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**BEHAVIOR OF THE NEW ZEALAND BUSINESS LOAN RATES
IN POST 1997 ASIAN FINANCIAL CRISIS**

Chu V. Nguyen Assistant Professor of Economics and Finance FAEIS Department College of Business University of Houston-Downtown, USA nguyenchu@uhd.edu	Muhammad Mahboob Ali Vice Chancellor and Dean School of Business Presidency University, Dhaka, Bangladesh pipulbd@gmail.com
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ABSTRACT

Asymmetries in the New Zealand business loan-overnight interbank cash rate spread (business loan premium) were documented. Empirical results revealed that the business loan premium adjusts to the threshold faster when the overnight interbank cash rates increase relative to the business loan rates than when the overnight interbank cash rates move in the opposite direction. Additionally, the empirical findings indicate that New Zealand commercial banks still exhibit predatory rate setting behavior, despite of the effort by the government to liberalize and deregulate the banking sector. The bidirectional Granger causality was indicated by the experiential inferences amongst the New Zealand business loan rate and the overnight interbank cash rate, indicating that the business loan rate and the overnight interbank cash rate affect each other's movements. These empirical results suggest that New Zealand monetary authority can use its countercyclical monetary policy instrument to achieve its macroeconomics objectives in the short run.

Key Words: Asymmetry, business loan rate, overnight interbank cash rate, business loan premium, New Zealand, predatory pricing behavior.

JEL classification codes: C22; E44; G21

1. Introduction

One of the most crucial functions enacted by commercial banks in financial advancement pivots around the range of the lending rate they command from the borrowers and the deposit rate they disburse to the savers. This range apart from offering the interest income to economic mediators, also impacts a nation's degree of savings

and investment, in addition to impacting the success of the fiscal strategy making of the central bank. One segment of the range is linked to risk; the remainder—the portion which exceeds a “risk free” level as measured by the US Treasury bill rate, for instant—constitutes a risk premium or loan premium. Evaluation of this “risk or loan

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premium” segment elucidates and offers comprehensions related to the conducts of the bank. Thus, the current study investigates the New Zealand financial sector in general and the behavior of New Zealand banks in particular with a focus on the factors that affect the spread between New Zealand business loan rates and overnight interbank cash rates or hence forth the “business-loan premium,” and in turn the dynamic, interrelationship of the elements that determine them.

Considering the hypothetical viewpoint of interest rate conditions, banks in a free market economy would include all aspects of risk and decide a risk free equilibrium ranging from the rate paid to the lenders and the rate charged from the borrowers. If banks set a loan premium that is either too high or too low, market forces would compel a modification to the equipoise range. Three chief hypothetical descriptions assist the rate-setting conduct of the banking segment: the bank focus hypothesis, the client attribute hypothesis, and the client response hypothesis. The bank

focus hypothesis postulates that oligopolistic banks increase lending rates quickly as a response to positive market forces but are extremely slower in increasing deposit rates. The opposite is true in the instance of falling markets as they response rapidly to alter and reduce the rates paid to depositors and are slower to lower the rates charged to the borrowers (Neumark and Sharpe, 1992; Hannan and Berger, 1991). The client attribute and client response hypotheses postulate that higher the ratio of simple clients combined with higher search and switching costs, the greater is the banks’ capability to alter rates to widen the range and thereby enhance the advantage of the banks’. (Calem and Mester, 1995; Hutchison, 1995; Rosen, 2002).

Fascinatingly, the unequal change in lending rates may be impacted by a further irregularity. Banks may be unwilling to increase rates completely, permitted by a rising market since to do so could result in a negative selection pool of chiefly higher risk loans. Limit in optimizing lending rates supports a wider base of loans with an innate

reduced damaging risk pool (Stiglitz and Weiss, 1981).

