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Responses to Interest Rate Changes: A Comparison between Domestic and Foreign Commercial Banks in Malaysia[1]

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Abstract: This study aims to analyse the impact of interest rate changes on the domestic and foreign banks and determine its monetary policy implications. The study employed the impulse response functions and variance decomposition analysis based on the Vector Autoregression model to study the responses of major balance sheet items, namely deposit and loan to interest rate shocks based on Malaysian data from the period January 1997 to December 2006. The study found that domestic banks responded differently to interest rate shocks compared to the foreign banks. The different responses of the balance sheet items of the domestic and foreign banks show that the impact of tight monetary policy is uneven across the banking institutions. It also implies that the domestic banks could learn from the prudent risk management practices of the foreign banks that enable them to resume lending after a shorter lapse compared to domestic banks.

Keywords: Domestic banks, foreign banks, impulse response functions, interest rate changes, Malaysia, variance decomposition analysis
JEL classification: G15, G21, G24, G32

1. Introduction

Financial institutions such as commercial banks play an important role in enabling productive activity to take place in the economy by contributing towards efficient allocation of capital from the surplus unit to the deficit unit. The ability of commercial banks to play the role of an effective financial intermediary, however, is highly dependent on the level of interest rate in the economy. A high interest rate environment would reduce the liquidity of the banks due to the high cost of funds, thus reducing the lending capability of the banks. Simultaneously, a high interest rate environment would discourage borrowing by the private sector due to the high cost of borrowing. Consequently, in a high interest rate environment, commercial banks would normally curb lending due to the low liquidity as well as low loan demand from the private sector. In this context, it is very critical for the policymakers to ensure that the level of interest rate is sufficiently conducive for the private sector to continue to demand financing from the commercial banks.

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However, several studies have documented empirical evidence that the impact of changes on the interest rate environment is uneven across the banking institutions. A critical factor determining the sensitivity of the commercial banks to interest rate changes is the structure of the banks' loan portfolio. Commercial banks focusing on corporate lending are shown to respond differently to changes in the interest rate environment compared to those catering for retail customers. The study by Dale and Haldane (1995) shows that lending to the corporate sector responds to changes in interest rate with a lag, while lending to the retail customer sector declines instantaneously to a high interest rate environment. This finding is further supported by Garretsen and Swank (1997) who showed that household loans declined instantaneously following an interest rate rise, while corporate loans declined only after nine months of the policy shocks. Other studies by Gilchrist and Zakrajsek (1995), Gertler and Gilchrist (1992), Gibson (1997), Kuppers (2002), Iacoviello and Minetti (2008), and Dedola and Lippi (2005) are also supportive of the observation that banks with different portfolio structures respond differently to interest rate changes.

This study aims to determine if the impact of interest rate changes on the domestic commercial banks is different compared to the foreign commercial banks in Malaysia. The study is motivated by the significant presence of the foreign banks in the Malaysian financial sector. These foreign banks are known to have a distinct niche market and a different risk profile compared to the domestic commercial banks. The foreign banks in Malaysia are characterised by big and stable banks with prudent liquidity management strategies. Laeven (1999) studied the risk appetite of commercial banks in Indonesia, Korea, Malaysia, the Philippines and Thailand and found that foreign-owned banks took little risk relative to other banks in the East Asian region, and that family-owned banks were among the most risk-taking banks, together with company-owned banks. The study found that restructured banks which are mostly family-owned or company-owned that are locally incorporated had excessive credit growth, indicating the excessive risk-taking behaviour of these banks.

Based on this background information, we studied the reaction of domestic and foreign banks to interest rate shocks by analysing the behaviour of major balance sheet items, namely, loans and deposits to a positive innovation in interest rates. Using aggregated data, we compared the differences in behaviour between these two banking groups. This study contributes to the current literature in several aspects. First, to our knowledge, no studies have been done so far in analysing the impact of monetary policy on these two banking groups using aggregated data based on the methodology that this study is adopting. Also, findings of this study would enable some policy recommendations on the impact of monetary policy changes on the banking institutions and the liberalisation of the Malaysian financial sector under the World Trade Organization (WTO).

