The Dynamics of Bank Spreads in the Jamaican Banking Sector: An Empirical Assessment.

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Abstract

This paper investigates the dynamics of the pass-through between market rates and bank retail rates across the Jamaican banking sector. Accordingly, commercial banks, merchant banks and building societies were sampled to ascertain the extent to which their price setting behaviour influences the pass-through process. The paper builds on the framework developed by Ho and Saunders (1981) and Maudos and Fernandez de Guevara (2004) by incorporating a variable to capture the policy rate impact on the pass-through process. The results suggest that, for all three sectors, the pass-through for loans is significantly faster and more complete when compared to deposits. Additionally, for the commercial banks, the findings show that the pass-through to retail rates occurs after three quarters but is much faster (slower) for loans (deposits) when market rates adjust upwards in the commercial banking sector. Similarly, the pass-through in building societies occurred after one quarter but was slower for both loans and deposits, while a complete and full pass-through was evident in the merchant bank sector in both deposit and loan categories after two quarters. Further results across all the sectors show no clear evidence that the risk premia associated with market risk affect the pass-through process.

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1.0 Introduction

A key aspect of monetary policy transmission is the extent to which policy rates affect market rates, in particular money market rates, and how these changes affect banks' interest rates. This issue is important in assessing the effectiveness of the monetary policy since the pass-through of market rates to bank retail rates is a critical element in the monetary transmission process. A common finding in the international literature is that market conditions are not passed on to bank interest rates immediately.

The empirical literature provides evidence that corporate lending rates, in particular, respond sluggishly to market rates (see Cottarelli and Kourelis, 1994; Borio and Fritz, 1995; Mojon, 2000). For instance, when the central bank takes a monetary policy stance, there is the presumption that these official rate changes will feed through to influence the array of short-term money market rates and the rates set on retail products, such as deposit and loan accounts and mortgages. However, the extent to which monetary policy can be effective is heavily influenced by factors such as banks' price setting behaviour.

It is widely established that an important relationship exists between banks price setting behaviour and the transmission of monetary policy. For instance, as banks price their products more in line with the market, the transmission of monetary policy is typically smoother.[2] In addition, studies on the monetary transmission process in Jamaica have found this to be the case. Robinson (2000) found that the absolute size of banking spreads in Jamaica is an outcome of the factors that have defined the economic environment, such

[2] See Hannan, T. H., and A. N. Berger (1991), "The rigidity of prices: evidence from the banking industry". American Economic Review, 81, 938-945.

as, uncertainty, market structure and inefficiency. Ultimately, banks pass on these costs in terms of higher (lower) interest premiums on loans (deposit) rates.[3]

The focus in this paper will be on the price-setting behaviour of Jamaican banks as well as the pass-through mechanism from changes in official policy rates through market rates to bank rates. By applying the econometric framework originally developed by Ho and Saunders (1981), the paper estimates the dynamic adjustment of bank spreads (i.e. the difference between the bank interest rate and its corresponding market rate for various bank loan and deposits categories) to changes in monetary policy as a function of various exogenous factors, such as bank competition and financial structures.[4]

The paper is structured as follows: Section 2 presents a review of the literature underlying bank spreads. Section 3 breaks down the determinants of bank spreads and section 4 gives description of variables used in the study. Section 5 outlines the econometric framework employed in the investigation of the pass-through and its determinants and section 6 describes the data used in the study. Estimation results are shown in Section 7, robustness checks are presented in section 8 and section 9 outlines the conclusions and policy implications of the study.

[3] Robinson (2000) showed that cash reserve requirements have minimal impact on bank spreads in Jamaica. In particular, the findings showed that cash reserve requirements represent only 2.0 percentage points of a loan rate of 22.0 per cent.
[4] See Courvoiser and Gropp (2001).

2.0 Literature Review

In recognising the two-sided nature of bank spreads, several authors model lending and deposit rates simultaneously. One of these models is the dealership approach, originally proposed by Ho and Saunders (1981, 1982). Ho and Saunders (1982) advocated a two-step procedure in explaining the determinants of bank interest spreads. In the first-step, bank interest margin is regressed against a set of bank-specific variables such as non-performing loans, operating costs, capital to asset ratio and time dummies. The time dummy coefficients of this regression are interpreted as being measures of the “pure” component of a country's bank spread. In the second-step, the constant terms are re-gressed against variables reflecting macroeconomic factors. For this second step, the in-clusion of a constant term aims at capturing the influence of factors such as market struc-ture or risk-aversion coefficient, which reflect neither bank-specific observed characteris-tics or macroeconomic elements.

Following the work of Ho and Saunders (1981, 1982), Hannan and Berger (1991) showed that the pace of adjustment of deposit rates to policy rates depends on the elasticity of de-posit supply. Further, the elasticity of supply may depend on factors such as market con-centration and the depositor base of the bank. Overall, the studies found that banks tend to adjust rates in asymmetric fashion, as deposit rates tend to be more rigid in the case of interest rate increases than in periods of decreasing interest rates.

Scholnick (1996) argued that the issue of interest rate rigidity is best examined using the co-integration and error correction methodology, by utilizing results on speeds of adjustment of retail (lending and deposit) rates to changes in wholesale (inter-bank or money market) rates. A further innovation by Scholnick (1996) is the use of an asymmetric error correction methodology, which makes it possible to examine whether retail rates have greater rigidity upwards or downwards.

Angbazo (1997) studied the determinants of bank net interest margins using a sample of US banks' data over the period 1989 to 1993. The empirical model for the net interest margin/ bank spreads is postulated to be a function of a wide cross-section of variables that impact banks' price setting behaviour. The variables covered include default risk, interest rate risk, an interaction term for default and interest risk, liquidity risk, leverage, implicit interest payments, opportunity cost of non-interest bearing reserves, management efficiency and a dummy variable for states with branch restrictions. The results for the pooled sample suggest that the proxies for default risk (ratio of net loan charge-offs to total loans), the opportunity cost of non-interest bearing reserves, leverage (ratio of core capital to total assets) and management efficiency (ratio of earning assets to total assets) are all statistically significant and positively related to bank interest margins. The ratio of liquid assets to total liabilities, a proxy for liquidity risk, was inversely related to bank net interest margin. The other variables were not statistically significant.

Demirguc-Kunt and Huizinga (1999) also investigated the determinants of bank interest margins using bank-level data. This study covered 80 countries over the period 1988-1995 and utilized regressors capturing bank characteristics, macroeconomic conditions, explicit and implicit bank taxation, deposit insurance regulation, financial structure as well as legal and institutional indicators. Their findings showed that bank interest margins are positively influenced by the ratio of equity to the lag of total assets, the ratio of loans to total assets, a foreign ownership dummy, bank size, the ratio of overhead costs to total assets, the inflation rate and the short-term market real interest rate. The ratio of non-interest earning assets to total assets, on the other hand, was negatively related to bank interest margin, while output growth did not have an impact on bank spreads.

In investigating the determinants of banks' interest margins, Brock and Rojas-Suarez (2000) applied the two-step procedure developed by Ho and Sanders (1982) for a sample of Latin American countries. For each country, the first-stage of regressions for bank spread included variables such as the slope of the yield curve and time dummies as well as various microeconomic variables covering non-performing loans (NPLs), capital ratio, operating costs and a measure of liquidity. Their findings show positive and significant results for the capital, cost and liquidity ratios. However, the evidence was mixed regarding the impact of non-performing loans. They explained that this finding reflected inadequate provisioning for loan losses, which was used as a proxy for NPLs, thereby lowering the spread in the absence of adequate loan loss reserves.

