THE EFFECT OF TERM SPREADS ON MALAYSIAN COMMERCIAL BANK ACTIVITY

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I. INTRODUCTION

The effect of fluctuation of market interest rates on banking activities has been an important theoretical issue for many years. Samuelson (1945) provided earlier treatment on this issue. He indicates that bank profits increase as interest rates increase. The extent of the effect of fluctuation in market interest rates on bank profitability largely depends on the sensitivity of bank assets and liabilities towards changes in these rates. Later study by Hancock (1985) confirms this conjecture. Hancock (1985) finds that higher level of market interest rates improve banking profitability. Earlier, Ho and Saunders (1981) indicate that bank interest rates spreads are affected by the volatility in the open market rates.

In this paper, the impact of changes in bank term spreads on banking profitability is investigated. Since both side of bank balance sheets are affected by market interest rates, and following the result indicated by Ho and Saunders (1981), the impact of its volatility on bank spread is first examined. Test results of the vector autoregression analysis indicate that bank term spread for an asset and liability is influenced by the changes in open market rates. The impulse response functions show that the low response of the long-term asset rates contribute to the decline in the spreads immediately following shock to open market rates. This also contributes to the decline in ratio of long-term asset to total asset. Results for the liability side of the balance sheet, however, shows an opposite direction. The long-term liability rates respond positively immediately following shock to open market rates and therefore produce upward sloping spreads. This, however, causes the ratio of long-term liability to total assets respond negatively. The presentation of the paper is as follow; Section 2 discusses the literature related to the issue of this pa This is followed by description of the model in Section 3. Section 4 discusses data and methodo employed in this study followed by discussion of the empirical results of the analysis in Se 5. Finally, a brief conclusion is presented in Section 6.

II. TERM SPREAD AND COMMERCIAL BANK PROFITABILITY

The effect of interest rates and term spreads movement on economic activity has bee important theoretical issue for many years. According to recent studies, these two variable able to predict economic activities (see, for example Bernanke 1990; Bernanke and Blinder Stock and Watson 1989). The fact that term spread inverts prior to business slowdowns increasing steadily ahead of expansionary cycles attracted volume of studies by various resea in examining the information content of the term spread. The first to document this iss Kessel (1965). He notes that the spread narrowed before approaching economic contractio widened before economic upswing. His findings is supported by Fama (1986) who notes 'term premiums tend to increase with maturity during good times, but humps and inversi the term structure of expected returns are typical during recessions'.

Recent empirical evidence show that various measures of term spreads are shown vital information of the future states of macroeconomic variables such as short-term rates, inflation, output and consumption. Earlier works on predictive power of term stru focus on its ability to predict future interest rates movement. Evidence produced by Fama Hardouvelis (1988) and Mishkin (1988) are consistent with the hypothesis that vital inform about future movement of interest rates is embodied in the current observed spot rates.

In a different perspective, several recent studies support the role of term spread as indicator that signals future economic conditions. Harvey (1988), for example, proves tha spread possesses superior power in predicting consumption path of U.S economy. Harvey shows that the Canadian bond market contains valuable information about future Canadian economy. He also argues that this information is unique beyond the inform embodied in the U.S. term structure. Portion of Canadian business cycle, which ca explained by the U.S. term structure is captured by domestic term structure.

Stock and Watson (1989) highlights the significant contribution of the ten-year and U.S. Treasury bond spread in their newly constructed index of leading indicators. The of the reaction of output measures (GNP, investments, and consumption) toward increase spread is produced by Strongin (1990). It is shown that output react positively toward increased term spread and up to forty two percent of variance in output forecast is due to shocks in spread. Estrella and Hardouvellis (1991) provide same favourable results. The four-quarter ahead level of term spread, which is defined as the difference between the annualized bond equivalent yield of the ten-year bond and three-month T-bill rates, is shown to be an accurate indicator of NBER-dated recessions period.[1]

Several recent studies argue on the weakening power of term spread in recent years. Haubrich and Dombrosky (1996) show that term spreads are not able to accurately predict GDP growth when data set is limited to post-1985. Dotsey (1998) also notes that inclusion of other variables such as lagged output and level of short-term rates reduces the predictive power of the spread between the discount equivalent yield on the ten-year U.S. Treasury bond and the three-month Treasury bill. The root mean square errors (RMSE) of out of sample forecast with or without term spread are not significantly different suggesting non-uniqueness of information content of term spread.[2]

Although the literature on models of term structure is extensive, the commercial bank's term spreads, i.e. the difference between long and short-term interest rates of asset and liability have drawn relatively less attention in the literature. It is widely known that commercial banks activities greatly rely on their intermediation services, which links suppliers and demanders of fund. The bank's profitability is therefore depends on the difference between interest charged on loans and interest paid to depositors. Pyle (1971) shows that the larger this spread, the more likely the necessary condition for intermediation to occur can be met.

It has also been widely accepted that the changes in market interest rates exert significant influence on commercial bank revenues, costs, and profitability. It is therefore has become an increasingly concern to economists and policy makers. Samuelson (1945) earlier provided this issue. He shows that under general conditions bank profits increase with rising interest rates. He notes "The banking system as a whole is immeasurably helped rather than hindered by an increase in interest rates ….. and commercial banks would profit more than savings bank" (Samuelson 1945, p. 25). Hancock (1985) later confirmed this conjecture.

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[1] The probability of recession is calculated based on a time series probit model. Estrella and Mishkin (1998) and Dueker (1997) using various other measures of term spread and economic activity perform similar analysis. Both conclude on the superiority of term spread. The yield curve slope remains the single best recession predictor compared to other measures of leading indicators.

[2] Skeptical views on the ability of term spread to predict future inflation is also argued in several studies (see Fama (1990), Mishkin (1990), and Koedijk and Kook (1995). Fama (1990) and Mishkin (1990) reject the ability of term spread to predict inflation in the short run but support its significance for the long run forecast. As shown later, this is inline with our findings that term spread has no information of short run variations in stock prices but assume significant role in the long run movement.

The impact of changes in market interest rates on bank interest spreads, or better known as interest rate risk, has been analyzed by various researches (see Flannery and James 19 Yourougou 1990; Akella and Greenbaum 1992; and Madura and Zarruk 1995). The widesp notion of 'borrow short and lend long' is argued as the main source of interest rate risk fa by commercial banks.

Flannery (1981) explains that banks cost and revenue could respond to the fluctuation market interest rates for two reasons. First reason is due to the different average maturities the asset and liability portfolios. This imbalance of maturities subject banks to nonsynchro refunding which could affect the bank badly when market interest rates rise. In view of Tobin (1982) presented a simple model of precautionary portfolio decision by profit-maximi bank that tries to minimize the cost of unanticipated withdrawals. Since bank would be pena in case deposit withdrawals exceed its defensive position, it must therefore decide on its volu of earnings assets and defensive assets. Second, even if the duration of its assets and liabili are perfectly matched, its profitability may still respond differently to the fluctuation of ma interest rates if borrowers and depositors have different elasticities of substitution between securities and market securities.

Ho and Saunders (1981) dealership model of interest margins provides a theoretical m for investigating the relationship between interest rate risk and bank net interest margins. T show that bank will demand a positive interest spread as the price of providing immedia loans and deposits which arrive at different times. It was also shown that the 'pure sprea the margin due to transactions uncertainty, is positively and significantly affected by intere volatility. Following this, Slovin and Sushka (1983) indicate that deposit markets have no influence on commercial loan rates. Overall, the asset and liability of bank operations dichotomized. The loan rate is shown as a positive function of open market interest rates the deposit rates are not. In a related study, Hancock (1985) shows that bank profitabili elastic in loan rates, but inelastic with respect to deposit rates.

However, since deposit instruments as well as assets with various maturities (e.g., 'short' 'long') are available, the question of the appropriate volume of these instruments be meaningful. This is discussed by Niehans and Hewson (1976, appendix), in a 'term stru model where the bank has to choose between long- and short-term deposits and loans an direction and extent of maturity transformation, i.e. different amounts of various maturi the two sides of the balance sheet. Therefore, it is the purpose of this paper to provi evidence of this issue.

In the early eighties, interest rate liberalization occurred in Malaysia and this has freed interest rates from a controlled regime. Interest rates are now more exposed to the influence of open market interest rates and this might have an effect on bank profitability. Therefore, the impact of market rates fluctuation on bank term spreads is a critical issue and need to be investigated. Though numerous studies have documented the behaviour of U.S. commercial banks interest term spreads with respect to fluctuations in open market rates, this result cannot be used to make inferences about banks of other countries as the operations of banks in the U.S. differ from those in other countries. While the banking system has been globalized, banks still retain their country-specific characteristics such as bank regulations. In this study, using data on Malaysia, vector autoregression (VAR) analyses is performed to shed some lights on this issue for commercial banks of a small economy.

III. THE MODEL

Consider a bank, which makes decision in a single period horizon. The bank acquires two kinds of assets that differ in maturity: short-term asset (A_{st}) and long term asset (A_{lt}). At the same time, the bank holds two types of claims: short-term liability (L_{st}) and long-term liability (L_{lt}). The bank earns interest rates r_{st}^{a} for its short-term asset and r_{lt}^{a} for its long-term asset. For each type of claims, the bank has to pay interest rates r_{st}^{l} and r_{lt}^{l}, respectively.

Net interest income (NII), i.e. the gap between the total interest income the bank receives on assets and the total interest cost of its borrowed funds, provides the life blood of bank's earnings. NII is usually a key determinant of bank profitability. Therefore, NII can be written as follow:

$$NII = \left((A_{st})(r_{st}^{a}) + (A_{lt})(r_{lt}^{a}) \right) - \left((L_{st})(r_{st}^{l}) + (L_{lt})(r_{lt}^{l}) \right) \tag{1}$$

The balance sheet identity can be written as:

$$A_{st} + A_{lt} = L_{st} + L_{lt}$$

Banks term spreads are given by

$$S^{AA} = r_{lt}^{a} - r_{st}^{a},$$

$$S^{LL} = r_{lt}^{l} - r_{st}^{l}, \text{ and}$$

$$S_{st}^{AL} = r_{st}^{a} - r_{st}^{l} \tag{2}$$

Subject to the above constraint and using the spreads given in (2), NII can be rewritten as follow (refer to APPENDIX for the derivation):

$$NII = A_{lt}(S^{AA}) - L_{lt}(S^{LL}) + (A_{st} + A_{lt})(S^{AL}_{st}) \quad (3)$$

Goudreau and King (1991) suggest three profitability measures: net interest margin, return on assets (ROA) and return on equity (ROE). Briefly, net interest margin indicates a bank's interest revenues less interest costs as a proportion of interest-earning assets. For the purpose of this study, the sum of A_{st} and A_{lt} is used to represent the interest-earning assets. Using this assumption, commercial banks' profit function (π) derived from (3) is

$$\pi = \frac{NII}{TOTAL\ ASSET} = \frac{A_{lt}(S^{AA}) - L_{lt}(S^{LL}) + (A_{st} + A_{lt})(S^{AL}_{st})}{A_{st} + A_{lt}} \quad (4)$$

Since the study is about banking term spread and profitability, (4) is simplified further as below

$$\pi = \left[\frac{A_{lt}}{A_{st} + A_{lt}}\right](S^{AA}) - \left[\frac{L_{lt}}{A_{st} + A_{lt}}\right](S^{LL}) + S^{AL}_{st} \quad (5)$$

Following Slovin and Sushka (1983) who found that changes in market interest rates are fully and quickly transmitted to bank loan rate, it is therefore assumed that the spreads are all endogeniously determined by market interest rates. With this assumption, the profit function is

$$\pi = \left[\frac{A_{lt}}{A_{st} + A_{lt}}\right]\left(S^{AA}(i_{mkt})\right) - \left[\frac{L_{lt}}{A_{st} + A_{lt}}\right]\left(S^{LL}(i_{mkt})\right) + S^{AL}_{st}(i_{mkt}) \quad (6)$$

Accordingly, based on equation (6), the level of bank term spreads dictate the volume of asset and liability that the bank should hold. A positive S^{AA} indicates that the holding of long-term asset A_{lt} in proportion to total assets should be increasing. In contrast, a positive S^{LL} signals decline in holding of long-term liability L_{lt} in proportion to total assets. The spread of the short-term asset and liability will have no effect on the volume of asset and liability that the bank holds, and would always be positive.

This study adds to the list of literatures on predictive power of term spread in several ways. Most of the existing studies generally use final output measures as dependent variable to predictive power of term spread. In this study, I move one step forward. I investigate whether term spread leads to the movement of bank's operation. As the trend towards deregulation continues, banks will have to devote more attention to the management of their term spreads. The results of the study will give clear understanding of how banks adjust their balance sheet components in response to changes in the banking environment. In addition, this study is based on data set of a developing country that is experiencing rapid financial progress. Though there are numerous studies that document the behaviour of U.S. commercial banks with respect to changes in interest rates, literature on countries like Malaysia is almost negligible. The findings of this study will therefore add to the list of literature on term spread.

III. DATA AND METHODOLOGY

The analysis of the link between term spread and banking activity covers a period of ten years (1987:1 to 1997:12). The data set is extracted from the Monthly Statistical Bulletin of the Bank Negara Malaysia (Central Bank of Malaysia). The first data set involves monthly observation of commercial banks assets and liabilities of two different maturities, i.e. Treasury bills and term loans of more than four years for the assets and savings deposits and fixed deposits for the liabilities. The sum of savings deposits, one-month fixed deposit, three-month fixed deposit and six-month fixed deposit is taken as short-term liability while the sum of nine-months and twelve-months fixed deposits as long term liability.