In Malaysia, foreign banks have made significant presence early in the existence of the country's banking industry. The pioneers in the country's commercial banking industry were the Chartered Mercantile Bank of India, London and China which was established in 1823 and the Standard Chartered Bank in 1875. During the early years, commercial banks were set up to serve the financing needs of major economic activities at that time such as trading and tin mining. Today, the commercial banking business in Malaysia has undergone remarkable growth. Following the consolidation program undertaken by Bank Negara

Malaysia after the crisis in 1998, the commercial banking industry now comprises 22 institutions[2], of which 9 are domestically-owned[3] and 13 are foreign-owned.[4]

Despite several regulatory limitations imposed on the operations of the foreign banks in Malaysia such as the establishment of new bank branches, linkage with the domestic banks' ATM network and internet banking services, the growth of the foreign banks is comparable to that of the domestic banks. From 1990 to 2006, total assets of the foreign banks grew at a compounded growth rate of 14 per cent per annum, a growth rate very close to that of the domestic banks at 15 per cent per annum. More importantly, despite the limited opportunities to establish new branches, total loans and total deposits of the foreign banks grew by 12 per cent and 16 per cent, respectively, comparable to that of the domestic banks at 14.6 per cent and 19 per cent, respectively. In the recent period, several restrictions have been lifted in line with Malaysia's efforts to gradually liberalise the domestic banking industry.

The rest of the paper is organised as follows. Section 2 highlights the methodological framework which includes discussion on the nature of data, model specification, and preliminary analysis of the data. Section 3 presents the empirical findings based on the impulse response functions and variance decomposition analysis. Finally, Section 4 highlights the major findings and provides some relevant policy recommendations.

2. Methodological Framework

2.1 Data

This study adopts a Vector Autoregression (VAR) model in the estimation process in order to investigate the impact of interest shocks on the domestic commercial bank lending and foreign commercial banking lending in Malaysia. The VAR model is suitable for the case of this study since the macro-variables such as exchange rate and interest rate are endogenous; thus, it is difficult to infer how changes in these variables affect bank lending and other economic variables under investigation. A VAR model helps to solve the simultaneous causality problem by assuming that all the variables under consideration are endogenous.

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[2] This does not include the 11 Islamic Banks which are Asian Financial Bank (M) Berhad, Bank Islam Malaysia Berhad, Bank Muamalat Malaysia Berhad, Hong Leong Islamic Banking Berhad, CIMB Islamic Bank Berhad, RHB Islamic Bank Berhad, AmIslamic Bank Berhad, Affin Islamic Bank Berhad, Al Rajhi Banking and Investment Corporation (Malaysia) Berhad, EONCAP Islamic Bank Berhad, and Kuwait Finance House (Malaysia) Berhad.

[3] The domestic-owned commercial banks are Affin Bank Berhad, Alliance Bank Malaysia Berhad, AmBank Berhad, CIMB Bank Berhad, EON Bank Berhad, Hong Leong Bank Berhad, Malayan Banking Berhad, Public Bank Berhad and RHB Bank Berhad.

[4] The foreign-owned commercial banks are ABN AMRO Bank Berhad, Bangkok Bank Berhad, Bank of America Malaysia Berhad, Bank of China (Malaysia) Berhad, Bank of Tokyo-Mitsubishi (Malaysia) Berhad, Citibank Berhad, Deutsche Bank (Malaysia) Berhad, HSBC Bank Malaysia Berhad, J.P. Morgan Chase Bank Berhad, OCBC Bank (Malaysia) Berhad, Standard Chartered Bank Malaysia Berhad, The Bank of Nova Scotia Berhad and United Overseas Bank (Malaysia) Berhad.

Eight variables are being considered in this study comprising of the monetary policy indicators, bank balance sheet items, and selected macro-economic variables. The overnight interbank money market rate (ONR) is used to represent the policy rate in Malaysia which is consistent with the current adoption of the ONR as the monetary policy indicator by the Malaysian Central Bank - Bank Negara Malaysia (BNM). Meanwhile, the objective variables are the balance sheet items of the domestic and foreign banks, namely, domestic loans (DL), domestic deposits (DD), foreign loans (FL) and foreign deposits (FD). Since the monetary policy objective of BNM is to ensure sustainable economic growth with price stability, we included the consumer price index (CPI). Given that Malaysia is a highly open economy, the real exchange rate (RER)[5] variable is also included as a control variable.

All series are in real term (adjusted by the price index with year 2000 as the base year). The study used monthly data covering the period from January 1997 to December 2006. All data were sourced from the BNM's *Monthly Statistical Bulletin* (BNM 1997-2006) except for the RER which was gathered from the International Monetary Fund's *International Financial Statistics* (IMF1997-2006).

2.2 Model Specification and Empirical Method

To investigate the impact of interest rate shocks on the lending of domestic and foreign commercial banks in Malaysia, we adopted a VAR model in the estimation process. The VAR model is helpful to solve the simultaneous causality problem among the variables. For instance, in the case of this paper, as the exchange rate and interest rate variables were endogenous, it was difficult to infer how changes in these variables affect bank lending and other economic variables under investigation. We begin this section with a brief description of the VAR approach. Suppose the economy evolves according to