3.0 Ho and Suanders (1981) & Maudos and de Guevara (2004) model of Banks' Price-Setting Behaviour

In this paper, the determinants of banks' price-setting behaviour are analyzed using the influential model developed by Ho and Saunders (1981). This paper also builds on the work of Maudos and de Guevara (2004), which extended the original model of Ho and Saunders (1981) to include the production costs associated with the process of intermediation between deposits and loans. The theoretical model captures a number of factors that influence banks' price setting behaviour such as the competitive structure of the market, operating costs, the volatility of money market rates, credit risk as well as the interaction between interest rate risk and credit risk.

Similar to the Ho and Saunders model, a bank is viewed as a dealer in the credit market and acts as an intermediary between the demanders and suppliers of funds. Furthermore, decisions are assumed to be made in a finite horizon, where the bank maximises the expected utility of terminal wealth. The bank has three components to its wealth portfolio. The first component is its initial wealth, W_0, which is invested in a diversified portfolio. Wealth is determined by the difference between the assets and liabilities. Assets comprise of the sum of loans (*L*) and money market assets (*M*), while liabilities consist of deposits (*D*). Thus, initial wealth is, $W_0 = L_0 - D_0 + M_0$. The second component is a net credit inventory, *I*, which is the difference in market values of loans and deposits, $I = L - D$. It is assumed that the credit inventory will be subject to interest rate-risk. The third component is the banks' money market position (*M*).

The operating or production costs of a banking firm are assumed to be a function of the deposits captured, $C(D)$, and the loans made, $C(L)$, so that the cost of net credit inventory *C(I)* can be expressed as $C(I) = C(L) + C(D)$.[5] Therefore, the bank's wealth portfolio at the end of the decision period is the sum of initial wealth, money market position,

[5] See Maudos and de Guevara (2004), "Factors Explaining the interest margin in the banking sectors of the European Union", *Journal of Banking and Finance.*

and net credit inventory less the cost of these net credit inventories. This can be expressed as follows:

$$\begin{aligned} W &= (1 + r_I + Z_I)I_0 + (1 + r + Z_M)M_0 - C(I_0) \\ &= I_0 + I_0 r_I + I_0 Z_I + M_0 + M_0 r + Z_M M_0 - C(I_0) \\ &= W_0(1 + r_w) + I_0 Z_I + M_0 Z_M - C(I_0) \end{aligned} \tag{1}$$

where, r_w, r_I, r are the expected rates of return on initial wealth, net credit inventory and the net cash position, respectively.[6] Uncertainty faced by the banks is captured by Z_L and Z_M, which represent interest rate risks and credit risks, respectively. The variables Z_M and Z_L are random variables distributed $Z_M \sim N(0, \sigma_M^2)$ and $Z_L \sim N(0, \sigma_L^2)$, respectively. The joint distribution of interest rate and credit risk assumes a bivariate normal function.

Through the intermediation process, banks continue to accumulate wealth based on the intermediation margins on new deposits and loans. As such, banks set loan and deposit prices, p_L and p_D, respectively, and the quantity is determined exogenously, where

$$p_L = r + b \text{ and } p_D = r - a \tag{2}$$

where a and b are the margins for deposits and loans, respectively, relative to the money market interest rate.

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[6] In equation (1) $r_I = \dfrac{r_L L_0 - r_D D_0}{I_0}$ and $r_w = r_I \dfrac{I_0}{W_0} + r\dfrac{M_0}{W_0}$ are the respective average profitability on net credit inventory and bank's initial wealth and $Z_I = Z_L \dfrac{L_0}{I_0} + Z_D \dfrac{D_0}{I_0} = Z_L \dfrac{L_0}{I_0}$ is the average risk of net credit inventory.

The bank's decision problem in the face of these transaction and interest-rate risks is to determine the expected utility-maximising deposit and loan rates, where spreads are determined by the margins on deposits and loans, $S = a + b$. The expected utility of wealth at the end of the period is approximated using the Taylor series expansion around the level of wealth, W, where $\overline{W} = E(W)$, and the expected utility of wealth is given by:

$$EU(W) = U(\overline{W}) + U'(\overline{W})E(W - \overline{W}) + \frac{1}{2}U''(\overline{W})E(W - \overline{W})^2 \qquad (3)$$

where it is assumed that the bank's utility function is concave, such that $U' > 0$ and $U'' < 0$ and, therefore, that the bank is risk averse.[7] When a new deposit, *D*, is made, if no additional credit is granted, whatever funds that are captured by the bank will be invested in the money market obtaining a return of $(r + Z_M)D$. Moreover, taking into consideration that $W - \overline{W} = L_0 Z_L + M_0 Z_M$ and given the existence of operating costs in the capture of deposits $C(D)$, substituting the new value of the final wealth in (3), the increase in expected utility associated with the new deposit is:[8]

$$\Delta EU(W_D) = EU(W_T) - EU(W)$$

$$= U'(\overline{W})\left[aD - C(D)\right] + \frac{1}{2}U''(\overline{W})\begin{bmatrix}(aD - C(D))^2 + (L + 2L_0)L\sigma_L^2 + \\ (L - 2M_0)L\sigma_M^2 + 2(M_0 - L_0 - L)L\sigma_{LM}\end{bmatrix} \qquad (4)$$

Similarly, if a new request for credit is made for which there is also a cost of production, $C(L)$, the increase in expected utility for new loans is given as:

[7] If the bank were risk neutral, the bank would be an expected wealth maximizer. That is, the bank faces no risk associated with market rates or credit facilities.
[8] See Appendix A.

$$\Delta EU(W_L) = EU(W_T) - EU(W)$$

$$= U'(\overline{W})\left[bL - C(L)\right] + \frac{1}{2}U''(\overline{W})\begin{bmatrix}(bL - C(L))^2 + (L + 2L_0)L\sigma_L^2 + \\ (L - 2M_0)L\sigma_M^2 + 2(M_0 - L_0 - L)L\sigma_{LM}\end{bmatrix} \quad (5)$$

Similar to the Ho and Saunders (1981) model, it is assumed that loans and deposits are made randomly according to a Poisson process. As such, the probability of granting a loan or capturing a deposit is represented as a decreasing function of the margins applied by the bank:

$$\begin{aligned}\Pr_D &= \alpha_D - \beta_D a, \\ \Pr_L &= \alpha_L - \beta_L b\end{aligned} \quad (6)$$

The maximisation problem, which is the linear combination of equations 4, 5 and 6, therefore becomes:

$$Max_{a,b} EU(\Delta W) = (\alpha_D - \beta_D a)\Delta EU(W_D) + (\alpha_L + \beta_L b)\Delta EU(W_L) \quad (7)$$

where total spreads, s, is equal to:

$$\begin{aligned} S = {} & \frac{1}{2}\left(\frac{\alpha_D}{\beta_D} + \frac{\alpha_L}{\beta_L}\right) + \frac{1}{2}\left(\frac{C(L)}{L} + \frac{C(D)}{D}\right) \\ & - \frac{1}{4}\frac{U''(\overline{W})}{U'(\overline{W})}\left[(L + 2L_0)\sigma_L^2 + (L + D)\sigma_M^2 + 2(M_0 - L)\sigma_{LM}\right] \end{aligned} \quad (8)$$

In the model, the competitive structure of the market is captured by the β terms. This term measures the elasticity of the demand for loans and the elasticity of deposits supply. Therefore, the less elastic the demand for credit, the less will be the value of β and the bank will be able to apply a higher margin if it exercises monopoly power. Hannan and Berger (1991) summarize these arguments in literature on the Structure-Conduct-Performance hypothesis (SCP), which asserts that higher market concentration leads to less favourable pricing to consumers due to some form of collusion among banks. That is, the interest income earned on loans are generally higher for institutions that have a larger share of the market, while interest expenses tend to be lower for these institutions.