As discussed in the section on the New Zealand Reserve Bank (the Central Bank) and banking sector, across the spectrum of changes that took place in the country a little over the last decade, the banking industry can be characterized as deregulated and liberalized. Economic theory and banking experience suggest that financial liberalization may still lead to asymmetric adjustment of lending rate and lending institutions may still exhibit competitive or predatory pricing behavior. The emphasis of the current study is to analyse this plan and in detail investigate the query: do asymmetries exist in the New

Zealand business loan—overnight interbank cash rate spread, and if such asymmetries are present, how do business loan and overnight interbank cash rates respond to these asymmetries? Are the responses independent or dynamically interrelated? How do New Zealand banks price their business loans? The rest of the research is arranged in this way: the subsequent segment recapitulates the New Zealand Reserve Bank and its banking sector; the following segment explains the details and the explanatory statistics employed in the study; the following segment talks about the procedure employed for the analysis; the subsequent one accounts for the experiential inferences; the concluding section provides some concluding remarks.

2. New Zealand Reserve Bank and the Banking Sector

As mentioned in its description of the Country Monetary Policy (2007), the New Zealand Reserve Bank mentioned that in the late 1980s, after a period of analysis and debate, the New Zealand government

provided the Reserve Bank statutory authority to deal with inflation, so that the inflation rate was restrained in a preset range. This authorization was offered for in section 8 of the Reserve Bank of New Zealand Act 1989. The conditions were

mentioned in an agreement amongst the Governor of the Reserve Bank and the Minister of Finance, signed in 1990. This is referred to as the Policy Targets Agreement.

Every time a Governor is appointed or reappointed, a new Policy Targets Agreement needs to be signed, however, a new Policy Targets Agreement can also be formulated at other times. The Policy Targets Agreement also needs the Reserve Bank to attain the inflation target without “pointless uncertainty in output, interest rates and the exchange rate.”

To undertake its legal duty, the Reserve Bank has executed a fiscal strategy with a toll also referred to as the official cash rate (OCR). This is an interest rate predetermined by the Reserve Bank, equivalent to the US discount rate, to fulfill the inflation range a mentioned in the Policy Targets Agreement. As specified in the Explanation of the Country Monetary Policy (2007, p. 9), the OCR is re-evaluated eight times every year by the Reserve Bank. Unofficial modifications to OCR may take place at other times in reaction to

unanticipated advancements. This condition was suggested post the September 11, 2001 attacks on the World Trade Center in New York.

Akin to the US discount rate, the OCR’s transmission mode is via its impacts on the price of borrowing money in the economy, and moderately traditional fiscal strategy tool by global benchmarks.. Prior to 1999, the New Zealand Reserve Bank employed several different other tools to control inflation, comprising of impacting the supply of money and indicating anticipated fiscal settings to the monetary markets by a very direct but tough to comprehend and a less traditional index, referred to as “Monetary Condition Index.”

Description of the Country Monetary Policy (2007, pp. 10–11).

As to the transmission mode of its only fiscal strategy tool, the New Zealand Reserve Bank articulates the Explanation of the Country Monetary Policy (2007, pp. 12–13), that majority of their registered banks hold accounts at the Reserve Bank, which the banks employ to fulfill their debts with

each other when the day ends. Depending on the rates linked to the OCR, the Reserve Bank pays interest on settlement account balances, and charges interest on overnight borrowing. The Reserve Bank additionally contends that the most significant element of the system is the detail that there is no prescribed restriction on the amount of cash it would lend or borrow at the rates linked to OCR's. The Reserve bank suggests that hypothetically the impact of this essential element of the strategy is that no commercial bank will perhaps provide short-term loans at a rate marginally higher than the OCR, since other banks would challenge the interest by employing the credit from the Reserve Bank. However, a bank is not likely to initiate a short-term loan at rates far below the OCR as the same bank can lend to the reserve bank and obtain interest at the OCR level. As a result, market interest rates are usually similar to the Reserve Bank's OCR level.

However, as professed by the New

Zealand Reserve Bank, OCR undoubtedly influences the country's market interest rates; but, it is not the only one. New Zealand fiscal firms are global net borrowers (i.e., they borrow and lend globally.) Hence, changes in the rates abroad, global monetary and fiscal settings, and anticipations by the New Zealand's banks can also alter market interest rates in addition to the overnight lending rates despite the OCR remaining constant. As stated previously, commercial banks are an innate part of the fiscal policy transmission mode. Furthermore, *it is obvious to presume that lending organizations price their monetary services as per their opinion related to their costs in the times to come. Consequently, it is of great interest to study how the overnight interbank cash rate, which is conjectured to be more accurate measure of cost of fund to lending institutions, influences the business loan rate charged by New Zealand commercial banks.*

