

The Impact of Interest Rate Shocks on the Performance of the Banking Sector

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A rise in the Hong Kong dollar risk premium, signified by a widening of the spread between Hong Kong dollar and US dollar interest rates, would influence banks' profitability mainly through its impact on (i) asset quality that affects provisioning charges and (ii) net interest margin. Empirical estimates on data from 1992-2002 show the net interest margin declined in response to increases in the risk premium, because deposit interest rates were more sensitive to changes in the risk premium than the lending rate. A change in the domestic interest rate along with the US interest rate had little impact on the margin in the period under study.

I. INTRODUCTION

This article provides an assessment of how an increase in interest rates affects bank profits. For this purpose, changes in Hong Kong dollar interest rates are decomposed into movements in the US interest rate and the spread over the US rate. The latter reflects the Hong Kong dollar risk premium, which is determined by speculative pressures on the currency.

There are different ways of considering the effects of interest rate changes on banks' financial conditions.¹ This article focuses on the empirical relationship between the market interest rate, and banks' net interest margin and the classified-loan ratio (which determines charges for provisions).² The latter two have been the main factors influencing bank profits.

The article is organised as follows. The next section offers some observations on the profitability of the

banking sector in recent years. It shows that the pre-tax return of retail banks in Hong Kong has been mainly driven by the net interest margin and the net charge for provisions. Section III provides estimates of the sensitivity of banks' net interest margin to changes in interest rates and discusses how it is related to the pass-through of interbank interest rates to deposit and lending rates. Section IV looks into how interest rate changes may affect the classified-loan ratio and thus the net charge for provisions. The conclusions are given in Section V.

II. OBSERVATIONS ON PROFITABILITY OF THE BANKING SECTOR

A natural starting point for examining the profit position of banks is the aggregate profit and loss account (P&L account) of the banking sector. For the purpose of this study, the banking sector is confined to retail banks.³ The major components

¹ Some studies focus on the economic value of banks, by examining the impact of interest rate changes on bank assets, liabilities and off-balance sheet positions, or on the implications for the future cash flows accruing to banks. These approaches require detailed information about a number of possible sources of interest rate risk (e.g. re-pricing risk, yield curve risk and basis risk), originating largely from differences in the characteristics of banks' assets and liabilities (e.g. composition of fixed-rate and floating-rate instruments, maturity structure, re-pricing period and base rates). For details, see BIS (2002).

² A similar analysis on the OECD economies was covered in BIS (2002).

³ Retail banks include all locally incorporated banks plus the local offices of a number of relatively large foreign banks. The foreign banks in this group have significant local presence and, similar to their local counterparts, have substantial retail banking activities conducted within a branch network. Hence, retail banks are representative of mainstream banking trends in Hong Kong. Retail banks altogether accounted for over three quarters of Hong Kong dollar assets of all Authorized Institutions and 90% of Hong Kong dollar deposits.

of the P&L account can be summarised as follows:

	Net interest income
+	Non-interest income
-	General and administrative expenses
-	Net charges for provisions
<hr/>	
=	Pre-tax operating profit

Total income is broken down into net interest income and non-interest income, while expenses are classified into general and administrative expenses and net charges for provisions.⁴ To measure profitability in terms of a rate of return on assets, these components are divided by the average level of total assets for the period. Specifically,

$$\pi = nim + nii - ga - pv$$

where π = pre-tax return on assets (ratio of pre-tax operating profit to total assets)

nim = net interest margin (ratio of net interest income to total assets)

nii = non-interest income as a ratio to total assets

ga = general and administrative expenses as a ratio to total assets

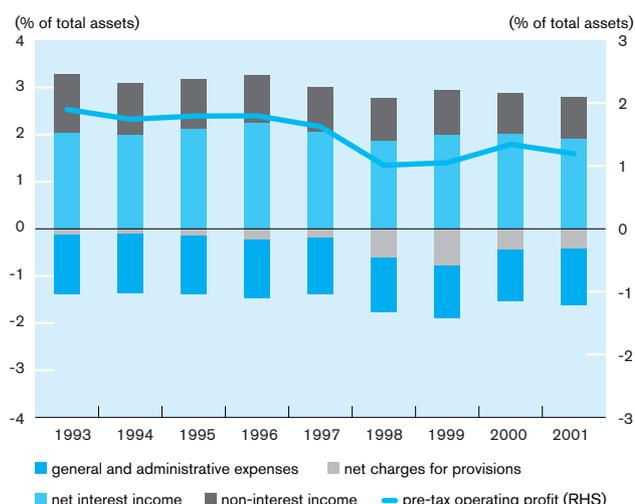
pv = net charges for provisions as a ratio to total assets