The Maudos and de Guevara (2004) model yielded an additional term, which captures the average operating costs of banks in the determination of interest spreads. Firms that incur high unit costs will logically need to work with higher margins to enable them to cover their higher operating costs.

Another conclusion from the Maudos and de Guevara (2004) model was that spreads are affected by the volatility of money market rates, σ_M^2 in equation 8. That is, the more volatile the rates in the money market, the greater will be the market risk, which will therefore cause banks to want to operate with a higher premium for this uncertainty. From most of the empirical literature on bank spreads, the relationship between spreads and interest rate risk is statistically significant.

Credit risk in the Maudos and de Guevara (2004) model is captured by σ_L^2 in equation 8, which is defined as the risk associated with the volatility of the expected return on loans. This was included on the basis that the probability of borrowers defaulting on loans as well as the possibility of a loss of capital and interest, will likely result in a premium charged to cover the likelihood of a default. The interaction of credit and market risk, which is also a measure of default probability, was brought out in the model as having a meaningful role in the determination of bank spreads.

4.0 Description of Variables

A number of variables was employed in assessing the response of bank spreads to policy rates. The policy rate variable is proxied by the 180-day BOJ Open Market Operation (OMO) rate, which has a strong influence on market rates given that it serves as signal rate to market participants.[9] Proxies for the variable used to capture the theoretical model on banks' price setting behaviour cover the market structure, market risk and credit risk as well as the interaction between credit and market risk and operating costs.

Market Structure

In attempting to capture the market structure based on the theoretical model, two alternative measures were selected. As a proxy for market structure, the Lerner Index, which measures the degree of competition in the sector was used. The Lerner index is measured as the difference between the price of output (asset) and marginal cost as a share of the price of the asset (see equation 11). The price of asset is computed as total revenues divided by total assets.

$$LI_i = \frac{p_i - MC_i}{p_i} \qquad (11)$$

The marginal cost is based on the estimation of the cost function:

[9] Other rates were considered as a proxy for policy rates such as, the 3-month money market rate (Gropp, Sorensen and Lichtenberger, 2007)), as well as the overnight rate, this is the interest rate at which major financial institutions borrow and lend one-day (or "overnight") funds among themselves. The Bank sets a target level for this rate. However, in a study of the lead lag structure of interest rates in Jamaica (McLeod ,2008) discovered that the 180-day t-bill rates was used more than any other BOJ rates in the pricing of private rates. Moreover, the study revealed that the 180-day rate had more influence on the market and was viewed as the signal rate by market participants.

$$\ln(TC_i) = \alpha_0 + \alpha_1 \ln A_i + \frac{1}{2}\alpha_k (\ln A_i)^2 + \sum_{j=1}^{3}\beta_j \ln w_{ji} + \frac{1}{2}\sum_{j=1}^{3}\sum_{k=1}^{3}\beta_{jk} \ln w_{ji} \ln w_{ki}$$
$$+\frac{1}{2}\sum_{j=1}^{3}\gamma_j \ln A_i \ln w_{ji} + \mu_1 trend + \mu_2 \frac{1}{2} trend^2 + \mu_3 trend \ln A_i \qquad (12)$$
$$+\sum_{j=1}^{3}\lambda_j trend \ln wji + \ln u_i$$

where TC_i denotes total costs, A_i represents total assets, where $i = 1...14$ is the number of institutions in the sector. On the other hand, w_j is the price of the factors of production, and jk is the cross-product of the price of input, $\forall \; j,k = 1...3$, where:

- $w_1 =$ price of labour: personnel costs/total assets.
- $w_2 =$ price of physical capital: operating costs/fixed assets
- $w_3 =$ price of deposits: financial costs/deposits.

The cost function is estimated by including fixed effects for individual banks to capture the influence of variables specific to each bank. A trend component is used to capture of technical change and shifts in the cost function over time. As usual, the estimation is done under the restrictions of symmetry and homogeneity in the prices of inputs.

The estimated coefficients of the cost function are then used to compute the marginal cost. The marginal cost can be expressed as:

$$MC = \frac{TC_i}{A_i} \cdot \frac{d \ln TC_i}{d \ln A_i} \qquad (13)$$

where the derivative of the logarithm of the total cost with respect to the logarithm of output is computed using the cost function specified in equation (12). Equation (14), shows the derivative of the cost function in equation (12) with respect to total assets:

$$\frac{d \ln TC_i}{d \ln A_i} = \alpha_j + \alpha_k \cdot \ln A_i + \frac{1}{2}\sum_{j=1}^{3}\gamma_j \cdot \ln w_{ji} + \mu_3 \cdot trend \tag{14}$$

Market Risk

From the theoretical model, the volatility in market interest rates causes uncertainty in the money markets. As such, in proxying for this variable in the empirical model, the monthly standard deviation in the 180-day Treasury bill (t-bill) rates is used. [10]

Credit risk

In this study, credit risk is measured as the ratio of non-performing loans to total loans. This variable is a measure of the willingness and ability of borrowers to repay their loans.[11]

Operating Cost

Equation (8) reflects the importance of operating costs and quality of management in the price setting behaviour of banks. As such, both of these variables are captured by estimating a cost efficiency measure based on the translogorithmic cost function specified in equation 15:

$$\begin{aligned} \ln tc = \alpha_0 &+ \sum_{i=1}^{2}\alpha_i \ln(y_i) + \sum_{j=1}^{3}\beta_j \ln(p_j) + 1/2\sum_{i=1}^{2}\sum_{k=1}^{2}\alpha_{ik} \ln(y_i)\ln(y_k) + \\ &+ 1/2\sum_{j=1}^{3}\sum_{h=1}^{3}\beta_{jh} \ln(p_j)\ln(p_h) + \sum_{i=1}^{2}\sum_{j=1}^{3}\delta_{ij} \ln(y_i)\ln(p_j) + \in \end{aligned} \tag{15}$$

[10] This information was taken from Bloomberg as well as Jamaica Money Market Brokers (JMMB), one of the largest stockbrokers and securities dealers in Jamaica. JMMB is also considered by many to be one of the most active players in the money market and has been collecting information on GOJ bond yields from 1999 for the client purposes.

[11] Other variable were considered such as, the slope of the yield curve and was calculated as the difference in 5-year government bond yields and 3-month interbank deposit rates.

where tc is total operating and interest costs, y_1 is total loans, y_2 is all other earning assets, and p_1, p_2, p_3 are the respective prices of labour, capital and borrowed funds. It is assumed that a higher quality of management translates into a profitable composition of assets and a low cost composition of liabilities.[12] As a result, the cost of doing business would be captured as well as the efficiency of management.

Interaction between credit risk and market risk

The interaction between credit risk and market risk is proxied as the product of the measures of credit risk and interest rate risk.