3. The Data and Descriptive Statistics

This study uses the monthly New Zealand business loan rates and overnight interbank cash rates from the New Zealand's Reserve Bank, over the period from 1998:06 to 2013:09 where the data is available. Coincidentally, this period can be considered the post 1997 Asian financial crisis. Therefore, the results can be articulated as how New Zealand business loan market behaves after the Asian financial crisis of international dimension, hence the title of this investigation. The monthly New Zealand business loan rates, overnight interbank cash rates, and their spread, defined hence forth as "business loan premium", are denoted by CR_t , OR_t , and SP_t , respectively. Figure 1 displays the behavior of the business loan rates, the overnight interbank cash rates, and the business loan premium over the sample period.

Figure 1 displays the behavior of the respective business loan rates, overnight interbank cash rates and their spread—the

business loan premium—over the sample period. The mean business loan rate during this period is 7.22 percent, and ranges from 5.48 to 9.82, with the standard deviation being 1.10. The mean overnight interbank cash rate over the same period is 5.08 percent, and ranges from 2.28 to 8.91, with the standard deviation being 1.97. The mean business loan premium during this period is 2.14 percent, and ranges from 0.51 to 4.95, with the standard deviation being 1.12. The correlation between the New Zealand business loan rates and overnight interbank cash rate is 88.38 percent. These descriptive statistics indicate that the levels of the business loan rates and the overnight interbank cash rates seem to be moderate in the region. In addition, Figure 1 also suggests the New Zealand business loan-overnight interbank cash rate spread experiences a structural shift in 2008 which may well be attributable to the contagion of the U.S. subprime financial crisis to international economies.

New Zealand Business Loan Rates, Overnight Interbank Cash Rates, and Business Loan-Overnight Interbank Cash Rate Spread

Figure 1

4. Methodological Issues and Analytical Framework

4.1 Structural Break

To search endogenously for the likelihood of any structural break in the New Zealand business loan- overnight interbank cash rate spread, the current research employed

Perron's (1997) endogenous unit root test function with the intercept, slope, and the trend dummy to validate the hypothesis that the spread has a unit root.

$$SP_t = \mu + \theta DU + \alpha t + \gamma DT + \delta D(T_b) + \beta SP_{t-1} + \sum_{i=1}^k \psi_i \Delta SP_{t-i} + v_t \quad (1)$$

Where $DU = 1(t > T_b)$ is a post-break constant dummy variable; αt is a linear time trend; $DT = 1(t > T_b)$ is a post-break slope dummy variable; $D(T_b) = 1(t = T_b + 1)$ is the break dummy

variable; and v_t are white-noise error terms. The null hypothesis of a unit root is mentioned to be $\beta = 1$. The break date, T_b , is chosen depending on the minimum t-statistic for validating $\beta = 1$ (see Perron, 1997, pp. 358–359).

Table 1: Perron's Endogenous Unit Root Test, New Zealand Data, 1998:06 to 2013:08

$$LP_t = 0.39692 + 0.24198DU - 0.00199t + 0.00214DT - 0.30466D(T_b) + 0.80377LP_{t-1} + v_t$$

$$(4.1348^*) \quad (0.9945) \quad (-2.7694^*) \quad (1.0683^*) \quad (-1.7371^{***}) \quad (21.3208^*)$$

Number of augmented lags: $k = 11$ Break Date: July 2008 $t(\alpha = 1) = -5.2051^{**}$

Notes: Critical values for t -statistics in parentheses: Critical values based $n = 100$ sample for the break date (Perron, 1997). “*” and “***” indicate significance at 1 and 5 percent levels.

The approximation inferences of Perron's endogenous unit root tests are outlined in Table 1. The post-break intercept dummy variable, DU , is affirmative and is irrelevant at any traditional stage while the DU post-break slope dummy variable, DT , is positive and is significant at 1 percent level. Also, the break

dummy is negative and marginally significant. The time trend is negative and is significant at 1 percent level. These empirical results suggest the New Zealand business loan premium followed a stationary trend process with a break date of August 2008, which may be attributable to the contagion of the American subprime crisis.