Chart 1 depicts the movements of these ratios during 1993-2001. Variations in the pre-tax return on assets were largely driven by movements in the net interest margin before the Asian financial crisis, and by the net charge for provisions in the subsequent period. Both non-interest income and general and administrative expenses were relatively stable.

Chart 2 compares the 3-month interbank interest rate with the performance ratios. The marked contraction in the net interest margin seemed to follow the significant rise in the Hong Kong dollar

CHART 1

Movements of the Performance Ratios



interest rate, which reflected an increase in the risk premium during the Asian financial crisis. The net charge for provisions also increased with a lag of about one year before easing in more recent times. The other two ratios, however, appear unrelated to changes in the interest rate.

In summary, the pre-tax return of the retail banks in Hong Kong has been mainly driven by the net interest margin and the net charge for provisions. They seem to have been affected by movements in the market interest rate to a significant degree.

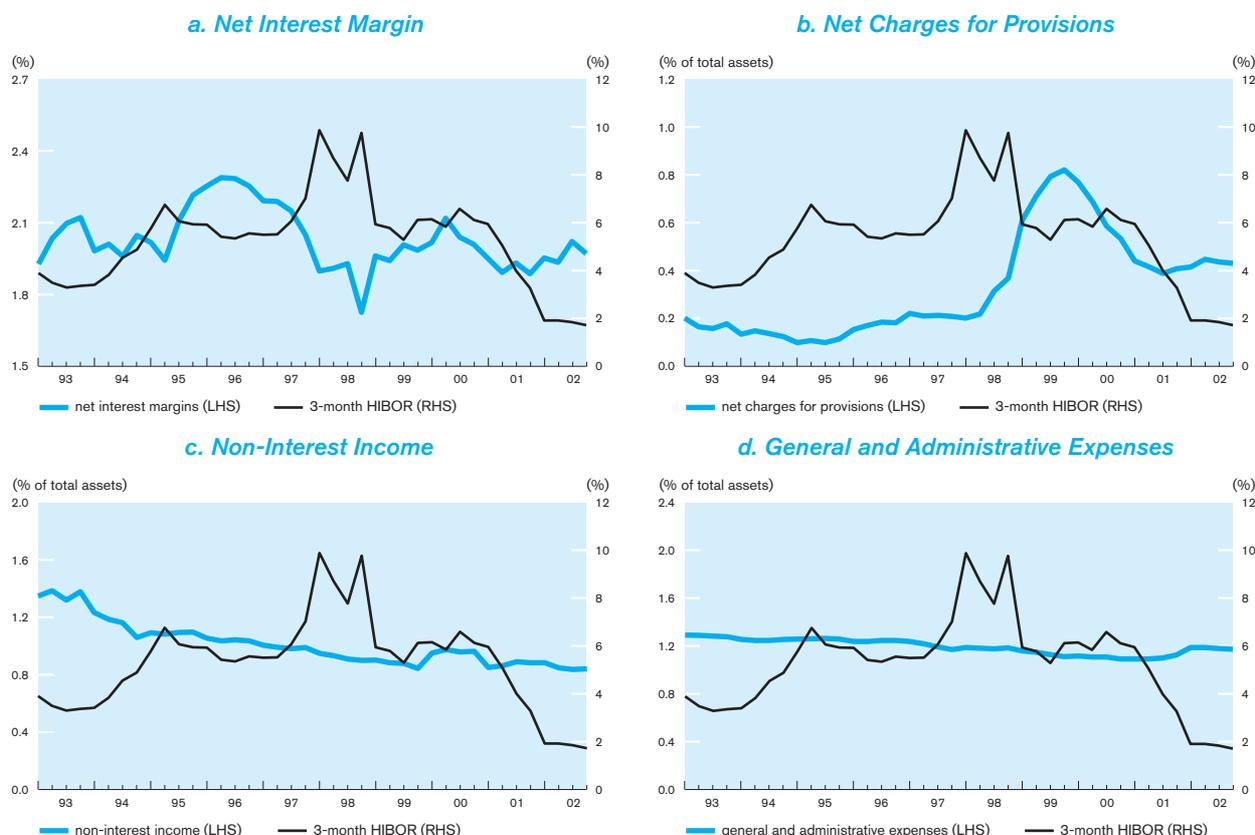
III. THE IMPACT OF INTEREST RATE CHANGES ON THE NET INTEREST MARGIN

This section provides estimates of the impact of changes in the US interest rate and the risk premium on the net interest margin. It is noted that a more conventional definition of net interest margin uses interest-bearing assets instead of total assets as the denominator. This avoids any distortion as a result of changes in other assets, say, owing to valuation effects. Nevertheless, the two measures of the net interest margin moved in step with a small difference, as interest-bearing assets account for over 90% of

⁴ General and administrative expenses include both recurring expenses (e.g. staff and rental expenses) as well as non-recurring expenses. It should be noted that exceptional items are not included here. Accordingly, the pre-tax operating profit is before exceptional items.