5.0 Econometric Framework

The paper employs a single-stage approach to assess the adjustment of bank spreads to changes in monetary policy, similar to what was employed by McShane and Sharp (1985) and Gropp, Sorensen and Litchtenberger (2007).[13] The model is expressed as:

$$S_{it} = \phi_0 + \phi_t PR_t + \sum_{i=1}^{t} \phi_b X_{bit} + \sum_{i=1}^{t} \phi_c X_{cit} + v_b + \varepsilon_{it} \qquad (16)$$

where ε_{it} ~ i.i.d and S_{it} represents the spread of bank products $i = 1,..., N$ (savings deposits, time deposits, and the different types of loans) in period $t = 1, \ ..., T$. Policy rate, PR represents the official rate of the central bank and is used to indicate policy direction at a particular time, t . The variable X_{bit} represents the determinants of bank spreads used in the study, while X_{cit} are a set of bank specific control variables.

[12] For further discussion on the estimation of technical inefficiencies using the translogorithmic cost function in equation (15) above see Bailey (2007).
[13] In this single step method variables captured in the theoretical model were incorporated as well as an additional variable capturing movement in policy rate.

To facilitate a robust test of the dynamic adjustment of bank spreads, *S*, in response to the level of the policy rate and permit a better identification of the model, equation (16) is estimated in first differences and is represented in equation 17:[14]

$$\Delta S_{it} = \phi_0 + \phi_1 \Delta PR_{it} + \sum_{i=1}^{t} \phi_b \Delta X_{bit} + \sum_{i=1}^{t} \phi_c \Delta X_{it} + v_b + \varepsilon_{it} \tag{17}$$

where Δ denotes first differences and ΔPR_t represents the innovation of the policy rate in period *t*. The innovation in policy rate is accomplished by taking the first difference of a 180-day OMO rate, which would mean considering the expected and the unexpected component of monetary policy.[15] One caveat of estimating the model in first differences is that this would result in an elimination of structural control variables, leaving only cyclical and other time-varying variables as controls.[16]

In assessing the dynamic adjustment of bank spreads to policy rates, the framework is refined to include asymmetries in the adjustment process as well as the movement in spreads across different bank products (see equation 17a). Given that bank products may exhibit varying adjustment dynamics to policy rates, an additional estimation is conducted to capture asymmetries in the adjustment in bank spreads.[17] Based on equation (17a), when the indicator variable I^{up} is equal to one, this translates to a tightening in monetary policy.

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[14] See Gropp, Sorensen and Litchtenberger (2007)

[15] In this context, one would say that the difference between an expected and an unexpected monetary policy is that the former is well communicated to the market.

[16] One could argue that by first differencing the bank specific effects would disappear as well. However, the equation is estimated in differences given that even in first differences there may be unobserved bank specific factors.

[17] This was done to determine whether a downward change in the policy rates results in a slower adjustment in loan rates and an upward change in the policy rate would result in a faster adjustment in loan rates.

$$\Delta S_{it} = \phi_0 + I^{up} * \sum_i \phi_i \Delta PR_{it} + (1 - I^{up}) * \sum_i \phi_i \Delta PR_t + \sum_{i=1}^{t} \phi_b \Delta X_{bit} + \sum_{i=1}^{t} \phi_c \Delta X_{cit} + v_b + \varepsilon_{it} \quad (17a)$$

As such, this specification allows for different dynamics based on the direction of the policy change. In this context, the framework is useful in ascertaining whether a downward change in the policy rate results in a slower adjustment for loan rates compared to deposit rates and whether an upward change in the policy rate results in a faster adjustment for loan rates.

6.0 Data and Descriptive Statistics

The paper employs quarterly data for the period March 1996 to June 2008. Spreads are computed on three types of loans including personal credit, instalment and mortgage credit as well as four types of deposits, namely, demand, savings, short- and long-term time deposits.

It is found that policy rates (PR_t) as well as variables capturing interest rate risk, credit risk, the interaction between credit and market risk and efficiency indicators exhibit positive skewness and a peaked distribution (see Table B1, Appendix A). This means that policy rates exhibit leptokurtic behaviour, which is typical of interest rate data. Positive skewness is an indication that the probability of observing a large positive jump usually exceeds the probability of observing a large negative jump in policy rates during the sample period.

7.0 Results

The bank spread equations are estimated in first differences with the introduction of fixed effects. The results from the baseline model (**model 1**) for commercial banks, merchant banks and building societies (see Tables 1, 2 and 3) show that at the 1.0 per cent level of significance, current changes in loan spreads are negatively related to changes in the 180-day money market rate, while the opposite is true for deposit spreads.[18] That is, in the current period, when policy rate changes are made, whether upwards or downwards, banks are slow to react to these changes, hence there is a narrowing in the spreads. Gropp et al (2007) argue that if there had been a swift pass-through, changes in the market rate would fully reflect changes in bank rates, thus leaving the spread unchanged. Second, if bank rates adjust fully to changes in market rates after a lag then we would expect the sum of the response to current and lagged changes to be equal to zero.

In contrast to results by Gropp et al (2007), it is determined that in the Jamaican commercial banking sector, deposit and lending spreads only react to a temporary shock to money market rates in the current period, as the lagged changes are largely insignificant.[19]

[18] This based on the assumption that there is almost a seamless pass-through from policy rate changes to market rates.

[19] Gropp et al (2007) found in a similar study, that when lending rates adjust with a lag to a given "one off" change in market rates, for example an increase, they would expect to observe a decrease in the spreads this period (as bank rates adjust upwards more slowly). That is, a negative relationship between the change in the market rate and the change in spread. As lending rates eventually rise there is, however, a positive relationship between bank spreads and the lagged change in the market rate. Conversely, they found that deposit spreads are positively related to current changes in market rates and negatively related to the lagged change in market rates.

While bank retail rates adjust sluggishly for both loans and deposits, the pass-through is more complete for lending rates than for deposit rates. Commercial banks' lending spreads are estimated to decrease by, on average, around 69 basis points (bps) following an increase of 100 bps in market rates in the same quarter, indicating that lending rates would increase by 32 bps. In the merchant banking sector, the results suggest that a complete pass-through in lending rates is attained after two quarters (see Table 2).[20] In addition,, an assumed shock of 100 bps in market rates among building societies would cause only 0.02 bps increase in their lending rates (see Table 3).

On average, commercial banks' deposit spreads increase by 88 bps following an increase of 100 basis points in market rates, suggesting that deposit rates increase by only 12 bps after one quarter. In contrast, deposit spreads in the merchant banking sector are estimated to increase by, on average, 71 bps following an increase of 100 bps in market rates in the same period (suggesting that deposit rates increase by only 29 bps), but decrease by, on average, 72 bps in response to the lagged increase of 100 bps in market rates. The combined impact thus indicates that an increase of market rates by 100 bps results in an upward adjustment of deposit rates after two quarters by approximately 100 per cent, further indicating that there is full pass-through in this sector after two quarters. The building societies, on the other hand, display a more sluggish pass-through in their deposit rates. The results indicate that a 100 bps increase in market rates would cause deposit spreads to increase by 87 bps. As such, deposit rates increase by roughly 10 bps after one quarter.

[20] Anecdotal evidence suggest that the products and services being offered in this sector as well as competition from the other sectors would play a significant role in the rate of pass-through from money market rates to retail rates.

The control variables, namely, bank soundness, credit risk, interest rate risk, competition and efficiency, are largely insignificant across all sectors.[21] An increase in the interest rate risk facing commercial banks, as measured by the change in the monthly standard deviation of the 180-day T-bills, has a negative impact on bank spreads. This result implies that commercial banks facing higher uncertainty regarding interest rate developments tend to operate with lower spreads relative to market rates. This result largely reflects commercial banks ability to access to cheap funds, which enables them to absorb the costs, associated with this higher risk without charging higher premiums. Further results indicate that competition plays an important role in the commercial bank's pricing mechanism, as reflected by the significance of the Lerner index for competition in the model. However, in the merchant banking sector, the sign on the interest rate risk variable is positive indicating that merchant banks facing higher uncertainty regarding interest rate developments tend to operate with higher spreads relative to market rates. Intuitively, uncertainties faced by the merchant banks regarding market interest rate developments is likely to be transferred to the consumers in the form of higher premiums.