As for the interest rates, interest rates for three-month t-bills are taken as the short-term asset rates and the reported average lending rates as the long-term asset rates. The interest rates for the short-term liability are derived by taking the average of savings deposits rates, one-month, three-months and six-months fixed deposits rates while the interest rates for the long-term liability are derived by taking the average of nine-months and twelve-months fixed deposit rates. The measurements of money market rates, i.e. one-month and three-month interbank rates, are used as proxy for the open market rates. In Malaysia, policy makers and financial analysts closely watch the movement of Kuala Lumpur interbank rates (KLIBOR). Data series for the asset and liability are expressed in annualized month to month growth.

Figure 1, 2 and 3 show the general pattern of spread and both market interest rates over the period tested. Figure 1a and 1b indicates opposite movement between spread and open market rates. Figure 2a, 2b, 3a and 3b show the close movement of spreads with open market rates from 1987 to about 1994,which then begin to indicate opposite movement to the end of the period. Figure 4a and 4b show the pattern of spreads and long term asset and long-term liability as proportion to total assets, respectively. Figure 4a indicates a close movement of long-term asset with spreads over the entire period tested while Figure 4b shows an opposite movement betw spreads and long-term liability. Despite this graphical illustrations, identifying and analyzing the exact relationship among these variables using proper econometric is still required.

This paper uses vector autoregression (VAR) methodology similar to Sims (1980) to obt a better understanding of banking activities and the way it interacts with other variables su as bank term spreads. A vector autoregressive process for a system of M varia $y_t = (y_{1t},\ldots, y_{Mt})$ may be defined as follow

$$y_t = v + \Theta_1 y_{t-1} + \ldots + \Theta_p y_{t-p} + v_t$$

In this system of M equations $\mathbf{v} = (v_1,\ldots, v_m)$ is an M-dimensional vector, the

$$\Theta_i = \begin{bmatrix} \theta_{11,i} & \cdots & \theta_{1M,i} \\ \vdots & \ddots & \vdots \\ \theta_{M1,i} & \cdots & \theta_{MM,i} \end{bmatrix}$$

are (M x M) coefficient matrices and $\mathbf{v} = (v_1,\ldots, v_m)$ has the same stochastic propert reduced-form errors in simultaneous equations system. In other words, $E[v_1] = 0$, and the sa covariance matrix $\sum_v = E[v_t v_t]$ for all t. v_t's are serially uncorrelated.

The VAR permits us to perform two important tasks: (1) decompose the variance of in rates to determine the sources of its volatility, and (2) examine the dynamic interactions be variables through the use of impulse response functions, which measure the speed of adju among variables (Sim 1980). In the VAR analysis, each variable can be expressed mathema as linear combination of its and other variables' current and past forecast errors (residual Such decomposition enables us to estimate the proportion of its future variations that ca explained by itself and by the forecast errors of other variables. This procedure is the va decomposition analysis.

All variables, such market interest rates and spreads, in the VAR system are moving a representations of their respective residual terms (forecast errors), thus we can exami impact of the change of these forecast errors on the dependent variable (e.g., spread impulse response analysis identifies the changes over time in the dependent variable th caused by the unit change in the residual error terms of itself or other variables. As this

...to examine the relationship between market interest rates, spreads and ratio of asset (liability) to total interest-earning assets, the model is therefore as specified below:

$$KLIBOR_t = \alpha_1 + \sum_{j=1}^{n} a_{1j} KLIBOR_{t-j} + \sum_{j=1}^{n} b_{1j} SPREAD_{t-j} + \sum_{j=1}^{n} c_{1j} RATIO_{t-j} + e_{1t}$$

$$SPREAD_t = \alpha_2 + \sum_{j=1}^{n} a_{2j} KLIBOR_{t-j} + \sum_{j=1}^{n} b_{2j} SPREAD_{t-j} + \sum_{j=1}^{n} c_{2j} RATIO_{t-j} + e_{2t}$$

$$RATIO_t = \alpha_3 + \sum_{j=1}^{n} a_{3j} KLIBOR_{t-j} + \sum_{j=1}^{n} b_{3j} SPREAD_{t-j} + \sum_{j=1}^{n} c_{3j} RATIO_{t-j} + e_{3t} \quad (7),$$

where KLIBOR represent market interest rates one- and three-months, SPREAD reflects bank term spread during year t, RATIO represents ratio of asset (liability) to total assets; and a_{ij}, b_{ij} and c_{ij} are constants to be estimated. n is the number of lags for each variable and would be 3, 6, 9 and 12.

V. RESULTS AND DISCUSSION

Figure 5a and 5b displays the response of interest rates, spreads and ratio of asset (liability) to total assets to market rates shocks for four different lags. The first column shows the effect of an unexpected increase in market interest rates on interest rates. The second and third column shows the effect on the corresponding spreads and ratio to total asset (liability), respectively.

From Figure 5a, all lags show a positive response of interest rates immediately following the market rates shock. Initially, shocks to both market rates at all lags increase the short rates above the long rates and therefore produce a negative spread (S^{AA}). However, the short rates start to decline and become smaller than the long rates, on average, at the tenth period which then turns the spread positive. This spread keeps on increasing right after it turns positive. Unfortunately, strong evidence of the hypothesized sign for ratio of asset to total assets can only be found in Figure 5a, rows three, five and seven. The results show that only one-month market rate shocks at lag six, nine and twelve will have an effect on this ratio positively; a pattern consistent with the model. However, the increase in this ratio stabilizes at about the tenth period while the positive spread is still increasing during this period.

Figure 5b present the effect of shocks to market rates on interest rates and its corresponding spreads and ratio of long-term liability to total assets. All lags show a positive response of interest rates immediately following the market rates shock with the long rates always above the short rates. This produces a positive spread (S^{LL}). The persistence of market rates effect on spreads shows an interesting pattern. The effect increases as the lag increases. Lag 3 shows the shortest persistence of three months and lag twelve shows a continuous persistency through out the twenty-four months period. All lags seem to produce the hypothesized sign of the ratio of liability to total assets though there are some delay for some of the lags. For example, for lag 9, spread has started to decline beginning period seven, and to be consistent with the model, the corresponding ratio should start to increase. However, these changes only begin to take place two periods later.

The variance decomposition analyses from VAR estimations are presented in Table 1, Table 2 and Table 3. Table 1a and 1b reports the results of the variance decomposition of S^{AA} and S^{LL}, respectively, for lag 3, 6, 9 and 12. Test results find that forecast error variance for those spreads are explained by both open market rates. On average, innovations in three-month open market rates contribute more effect to the variation in the variance of both spreads at all lags.

The analysis in Table 2a shows that innovations in the market rates are responsible for the variation in asset interest rates variance for up to twenty-four months period. Overall, innovations in three-months open market rates contributes more than innovations in one-month open market rates on the variation in the variance of long-term asset rates. The largest contribution is for lag 12, followed by lag 3, lag 6 and lag 9, which on average explained about 38.88%, 38.15%, 33.98% and 32.65% of interest rates variance respectively. The explanation power is significant for all period. A similar result is produced for the short-term asset rates with the largest contribution is for lag 6, followed by lag 9, lag 12 and lag 3 which on average explained about 50.3[illegible]%, 42.40%, 43.87% and 39.13% of interest rates variance respectively. Innovations in one-month open market rates contributes more on the variation in the variance of long-term asset rates (average of 34.07%) than on the variation in the variance of short-term asset rates (average of 29.27%). A contrasting result is produced by innovation in three-month open market rates where it contributes more on the variation in the variance of short-term asset rates (average of 43.[illegible]%) than on the variation in the variance of long-term asset rates (average of 35.92%). Initially, the innovations in market rates have more effect on the short-term rates. The effects due to innovations in one-month open market rates ranges from 3 to 8 months, which lag 12 shows the shortest period for this reaction and lag 6 shows the longest period of the same reaction. The same pattern of results is produced when innovations are given on the three-month open market rates. This explains why the graph of the impulse response function given in Figure 2 shows a negative response of the spreads immediately following the market rates shock and turns positive some months later.

Table 2b reports the variance decomposition for short-term and long-term liability rates. Results produced by Table 2a shows that innovations in one-month open market rates contributes more on the variation in the variance of long-term asset rates (average of 46.11%) than on the variation in the variance of short-term asset rates (average of 40.95%). Innovations in three-month open market rates explained about 45.46% of long-term liability rates variance and 42.73% of short-term liability rate variance. This explains why the graph of the impulse response function given in Figure 2b shows a positive response of the S^{LL} immediately following the market rates shock.

The objective of this paper is to examine how the components of bank balance sheet changes when its corresponding spreads changes. Its impulse response function has been discussed earlier. Table 3a and 3b reports the variance decomposition of both asset and liability ratios to total asset. An innovation to one-month open market rates shows that S^{AA} explained an average of 23.19% of asset ratio variance. Innovations to three-month open market rates produce slightly higher percentage (average of 23.61%). Compared to decomposition of variance presented in Table 3a, the percentage of liability ratio variance explained by its corresponding spreads is very much lower, with an average of only 2.69% and 3.35% for an innovations to one-month and three-month open market rates, respectively. The open market rates explain more of this liability ratio variance (average of 16.97% for one-month open market rates and 16.8% for three-month open market rates). Thus, liability ratios are shown to be more affected by the open market rates as compared to the asset ratios.

VI. CONCLUSIONS

The effect of changes in bank term spread, i.e. the difference between long-term asset (liability) rates and short-term asset (liability) rates, on banks profitability is investigated in this paper. The analysis is done in two stages. First, the reaction of bank term spread towards changes in open market rates is examined. This analysis is crucial since both sides of bank balance sheets are subject to changes in open market rates. Finally, the reaction of ratio of long-term asset (liability) to total assets to changes in its corresponding spreads is investigated.

The analysis on Malaysian banking industry using data 1987:1 to 1997:12 reveals that bank term spread is significantly influenced by changes in open market rates. Although, the liability rates are shown to be more affected by changes in the open market rates, the reaction of its spreads towards these changes is not as high as the reaction of the asset spreads. In addition, the second part of the analysis reveals that the liability ratios are less affected by changes in its spreads as compared to the effect shown by the asset ratios towards changes in its corresponding spreads. Therefore, the hypotheses derived from the model of this study are supported. Bank can take advantage from the increase in its asset spreads by increasing its ratio of long-term asset to total asset, and at the same time reduce its liability ratio if its spreads is increasing and thus maximize its profitability.