4.2 Nonlinear Cointegration

Furthermore, as recommended by Breitung (2001, p. 331), economic theory hypothesizes, in several instances, a nonlinear correlation amongst monetary and fiscal time series. This implies that CR_t and OR_t , may be nonlinearly cointegrated. To detect this likelihood, Breitung's nonparametric process is used to validate for their nonlinear cointegration.

Breitung's nonparametric validation

procedure comprises of the cointegration test, referred to as the rank test for cointegration, and the nonlinearity test, known to be the score statistic for a rank test of overlooked nonlinear cointegration. Considering Breitung (2001), the current research described a graded series as $R_T(CR_t)$ [of LR_t among $CR_1, \dots, CR_T$] and $R_T(OR_t)$ consequently. Breitung's two-sided rank test statistic, testing for cointegration, denoted by Ξ_T^* , is computed as under:

$$\Xi_T^* = T^{-3} \sum_{i=1}^T (r_i^R)^2 / (\sigma_{\Delta r}^2) \quad (2)$$

where T is the sample size, r_i^R is the least squares residual from a regression of $R_T(CR_t)$ on $R_T(OR_t)$. As pointed out by Haug and Basher (2011, p. 187), $\sigma_{\Delta r}^2$ is the variance of Δr_i^R , which is included to adjust for the potential correlation between the two time series CR_t and OR_t . The significant values for this rank test are provided in Table 1 in Breitung (2001, p. 334).

Considering the affirmative inference of the rank test, the initial phase in computing Breitung's score statistic for a rank test of disregarded nonlinear cointegration (testing for nonlinearity) is to regress the New Zealand business loan rate, CR_t , on a constant, the overnight interbank cash rate, OR_t , the ranked series of the overnight interbank cash rate, $R_T(OR_t)$, and the disturbance ζ_t .

4.3 Threshold Autoregressive (TAR) mode

If the inferences of Breitung's

$$CR_t = \delta_0 + \delta_1 OR_t + R_t^*(OR_t) + \zeta_t \quad (3)$$

where $\delta_0 + \delta_1 OR_t$ is the linear part. Under the null hypothesis, $R_t^*(OR_t) = 0$ implying that CR_t and OR_t are linearly cointegrated. Under the alternate hypothesis, $R_t^*(OR_t) \neq 0$ implying that CR_t and OR_t are nonlinearly cointegrated. The score test statistic is given by $T.R^2$, where R^2 is the coefficient of determination of the least squares regression of ζ_t , under the null hypothesis, on a constant, the ranked series of the overnight interbank cash rate, $R_T(OR_t)$, and a disturbance term. T is again the sample size. As articulated by Breitung (2001, p. 337), under the null hypothesis of linear cointegration, the score statistic for a rank test of neglected nonlinear cointegration is asymptotically Chi-Square distributed with one degree of freedom.

nonparametric tests are affirmative, this research tracks Thompson (2006) to regress the spread,

SP_t , on a constant, a linear trend and an intercept dummy (with values of zero prior to July 2008 and values of one for July 2008 and thereafter) to formally examine the New Zealand business loan rate, overnight interbank cash rate, and the business loan premium (the estimation results are reported in Appendix I). The saved residuals from the above approximated prototype, indicated by $\hat{\varepsilon}_t$, are then employed to estimate the following TAR model:

$$\Delta \hat{\varepsilon}_t = I_t \rho_1 \hat{\varepsilon}_{t-1} + (1 - I_t) \rho_2 \hat{\varepsilon}_{t-1} + \sum_{i=1}^p \alpha_i \Delta \hat{\varepsilon}_{t-i} + \hat{u}_t \quad (4)$$

where $\hat{u}_t \sim i.i.d. (0, \sigma^2)$, and the lagged values of are meant to yield uncorrelated residuals. As defined by Enders and Granger (1998), the Heaviside indicator function for the TAR specification is given as:

$$I_t = \begin{cases} 1 & \text{if } \hat{\varepsilon}_{t-1} \geq \tau \\ 0 & \text{if } \hat{\varepsilon}_{t-1} < \tau \end{cases} \quad (5)$$

The threshold value, τ , is endogenously ascertained employing the Chan (1993) process, which gets τ by

mitigating the total of squared residuals after organizing the projected residuals in ascending order, and removing 15 percent of the largest and smallest values. The elimination of the largest and the smallest values is to assure that the $\hat{\varepsilon}_t$ series crosses through the threshold in the sample period.