Finally, with respect to the building societies sector, the results show that changes in bank spreads are negatively related to competition. That is, as the building societies sector becomes more competitive, bank spreads are likely to fall in line with market rates.

[21] Henceforth, only those variables that are significant will be discussed.

Table 1 Estimation results: Baseline Model Commercial Banks

		Model 1 Bank Fixed effects			Model 2 Bank Fixed effects		
		$PR_{(t)}$	**PR(t-1)**	**Pass-through**	**$PR_{(t)}$**	**$PR_{(t-1)}$**	**Pass-through**
Policy Rate	Loans	-0.69 ***	-0.138	0.31			
		(0.06)	(0.05)				
	Deposits	0.881 ***	-0.012	0.13			
		(0.06)	(0.05)				
	Personal				-0.771 ***	-0.11	0.23
					(0.07)	(0.07)	
	Installment				-0.19 **	-0.26 ***	0.56
					(0.07)	(0.07)	
	Commercial				-0.69 ***	-0.10	0.31
					(0.07)	(0.07)	
	Savings				0.91 ***	0.04	0.09
					(0.07)	(0.07)	
	Time deposit (st)				0.90 ***	-0.19 **	0.30
					(0.07)	(0.07)	
	Time deposit (lt)				0.88 ***	-0.07	0.12
					(0.07)	(0.07)	
Bank Soundness		-0.239			-1.196		
		(0.95)			(0.79)		
Credit Risk		0.707			3.378		
		(2.51)			(2.08)		
Interest rate risk		-0.38 **			-0.11		
		(0.13)			(0.17)		
Competition		-1.008 *			-2.821 *		
		(2.34)			(1.95)		
Efficiency		-0.168			-1.002		
		(2.24)			(1.86)		
Observations		576			1728		
Wald Statistic		59.82***			43.86***		
R-Square		0.49			0.31		

Notes:

1) Models were estimated using fixed-effects across banks. Standard errors are in parenthesis. *,**,*** indicates significance at the 10%, 5% and 1% level, respectively.
2) The column "pass-through" reports the share of changes in bank rates after two quarters to the change in the policy rate.

Table 2 Estimation results: Baseline Model Merchant Banks

		Model 1 Bank Fixed effects			Model 2 Bank Fixed effects		
		$PR_{(t)}$	PR(t-1)	Pass-through	$PR_{(t)}$	$PR_{(t-1)}$	Pass-through
Policy Rate	Loans	-1.1371 ***	1.1906 ***	1.05			
		(0.16)	(0.14)				
	Deposits	0.7142 ***	-0.729 ***	1.01			
		(0.16)	(0.14)				
	Personal				-0.98 ***	0.97 ***	0.99
					(0.14)	(0.12)	
	Commercial				-0.94 ***	1.00 ***	1.07
					(0.14)	(0.12)	
	Time deposit (st)				0.71 ***	-0.67 ***	0.96
					(0.14)	(0.12)	
	Time deposit (lt)				0.63 ***	-0.73 ***	1.09
					(0.14)	(0.12)	
Bank Soundness		-3.00			-1.156		
		(2.24)			(1.47)		
Credit Risk		2.1385			-1.279		
		(3.25)			(2.14)		
Interest rate risk		0.5453 **			0.295 **		
		(0.28)			(0.18)		
Competition		0.6995			0.485		
		(1.78)			(1.17)		
Efficiency		0.7366			-1.817		
		(2.02)			(1.33)		
Observations		392			784		
Wald Statistic		12.83***			17.18***		
R-Square		0.25			0.23		

Notes:

3) Models were estimated using fixed-effects across banks. Standard errors are in parenthesis. *,**,*** indicates significance at the 10%, 5% and 1% level, respectively.
4) The column "pass-through" reports the share of changes in bank rates after two quarters to the change in the policy rate.

Table 3 Estimation results: Baseline Model Building Societies

		Model 1 Bank Fixed effects			Model 2 Bank Fixed effects		
		$PR_{(t)}$	PR(t-1)	Pass-through	$PR_{(t)}$	$PR_{(t-1)}$	Pass-through
Policy Rate	Loans	-0.8546 ***	-0.126 **	0.02			
		(0.16)	(0.14)				
	Deposits	0.8794 ***	0.0162	0.10			
		(0.16)	(0.14)				
	Mortgage				-0.964 ***	0.03	0.06
					(0.06)	(0.06)	
	Savings				0.824 ***	0.12 *	0.05
					(0.06)	(0.06)	
	Time deposit (st)				0.82 ***	0.00	0.18
					(0.06)	(0.06)	
	Time deposit (lt)				0.80 ***	0.10 *	0.10
					(0.06)	(0.06)	
Bank Soundness		-0.61			-1.808		
		(2.16)			(1.73)		
Credit Risk		-9.995			-3.508		
		(8.08)			(6.45)		
Interest rate risk		-0.0266			0.235 *		
		(0.18)			(0.14)		
Competition		-21.916 **			0.124		
		(9.50)			(2.29)		
Efficiency		-0.4339			-15.12 *		
		(2.86)			(7.59)		
Observations		384			784		
Wald Statistic		58.27***			64.63***		
R-Square		0.61			0.55		

Notes:

5) Models were estimated using fixed-effects across banks. Standard errors are in parenthesis. *,**,*** indicates significance at the 10%, 5% and 1% level, respectively.
6) The column "pass-through" reports the share of changes in bank rates after two quarters to the change in the policy rate.

In order to assess how individual bank products react to changes in market rates, **model 2** shows the disaggregation across different products for all sectors. The results are considerably different in some cases depending on the loan and deposit categories, as well as depending on the final pass-through after two quarters. For loans in the commercial banking sector, the pass-through is sluggish, except for instalment credit, which shows that after two quarters, the pass-though would approximate 56 bps after a 100 bps increase in market rates. Consistent with a priori expectations, loans in the building societies sector have a similar sluggish pass-through given that their loan portfolio is highly dominated by mortgage-related loans. Loans in the merchant banking sector, across all categories, have full pass-through after two quarters.

Across the sectors, the pass-through in rates is generally more sluggish and significantly less complete for deposit rates relative to loan rates. However, for short-term time deposits, the pass-through amount to 30 bps, 96 bps and 18 bps for commercial banks, merchant banks and building societies. These figures indicate a swift pass-through relative to the other deposit segments that have an average pass-through of 0.06 bps across all sectors.

7.1 Extension of Model

In order to investigate whether the pass-through is asymmetric, equation (17a) was estimated with different slopes for periods when market rates increased and when they decreased across all three banking sectors.[22] According to Gropp et al (2007), the pass-through to retail rates could be asymmetric if the price elasticity of demand is low or if competition is less than perfect. As such, banks would adjust loan rates more quickly when interest rates are increasing than when they are decreasing and vice versa for deposit rates.

The results obtained suggest that there is some evidence of asymmetry in the pass-through. Model 3 shows that in the case of commercial banks, while loan rates adjusted upwards quickly in response to market rate increases, the same can be said of loan rates

[22] Over the sample period the 180-day money market rate (PR_t) increased approximately 56.0 per cent of the total number of quarters.

when market rates adjust downwards.[23] The results, for building societies were largely similar to those of the commercial banks for the parsimonious model (see Appendix A, Table 6). For the merchant banks, the results indicate that loan rates adjusted faster and more completely when rates adjusted upwards than when they were moving downwards. Conversely, deposit rates tended to adjust more completely after two quarters when interest rates were declining (see Appendix A, Table 5).