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Figure 1a

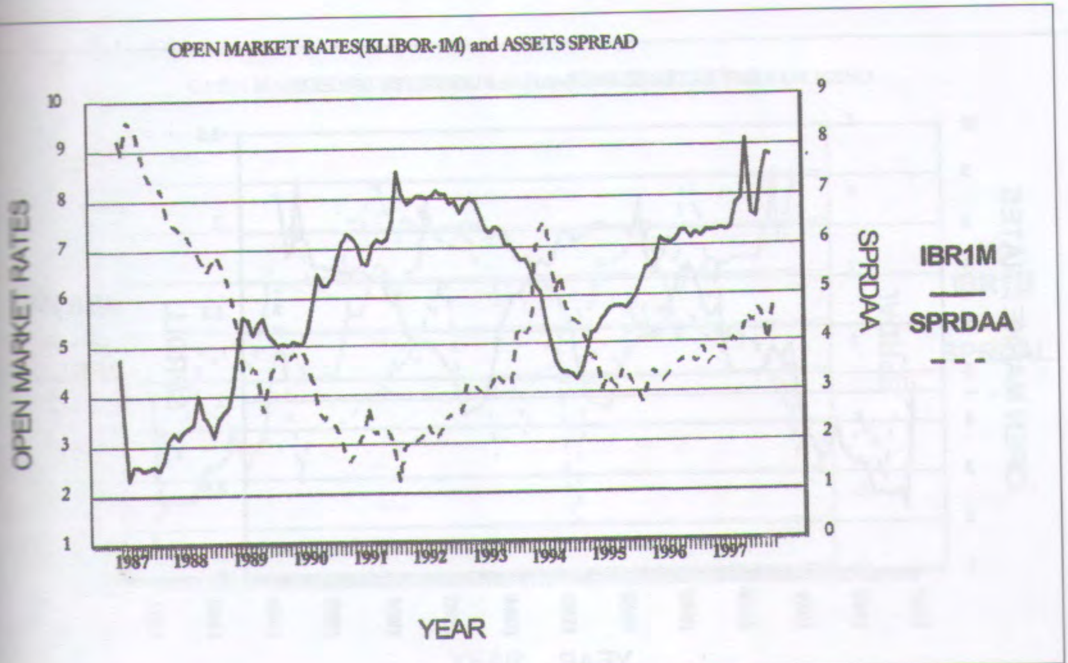

Figure 1b

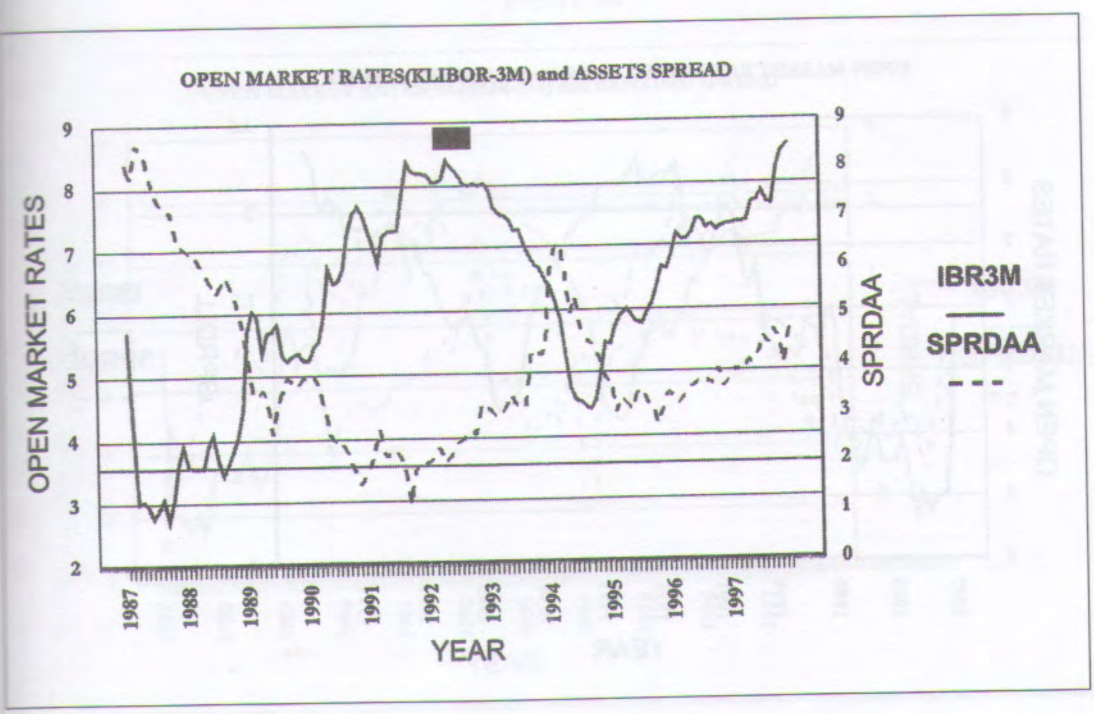

Figure 2a

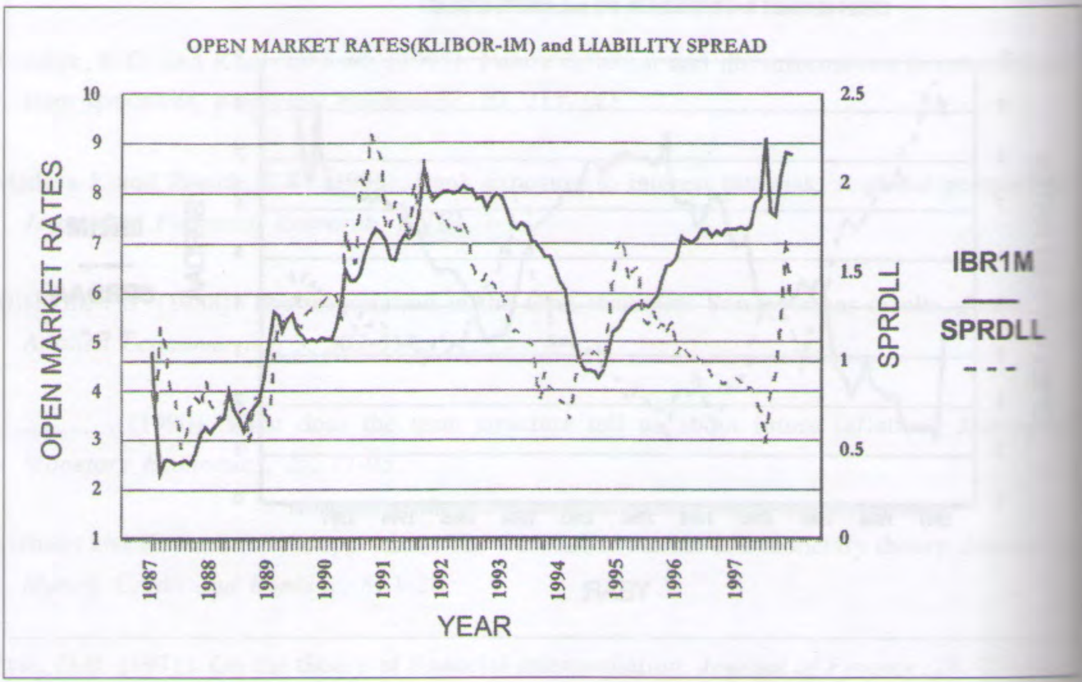

Figure 2b

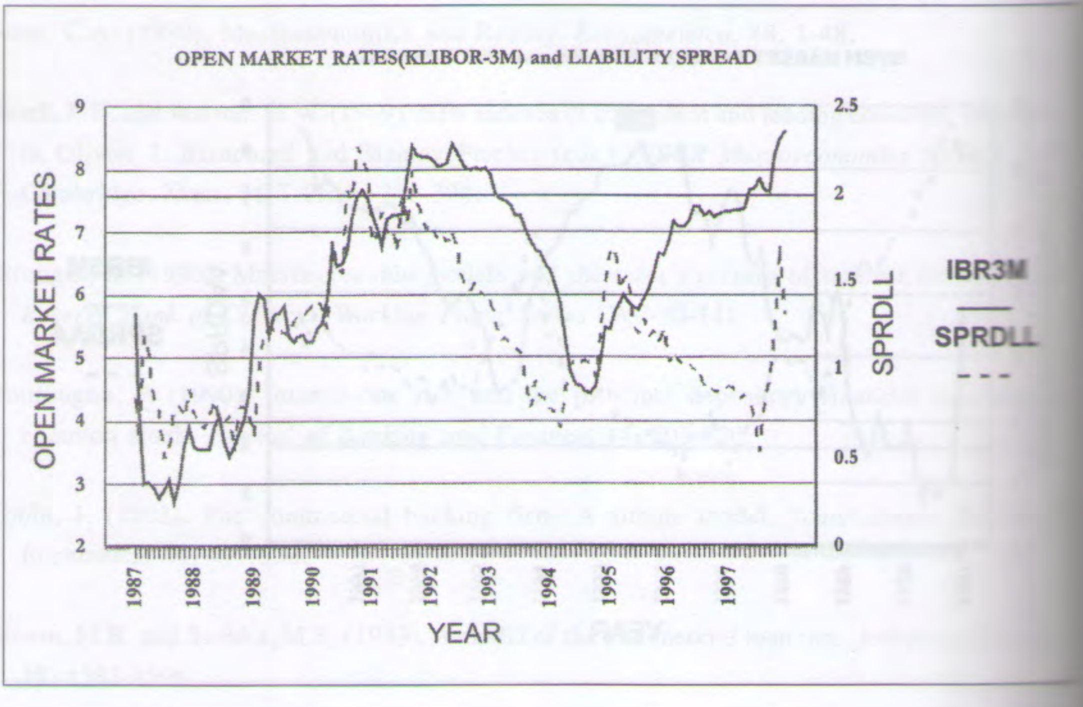

Figure 3a

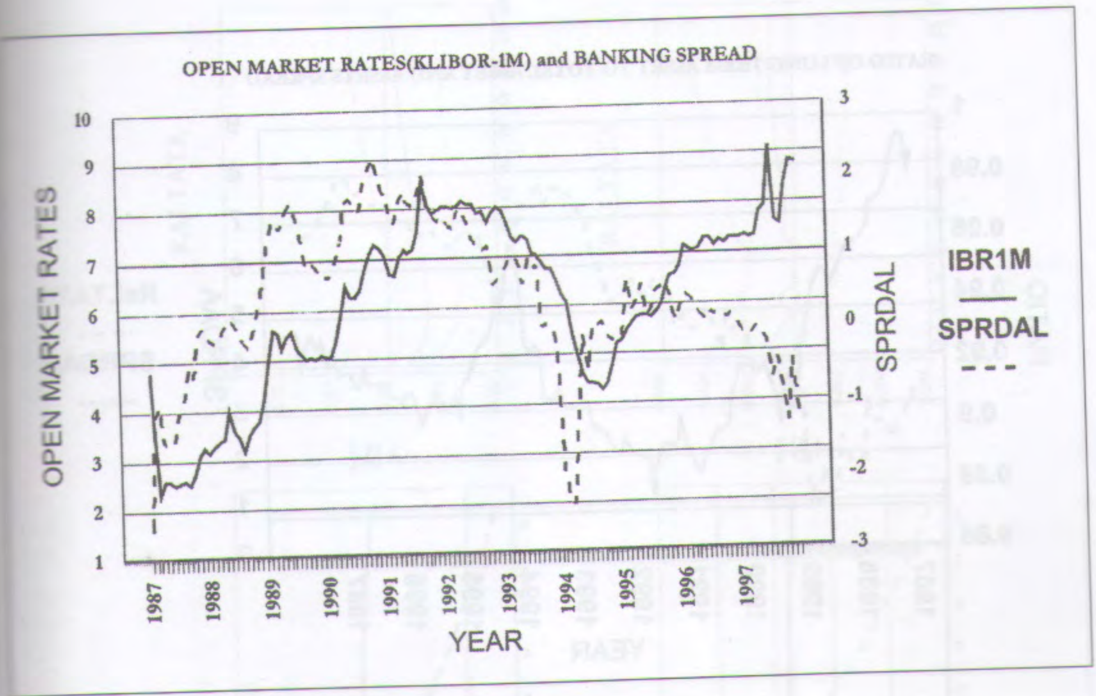

Figure 3b

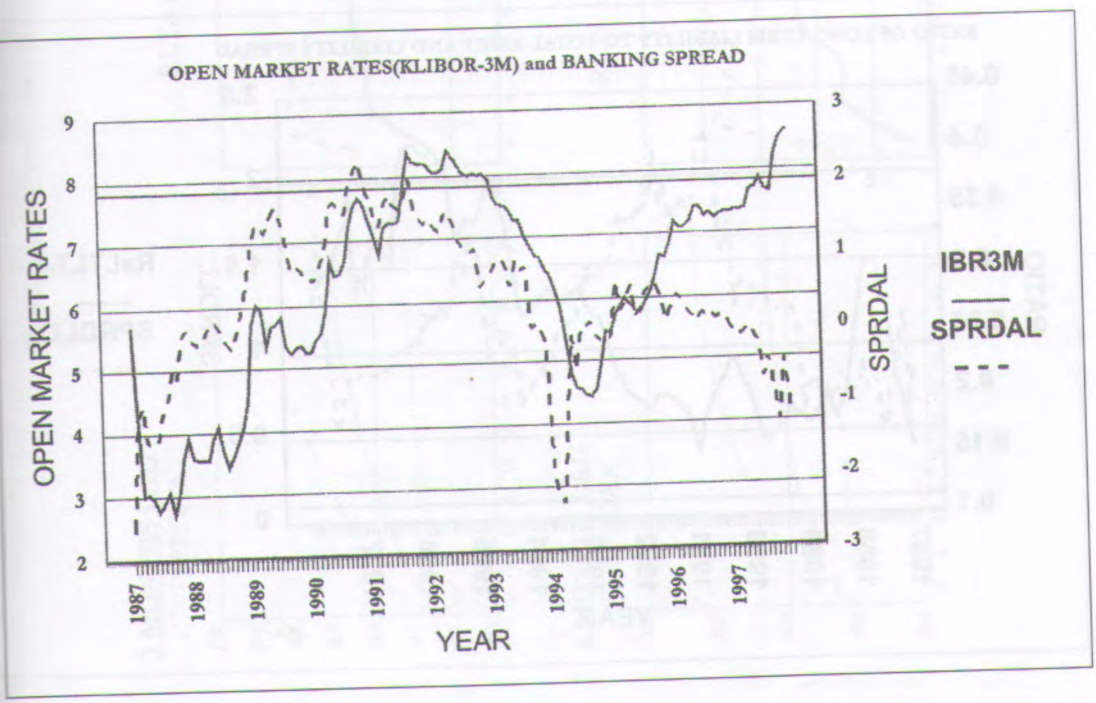

Figure 4a