The threshold autoregressive (TAR) prototype permits the level of autoregressive decay to rely on the state of the intermediation premium, i.e. the “deepness” of cycles. The estimated TAR model empirically reveals if the intermediation premium tends to revert back to the long run position faster when the premium is above or below the threshold. Thus, the TAR prototype shoes if the depressions or pikes continue more when the surprises or countercyclical fiscal policy actions push the intermediation premium out of its long-run equilibrium path. In this model’s specification, the null hypothesis that the intermediation premium contains a unit root can be expressed as $\rho_1 = \rho_2 = 0$, while the hypothesis that the premium is stationary with symmetric adjustments can be stated as $\rho_1 = \rho_2$.

5. Empirical Results

5.1 Results of the Cointegration Test with

Asymmetric Adjustment

Empirical calculations indicate that Breitung's nonparametric rank tests and score test are 0.000704, which fails to reject the null hypothesis of cointegration, and 0.391638 which also fails to reject the null hypothesis of linear cointegration, respectively. These test results reveal that the New Zealand business loan rates overnight interbank cash rates are linearly cointegrated at all conventional levels of significance. Additionally, the estimation results of the TAR model are summarized in Table 2.

An evaluation of the general approximation inferences shows that the approximation inferences are lacking sequential links and have good envisaging strength as proved by the Ljung-Box statistics and the general F-statistics, respectively. The calculated statistic $\Phi_\mu = 9.0611$ indicates that the null hypothesis of no co-integration, $\rho_1 = \rho_2 = 0$, should be rejected at the 1 percent significant level, confirming that the New Zealand business loan-overnight interbank cash rate spread is stationary.

Table 2: Unit Root and Tests of Asymmetry, New Zealand Data, 1998:06 to 2013:08

ρ_1	ρ_2	τ	$H_0: \rho_1 = \rho_2 = 0$	$H_0: \rho_1 = \rho_2$	aic	sic
-0.1661*	-0.3927*	-0.32907	$\Phi_\mu = 9.0611^*$	$F = 3.0874^{***}$	-2.3789	-2.2724
$QLB(12) = 8.0100[0.7844]$			$\ln L = -35.3128$	$F_{(5,174)} = 4.8813^*$	D.W. = 2.0631	

Notes: The null hypothesis of a unit root, $H_0: \rho_1 = \rho_2 = 0$, uses the critical values from Enders and Siklos (2001, p. 170, Table 1 for four lagged changes and $n = 100$). *** and ** indicate 1 percent and 10 percent levels of significance. The null hypothesis of symmetry, $H_0: \rho_1 = \rho_2$, uses the standard F distribution. τ is the threshold value determined via the Chan (1993) method. $QLB(12)$ denotes the Ljung-Box Q-statistic with 12 lags

The estimation results further reveal that both ρ_1 and ρ_2 are statistically significant at 1 percent level. In fact,

the point estimates suggest that the New Zealand business loan-overnight spread tends to decay at the rate of $|\rho_1| = 0.16661$ for $\hat{\varepsilon}_{t-1}$

above the threshold, $\tau = -0.32907$, and at the rate of $|\rho_2| = 0.32907$ for $\hat{\varepsilon}_{t-1}$ below the threshold. Additionally, the empirical results also reveal that, based on the partial $F = 3.087$, the null hypothesis of symmetry, $\rho_1 = \rho_2$ should be rejected at 10 percent significant level, indicating statistically that adjustments around the threshold value the New Zealand business loan-overnight interbank cash rate spread are asymmetric.

More specifically, given the finding of $|\rho_2| > |\rho_1|$, the adjustment of the New Zealand business loan-overnight interbank cash spread toward the long-run equilibrium tends to persist

more when the business loan premium is widening than when it is narrowing. These findings suggest that New Zealand commercial banks react differently to rising versus declining official cash rates. These inferences can also be decoded to indicate that these organizations respond in a varied manner to expansionary fiscal strategy than to the opposite. These inferences match those described by Thompson (2006) for the U.S. and seem to indicate the predatory pricing behavior of the New Zealand institutions, despite of the aforementioned effort by the government to deregulate and liberalize the country's financial sector in general and the banking industry in particular.