The product specific effects of the parsimonious model indicate that rates on personal, commercial and instalment loans were insensitive to declines in market rates.

On the other hand, savings and time deposits rates adjust more quickly and completely when market rates adjusted downwards, which is consistent with the findings of Gropp (2007). For the merchant banks and the building societies, the results were uni-directional for loan rates (mortgages, personal, commercial, and instalment) as the statistical test indicated that when market rates adjusted downwards, there were minimal movements in loan rates.

[23] In the case of the deposit rates, the movements were largely in accordance with those of Hannan Berger (1991) and Gropp (2007) in which they found that deposit rates tended to adjust faster and more completely after two quarters when interest rates are declining.

Table 4 Estimation results: Baseline Model Commercial Banks

		Model 3 Asymmetry			Model 4 Asymmetry		
		$PR_{(t)}$	PR(t-1)	Pass-through	$PR_{(t)}$	$PR_{(t-1)}$	Pass-through
Loans	up	-0.187 ***	0.0188 **	0.83			
		(0.02)	(0.02)				
	down	0.234 ***	-0.26 ***	0.97			
		(0.04)	(0.04)				
Deposits	up	0.157 ***	-0.012	0.84			
		(0.02)	(0.02)				
	down	-0.179 ***	0.1829 ***	1.00			
		(0.04)	(0.04)				
Personal	up				-0.202 ***	0.0215	0.80
					(0.03)	(0.03)	
	down				0.08	-0.197	0.88
					(0.05)	(0.05)	
Commercial	up				-0.172 ***	0.02 ***	0.83
					(0.03)	(0.03)	
	down				0.15 **	-0.226	0.93
					(0.05)	(0.05)	
Installment	up				-0.083 ***	0.0757 ***	0.99
					(0.03)	(0.03)	
	down				0.10 *	-0.063	1.04
					(0.05)	(0.05)	
Savings	up				0.167 ***	0.003	0.83
					(0.03)	(0.03)	
	down				-0.21 ***	0.2039 ***	1.21
					(0.05)	(0.05)	
Time deposit (st)	up				0.13 ***	-0.047 **	0.91
					(0.03)	(0.03)	
	down				-0.18 ***	0.2814 ***	1.18
					(0.05)	(0.05)	
Time deposit (lt)	up				0.1491 ***	-0.022	0.85
					(0.03)	(0.03)	
	down				-0.156 ***	0.2387 ***	1.16
					(0.05)	(0.05)	
Observations		576			1728		
Wald Statistic		38.89***			20.26***		
R-Square		0.22			0.14		

Notes:

7) Models were estimated using fixed-effects across banks. Standard errors are in parenthesis. *,**,*** indicates significance at the 10%, 5% and 1% level, respectively.
8) The column "pass-through" reports the share of changes in bank rates after two quarters to the change in the policy rate.

8.0 Robustness Checks

To permit robustness checks, the baseline models for the sectors were estimated under different conditions to ensure consistency under different specifications (see Appendix). The models were estimated with and without fixed effects as well as with random effects across sectors and product segments (see Appendix A, Tables 4, 5 and 6; model R1). Furthermore, the models were estimated using a seemingly unrelated regression (SUR) (see Appendix A, Tables 4, 5 and 6; model R2). The results obtained with these alternative specifications were essentially the same as with the results obtained with our baseline **models 1** and **2**.

9.0 Conclusion

It is a well-known feature of monetary policy operations that central banks aim to exercise control over short-term interest rates by adjusting the official rate. Moreover, it is also commonly assumed that there is complete transmission to short-term rates within a short period. Furthermore, studies on bank spreads are crucial given that with complete pass-through monetary policy can be more efficient in its ability to control inflation.

The results of this study are generally consistent with the empirical literature on pass-through and bank spreads. It was determined that bank spreads tended to adjust very slowly to official policy rate changes. The findings may suggest that the stickiness of deposit spreads largely reflect the fact that banks exert a moderate degree of market power in the market for retail products. The results also showed that there are significant differences in the adjustment processes for the different categories of loan and deposit products. The rates on saving deposits displayed a high degree of rigidity and, as a result, reactions to changes in market rates were almost non-existent.

Findings from this study also suggest that commercial banks hold a fair degree of market power in the market for loans and deposits due to their dominance in the banking sector. As such, there should be a concerted effort to enhancing the competitive environment for banks by encouraging the availability of alternative capital market-based instruments for financing investment in order to increase access to financing (e.g. for small and medium size enterprises). This can be done by promoting innovation in the non-bank financial sector.

In addition, the results provide evidence of asymmetry in the pass-through process, as banks tend to adjust loan rates more quickly in relation to changes in policy rates when rates are increasing than when they are declining, while the opposite holds for deposit rates. Additionally, results from the study indicates that if banks' loan portfolio comprises largely insensitive assets then monetary policy would be less effective under such conditions and vice versa.

The findings of Maudos and Guevara de Fernandez (2004), and Gropp Reint, Kok Sørensen Christoffer and Lichtenberger Jung-Duk (2007) suggest the potential benefits to be gained from enhanced risk management practices. Strengthened risk management practices enables banks to charge lower premia, which will result in lower spreads, thus amplifying the effects of monetary policy changes on bank interest rates. However, we find that in Jamaica risk premia may not have such a significant impact on banks' price setting behaviour.

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Appendix A

Taking into account Eq. (5), the expected utility of the bank is [24]

$$EU(W) = U(\overline{W}) + U'(\overline{W})E(L_0 Z_L + M_0 Z_M) + \frac{1}{2}U''(\overline{W})E(L_0 Z_L + M_0 Z_M)^2$$
$$= U(\overline{W}) + \frac{1}{2}U''(\overline{W})(L_0^2\sigma_L^2 + M_0^2\sigma_M^2 + 2L_0 M_0 \sigma_{LM}) \quad \text{(A.1)}$$

When a new deposit, D, is made, the banking firm has to pay $r_D D$ and operating costs $C(D)$, and will obtain a return $(r + Z_M)D$ in the money market. In this way, the bank's final wealth will be:

$$W_T = (1 + r_I + Z_I)I_0 - (1 + r_D)D + (1 + r + Z_M)M_0 + (1 + r + Z_M)D - C(I_0) - C(D)$$
$$= W_0(1 + r_w) + L_0 Z_L + aD + (M_0 + D)Z_M - C(I_0) = C(D) \quad \text{(A.2)}$$

and expected utility after the new deposit has been made is given by the following expression:

$$EU(W_T) = U(\overline{W})E(W - \overline{W}) + \frac{1}{2}U''(\overline{W})E(W - \overline{W})^2$$
$$= U(W) + U'(\overline{W})\left[aD - C(D)\right]$$
$$+ \frac{1}{2}U''(\overline{W})\left[(aD - C(D))^2 + L_0\sigma_L^2 + (M_0 + D)\sigma_M^2 + 2L_0(M_0 + D)\sigma_{LM}\right] \quad \text{(A.3)}$$

Given the level of wealth after the arrival of the new deposit, the increase in expected utility is as follows:

$$\Delta EU(W_D) = EU(W_T) - EU(W)$$
$$= U'(\overline{W})\left[aD - C(D)\right] + \frac{1}{2}U''(\overline{W})\begin{bmatrix}(aD - C(D))^2 \\ + (D + 2M_0)D\sigma_M^2 + 2L_0 D\sigma_{LM}\end{bmatrix} \quad \text{(A.4)}$$

[24] Given by $\overline{W} = E(W) = E(W_0(1 + r_w) + L_0 Z_L + M_0 Z_M - C(I_0) = W_0(1 + r_w) - C(I_0)$.