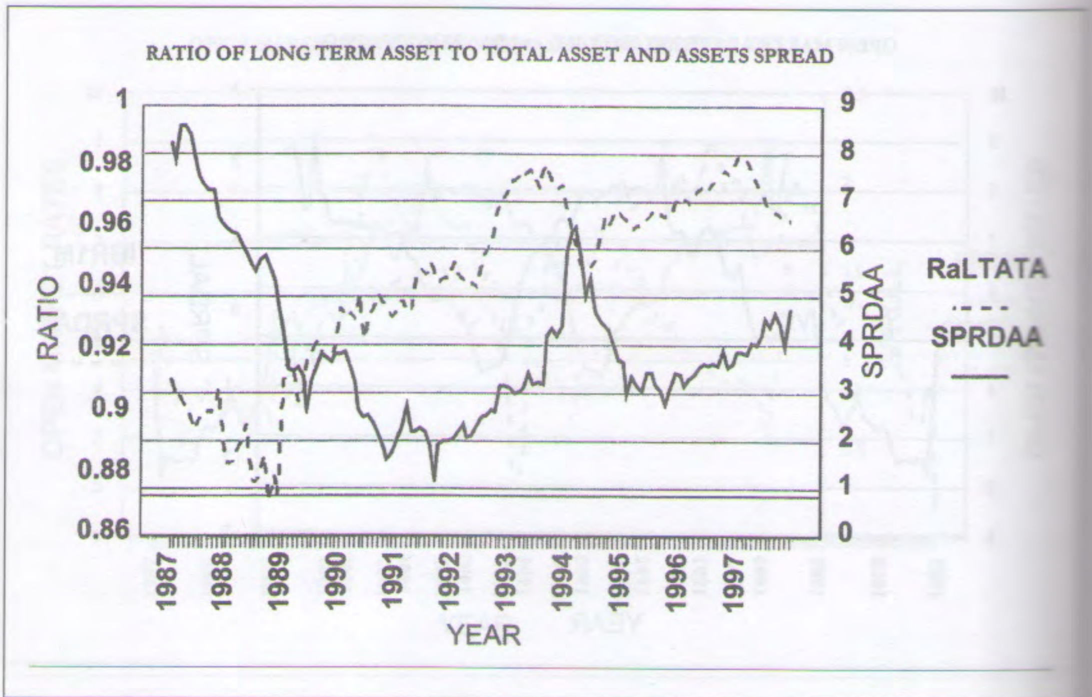

Figure 4b

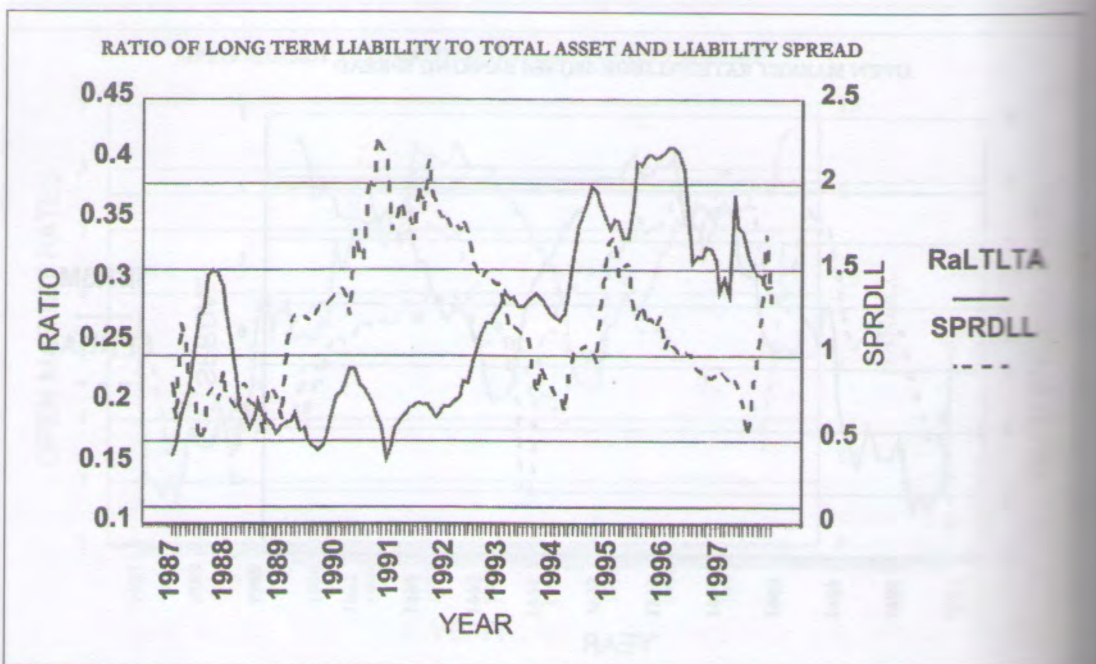

Figure 5a: RESPONSE TO ONE S.D INNOVATIONS ± 2 S.E (Klibor1M)

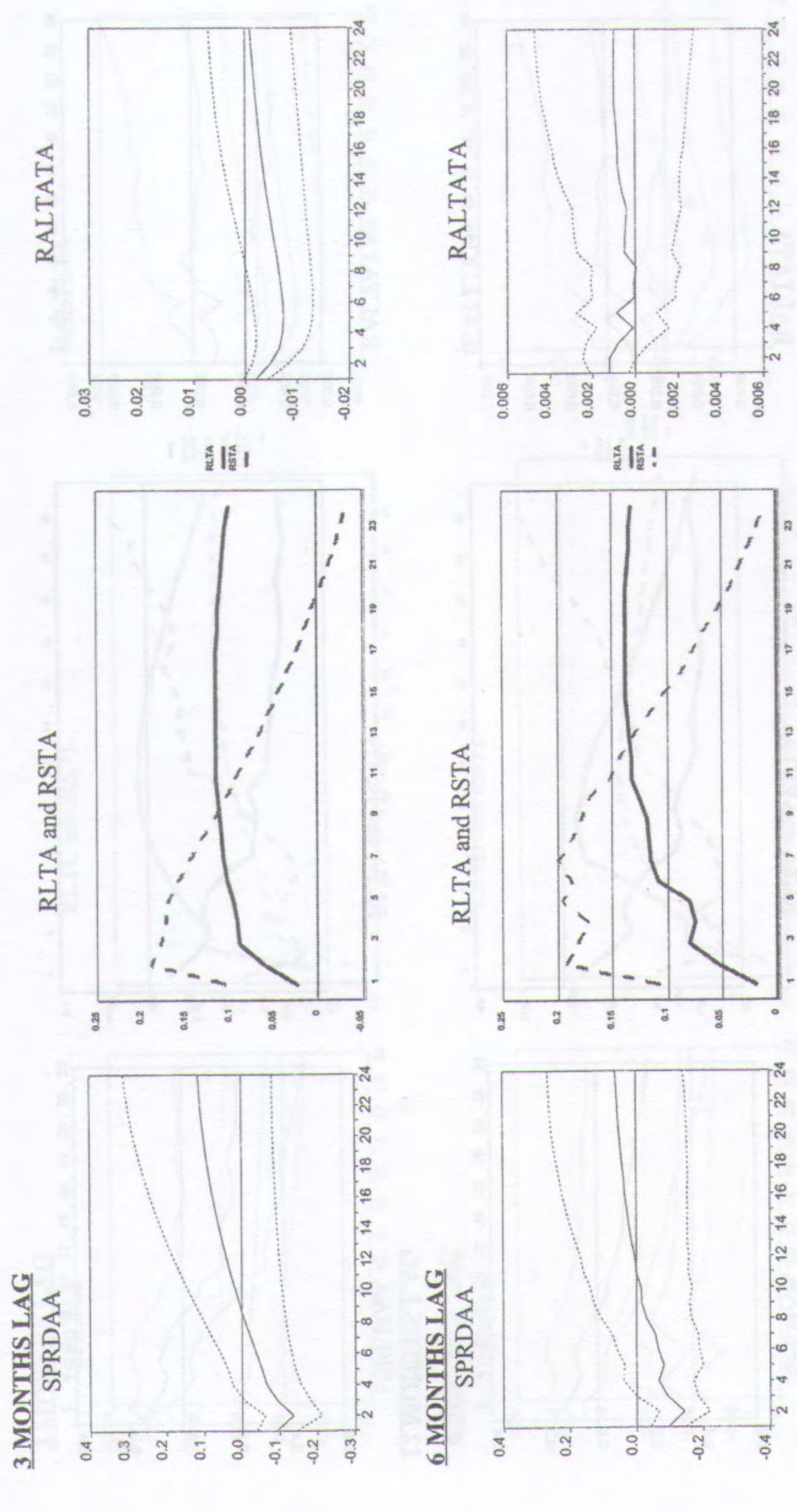

Figure 5a: RESPONSE TO ONE S.D INNOVATIONS ± 2 S.E (Klibor1M)—*(Continue)*

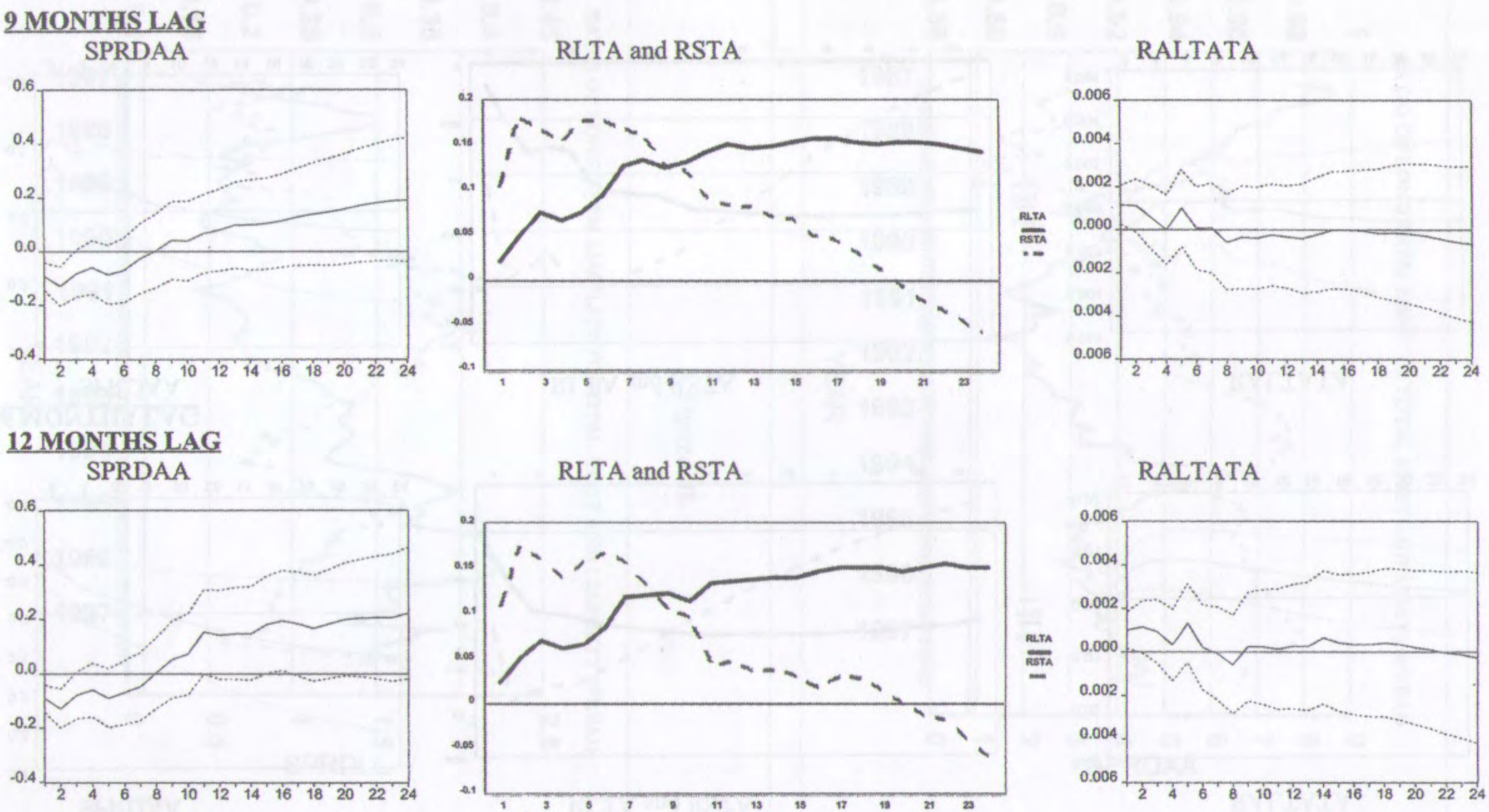

Figure 5b: RESPONSE TO ONE S.D INNOVATIONS ± 2 S.E (Klibor1M)