5.2 Results of the Asymmetric Error-Correction Model

The affirmative inferences of the above unequal co-integration tests and the aic's and the sic's that resulted from estimating the above TAR model necessitate the use of a Threshold Autoregressive Vector Error-Correction (TAR-VEC) model to further investigate the asymmetric short-run dynamic behavior between the New Zealand business loan rates and overnight interbank cash rates. The approximation inferences of this prototype can

be employed to analyze the character of the Granger causality between the behavior between the New Zealand business loan rates and overnight interbank cash rates. The empirical determined nature of the Granger causality will help to evaluate empirically whether and how the New Zealand business loan rate and overnight interbank cash rates react to alterations in business loan premium, encouraged by extrinsic financial surprises or countercyclical policy measures. Additionally as

aforementioned, the following TAR VEC model differs from the conventional error-correction

models by allowing asymmetric adjustments toward the long-run equilibrium.

$$\Delta CR_t = \alpha_0 + \rho_1 I \rho_t \hat{\epsilon}_{t-1} + \rho_2 (1 - I_t) \hat{\epsilon}_{t-1} + A_{11}(L) \Delta CR_{t-i} + A_{12}(L) \Delta OR_{t-i} + u_{1t} \quad (6)$$

$$\Delta OR_t = \tilde{\alpha}_0 + \tilde{\rho}_1 I \rho_t \hat{\epsilon}_{t-1} + \tilde{\rho}_2 (1 - I_t) \hat{\epsilon}_{t-1} + A_{21}(L) \Delta CR_{t-i} + A_{22}(L) \Delta OR_{t-i} + u_{2t} \quad (7)$$

Where $u_{1,2t} \sim i.i.d.(0, \sigma^2)$ and the Heaviside indicator function is set in accord with (5). This model specification recognizes the fact that the New Zealand business loan rates may respond differently, depending on whether the business loan premium is widening or narrowing (i.e., expansionary or contractionary monetary policy).

The following are the estimation results for the TAR-VEC model specified by equations (5), (6), and (7), using the New Zealand business loan rates and the overnight interbank cash rates. In the approximation inferences $A_{ij}(L)$ symbolizes the first-order polynomials in the lag operator L . The F_{ij} symbolizes the computed F -statistics with the p-value in squared brackets, validating the null hypothesis that all coefficients of A_{ij} are equivalent to zero. The t -statistics are described with “*” specifying the 1 percent significant level, respectively. $Q_{(12)}$ is the Ljung-Box statistics and its significance is in

squared brackets, testing for the first twelve of the residual autocorrelations to be jointly equal to zero. $\ln L$ is the log likelihood. The overall, F -statistics with “*”, indicates the significant level of 1 percent.

An analysis of the overall empirical results indicates that the estimated equations (6) and (7) are absent of serial correlation and have good envisaging strength as proved by the Ljung-Box statistics and the overall F -statistics, particularly. As to the long-run alteration, the approximation inferences of equation (6) of the TAR-VEC prototype reveal that ρ_1 is statistically significant at 1 percent level, while ρ_2 is insignificant at any conventional level. This finding indicates that when introducing the short-run dynamic adjustment to the model, the New Zealand business loan rates respond only to the widening but not to the narrowing of the loan premium. This finding suggests that New Zealand lending institutions respond only to expansionary, but not to contractionary

monetary policy in the long-run.

Table 3: New Zealand Business Loan and Overnight Interbank Cash Rates Data, 1998:06 to 2013:08

$\Delta CR_t = 0.0026 - 0.0835 I_t \hat{\varepsilon}_{t-1} - 0.0001 (1 - I_t) \hat{\varepsilon}_{t-1} + A_{11}(L) \Delta CR_{t-1} + A_{12}(L) \Delta CR_{t-1} + u_{1t}$					
(0.2561)	(-2.9044 [*])	(-0.0003)	F ₁₁ =4.0222[0.0197]	F ₂₁ =81.0486[0.0000]	
$Q_{(12)} = 6.5760[0.8843]$		$\ln L = 136.7316$		$F_{(6,168)\text{-statistic}} = 31.0055^*$	
<hr/>					
$\Delta OR_t = 0.3308 + 0.0090 I_t \hat{\varepsilon}_{t-1} - 0.1627 (1 - I_t) \hat{\varepsilon}_{t-1} + A_{21}(L) \Delta CR_{t-i} + A_{22}(L) \Delta OR_{t-i} + u_{2t}$					
(1.2557)	(0.1877)	(5.3881 [*])	F ₁₁ =18.0186[0.0000]	F ₂₁ =29.0789[0.0000]	
$Q_{(12)} = 10.8580 [0.5411]$		$\ln L = 102.0934$		$F_{(10,152)\text{-statistic}} = 24.8001^*$	

Note: " " indicates 1% level of significance.