$$AX_t = C(L)X_{t-1} + \varepsilon_t \tag{1}$$

Here X_t is a vector of variables summarising the state of the economic system. In this study, we considered an eight-variable VAR consisting of the overnight rate (ONR), domestic loan (DL) and deposit (DD), foreign loan (FL) and deposit (FD), industrial production index (IPI), consumer price index (CPI) and real exchange rate (RER). The matrix A is a square matrix of structural parameters on the contemporaneous endogenous variables that indicates the contemporaneous relationships in the model. *C(L)* is a matrix polynomial in positive powers of the lag operator *L*. The structural disturbances in this economy are summarised by the identical, independently distributed random variable ε_t, which is a vector of white noise. The problem with the representation in (1) is that because the coefficients in the matrices are unknown and the variables have contemporaneous effects on each other, it is not possible to uniquely determine the values of the parameters in the model. Equation (1) can be transformed into the following reduced form:

$$x_t = G(L)X_t + e_t \tag{2}$$

[5] It is natural to use the RM/USD exchange rate in this model as in many other studies due to the position of the US in Malaysia's trade profile and that of a large part of Malaysia's total trade are denominated in US dollar. However, we did not use it here due to the fixed exchange rate during the sample period.

where $G(L) = A^{-1}C(L)$ and $e_t = A^{-1}\varepsilon_t$. This is a VAR representation of the structural model in (1). Note that the error term e_t is a linear combination of the structural form errors u_t. As a result, even though the structural form errors are assumed to be uncorrelated with each other, reduced-form errors will be correlated in general. The SVAR approach that we employed here imposes restrictions on the covariance matrix of the structural shocks, which are both eight by eight matrices, to identify these structural parameters from the covariance matrix of the residuals. This is because we have

$$\sum_{\varepsilon} = E(\varepsilon_t \varepsilon\prime) = A_0 \sum_{e} A_0.$$

It can be seen from this decomposition that if one knew the structural form matrix A_0 , then it would be possible to solve for the structural form error variances from the reduced-form variance-covariance matrix Σ_e. Specifically, Σ_ε is specified as a diagonal matrix, because the primitive structural disturbances are assumed to originate from independent sources and Σ_ε is further normalised to be the identity matrix. However, additional restrictions are still required to identify the matrix A. Once the structural model is identified, interrelationships between the variables can be investigated via impulse response functions and forecast error variance decompositions, which show the evolution of economic shocks through the system. This type of identification has been widely used in the literature since its proposal by Sims (1980) which is known as Cholesky decomposition. This kind of decomposition implies that the first variable responds only to its own exogenous shocks, the second variable responds to the first variable and to the second variable's exogenous shocks and so on. In other words, we are assuming a recursive structure.

When the variables are ordered as {ONR, DD, DL, FD, FL, IPI, CPI, RER}, they indicate that domestic loans are affected by the shocks in policy rates and domestic deposits but not by other contemporaneous variables in the system. The ordering of {ONR, IPI, CPI, RER, DD, DL, FD, FL} indicates that domestic loans are affected not only by policy rates but also the general economic conditions, but not by foreign deposits and foreign loan status. Thus, the results from VARs can be quite sensitive to the ordering imposed. Unless there is a strong theoretical foundation for this ordering, it may be that the underlying shocks could be improperly identified. Despite this, in order to orthogonalise the innovations, a predetermined ordering of the variables had to be made. For instance, policy rate could be ordered after price and output to mimic a simplified monetary feedback rule whereby interest rate decisions are made based on the contemporaneous availability of aforementioned information. As pointed out by Kamas and Joyce (1993), the choice of ordering is unlikely to be important if the correlation between the residuals in absolute value is less than 0.2 given our sample size (Enders 2004).[6]

The estimation was performed with natural logarithm of the variables in level, except for the overnight interbank rate (ONR). Bernanke and Blinder (1992), Sims (1992) and Levy and Halikias (1997), to name a few, estimated VAR model in levels, despite having most variables which are non-stationary and cointegrated. The debate between estimating in levels or via the vector error correction model (VECM) is best summarised by Ramaswanmy and Sloek

[6] We have tried all possible ordering in this study but the results remain the same, quantitatively and qualitatively. For brevity, we do not report the results here.

Table 1. ADF and KPSS unit root tests results

Time series	ADF		KPSS	
	Level	First Difference	Level	First Difference
Domestic Deposit	-1.36	-12.73***	0.3312***	0.1564
Domestic Loan	-1.19	-9.79***	0.2662**	0.1467
Foreign Deposit	-1.71	-13.46***	0.3283***	0.0665
Foreign Loan	-1.25	-14.14***	0.3480***	0.0728
Industrial Production Index	-1.70	-7.24***	0.2350**	0.0506
Consumer Price Index	-1.94	-13.13***	0.3913***	0.1172
Real Exchange Rate	-1.71	-12.28***	0.1745*	0.1217
Overnight Interest Rate	-1.93	-21.53***	0.1053*	0.0576

Notes: The lag lengths are selected according to SIC (Schwartz information criterion) rule. The critical values for the ADF tests are based on MacKinnon (1996) and for KPSS are based on Kwiatkowski et al.(1992). ***, **, * significant at 1%, 5% and 10%, respectively.