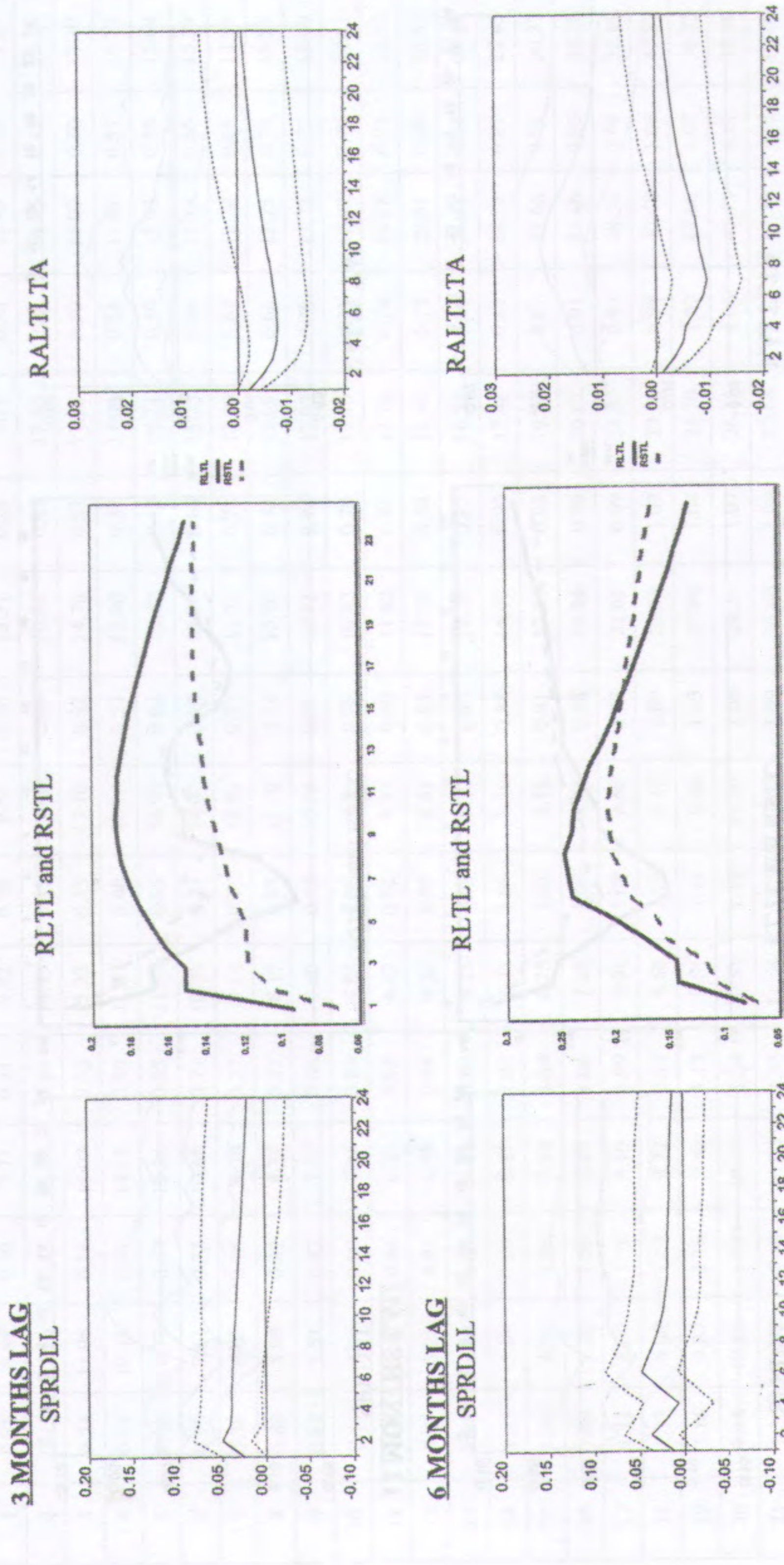

Figure 5b: RESPONSE TO ONE S.D INNOVATIONS ± 2 S.E (Klibor1M)—*(Continue)*

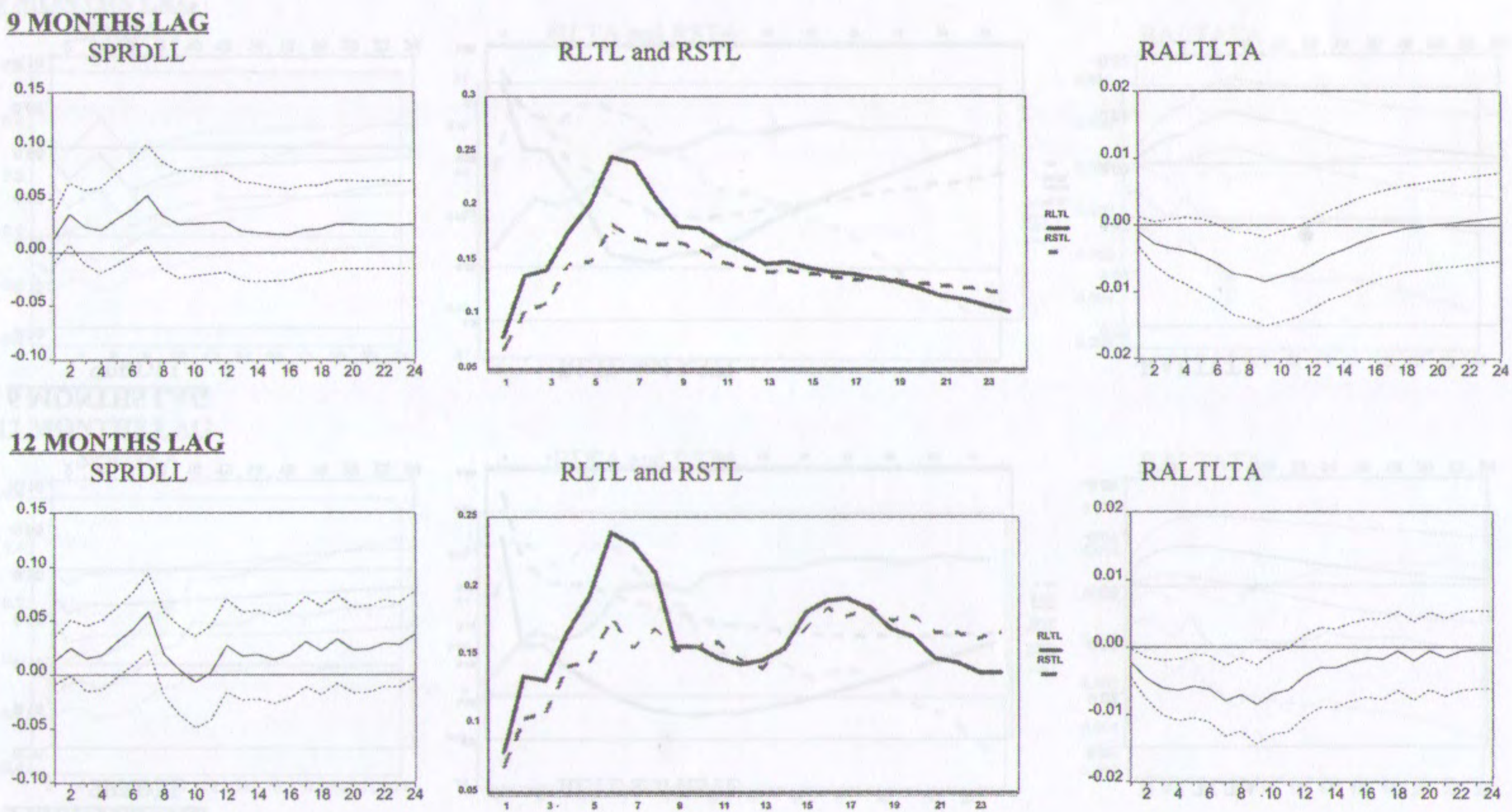

Table 1a: VARIANCE DECOMPOSITION OF SPRDAA

	LAG 3				LAG 6				LAG 9				LAG 12			
	S.E	IBR1M	S.E	IBR3M	S.E	IBR1M	S.E	IBR3M	S.E	IBR1M	S.E	IBR3M	S.E	IBR1M	S.E	IBR3M
1	0.31	8.88	0.30	7.71	0.31	9.42	0.30	8.55	0.30	10.31	0.29	9.19	0.30	11.43	0.29	9.15
2	0.45	13.16	0.45	16.20	0.44	14.75	0.45	17.96	0.43	16.24	0.43	17.96	0.42	16.45	0.42	17.26
3	0.54	11.96	0.54	16.03	0.53	13.22	0.53	17.10	0.52	14.76	0.51	17.98	0.50	15.02	0.50	17.30
4	0.61	10.18	0.61	14.11	0.59	11.87	0.60	16.13	0.58	13.40	0.57	17.05	0.55	13.81	0.55	16.74
5	0.68	8.77	0.67	12.24	0.65	11.51	0.65	14.94	0.63	13.47	0.62	15.71	0.59	13.93	0.59	15.69
6	0.73	7.61	0.73	10.68	0.71	10.21	0.71	14.02	0.68	12.38	0.68	15.23	0.64	13.13	0.65	15.29
7	0.78	6.68	0.78	9.39	0.77	9.14	0.77	12.88	0.72	11.31	0.72	13.90	0.67	12.24	0.68	13.98
8	0.83	5.98	0.82	8.37	0.82	8.15	0.81	11.70	0.74	10.70	0.74	13.09	0.68	11.75	0.70	13.27
9	0.87	5.51	0.87	7.60	0.86	7.40	0.85	10.66	0.76	10.71	0.76	12.92	0.70	12.23	0.72	13.29
10	0.91	5.24	0.90	7.06	0.89	6.83	0.89	9.81	0.78	10.82	0.79	13.15	0.71	12.92	0.74	14.21
11	0.94	5.17	0.94	6.73	0.93	6.42	0.92	9.11	0.80	11.42	0.81	13.78	0.74	16.88	0.77	16.96
12	0.97	5.28	0.97	6.59	0.96	6.22	0.95	8.61	0.83	12.70	0.84	14.96	0.77	20.61	0.80	20.87
13	1.01	5.56	1.01	6.62	0.99	6.23	0.98	8.30	0.86	14.34	0.87	16.35	0.80	24.51	0.83	24.25
14	1.03	5.99	1.04	6.81	1.01	6.41	1.01	8.16	0.88	16.07	0.90	17.98	0.83	28.21	0.87	27.45
15	1.06	6.56	1.06	7.13	1.04	6.75	1.03	8.18	0.91	17.72	0.93	19.35	0.87	31.66	0.91	30.37
16	1.09	7.25	1.09	7.57	1.06	7.25	1.06	8.36	0.94	19.56	0.96	20.62	0.91	35.46	0.95	33.38
17	1.11	8.04	1.11	8.10	1.09	7.91	1.08	8.68	0.97	21.61	0.99	21.87	0.95	38.31	0.99	35.89
18	1.13	8.92	1.13	8.72	1.11	8.68	1.10	9.12	1.00	23.78	1.02	23.26	0.98	40.58	1.03	37.87
19	1.16	9.87	1.16	9.40	1.13	9.56	1.11	9.66	1.03	25.98	1.04	24.70	1.02	42.96	1.07	39.75
20	1.18	10.88	1.18	10.13	1.14	10.51	1.13	10.30	1.06	28.23	1.07	26.15	1.06	45.15	1.11	41.66
21	1.20	11.94	1.19	10.90	1.16	11.54	1.15	11.02	1.09	30.60	1.09	27.68	1.10	47.58	1.15	43.69
22	1.21	13.04	1.21	11.71	1.18	12.63	1.16	11.80	1.12	33.00	1.12	29.31	1.13	49.86	1.19	45.76
23	1.23	14.15	1.22	12.53	1.20	13.75	1.18	12.63	1.15	35.38	1.14	31.02	1.17	52.14	1.22	47.93
24	1.25	15.28	1.24	13.35	1.21	14.88	1.19	13.50	1.17	37.67	1.17	32.74	1.21	54.51	1.26	50.08

Figure 5b: RESPONSE TO ONE S.D INNOVATIONS ± 2 S.E (Klibor1M)—(*Continue*)