With regard to the long-term adjustment of the overnight interbank cash rates, the estimation results of equation (7) show that $\tilde{\rho}_2$, are statistically significant at 1 percent level, while $\tilde{\rho}_1$ is not significant at any conventional level. Interestingly, when introducing the short-run dynamic adjustment to the model, the New Zealand overnight interbank rates respond only to the narrowing, but not to the widening of the business loan premium.

In addition to estimating the long-run equilibrium relationship and asymmetric adjustment, the estimated TAR-VEC model also allows for determinations of the Granger causality between the New Zealand business

loan rates and the overnight interbank cash rates. The partial *F*-statistics in equation (6) reveals that the business loan rate responds to both the lagged changes in the overnight interbank cash rate and its own lagged changes. Similarly, the estimation results also indicate that the overnight interbank cash rate responds to both its own lagged changes and lagged changes of the business loan rates. These findings indicate a bi-directional Granger-causality between the New Zealand business loan rate and the overnight interbank cash rate in the short run. Therefore, these findings reveal that the New Zealand business loan rate and the overnight interbank cash rate affect movements of each other's rate in the short run in post 1997 Asian financial crisis.

5. Concluding Remarks

This study estimated the threshold autoregressive (TAR) model developed by Enders and Siklos (2001) to investigate the behavior the New Zealand business loan rates, overnight interbank cash rates and the business loan premium in the post 1997 Asian financial crisis. Also, the New Zealand Central Bank has changed from using a variety of instruments, including money supply, Monetary Condition Index to employing the OCR, as a single instrument, to control inflation over this period.

Initially, following Perron (1997) process, an endogenous unit root test function with the intercept, slope, and trend were stated and projected to validate the hypothesis that the business loan premium has a unit root. The results of this test suggest that the premium followed a stationary trend process with a structural break in July 19988, which was attributable to the contagion of the U.S. subprime financial crisis. Secondly, Breitung's nonparametric rank tests reveal that the New Zealand business loan rates overnight interbank cash rates are linearly cointegrated at all traditional levels of significance.

Third, the approximation inferences of the the TAR model reveal that New Zealand commercial banks react differently to rising versus declining official cash rates. These findings suggest that these institutions react differently to expansionary monetary policy than to contractionary. These results indicate the predatory pricing behavior of the New Zealand institutions, despite of the aforementioned effort by the government to deregulate and liberalize the country's financial sector in general and the banking industry in particular.

Finally, the empirical estimation of the TAR-VEC model reveals bi-directional Granger-causality between the business loan rate and the overnight interbank cash rate in the short run. This finding indicates that the business loan rate and the overnight interbank cash rate affect each other's movement in the short run. The inference of bi-directional Granger causality is crucial as it indicates unequal replies of monetary markets to contractionary and expansionary monetary policy actions. The New Zealand monetary authority can use its countercyclical monetary

policy instrument to achieve its short-run macroeconomics objectives.

Appendix I

Table 4: Estimation Inferences for Equation, New Zealand Data, 1998:06 - 2013:08

$SP_t = 2.4316 - 0.0143 \text{Trend}_t + 3.0790 \text{Dummy}_t + \varepsilon_t$		
$(22.7253^*) \quad (-9.6310^*) \quad (18.4685^*)$		
$\ln L = -168.7507$	$R^2 = 0.7020$	$\text{DW statistic}^{(a)} = 0.3133 \quad F_{(2,180)} = 215.3953^*$

Notes: “*” indicates significance at 1 percent level.

(a) As articulated by Enders and Siklos (2001, p. 166), in this type of model specification, ε_t may be contemporaneously correlated.

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