(1997). According to them, it is reasonable not to impose restrictions on the VAR model if the true cointegrating relationships are unknown and the main focus is to investigate the relationships. However, if the variables under investigation are not cointegrated, it is advised to estimate the VAR model with first difference.

2.3 Preliminary Data

As a preliminary exercise to any VAR model, we tested for the unit root property of the variables. Two alternative popular unit root tests were performed on these time series. First, we applied the Augmented Dickey Fuller (ADF) test by Dickey and Fuller (1981) which is the benchmark test. As shown in Table 1, the ADF test results failed to reject the null hypothesis of unit root for all variables. However, at better than 5 per cent significance level, the first difference of these variables was found to be stationary. Given these results, the KPSS test proposed by Kwiatkowski *et al.* (1992) was used to double-check the time series properties of the data. Contrary to the ADF test, the KPSS test considers the null hypothesis of a stationary series against the alternative of a unit root, thus complementing the ADF test's results. As shown in Table 1, the KPSS test statistics confirmed the results of the ADF test. In view of this, we treated all the series as I(1) process.

A critical element in the specification of the VAR models is the determination of the lag length of the VAR. The importance of lag length determination is demonstrated by Braun and Mittnik (1993) who showed that estimates of a VAR whose lag length differs from the true lag length are inconsistent, as are the impulse response functions and variance decompositions derived from the estimated VAR. Lütkepohl (1993) indicated that over-fitting (selecting a higher order lag length than the true lag length) causes an increase in the mean-square forecast errors of the VAR and that under-fitting the lag length often generates auto correlated errors. Hafer and Sheehan (1989) found that the accuracy of forecasts from VAR models varied substantially for alternative lag lengths. Our optimal lag was determined

by the sequential modified LR test statistic, Final prediction error (FPE) and Akaike information criterion (AIC).

Since our data are I(1), we applied the Johansen-Juselius co-integration test (Johansen 1988) to evaluate whether they are co-integrated. Both Trace and Max-eigenvalue tests indicated the series under consideration to be co-integrated at the 5 per cent level. When there is evidence of co-integration among the variables of a VAR system, such information can be incorporated into the VAR system. Therefore, a modified version of VAR which is known as the Vector Error Correction Model (VECM) had to be estimated. In the VECM, the lagged co-integration vector(s) were added to the list of explanatory terms on the right-hand side of the VAR equations that were specified in first differences. The co-integration vectors were presumed to be the long run 'equilibrium' relationships among the variables. However, the co-integration constraints were not undertaken in our analysis. The justification attributed to is that the analysis was generally focused on short-run constraints and the short-run dynamic response of the system. When co-integration constraints were excluded, this only implied that the long-run response of some variables were not constrained and might follow a divergent path. However, the short-run analysis was still valid. Second, Sims *et al.* (1990) proved that standard asymptotic inference was not affected even when the variables included in the VAR in levels were co-integrated. Finally, although estimates are no longer efficient if co-integration constraints are not included, they still remain consistent. Hence, the lower efficiency in the estimates can be justified by the difficulty in the economic interpretation of some of the co-integration constraints showed by the data (De Arcangelis and Di Giorgio 1999).

In terms of ordering of the variables, as mentioned earlier, the results from VARs can be quite sensitive to the ordering imposed. Unless there is a strong theoretical foundation for this ordering, it may be that the underlying shocks could be improperly identified. Despite this, in order to orthogonalise the innovations, a predetermined ordering of the variables had to be made. As pointed out by Kamas and Joyce (1993), the choice of ordering is unlikely to be important if the correlation between the residuals in absolute value is less than 0.2, given our sample size (Enders 2004). An investigation of the residual correlation matrix (Table 2) indicates that the ordering of the variables is important for our model. Since the ordering is important in our VAR model, the best strategy is to compare the results to the IRF obtained by reversing the ordering. However, the results from different orderings showed no significant differences. For the purpose of this study, the interest rate was ordered first and exchange rate ordered last. The rationale for this is that the aim of the study was to analyse the effects of interest rate shocks on the objective variables rather than the reaction of interest rate to changes in the other variables. Therefore, we ordered the interest rate in the first position, followed by the domestic loan and deposist, foreign loan and deposits, output, price and exchange rate.