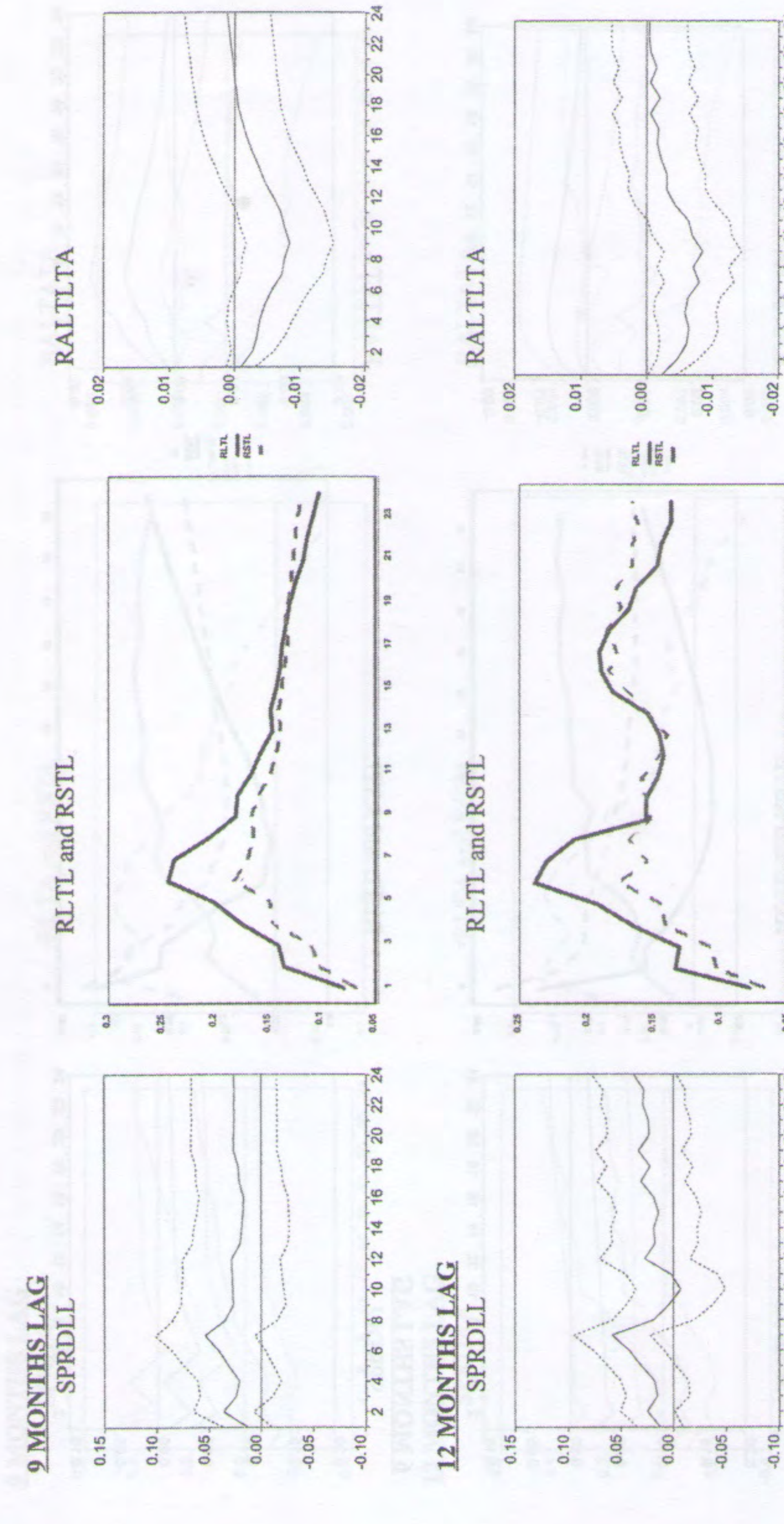

Table 2a: VARIANCE DECOMPOSITION OF ASSET INTEREST RATES

VAR.DEC	LAG 3 RLTA		RSTA		RLTA		RSTA		LAG 6 RLTA		RSTA		RLTA		RSTA	
PERIOD	S.E	IBR1M	S.E	IBR3M	S.E	IBR1M	S.E	IBR3M	S.E	IBR1M	S.E	IBR3M	S.E	IBR1M	S.E	IBR3M
1	0.13	3.68	0.28	14.60	0.13	4.55	0.27	17.70	0.13	2.52	0.27	15.59	0.13	2.98	0.27	20.22
2	0.18	14.74	0.44	24.44	0.17	11.77	0.44	32.94	0.17	11.61	0.43	25.84	0.17	8.34	0.43	37.15
3	0.23	23.51	0.56	25.43	0.23	22.71	0.56	35.94	0.22	20.75	0.56	26.29	0.22	20.31	0.55	39.65
4	0.28	27.59	0.65	26.16	0.27	29.02	0.64	37.73	0.26	22.09	0.64	26.98	0.27	24.86	0.64	42.65
5	0.32	30.03	0.72	26.91	0.32	32.51	0.71	39.12	0.31	23.28	0.71	29.36	0.32	28.89	0.71	45.56
6	0.36	32.03	0.77	27.41	0.36	34.88	0.77	40.22	0.35	26.86	0.78	29.95	0.37	30.12	0.78	47.44
7	0.39	33.66	0.82	27.70	0.39	36.70	0.81	40.96	0.40	29.57	0.84	31.40	0.42	31.69	0.85	48.90
8	0.43	35.02	0.85	27.86	0.43	38.16	0.84	41.45	0.44	31.55	0.89	32.39	0.47	32.64	0.90	49.72
9	0.46	36.18	0.88	27.92	0.46	39.36	0.87	41.74	0.48	32.69	0.93	33.58	0.52	33.81	0.94	50.81
10	0.49	37.18	0.91	27.91	0.49	40.38	0.90	41.89	0.52	33.90	0.96	34.75	0.56	34.75	0.96	51.98
11	0.52	38.07	0.92	27.83	0.52	41.26	0.91	41.93	0.55	35.24	0.98	35.53	0.60	35.75	0.99	52.98
12	0.55	38.85	0.94	27.71	0.55	42.03	0.93	41.88	0.59	36.29	1.00	36.31	0.64	36.67	1.01	53.83
13	0.58	39.55	0.95	27.54	0.58	42.71	0.94	41.77	0.62	37.17	1.02	36.96	0.67	37.56	1.02	54.51
14	0.60	40.17	0.96	27.34	0.61	43.32	0.95	41.61	0.65	37.96	1.03	37.54	0.71	38.38	1.03	55.08
15	0.62	40.72	0.97	27.13	0.63	43.87	0.96	41.40	0.68	38.73	1.03	38.01	0.74	39.15	1.04	55.52
16	0.65	41.21	0.98	26.90	0.66	44.37	0.97	41.16	0.71	39.45	1.04	38.34	0.77	39.87	1.04	55.83
17	0.67	41.66	0.98	26.67	0.68	44.81	0.97	40.90	0.74	40.08	1.04	38.59	0.80	40.54	1.04	56.03
18	0.69	42.05	0.99	26.44	0.70	45.22	0.98	40.63	0.77	40.66	1.05	38.77	0.83	41.16	1.05	56.12
19	0.71	42.41	0.99	26.22	0.72	45.59	0.98	40.35	0.79	41.21	1.05	38.87	0.86	41.75	1.05	56.13
20	0.72	42.72	0.99	26.02	0.74	45.92	0.98	40.07	0.81	41.72	1.05	38.92	0.88	42.30	1.05	56.07
21	0.74	43.01	1.00	25.84	0.76	46.23	0.99	39.79	0.84	42.20	1.05	38.91	0.91	42.82	1.05	55.94
22	0.76	43.26	1.00	25.69	0.77	46.51	0.99	39.53	0.86	42.65	1.05	38.87	0.93	43.31	1.05	55.76
23	0.77	43.48	1.00	25.56	0.79	46.76	0.99	39.28	0.88	43.07	1.06	38.79	0.95	43.77	1.06	55.54
24	0.78	43.68	1.01	25.47	0.80	46.99	1.00	39.06	0.90	43.46	1.06	38.70	0.97	44.21	1.06	55.28

Table 2a: VARIANCE DECOMPOSITION OF ASSET INTEREST RATES–*(Continue)*

	LAG 9								LAG 12							
VAR.DEC	RLTA		RSTA		RLTA		RSTA		RLTA		RSTA		RLTA		RSTA	
PERIOD	**S.E**	**IBR1M**	**S.E**	**IBR3M**	**S.E**	**IBR1M**	**S.E**	**IBR3M**	**S.E**	**IBR1M**	**S.E**	**IBR3M**	**S.E**	**IBR1M**	**S.E**	**IBR3M**
1	0.12	2.94	0.26	15.97	0.12	2.87	0.26	20.15	0.11	4.20	0.26	17.71	0.11	3.45	0.25	19.22
2	0.15	11.77	0.41	25.58	0.16	9.72	0.41	37.10	0.14	15.13	0.41	25.38	0.14	10.06	0.40	34.94
3	0.20	20.97	0.53	25.54	0.20	21.91	0.52	40.12	0.18	24.53	0.52	24.73	0.18	24.11	0.51	37.97
4	0.24	22.00	0.61	25.63	0.24	25.96	0.61	42.58	0.22	25.67	0.59	24.53	0.22	29.89	0.59	40.85
5	0.28	23.75	0.68	27.74	0.29	31.71	0.67	44.16	0.24	27.25	0.65	26.26	0.26	36.31	0.65	42.80
6	0.32	27.29	0.75	28.58	0.33	32.06	0.75	45.33	0.28	30.39	0.71	27.43	0.29	36.94	0.72	44.25
7	0.37	32.13	0.79	29.93	0.38	35.08	0.79	46.64	0.32	35.47	0.75	28.89	0.33	40.15	0.77	45.46
8	0.42	34.37	0.83	30.78	0.43	36.45	0.83	46.58	0.37	37.37	0.79	29.16	0.38	41.42	0.81	45.26
9	0.47	34.50	0.86	30.97	0.49	36.61	0.86	46.40	0.42	37.99	0.81	29.17	0.44	42.53	0.84	45.31
10	0.52	34.76	0.89	31.22	0.54	36.41	0.89	46.08	0.46	37.40	0.83	29.07	0.49	42.97	0.87	44.79
11	0.57	35.37	0.90	30.96	0.60	36.36	0.91	45.57	0.51	38.00	0.85	28.26	0.54	43.17	0.89	43.84
12	0.62	36.31	0.92	31.00	0.65	36.60	0.92	45.37	0.55	37.87	0.85	28.09	0.59	43.15	0.90	43.52
13	0.66	36.89	0.93	31.15	0.69	36.75	0.93	45.24	0.59	38.70	0.86	27.96	0.64	43.79	0.91	43.50
14	0.70	37.28	0.93	31.30	0.74	36.91	0.93	45.34	0.63	39.08	0.86	27.97	0.69	44.42	0.91	43.72
15	0.74	37.70	0.94	31.44	0.78	36.97	0.94	45.47	0.66	39.17	0.86	27.94	0.74	44.80	0.92	43.85
16	0.77	38.17	0.94	31.44	0.83	36.91	0.94	45.56	0.70	39.54	0.86	27.87	0.78	45.02	0.92	43.99
17	0.81	38.61	0.94	31.49	0.88	36.77	0.94	45.70	0.74	39.96	0.87	27.91	0.83	44.88	0.92	44.20
18	0.84	38.95	0.95	31.50	0.92	36.78	0.94	45.80	0.77	40.31	0.87	27.91	0.88	44.97	0.92	44.41
19	0.88	39.28	0.95	31.44	0.96	36.80	0.95	45.86	0.80	40.75	0.87	27.87	0.92	45.16	0.93	44.53
20	0.90	39.64	0.95	31.34	1.00	36.83	0.95	45.83	0.83	40.92	0.87	27.74	0.97	45.28	0.93	44.49
21	0.93	40.03	0.95	31.22	1.04	36.81	0.95	45.74	0.86	41.27	0.87	27.66	1.01	45.30	0.93	44.39
22	0.96	40.39	0.95	31.10	1.07	36.80	0.95	45.60	0.89	41.62	0.87	27.56	1.05	45.19	0.93	44.26
23	0.98	40.70	0.96	30.99	1.11	36.78	0.95	45.45	0.92	41.85	0.88	27.49	1.09	45.11	0.93	44.06
24	1.00	40.98	0.97	30.90	1.14	36.74	0.96	45.26	0.95	42.16	0.89	27.52	1.13	45.00	0.94	43.88

Table 2b: VARIANCE DECOMPOSITION OF LIABILITY INTEREST RATES

	LAG 3								LAG 6							
VAR.DEC	RLTL		RSTL		RLTL		RSTL		RLTL		RSTL		RLTL		RSTL	
PERIOD	S.E	IBR1M	S.E	IBR3M	S.E	IBR1M	S.E	IBR3M	S.E	IBR1M	S.E	IBR3M	S.E	IBR1M	S.E	IBR3M
1	0.19	25.29	0.14	25.26	0.18	22.03	0.14	20.76	0.18	22.33	0.13	28.92	0.17	21.63	0.13	22.21
2	0.31	32.95	0.22	32.92	0.31	37.92	0.21	32.84	0.29	32.27	0.21	37.82	0.29	39.12	0.21	36.97
3	0.41	32.82	0.30	34.37	0.41	43.47	0.29	41.14	0.39	31.69	0.28	39.15	0.40	43.67	0.28	44.95
4	0.49	34.13	0.36	34.38	0.50	46.53	0.36	44.01	0.48	34.99	0.36	43.12	0.50	47.03	0.36	47.12
5	0.55	36.03	0.41	34.41	0.57	48.43	0.42	44.49	0.55	39.15	0.43	43.68	0.59	47.70	0.45	47.43
6	0.61	38.24	0.46	34.93	0.63	49.85	0.47	44.43	0.63	44.78	0.50	46.19	0.68	49.56	0.53	47.61
7	0.66	40.54	0.50	35.70	0.69	51.06	0.52	44.24	0.70	48.69	0.57	47.99	0.75	50.86	0.60	47.44
8	0.70	42.78	0.54	36.61	0.74	52.13	0.56	44.04	0.76	51.54	0.63	49.49	0.83	51.88	0.67	47.18
9	0.74	44.89	0.58	37.57	0.78	53.07	0.60	43.87	0.82	53.28	0.69	50.47	0.89	52.39	0.74	46.92
10	0.77	46.83	0.61	38.55	0.82	53.91	0.64	43.75	0.87	54.62	0.74	51.15	0.95	52.79	0.80	46.69
11	0.80	48.61	0.65	39.52	0.86	54.66	0.68	43.68	0.92	55.62	0.79	51.48	1.01	53.02	0.86	46.47
12	0.83	50.23	0.68	40.47	0.89	55.33	0.71	43.65	0.96	56.28	0.84	51.55	1.06	53.14	0.92	46.20
13	0.86	51.69	0.70	41.40	0.92	55.93	0.75	43.66	1.00	56.65	0.89	51.46	1.11	53.17	0.98	45.90
14	0.89	53.02	0.73	42.29	0.95	56.46	0.78	43.71	1.03	56.81	0.93	51.26	1.15	53.16	1.03	45.61
15	0.91	54.22	0.76	43.15	0.98	56.95	0.81	43.79	1.06	56.84	0.97	51.02	1.19	53.13	1.08	45.34
16	0.93	55.31	0.78	43.97	1.01	57.38	0.84	43.89	1.09	56.78	1.01	50.73	1.23	53.09	1.13	45.08
17	0.95	56.30	0.81	44.76	1.03	57.78	0.87	44.01	1.12	56.68	1.05	50.43	1.27	53.02	1.17	44.84
18	0.97	57.20	0.83	45.52	1.06	58.13	0.90	44.14	1.15	56.55	1.09	50.13	1.30	52.95	1.21	44.62
19	0.99	58.01	0.85	46.24	1.08	58.46	0.93	44.30	1.17	56.42	1.12	49.84	1.33	52.87	1.26	44.41
20	1.01	58.76	0.87	46.93	1.10	58.76	0.95	44.46	1.19	56.29	1.15	49.58	1.35	52.79	1.30	44.21
21	1.02	59.44	0.89	47.60	1.12	59.03	0.98	44.63	1.21	56.18	1.18	49.34	1.38	52.71	1.34	44.03
22	1.04	60.06	0.91	48.23	1.14	59.28	1.01	44.81	1.22	56.07	1.21	49.12	1.40	52.63	1.37	43.85
23	1.05	60.63	0.93	48.84	1.16	59.51	1.03	45.00	1.24	55.98	1.24	48.92	1.43	52.56	1.41	43.68
24	1.07	61.15	0.94	49.42	1.17	59.72	1.05	45.19	1.25	55.90	1.26	48.74	1.45	52.48	1.44	43.52