CHART 2

Performance Ratios and the Interest Rate

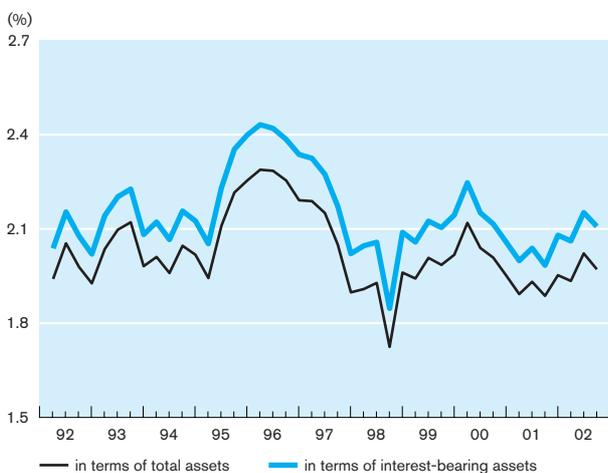


Note: The performance ratios in panels b, c and d are smoothed to even out seasonal effects.

the total assets (Chart 3). The empirical estimates were very similar for the two, thus, in what follows, only the results for the more conventional measure of the net interest margin is presented.

CHART 3

The Alternative Measures of the Net Interest Margin



A regression was estimated relating the net interest margin to 3-month LIBOR, 3-month HIBOR-LIBOR spread (*prem*) and the Herfindahl-Hirschman index (*hh*).⁵ The latter was intended to capture the effect of competition in the banking system. An increase in the index is associated with a higher concentration of market share and thus a lower degree of competition. As an increase in competition may exert a negative influence on the interest margins of banks, a positive sign is expected for the coefficient on the index. Chart 4 shows a decline in the index, indicating increasing competition over time.

⁵ The Herfindahl-Hirschman index is a concentration index, which is calculated by taking the sum of the squares of market shares (in terms of total assets) of individual banks. It provides a proxy measure of competition in the banking industry. It is noted that the BoC group is treated as a single entity in compiling the index.

CHART 4

The Herfindahl-Hirschman Index



Following the general-to-specific approach, the following results were obtained.⁶

$$(1) \quad nim_t = -0.457 + 0.642nim_{t-1} - 0.039prem_t + 0.974hh_{t-3}$$

(0.43) (0.09) (0.01) (0.34)

Sample period	1992Q2-2002Q3
\bar{R}_2	0.69
Equation standard error	0.07
Mean of the dependent variable	2.15
LM test for serial correlation	F-statistic = 0.49 [0.49]
White test for heteroskedasticity	F-statistic = 0.83 [0.59]

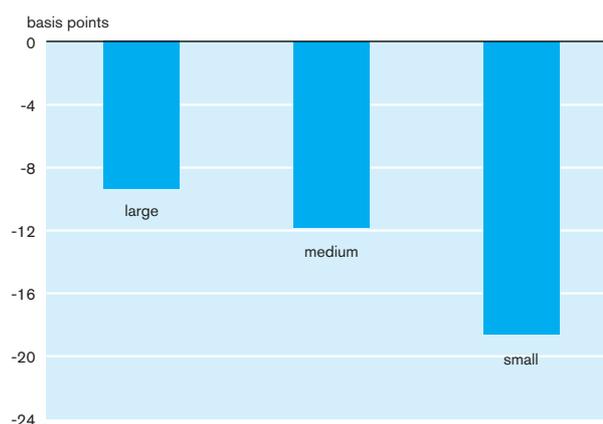
Note: Numbers in parentheses are t-ratios and those in brackets are p-values.