3. Results and Discussion

3.1. Impulse Response Functions (IRF)

Figure 1 shows the responses of the domestic and foreign banks' deposits and loans, industrial production index, consumer price index and real exchange rate to a one standard-deviation shock in the interest rate. The horizontal axis in the graphs represents time

Table 2. Residual cross-correlation matrix

	ONR	DD	FD	DL	FL	IPI	CPI
ONR	1.000						
DD	-0.197	1.000					
FD	-0.240	0.299	1.000				
DL	-0.111	0.359	-0.075	1.000			
FL	-0.083	0.141	0.016	0.418	1.000		
IPI	-0.059	0.112	0.079	0.068	0.046	1.000	
CPI	0.147	0.089	0.097	-0.075	-0.113	-0.036	1.000
RER	-0.329	-0.080	0.269	0.041	0.193	-0.021	-0.140

Notes: ONR, DD, FD, DL, FL, IPI, CP and RER denote overnight policy rate, domestic deposits, foreign deposits, domestic loan, foreign loan, industrial production index, consumer price index and real exchange rate, respectively.

horizon, extending from three months to thirty-six months. To provide some idea of uncertainty surrounding the estimated responses, following the recommendation of Sims and Zha (1995), a one standard deviation of confidence band around the point estimates was estimated for the IRFs using the Monte Carlo integration based on 10,000 draws (shown by the two dashed lines).

The IRF results show that domestic deposit responded instantaneously negative to a one-standard-deviation shock in the policy interest rate, implying that deposits of the domestic banks declined in response to a high interest rate condition. The negative response of the domestic deposits to an increase in the policy rate remained significant until about four months following the interest rate shock. As for foreign deposits, even though it also responded negatively to the interest rate shocks, the initial response was shown to be statistically insignificant. In contrast to the domestic deposits which responded instantaneously and significantly negative to interest rate shocks, foreign deposits responded to interest rate shock with a lag. Foreign deposits declined only after the third month following the interest rate shocks, which could reflect the nature of the deposits in the foreign banks which were mainly fixed deposits as well as the customers' profile which was mainly less sensitive to interest rate changes. The different responses of the deposits in the domestic banks and foreign banks could also be due to the confidence and perception of the customers that the foreign banks are better able to weather economic shocks than the domestic banks.

Shifting to loans, the IRF results reveal interesting findings. Domestic loans were shown to respond instantaneously negative following a positive one-standard deviation interest rate shock. This implies that the domestic banks instantaneously curtailed lending following a tight monetary condition. Relating this with the decline in deposits, the decline in domestic banks' loans was due to the lower liquidity following the decline in deposits. On the contrary, foreign loans showed the opposite reaction to interest rate shocks. In particular, foreign loans responded with a lag, registering a significant and positive response around the fifth to sixth month following the shocks. The results show that foreign loans responded significantly positive to interest rate shock, implying that the foreign banks resumed lending despite the tight monetary condition. In the context of this study, it is important to highlight