Table 2b: VARIANCE DECOMPOSITION OF LIABILITY INTEREST RATES–*(Continue)*

	LAG 9								LAG 12							
VAR.DEC	RLTL		RSTL		RLTL		RSTL		RLTL		RSTL		RLTL		RSTL	
PERIOD	S.E	IBR1M	S.E	IBR3M	S.E	IBR1M	S.E	IBR3M	S.E	IBR1M	S.E	IBR3M	S.E	IBR1M	S.E	IBR3M
1	0.17	21.52	0.13	27.80	0.17	23.76	0.13	21.17	0.16	23.38	0.12	31.92	0.16	30.09	0.12	25.80
2	0.29	30.20	0.21	35.74	0.29	41.48	0.20	37.20	0.27	33.26	0.20	40.51	0.27	50.00	0.19	45.22
3	0.39	30.13	0.27	36.89	0.39	46.01	0.27	46.04	0.36	32.94	0.26	41.49	0.37	54.04	0.26	54.26
4	0.47	34.09	0.35	40.15	0.49	49.96	0.35	47.72	0.43	37.23	0.33	44.45	0.46	58.10	0.34	56.21
5	0.56	37.98	0.42	39.78	0.58	49.52	0.43	46.50	0.51	41.76	0.39	44.20	0.55	58.66	0.41	55.61
6	0.64	43.59	0.50	42.42	0.67	50.14	0.51	45.49	0.59	47.83	0.46	46.87	0.63	60.59	0.49	55.53
7	0.71	46.69	0.56	42.29	0.76	50.18	0.59	43.84	0.65	50.81	0.52	46.40	0.71	61.32	0.56	54.78
8	0.77	47.33	0.62	41.80	0.83	49.04	0.66	41.89	0.71	51.33	0.57	46.69	0.78	60.83	0.62	53.70
9	0.81	47.00	0.68	40.96	0.89	47.86	0.73	40.64	0.76	50.13	0.62	45.52	0.84	60.04	0.68	53.29
10	0.85	46.87	0.73	39.89	0.95	46.74	0.80	39.24	0.80	48.97	0.67	44.41	0.89	58.59	0.74	52.32
11	0.89	46.69	0.78	38.67	1.00	45.90	0.86	37.62	0.84	47.27	0.73	42.56	0.95	57.23	0.81	50.60
12	0.92	46.49	0.83	37.61	1.05	44.90	0.92	36.08	0.88	45.19	0.78	40.21	1.01	55.59	0.87	49.21
13	0.95	46.06	0.87	36.58	1.09	44.31	0.98	34.91	0.93	43.56	0.84	37.92	1.06	54.81	0.94	47.86
14	0.98	45.81	0.91	35.88	1.13	43.81	1.04	33.98	0.97	42.57	0.89	36.48	1.12	54.14	1.01	46.73
15	1.00	45.63	0.94	35.24	1.17	43.42	1.09	33.22	1.01	42.45	0.95	35.65	1.18	53.92	1.08	46.04
16	1.03	45.58	0.98	34.71	1.20	43.04	1.14	32.55	1.05	42.74	1.00	35.45	1.23	53.93	1.15	45.83
17	1.05	45.57	1.01	34.25	1.23	42.77	1.18	31.96	1.08	43.13	1.05	35.20	1.28	54.03	1.21	45.64
18	1.06	45.65	1.04	33.95	1.26	42.58	1.23	31.47	1.11	43.52	1.09	35.22	1.33	54.13	1.27	45.46
19	1.08	45.76	1.07	33.72	1.28	42.39	1.27	31.05	1.14	43.82	1.13	35.14	1.37	54.12	1.33	45.38
20	1.09	45.89	1.10	33.54	1.31	42.24	1.31	30.69	1.16	44.21	1.17	35.21	1.41	54.15	1.39	45.17
21	1.11	46.01	1.12	33.39	1.33	42.07	1.35	30.38	1.18	44.47	1.21	35.15	1.44	54.15	1.44	45.01
22	1.12	46.14	1.14	33.29	1.35	41.92	1.39	30.10	1.19	44.74	1.24	35.14	1.47	54.13	1.49	44.88
23	1.13	46.28	1.16	33.20	1.37	41.76	1.42	29.82	1.21	44.93	1.27	35.10	1.50	54.07	1.54	44.76
24	1.14	46.42	1.18	33.14	1.39	41.62	1.46	29.56	1.22	45.14	1.30	35.17	1.53	54.00	1.59	44.62

Table 3a: VARIANCE DECOMPOSITION OF RALTATA

	LAG 3						LAG 6					
Period	S.E.	IBR1M	SPRDAA	S.E.	IBR3M	SPRDAA	S.E.	IBR1M	SPRDAA	S.E.	IBR3M	SPRDAA
1	0.01	4.18	0.91	0.01	11.06	0.34	0.01	5.64	1.59	0.01	11.19	1.55
2	0.01	4.45	3.99	0.01	12.21	3.09	0.01	5.89	4.59	0.01	12.20	5.13
3	0.01	3.42	6.99	0.01	10.52	6.11	0.01	4.93	8.13	0.01	10.39	8.27
4	0.01	2.99	9.12	0.01	9.38	8.48	0.01	4.28	12.09	0.01	9.51	12.42
5	0.01	2.78	10.94	0.01	8.63	10.77	0.01	4.31	17.09	0.01	8.28	18.15
6	0.01	2.67	12.76	0.01	8.18	12.98	0.01	3.73	19.59	0.01	7.47	20.39
7	0.01	2.60	14.61	0.01	7.86	15.16	0.01	3.25	21.66	0.01	6.54	22.28
8	0.01	2.55	16.48	0.01	7.61	17.31	0.01	2.93	23.18	0.01	6.03	23.72
9	0.01	2.51	18.36	0.01	7.39	19.46	0.01	2.82	25.11	0.01	5.73	25.83
10	0.02	2.46	20.25	0.02	7.17	21.60	0.01	2.74	27.16	0.01	5.68	27.75
11	0.02	2.40	22.14	0.02	6.96	23.72	0.01	2.65	28.99	0.01	5.59	29.50
12	0.02	2.33	24.02	0.02	6.74	25.81	0.01	2.55	30.57	0.01	5.54	30.91
13	0.02	2.26	25.87	0.02	6.53	27.87	0.01	2.57	31.92	0.02	5.53	32.31
14	0.02	2.18	27.70	0.02	6.30	29.89	0.02	2.67	33.25	0.02	5.58	33.68
15	0.02	2.09	29.48	0.02	6.08	31.85	0.02	2.82	34.60	0.02	5.63	35.07
16	0.02	2.01	31.22	0.02	5.86	33.75	0.02	2.96	35.90	0.02	5.68	36.40
17	0.02	1.93	32.91	0.02	5.64	35.59	0.02	3.12	37.10	0.02	5.74	37.63
18	0.02	1.85	34.54	0.02	5.43	37.35	0.02	3.29	38.20	0.02	5.78	38.79
19	0.02	1.78	36.10	0.02	5.23	39.03	0.02	3.51	39.24	0.02	5.81	39.90
20	0.02	1.72	37.59	0.02	5.04	40.62	0.02	3.72	40.24	0.02	5.84	40.99
21	0.02	1.67	39.00	0.02	4.87	42.13	0.02	3.92	41.20	0.02	5.86	42.03
22	0.02	1.64	40.34	0.02	4.72	43.55	0.02	4.11	42.12	0.02	5.86	43.02
23	0.02	1.63	41.60	0.02	4.59	44.88	0.02	4.30	42.97	0.02	5.86	43.95
24	0.02	1.64	42.78	0.02	4.47	46.12	0.02	4.47	43.78	0.02	5.84	44.84

Table 3a: VARIANCE DECOMPOSITION OF RALTATA–*(Continue)*

	LAG 9						LAG 12					
Period	S.E.	IBR1M	SPRDAA	S.E.	IBR3M	SPRDAA	S.E.	IBR1M	SPRDAA	S.E.	IBR3M	SPRDAA
1	0.01	5.12	1.47	0.01	12.21	1.14	0.00	4.57	0.99	0.00	10.45	1.29
2	0.01	5.34	3.76	0.01	13.49	3.86	0.01	5.44	4.00	0.01	10.65	4.51
3	0.01	4.21	6.31	0.01	10.86	6.07	0.01	5.03	6.60	0.01	9.86	6.16
4	0.01	3.66	9.08	0.01	10.01	9.05	0.01	4.44	9.84	0.01	9.27	8.36
5	0.01	4.14	13.73	0.01	8.82	14.46	0.01	5.66	13.54	0.01	8.39	12.62
6	0.01	3.63	16.44	0.01	8.18	16.93	0.01	5.00	15.33	0.01	7.71	14.22
7	0.01	3.17	17.67	0.01	7.05	18.00	0.01	4.23	15.65	0.01	6.48	14.87
8	0.01	3.15	19.36	0.01	6.43	19.37	0.01	4.04	16.77	0.01	5.90	15.55
9	0.01	3.09	20.66	0.01	6.12	20.28	0.01	3.89	17.64	0.01	5.61	16.21
10	0.01	3.08	22.00	0.01	5.85	21.10	0.01	3.72	18.14	0.01	5.31	16.60
11	0.01	3.00	22.86	0.01	5.58	21.70	0.01	3.54	17.85	0.01	5.04	16.60
12	0.01	2.95	23.58	0.01	5.31	22.09	0.01	3.44	17.60	0.01	4.87	16.77
13	0.01	2.93	24.43	0.01	5.06	22.73	0.01	3.37	17.56	0.01	4.77	17.12
14	0.01	2.85	25.53	0.01	4.84	23.71	0.01	3.53	17.65	0.01	4.76	17.97
15	0.01	2.75	26.84	0.01	4.67	24.95	0.01	3.54	17.92	0.01	4.67	18.67
16	0.01	2.65	28.26	0.01	4.49	26.44	0.01	3.49	18.10	0.01	4.60	19.52
17	0.01	2.54	29.82	0.01	4.30	28.05	0.01	3.43	18.69	0.01	4.52	20.63
18	0.01	2.45	31.47	0.02	4.11	29.71	0.01	3.43	19.44	0.01	4.59	21.95
19	0.01	2.37	33.15	0.02	3.95	31.36	0.01	3.40	20.39	0.02	4.66	23.17
20	0.01	2.30	34.79	0.02	3.83	32.95	0.01	3.32	21.52	0.02	4.76	24.38
21	0.02	2.26	36.36	0.02	3.75	34.43	0.01	3.24	22.50	0.02	4.86	25.45
22	0.02	2.27	37.87	0.02	3.72	35.80	0.01	3.16	23.56	0.02	5.05	26.55
23	0.02	2.34	39.25	0.02	3.77	37.03	0.01	3.10	24.49	0.02	5.39	27.52
24	0.02	2.45	40.50	0.02	3.91	38.13	0.02	3.08	25.37	0.02	5.89	28.30

Table 3b: VARIANCE DECOMPOSITION OF RALTLTA

	LAG 3						LAG 6					
Period	S.E.	IBR1M	SPRDLL	S.E.	IBR3M	SPRDLL	S.E.	IBR1M	SPRDLL	S.E.	IBR3M	SPRDLL
1	0.01	2.19	0.05	0.01	1.78	0.00	0.01	0.79	0.00	0.01	0.97	0.00
2	0.02	6.28	0.56	0.02	6.42	0.31	0.02	3.40	0.11	0.02	5.12	0.17
3	0.03	8.87	1.17	0.03	8.99	0.77	0.03	5.54	0.21	0.03	7.10	0.30
4	0.03	10.46	1.60	0.03	10.83	1.09	0.03	7.17	0.23	0.03	8.88	0.31
5	0.04	11.32	1.85	0.04	11.86	1.28	0.03	10.06	0.38	0.04	11.67	0.43
6	0.04	11.84	1.96	0.04	12.47	1.37	0.04	13.83	0.46	0.04	15.33	0.50
7	0.05	12.12	1.99	0.05	12.81	1.39	0.04	17.28	0.47	0.04	18.61	0.51
8	0.05	12.26	1.96	0.05	12.98	1.37	0.04	19.72	0.45	0.04	20.70	0.50
9	0.05	12.31	1.90	0.05	13.03	1.33	0.05	21.32	0.41	0.05	21.93	0.45
10	0.06	12.29	1.83	0.06	13.02	1.27	0.05	22.55	0.43	0.05	22.62	0.44
11	0.06	12.24	1.75	0.06	12.95	1.22	0.05	23.37	0.50	0.05	22.90	0.49
12	0.06	12.15	1.68	0.06	12.85	1.16	0.05	23.83	0.59	0.05	22.87	0.55
13	0.06	12.05	1.61	0.06	12.73	1.11	0.05	23.99	0.67	0.05	22.68	0.62
14	0.06	11.94	1.54	0.06	12.60	1.07	0.05	23.91	0.74	0.05	22.38	0.67
15	0.06	11.82	1.49	0.06	12.47	1.03	0.05	23.67	0.81	0.05	22.00	0.73
16	0.06	11.70	1.45	0.06	12.33	1.00	0.05	23.33	0.89	0.06	21.57	0.78
17	0.07	11.59	1.42	0.07	12.20	0.98	0.06	22.95	0.96	0.06	21.14	0.85
18	0.07	11.47	1.39	0.07	12.07	0.97	0.06	22.56	1.04	0.06	20.73	0.92
19	0.07	11.36	1.38	0.07	11.95	0.97	0.06	22.17	1.12	0.06	20.34	1.01
20	0.07	11.25	1.38	0.07	11.83	0.97	0.06	21.78	1.22	0.06	19.97	1.10
21	0.07	11.15	1.38	0.07	11.72	0.98	0.06	21.41	1.32	0.06	19.63	1.21
22	0.07	11.05	1.39	0.07	11.62	0.99	0.06	21.04	1.43	0.06	19.30	1.33
23	0.07	10.96	1.41	0.07	11.52	1.01	0.06	20.68	1.55	0.06	18.98	1.46
24	0.07	10.88	1.43	0.07	11.43	1.03	0.06	20.34	1.70	0.06	18.67	1.60

