126	-1.264	0.103	14.698	0.144	35.759	0.000
Adversely Classified Loans	1.635	0.949	1.187	0.882	9.247	0.509	9.377	0.497
Cash Reserve Requirements	-2.433	0.008	-0.428	0.335	10.663	0.384	17.023	0.074
Concentration of Deposits	0.212	0.584	0.948	0.828	5.911	0.823	5.541	0.852
Market Share	3.119	0.999	2.927	0.998	8.160	0.613	7.125	0.714
Non-Interest Income	-0.908	0.182	1.330	0.092	15.566	0.113	35.271	0.000
Liquidity holdings above Required Levles	-1.323	0.093	-2.563	0.005	29.236	0.001	39.792	0.000
GDP Growth	0.899	0.816	3.887	0.000	33.035	0.000	58.647	0.000
Inflation	-8.480	0.000	6.504	0.000	58.921	0.000	67.516	0.000
	First Difference							
	L,L & C	Prob.	I,P & S	Prob.	ADF-F Chi-Sq	Prob.	PP-F Chi Sq.	Prob.
Wide Interest Margin	-4.701	0.000	10.496	0.000	100.542	0.000	140.459	0.000
Adversely Classified Loans	-7.320	0.000	-6.369	0.000	58.235	0.000	100.560	0.000
Cash Reserve Requirements	-0.355	0.361	-4.715	0.000	41.604	0.000	91.257	0.000
Concentration of Deposits	-6.294	0.000	-6.207	0.000	55.973	0.000	112.148	0.000
Market Share	-1.497	0.067	-4.638	0.000	40.822	0.000	117.935	0.000
Non-Interest Income	-5.866	0.000	-9.713	0.000	93.486	0.000	142.789	0.000

Appendix 10. Table A.10 Pedroni& Kao Cointegration Tests

Pedroni (1999)	Panel cointegration statistics		Group-mean panel cointegration statistics
	Unweighted	Weighted	
Varaince ratio	0.9961	-1.8569*	
PP rho-statistics	-2.5294***	-1.4852**	-1.2139
PP t-statistics	-5.1317***	-5.6461***	-6.8301***
ADF statistics	-2.2554***	-4.7523***	-3.4167***
Kao Test			
ADF	-1.6713**		

***, ** and * indicates significance at the 10%, 5% and 1% levels, respectively.