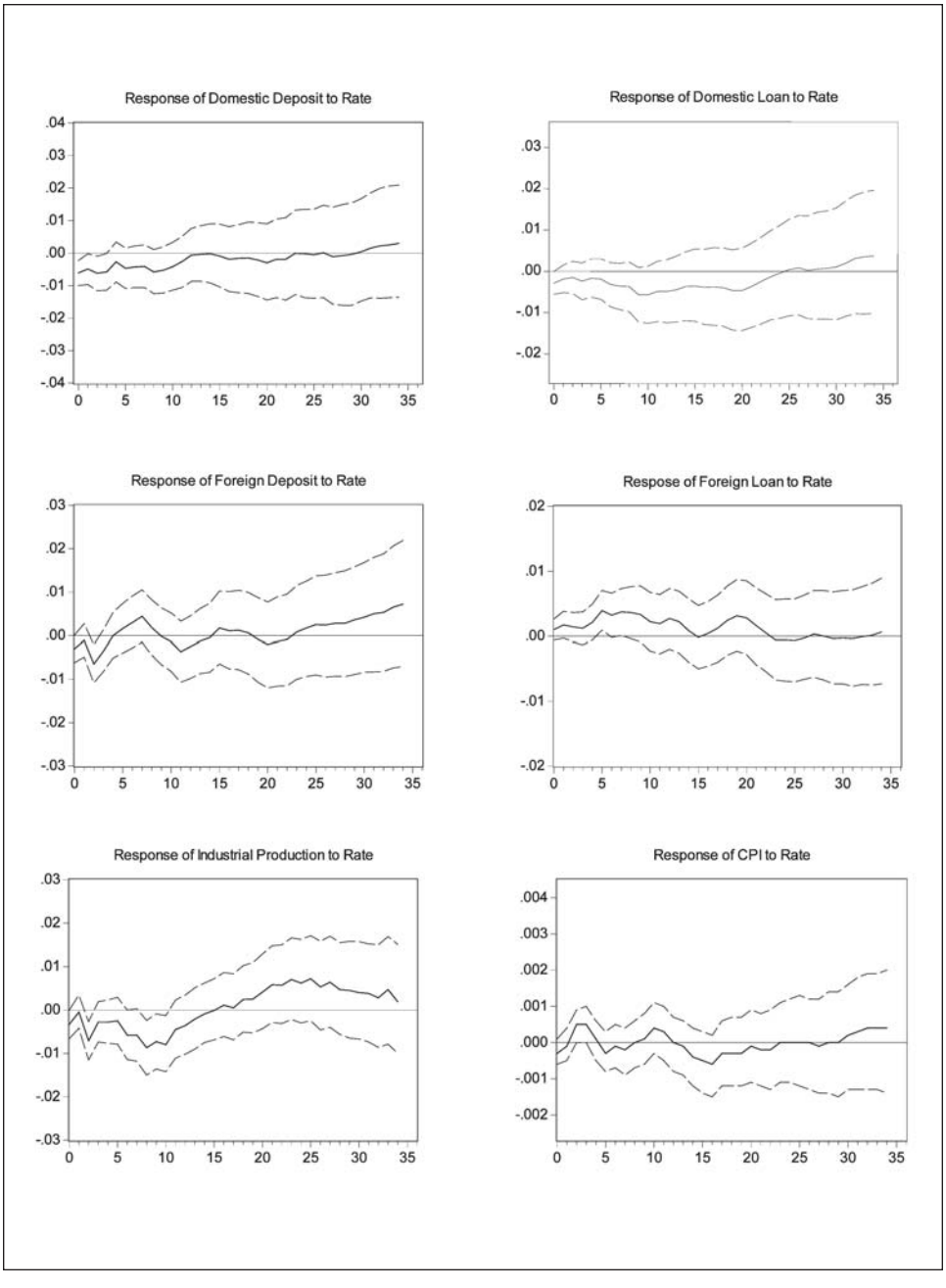

Figure 1. Impulse response functions of the variables to one standard deviation of interest rate shock

that the responses of the foreign banks to interest rate shocks were clearly different from the domestic banks.

As for the rest of the variables, their responses to interest rate shocks were as predicted and consistent with the traditional Keynesian macro-economic framework. A monetary policy shock led to contraction in output in the short run but left no significant impact in the long-run. Meanwhile, price decreased initially but increased later following an interest rate hike. A lower domestic price induced by a negative monetary policy shock caused the real exchange rate to depreciate, promoting the country's exports and decreasing its imports, and thereby improving the trade balance followed by an appreciation of real exchange rate.

3.2 Variance Decompositions (VDC)

While the IRFs are useful in assessing the signs and magnitudes of responses to specific shocks, the relative importance of different shocks in explaining the particular variable's fluctuations can be gauged by the variance decomposition analysis. Thus, the impacts of the structural shocks on the banking and macroeconomic variables were analysed by examining VDCs of the forecast errors based on the VAR.

As can be seen in Table 3, the results of the VDC analysis are generally consistent with those of the IRF findings. Of the four bank balance sheet variables, innovations in interest rate accounted for the highest in explaining the variations in domestic deposit, contributing up to around 6 per cent of its forecast error variances. Innovations in interest rate accounted for only around 1 to 4 per cent in explaining for the forecast error variances of domestic loans, foreign loans, and foreign deposits.

Focusing on the variance decomposition of domestic deposits, significant proportions of the forecast error variances are explained by variations in themselves, with a larger proportion in the shorter term horizons, and gradually declining in the longer term horizons. At longer term horizons, around 35 per cent of the variations in domestic deposit are explained by innovation in domestic loans and around 30 per cent by industrial production (IPI). In this context, a decline in output (or economic contraction) clearly affected the deposits of the domestic banks through the liquidity effects. The results indicate that variations in domestic deposits are influenced more by changes in interest rate in the shorter term horizons, and changes in domestic loan and industrial production in the longer term horizons.

Variations in foreign deposits are largely explained by its own innovations in the shorter term horizons (i.e., around 80%), suggesting the endogenous nature of the foreign deposits. In the longer term horizons, the contribution of self-innovation was still dominant in explaining the forecast error variances of foreign deposits (contributing around 31%), while the contributions of industrial production (around 30%) and domestic loans (around 16%) were also important in the longer term horizon. As in the case of domestic deposits, the contribution of the innovations to industrial output in explaining the variations in foreign deposit in the longer term horizon was rather clear, that is, the ups and downs of the economy clearly have an impact on the amount of deposits being placed in the commercial banks, regardless of whether they are domestic or foreign banks.

The fluctuation in domestic loans was mainly attributed to its own innovation in the first one and half years but from then on, the innovations in industrial production contributed

about 30 per cent of the fluctuation in domestic loans. This indicates that the economic situation had a significant impact on the loans being extended by the domestic banks. In comparison, for foreign loans, the contribution of industrial production in explaining the forecast error variance of foreign loans was smaller, at around 20 per cent, implying that foreign loans were more stable compared to domestic loan to output fluctuations. Innovations in foreign deposits were also significant in explaining the variations in foreign loan, contributing around 30 per cent at the longer time horizon, reflecting the close relationship between the banks' liquidity condition and the ability to supply loans.