Table 3b: VARIANCE DECOMPOSITION OF RALTLTA–*(Continue)*

	LAG 9						LAG 12					
Period	S.E.	IBR1M	SPRDLL	S.E.	IBR3M	SPRDLL	S.E.	IBR1M	SPRDLL	S.E.	IBR3M	SPRDLL
1	0.01	0.67	0.00	0.01	1.30	0.03	0.01	4.10	0.23	0.01	5.50	0.01
2	0.02	2.56	0.05	0.02	4.76	0.05	0.02	8.81	0.82	0.02	14.17	0.12
3	0.02	3.47	0.04	0.02	5.40	0.05	0.02	12.06	0.75	0.02	17.99	0.08
4	0.03	4.53	0.16	0.03	6.18	0.28	0.03	15.06	0.57	0.03	20.90	0.16
5	0.03	6.04	0.16	0.03	7.47	0.33	0.03	16.87	0.49	0.03	23.00	0.16
6	0.03	8.33	0.34	0.03	9.35	0.70	0.03	18.95	0.60	0.03	24.64	0.43
7	0.04	11.54	0.88	0.04	11.58	1.55	0.03	22.46	1.10	0.03	26.08	1.36
8	0.04	14.71	1.34	0.04	14.18	2.31	0.03	24.48	1.44	0.03	27.67	2.24
9	0.04	18.11	2.28	0.04	16.69	3.53	0.04	27.16	2.53	0.04	28.67	3.99
10	0.04	20.53	3.10	0.04	18.47	4.46	0.04	29.03	3.54	0.04	29.66	5.67
11	0.04	22.14	3.81	0.04	19.69	5.23	0.04	29.70	5.07	0.04	29.58	7.54
12	0.04	22.97	4.40	0.04	20.03	5.90	0.04	30.04	6.19	0.04	29.33	9.00
13	0.04	23.03	4.92	0.04	19.93	6.49	0.04	29.66	6.91	0.04	28.81	10.02
14	0.04	22.82	5.34	0.05	19.51	6.94	0.04	29.38	7.73	0.04	28.14	10.92
15	0.05	22.32	5.61	0.05	18.96	7.21	0.04	28.68	7.92	0.04	27.35	11.38
16	0.05	21.73	5.80	0.05	18.33	7.34	0.04	27.79	8.06	0.04	26.52	11.60
17	0.05	21.11	5.90	0.05	17.71	7.37	0.04	27.04	8.11	0.04	25.55	11.70
18	0.05	20.53	5.98	0.05	17.14	7.39	0.04	26.04	8.04	0.04	24.68	11.63
19	0.05	19.97	6.06	0.05	16.61	7.43	0.04	25.16	7.96	0.05	23.70	11.47
20	0.05	19.49	6.13	0.05	16.16	7.51	0.05	24.53	7.86	0.05	22.98	11.38
21	0.05	19.04	6.24	0.05	15.76	7.63	0.05	23.72	7.77	0.05	22.26	11.29
22	0.05	18.67	6.36	0.05	15.42	7.79	0.05	23.44	7.79	0.05	21.80	11.31
23	0.05	18.33	6.51	0.05	15.14	7.98	0.05	22.93	7.76	0.05	21.42	11.35
24	0.05	18.04	6.68	0.05	14.89	8.20	0.05	22.76	7.92	0.05	21.18	11.47

APPENDIX

APPENDIX 1

$$NII = \left(\left(A_{st}\right)\left(r^{a}_{st}\right)+\left(A_{lt}\right)\left(r^{a}_{st}\right)\right)-\left(\left(L_{st}\right)\left(r^{l}_{st}\right)+\left(L_{lt}\right)\left(r^{l}_{lt}\right)\right)$$

$$= \left(A_{st}\right)\left(r^{a}_{st}\right)+\left(A_{lt}\right)\left(r^{a}_{st}\right)-\left(L_{st}\right)\left(r^{l}_{st}\right)-\left(L_{lt}\right)\left(r^{l}_{lt}\right) \quad (1)$$

Plus and then minus $\left(A_{lt}\right)\left(r^{a}_{st}\right)$ from the right hand side of equation (1), gives us

$$NII = \left(A_{st}\right)\left(r^{a}_{st}\right)+\left(A_{lt}\right)\left(r^{a}_{lt}\right)+\left(A_{lt}\right)\left(r^{a}_{st}\right)-\left(A_{lt}\right)\left(r^{a}_{lt}\right)-\left(L_{st}\right)\left(r^{l}_{st}\right)-\left(L_{lt}\right)\left(r^{l}_{lt}\right)$$

$$= \left(A_{lt}\right)\left(r^{a}_{lt}\right)-\left(A_{lt}\right)\left(r^{a}_{st}\right)+\left(A_{st}\right)\left(r^{a}_{st}\right)+\left(A_{lt}\right)\left(r^{a}_{st}\right)-\left(L_{st}\right)\left(r^{l}_{st}\right)-\left(L_{lt}\right)\left(r^{l}_{lt}\right)$$

$$= \left(A_{lt}\right)\left(r^{a}_{lt}-r^{a}_{st}\right)+\left(A_{st}\right)\left(r^{a}_{st}\right)+\left(A_{lt}\right)\left(r^{a}_{st}\right)-\left(L_{st}\right)\left(r^{l}_{st}\right)-\left(L_{lt}\right)\left(r^{l}_{lt}\right) \quad (2)$$

Let $r^{a}_{lt}-r^{a}_{lt} = S^{AA}$, then (2) becomes

$$NII = \left(A_{lt}\right)\left(S^{AA}\right)+\left(A_{st}\right)\left(r^{a}_{st}\right)+\left(A_{lt}\right)\left(r^{a}_{st}\right)-\left(L_{st}\right)\left(r^{l}_{st}\right)-\left(L_{lt}\right)\left(r^{l}_{lt}\right) \quad (3)$$

Plus and minus $\left(L_{lt}\right)\left(r^{l}_{st}\right)$ from the right hand side of equation (3), we'll get

$$NII = \left(A_{lt}\right)\left(S^{AA}\right)+\left(A_{st}\right)\left(r^{a}_{st}\right)+\left(A_{lt}\right)\left(r^{a}_{st}\right)-\left(L_{st}\right)\left(r^{l}_{st}\right)-\left(L_{lt}\right)\left(r^{l}_{lt}\right)+\left(L_{lt}\right)\left(r^{l}_{st}\right)-\left(L_{lt}\right)\left(r^{l}_{st}\right)$$

$$= \left(A_{lt}\right)\left(S^{AA}\right)+\left(A_{st}\right)\left(r^{a}_{st}\right)+\left(A_{lt}\right)\left(r^{a}_{st}\right)-\left(L_{lt}\right)\left(r^{l}_{lt}-r^{l}_{lt}\right)\left(r^{l}_{lt}\right)-\left(L_{st}\right)\left(r^{l}_{st}\right)-\left(L_{lt}\right)\left(r^{l}_{st}\right) \quad (4)$$

By taking $\left(r^{l}_{lt}-r^{l}_{st}\right) = S^{LL}$, and substitute it into equation (4), gives us the following equation

$$NII = \left(A_{lt}\right)\left(S^{AA}\right)-\left(L_{lt}\right)\left(S^{LL}\right)+\left(A_{st}\right)\left(r^{a}_{st}\right)+\left(A_{lt}\right)\left(r^{a}_{st}\right)-\left(L_{st}\right)\left(r^{l}_{st}\right)-\left(L_{lt}\right)\left(r^{l}_{st}\right) \quad (5)$$

Plus and minus $\left(A_{lt}\right)\left(r^{l}_{st}\right)$ from right hand side of equation (5) gives us the following equation

$$NII =$$

$$\left(A_{lt}\right)\left(S^{AA}\right)-\left(L_{lt}\right)\left(S^{LL}\right)+\left(A_{st}\right)\left(r^{a}_{st}\right)+\left(A_{lt}\right)\left(r^{a}_{st}\right)-\left(L_{st}\right)\left(r^{l}_{st}\right)-\left(L_{lt}\right)\left(r^{l}_{st}\right)+\left(A_{st}\right)\left(r^{l}_{st}\right)-\left(A_{st}\right)\left(r^{l}_{st}\right)$$

Rearrange the above equation, *NII* becomes :

$$NII = (A_{lt})(S^{AA})-(L_{lt})(S^{LL})+(A_{st})(r_{st}^{a})-(A_{st})(r_{st}^{l})+(A_{lt})(r_{st}^{a})-(L_{st})(r_{st}^{l})-(L_{lt})(r_{st}^{l})+(A_{st})(r_{st}^{l})$$

$$= (A_{lt})(S^{AA})-(L_{lt})(S^{LL})+(A_{st})(r_{st}^{a}-r_{st}^{l})+(A_{lt})(r_{st}^{a})-(L_{st})(r_{st}^{l})-(L_{lt})(r_{st}^{l})+(A_{st})(r_{st}^{l}) \tag{6}$$

By taking $\left(r_{lt}^{a}-r_{st}^{l}\right)=S^{AL}$, and substitute it into (6), gives us the following equation

$$NII=(A_{lt})(S^{AA})-(L_{lt})(S^{LL})+(A_{st})(S_{st}^{AL})+(A_{lt})(r_{st}^{a})-(L_{st})(r_{st}^{l})-(L_{lt})(r_{st}^{l})+(A_{st})(r_{st}^{l}) \tag{7}$$

Factor out r_{st}^{l} from equation (7),

$$NII=\left(A_{lt}\right)\left(S^{AA}\right)-\left(L_{lt}\right)\left(S^{LL}\right)+\left(A_{st}\right)\left(S_{st}^{AL}\right)+\left(A_{lt}\right)\left(r_{st}^{a}\right)+\left(r_{st}^{l}\right)\left(A_{st}-L_{st}-L_{lt}\right) \tag{8}$$

Balance sheet identity is as given below :

$A_{st}+A_{lt}=L_{st}+L_{lt}$

or:

$$-A_{lt}=A_{st}-L_{st}-L_{lt} \tag{9}$$

Substitute (9) into equation (8) :

$$\begin{aligned} NII &= (A_{lt})(S^{AA})-(L_{lt})(S^{LL})+(A_{st})(S_{st}^{AL})+(A_{lt})(r_{st}^{a})+(r_{st}^{l})(-A_{lt}) \\ &= (A_{lt})(S^{AA})-(L_{lt})(S^{LL})+(A_{st})(S_{st}^{AL})+(A_{lt})(r_{st}^{a})-(A_{lt})(r_{st}^{l}) \\ &= (A_{lt})(S^{AA})-(L_{lt})(S^{LL})+(A_{st})(S_{st}^{AL})+(A_{lt})(r_{st}^{a}-r_{st}^{l}) \\ &= (A_{lt})(S^{AA})-(L_{lt})(S^{LL})+(A_{st})(S_{st}^{AL})+(A_{lt})(S_{st}^{AL}) \end{aligned}$$

$$NII=(A_{lt})(S^{AA})-(L_{lt})(S^{LL})+(A_{st}+A_{lt})(S_{st}^{AL})$$

Finally, by taking the ratio of NII to total assets as bank profitability function will give us the following equation:

$$\pi=\frac{NII}{JUMLAH\ ASET}=\frac{A_{lt}(S^{AA})-L_{lt}(S^{LL})+(A_{st}+A_{lt})(S_{st}^{AL})}{A_{st}+A_{lt}}$$

Rewriting the above equation :

$$\pi = \left(\frac{A_{lt}}{A_{st} + A_{lt}} \right) \left(S^{AA} \right) - \left(\frac{L_{lt}}{A_{st} + A_{lt}} \right) \left(S^{LL} \right) + S_{st}^{AL}$$

By taking S^{AA}, S^{LL} dan S_{st}^{AL} as a function of open market rates the above equation becomes :

$$\pi = \left(\frac{A_{lt}}{A_{st} + A_{lt}} \right) \left(S^{AA} \left(i_{mkt} \right) \right) - \left(\frac{L_{lt}}{A_{st} + A_{lt}} \right) \left(S^{LL} \left(i_{mkt} \right) \right) + S_{st}^{AL} \left(i_{mkt} \right)$$

where i_{mkt} is the market interest rates.