In the same way, if the bank grants a new credit for an amount L it will receive an income $r_L L = (r + b + Z_L)L$, and incur operating costs $C(L)$ and costs of financing the granting of credits $(r + Z_M L)$.

Analogously to the receiving of deposits, the increase of the bank's expected utility due to the granting of an additional credit will be

$$\begin{aligned}\Delta EU(W_T) &= EU(W_T) - EU(W) \\ &= U'(\overline{W})\left[bL - C(L)\right] \\ &\quad + \frac{1}{2}U''(\overline{W})\begin{bmatrix}\left(bL - C(L)\right)^2 + (L + 2L_0)L\sigma_L^2 \\ + (L - 2M_0)L\sigma_M^2 + 2(M_0 - L_0 - L)L\sigma_{LM}\end{bmatrix}\end{aligned} \tag{A.5}$$

Bearing in mind the probabilities of granting credits or capturing deposits reflected in Eq. (8), the problem of maximization of (9) can be written:

$$\begin{aligned}Max_{a,b}EU(\Delta W) &= (\alpha_D - \beta_D a)\begin{bmatrix}U'(\overline{W})\left[aD - C(D)\right] \\ + \frac{1}{2}U''(\overline{W})\begin{bmatrix}(aD - C(D))^2 \\ + (D + 2M_0)D\sigma_M^2 + 2L_0 D\sigma_{LC}\end{bmatrix}\end{bmatrix} \\ &\quad + (\alpha_L - \beta_L b)\begin{bmatrix}U'(\overline{W})\left[bL - C(L)\right] \\ + \frac{1}{2}U''(\overline{W})\begin{bmatrix}(bL - C(L))^2 + (L + 2L_0)L\sigma_L^2 \\ + (L - 2M_0)L\sigma_M^2 + 2(M_0 - L_0 - L)L\sigma_{LM}\end{bmatrix}\end{bmatrix}\end{aligned}$$

The first-order conditions with respect to a and b gives rise to the spreads of equation (10).

The first order condition with respect to *a* and *b* are[25]

[25] It is assumed, following Ho and Saunders (1981) and subsequent extensions that the second-order terms of the margins and costs of the Taylor's expansion of expressions (6) and (7) are negligible.

Deposit Taking Institutions: 1996-2008

Institution Name	Abbr. Name	Previous Name
Bank of Nova Scotia	BNS	None
National Commercial Bank	NCB	None
Royal Bank of Trinidad and Tobago	RBTT	Union Bank of Jamaica UBJ, now RBTT was a result of the transfer of assets and liabilities of six (6) financial institutions to Citizens Bank. The amalgamated entities were Citizens Merchant Bank Ltd., Corporate Merchant Bank, Island Life Merchant Bank, Workers Savings and Loan Bank, Island Vitoria Bank, and Eagle Commercial Bank.
First Caribbean International Bank Jamaica Ltd	FCIBJ	Canadian Imperial Bank of Commerce CIBC. CIBC later became Bank of Commerce Jamaica Ltd. On November 12, 1975, the bank was incorporated as CIBC West Indies Holdings Limited (incorporated in Barbados) purchased CIBC's 55.2 per cent share in CIBC Jamaica Ltd. on a share exchange basis. The metamorphosis continued on October 30, 2002 when the bank was incorporated locally as First Caribbean International Bank (FCIB) Jamaica Ltd. FCIB is currently an amalgamation of the retail, corporate and offshore banking operations of CIBC West Indies Holdings Ltd. and Barclays Bank, PLC in the Caribbean, its majority shareholders.
First Global Bank	FGB	FGB was formerly known as First Jamaica National Bank (FJNB) Ltd. In December 1992, Trafalgar Development Bank acquired GJNB from Jamaica National Building Society. The institution was renamed Trafalgar Commercial Bank (TCB) on the 26 of June 1993. As part of a rebranding exercise, TCB had its name changed to First Global Bank Limited, with effect from 11 December 2001.
Citibank		
FIAS		
Capital and Credit Merchant Bank	CCMB	None
Citi Merchant Bank Ltd.	CITIMER	

DB&G Merchant Bank Ltd.	DB&G	DB&G formerly Billy Craig merged the assets and liabilities of Issa Trust and Merchant Bank, in August 2003.
MF&G Trust & Finance	MF&G	None
Pan-Caribbean Merchant Bank	PCMB	PCMB is the outcome of the merger of the assets and liabilities of Pan Caribbean Merchant Bank and Manufacturers Sigma Merchant Bank MSMB on June 1, 2004. MSMB itself was the outcome of the merger of Manufacturers Merchant Bank (MMB) and Sigma Management Systems (SIGMA) Ltd.
Building Societies		
First Caribbean International Building Society (FCIBS)	FCIBS	FCIBS today is a result of the rebranding of CIBC Building Society following the merger of its retail, corporate and offshore banking operations of CIBC and Barclays Bank PLC in the Caribbean on October 30, 2002.
Jamaica National Building Society	JNBS	None
Scotia Building Society	SJBS	None
Victoria Building Society	VMBS	None

Table B1. Descriptive Statistics

	policy rate	*interest risk*	*credit risk*	*credit*interest*	*Lindex*	*Efficiency*
Mean	19.23	0.93	0.08	0.08	0.56	1.45
Standard Error	0.31	0.05	0.01	0.01	0.03	0.04
Median	16.08	0.72	0.04	0.02	0.58	1.12
Mode	12.00	1.37	-	-	-	2.04
Standard Deviation	8.10	1.33	0.14	0.18	0.82	1.00
Sample Variance	65.64	1.78	0.02	0.03	0.66	1.00
Kurtosis	3.12	20.64	41.87	29.93	64.00	38.81
Skewness	1.76	4.16	5.20	4.85	-6.52	5.38
Range	35.58	8.65	1.78	1.76	13.85	10.87
Minimum	12.00	0.02	-	-	-9.76	1.00
Maximum	47.58	8.67	1.78	1.76	4.09	11.87
Sum	13,458.17	650.57	57.44	59.23	393.41	1,016.87
Count	700	700	700	700	700	700

Table 4 Estimation results: Baseline Model Commercial Banks

		Model R1 No effects plus SUR			Model R2 No effects plus SUR		
		$PR_{(t)}$	PR(t-1)	Pass-through	$PR_{(t)}$	$PR_{(t-1)}$	Pass-through
Policy Rate	Loans	-0.673 ***	-0.118 **	0.21			
		(0.06)	(0.05)				
	Deposits	0.867 ***	-0.027	0.16			
		(0.06)	(0.05)				
	Personal				-0.795 ***	-0.05	0.21
					(0.07)	(0.07)	
	Installment				-0.21 **	-0.20 ***	0.59
					(0.07)	(0.07)	
	Commercial				-0.72 ***	-0.04	0.25
					(0.07)	(0.07)	
	Savings				0.86 ***	0.07	0.14
					(0.07)	(0.07)	
	Time deposit (st)				0.85 ***	-0.16 **	0.32
					(0.07)	(0.07)	
	Time deposit (lt)				0.83 ***	-0.043	0.17
					(0.07)	(0.07)	
Bank Soundness		-0.379			-2.434		
		(0.13)			(1.03)		
Credit Risk		0.832			2.109		
		(2.53)			(1.22)		
Interest rate risk		-0.379 **			-0.204		
		(0.13)			(0.12)		
Competition		0.982			-0.442		
		(2.37)			(0.39)		
Efficiency		1.181			0.21		
		(1.98)			(0.20)		
Observations		576			1728		
Wald Statistic		58.32***			42.57***		
R-Square		0.49			0.29		

Notes:

1) Models were estimated using fixed-effects across banks. Standard errors in parenthesis. *,**,*** indicates significance at the 10%, 5% and 1% level, respectively.
2) The column "pass-through" reports the share of changes in bank rates after two quarters to the change in the policy rate.