It is interesting to note that the VDC of IPI showed that its variations were mainly explained by innovations in domestic deposit and domestic loan as well as the interest rate. Meanwhile, innovations in foreign loans and deposits together contributed less than 20 per cent to the variations in the economic output. This implies that innovations in domestic loan and deposits have more impact on the domestic economic activities compared to foreign loans and deposits.

For CPI, even though the innovation in itself played a major role in the short run, shocks in domestic loan and output (IPI) tend to play major roles in the fluctuation of price particularly in the longer term horizons. Lastly, for exchange rate (RER), innovations in themselves explain most of the fluctuations in the short run, suggesting that RER is highly endogenous, followed by innovations in interest rate (ONR) and foreign loans. However, in the long run, the exchange rate becomes more exogenous as only around 7 per cent of its variations are due to innovations in themselves, while the remaining is largely explained by domestic loans (27%), foreign deposits (22%), CPI (17%) and domestic deposits (14%).

4. Conclusion

This study aimed to analyse the impact of interest rate changes on the domestic and foreign banks and determine its monetary policy implications. Based on the Malaysian experience, the results of the impulse response functions and variance decomposition analysis suggest that the impact of interest rate changes is relatively more de-stabilising on the domestic banks than the foreign banks. From the policy implementation point of view, the study shows that the impact of monetary policy shocks is uneven across the banking industry with the domestic banking institutions being more adversely affected by the tight monetary policy. As such, this is an important consideration that should be taken into account by the policymakers in implementing monetary policy. Since the results suggest that the brunt of monetary policy is largely borne by the domestic banks, the policymakers should consider measures that would shield the domestic banks in times of tight monetary policy. This could include preferential measures to the domestic banks in times of economic distress. More importantly, the results also show that the fluctuations of the domestic banking institutions have substantial impact on economic output. In this regard, it is crucial to ensure the health and stability of the domestic banking industry due to its significant influence on the domestic economy.

The study shows that the domestic banks are more sensitive to changes in interest rate compared to the foreign banks. The balance sheet items of the foreign banks are shown to be stable despite the shocks in the macro-economy. This finding implies that the domestic banks could learn from the prudent risk management practices of the foreign banks that

Table 3. Variance decomposition analysis

Variable / Horizon	ONR	DD	DL	FD	FL	IPI	CPI	RER
Variance Decomposition of Domestic Deposit								
3	4.63	85.28	1.26	0.03	6.28	0.87	1.06	0.59
6	5.73	75.53	0.81	0.28	9.42	3.09	3.42	1.73
9	6.09	68.59	1.88	0.67	11.31	2.89	4.49	4.06
12	6.17	56.07	10.02	0.90	9.22	8.26	3.71	5.64
18	3.52	32.06	23.41	0.86	5.68	26.11	3.15	5.22
24	2.23	19.98	35.56	2.11	5.49	27.72	3.05	3.87
30	1.82	15.71	37.21	3.42	6.68	29.24	2.65	3.28
36	2.30	14.97	34.89	3.66	7.72	30.73	2.46	3.27
Variance Decomposition of Domestic Loan								
3	1.49	16.95	78.97	0.91	0.15	1.18	0.02	0.34
6	1.53	24.37	64.40	7.38	0.18	1.01	0.27	0.87
9	2.04	22.60	55.04	14.75	0.14	3.21	1.60	0.62
12	3.11	21.23	50.63	14.56	0.11	8.27	1.37	0.73
18	3.01	16.73	44.78	14.40	0.08	17.69	1.11	2.21
24	2.59	13.20	44.66	11.21	0.37	23.67	0.98	3.33
30	2.21	10.67	42.46	8.52	1.60	28.39	2.04	4.11
36	2.73	11.57	37.49	6.88	3.90	30.01	3.64	3.79
Variance Decomposition of Foreign Deposit								
3	3.42	10.11	1.31	82.75	1.63	0.09	0.33	0.36
6	4.48	6.23	1.41	83.30	1.34	0.34	0.89	2.02
9	4.15	5.32	1.41	77.96	1.99	1.45	0.84	6.90
12	3.44	5.65	2.65	66.32	1.79	11.80	0.76	7.60
18	2.44	3.80	9.16	39.96	1.71	33.93	2.51	6.48
24	1.76	2.86	16.91	29.60	4.88	36.30	2.91	4.77
30	1.78	2.46	17.00	30.76	7.85	33.32	2.71	4.13
36	3.17	3.45	15.72	31.06	9.63	30.29	2.87	3.80
Variance Decomposition of Foreign Loan								
3	1.96	3.32	4.48	0.25	73.90	9.07	5.53	1.50
6	2.34	2.21	3.52	6.90	58.29	11.77	11.89	3.08
9	4.85	1.95	3.64	23.72	36.29	11.72	15.41	2.42
12	4.72	1.53	3.04	39.11	26.12	10.78	13.10	1.61
18	3.91	1.69	3.16	43.07	23.26	13.53	9.35	2.03
24	3.99	3.27	6.82	39.89	20.72	15.62	7.38	2.31
30	3.51	3.19	10.66	36.25	19.05	18.12	6.70	2.52
36	2.96	4.25	14.93	30.59	16.41	19.93	7.47	3.46