Table 5 Estimation results: Baseline Model Merchant Banks

		Model R1 No effects plus SUR			Model R2 No effects plus SUR		
		$PR_{(t)}$	$PR_{(t-1)}$	Pass-through	$PR_{(t)}$	$PR_{(t-1)}$	Pass-through
Policy Rate	Loans	-1.1264 ***	1.1109 ***	0.98			
		(0.17)	(0.16)				
	Deposits	0.8059 ***	-0.799 ***	0.99			
		(0.08)	(0.08)				
	Personal				-0.993 ***	0.97 ***	0.97
					(0.16)	(0.15)	
	Commercial				-1.00 ***	0.99 ***	0.99
					(0.15)	(0.14)	
	Time deposit (st)				0.69 ***	-0.68 ***	0.98
					(0.07)	(0.07)	
	Time deposit (lt)				0.71 ***	-0.72 ***	1.01
					(0.09)	(0.08)	
Bank Soundness		-0.53			0.147		
		(1.17)			(1.15)		
Credit Risk		-1.1174			-2.638		
		(1.70)			(1.67)		
Interest rate risk		0.26 **			0.283 **		
		(0.14)			(0.14)		
Competition		0.5446			0.473		
		(0.93)			(0.91)		
Efficiency		-0.2307			-0.954		
		1.03			(1.01)		
Observations		392			784		
Wald Statistic		16.74***			18.41***		
R-Square		0.28			0.23		

Notes:

1) Models were estimated using fixed-effects across banks. Standard errors in parenthesis. *,**,*** indicates significance at the 10%, 5% and 1% level, respectively.
2) The column "pass-through" reports the share of changes in bank rates after two quarters to the change in the policy rate.

Table 6 Estimation results: Baseline Model Building Societies

		Model R1 No effects plus SUR			Model R2 No effects plus SUR		
		$PR_{(t)}$	$PR_{(t-1)}$	Pass-through	$PR_{(t)}$	$PR_{(t-1)}$	Pass-through
Policy Rate	Loans	-0.8546 ***	-0.126 **	0.02			
		(0.16)	(0.14)				
	Deposits	0.8794 ***	0.0162	0.12			
		(0.16)	(0.14)				
	Mortgage				-0.923 ***	0.00	0.08
					(0.08)	(0.07)	
	Savings				0.861 ***	0.09 *	0.05
					(0.05)	0.05	
	Time deposit (st)				0.85 ***	-0.04	0.15
					(0.05)	(0.04)	
	Time deposit (lt)				0.83 ***	0.06	0.17
					(0.06)	(0.06)	
Bank Soundness		-1.70			0.656		
		(3.95)			(2.41)		
Credit Risk		-1.70			-2.277		
		(3.95)			(4.78)		
Interest rate risk		-0.0834			-0.02 *		
		(0.15)			(0.18)		
Competition		-21.916 **			-0.218		
		(9.50)			(0.74)		
Efficiency		-0.4339			0.203 *		
		(2.86)			(0.59)		
Observations		384			784		
Wald Statistic		57.75***			47.69***		
R-Square		0.58			0.45		

Notes:

1) Models were estimated using fixed-effects across banks. Standard errors in parenthesis. *,**,*** indicates significance at the 10%, 5% and 1% level, respectively.
2) The column “pass-through” reports the share of changes in bank rates after two quarters to the change in the policy rate.

Table 7 Estimation results: Baseline Model Merchant Banks

		Model 3 Asymmetry			Model 4 Asymetry		
		$PR_{(t)}$	$PR_{(t-1)}$	Pass-through	$PR_{(t)}$	$PR_{(t-1)}$	Pass-through
Loans	up	-0.2323 ***	0.026 ***	0.77			
		(0.05)	(0.05)				
	down	0.1199 *	-0.28 ***	0.72			
		(0.09)	(0.09)				
Deposits	up	0.113	-0.026	0.91			
		(0.05)	(0.05)				
	down	-0.2109 **	0.2744 **	0.94			
		(0.09)	(0.09)				
Personal	up				-0.227	0.059 **	1.06
					(0.04)	(0.04)	
	down				0.071	-0.205	1.07
					(0.08)	(0.08)	
Commercial	up				-0.204 ***	0.02	0.80
					(0.04)	(0.04)	
	down				0.089	-0.12	1.09
					(0.08)	(0.08)	
Time deposit (st)	up				0.104 **	-0.019	0.90
					(0.04)	(0.04)	
	down				-0.23 **	-0.23 **	1.23
					(0.08)	(0.08)	
Time deposit (lt)	up				0.096 **	-0.037	0.90
					(0.04)	(0.04)	
	down				-0.162 *	-0.162 **	1.16
					(0.08)	(0.08)	
Observations		392			784		
Wald Statistic		16.74***			18.41***		
R-Square		0.28			0.23		

Notes:

1) Models were estimated using fixed-effects across banks. Standard errors in parenthesis. *,**,*** indicates significance at the 10%, 5% and 1% level, respectively.
2) The column "pass-through" reports the share of changes in bank rates after two quarters to the change in the policy rate.

Table 8 Estimation results: Baseline Model Building Societies

		Model 3 Asymmetry					Model 4 Asymmetry				
		$PR_{(t)}$		$PR_{(t-1)}$		Pass-through	$PR_{(t)}$		$PR_{(t-1)}$		Pass-through
Loans	up	-0.1446	***	-0.029		0.86					
		(0.03)		(0.03)							
	down	0.1981	***	-0.261	***	0.94					
		(0.05)		(0.05)							
Deposits	up	0.1658	***	-0.025		0.83					
		(0.03)		(0.03)							
	down	-0.1265	**	0.2318	***	0.89					
		(0.05)		(0.05)							
Mortgage	up						-0.128	***	-0.006		0.87
							(0.03)		(0.03)		
	down						-0.011		-0.389	***	0.61
							(0.05)		(0.05)		
Savings	up						0.17	***	0.021		0.83
							(0.03)		(0.03)		
	down						-0.18	**	0.31	***	0.87
							(0.05)		(0.05)		
Time deposit (st)	up						0.15	***	-0.029		0.85
							(0.03)		(0.03)		
	down						-0.106	*	0.27	***	1.11
							(0.05)		(0.05)		
Time deposit (lt)	up						0.154	***	0.005		0.85
							(0.03)		(0.03)		
	down						-0.068		0.246	***	1.07
							(0.05)		(0.05)		
Observations		384					784				
Wald Statistic		57.75***					47.69***				
R-Square		0.58					0.45				

Notes:

1) Models were estimated using fixed-effects across banks. Standard errors in parenthesis. *,**,*** indicates significance at the 10%, 5% and 1% level, respectively.
2) The column "pass-through" reports the share of changes in bank rates after two quarters to the change in the policy rate.