Table 3. Continued

Variable / Horizon	ONR	DD	DL	FD	FL	IPI	CPI	RER
Variance Decomposition of Industrial Production Index								
3	1.29	2.28	3.72	0.35	0.11	86.05	0.64	5.55
6	4.17	3.90	5.21	2.52	0.36	75.01	0.61	8.22
9	5.23	5.76	8.17	6.33	0.74	64.43	0.76	8.57
12	8.85	7.19	11.93	7.85	0.86	54.63	0.74	7.95
18	8.17	7.65	14.63	8.12	2.41	48.85	2.68	7.48
24	9.11	15.41	12.07	7.21	7.33	38.39	4.27	6.22
30	12.00	19.30	10.53	7.46	9.89	31.01	4.11	5.72
36	12.35	19.22	13.23	7.79	9.78	28.33	3.81	5.49
Variance Decomposition of Consumer Price Index								
3	0.89	1.78	5.86	2.41	2.05	0.98	85.78	0.26
6	2.88	3.98	8.25	4.90	1.71	1.77	75.51	1.01
9	2.61	6.92	10.95	8.08	6.17	3.24	60.63	1.41
12	2.49	5.21	24.69	9.66	6.47	3.66	46.67	1.15
18	3.51	16.48	25.78	8.64	5.33	5.66	33.66	0.95
24	3.02	16.36	24.59	6.84	3.93	17.08	24.95	3.23
30	1.94	11.10	23.25	4.45	3.75	34.81	16.38	4.32
36	1.60	8.20	24.98	3.66	5.44	39.87	12.08	4.17
Variance Decomposition of Real Exchange Rate								
3	11.39	3.39	0.22	8.42	15.51	0.85	0.24	59.99
6	12.17	6.27	3.94	8.55	20.29	0.92	2.20	45.68
9	16.83	7.38	10.75	6.40	14.40	2.84	8.28	33.13
12	12.17	13.60	17.51	5.89	7.84	3.03	20.57	19.40
18	5.87	17.94	26.12	10.09	5.46	3.22	22.36	8.93
24	5.04	16.03	28.04	13.54	5.54	3.09	21.12	7.61
30	4.89	15.47	26.87	17.34	5.47	3.04	19.73	7.20
36	4.42	14.23	26.77	22.16	5.20	3.11	17.39	6.73

enable them to remain stable despite the tight liquidity condition. The study shows that the foreign banks continue to resume lending during tight liquidity condition with the impact of high interest rate being translated into lower lending after a lag period. The domestic banks could learn the best risk management practices from the foreign banks that enable them not to be adversely affected by the tight liquidity condition. Adopting best banking practices such as continuously being prudent in lending and continuous monitoring of existing accounts to enable 'early-warning' problem recognition have ensured that foreign banks are more resilient to weather shocks in times of tight liquidity conditions.

Another important implication of this study is in terms of the role of the foreign banks during tight liquidity conditions. The results of this study document that the foreign banks in Malaysia have been supportive of the domestic economy even in times of economic distress. Despite a tight monetary condition, the foreign banks continued to resume lending,

implying that the 'capital flight' argument is not applicable to the foreign banks' operations in Malaysia. Empirical evidence provided by this study lends support to the positive role played by the foreign banks in contributing to the financial and economic stability of the Malaysian economy. This finding concurs well with that of Goldberg *et al.* (2000) and Levin (1996) that the foreign banks help to fulfil the financing needs of the economy, particularly in times of shortages of funds from the domestic sources. Foreign banks' presence results in lower cost of capital to borrowers and higher economic activity in the host economy (Agenor 2001; Bekaert *et al.* 2005). In this context, foreign banks have been complementing the role of the domestic banks in providing credit during times of tight monetary conditions.

Despite this, further investigation could shed greater details on the findings of the study. In particular, while it is clear that the aggregated foreign loans increase following the interest rate shocks, it is important to analyse the components of the loans being extended. It could be possible that the increase in foreign lending is not due to continuous lending to the retail businesses and consumers, but due to higher interbank loans to the domestic banking institutions which are grappling for liquidity in times of economic distress.

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