It is noted that LIBOR is insignificant at all lags and thus not included in the final specification of the model. The parameter on the lagged dependent variable captures the speed of adjustment following a shock, say, to the interest rate spread. The estimated coefficients suggest that a rise of about 105 basis points in the spread between 3-month HIBOR and LIBOR (one standard deviation of the spread for the period from 1992Q2 to 2002Q3) would reduce the net interest margin by 4 basis points in the same quarter, and by a cumulative 11 basis points in the long run.

Similar results were obtained in an analysis of grouped data of large, medium and small banks, with the interest rate spread significantly influencing the net interest margin.⁷ The sensitivity to the spread was slightly lower for large banks than the other two groups, although statistically the difference was only weakly significant. Chart 5 shows that the negative effect on the net interest margin of the HIBOR-LIBOR differential increases as the size of banks decreases. Because larger banks faced lower liquidity pressures — as evidenced by a lower loan-to-deposit ratio — their net interest margins were less susceptible to a change in the interest rate.

CHART 5

Long-run Response of Net Interest Margins of Different Bank Groups to a Rise of 105 Basis Points in the 3-month HIBOR-LIBOR Differential



To understand why only changes in the HIBOR-LIBOR spread, but not LIBOR, seem to have mattered in the sample period, the net interest margin is decomposed into three components: the interest yield, the interest cost and the endowment effect (Appendix). The difference between interest yield and interest cost is termed the net interest yield, which is closely related to the lending spread defined as the difference between the lending and deposit rates. Thus, it is useful to examine how different sources of changes in the interbank interest rate impact on the lending and deposit rates.

⁶ Four lags of the dependent and independent variables were included in the initial specification. LIBOR was insignificant at all lags. Macroeconomic variables such as real GDP growth and property price changes were also included, but were found to be either insignificant or had a wrong sign.

⁷ Retail banks were classified as large, medium or small banks according to the market share in terms of Hong Kong dollar assets. For details, see HKMA (2003).

Error-correction models were estimated to gauge the pass-through of changes in the three-month interbank interest rate to lending and deposit rates respectively.⁹ To this end, the best lending rate (*blr*) was used as a proxy for the average lending rate, and an effective deposit rate (*dr*) was constructed to measure the average funding cost.⁹

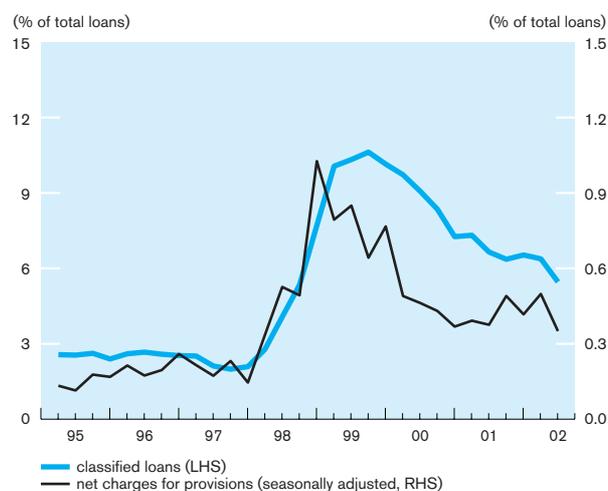
The empirical results suggest that the best lending rate and the effective deposit rate were equally responsive to changes in LIBOR in the short run, with a full pass-through in the long run. However, the deposit rate was much more responsive than the lending rate to changes in the interest rate spread. Specifically, a rise of 100 basis points in the spread would increase the lending and deposit rates by 48 and 83 basis points respectively in the long run, and by 13 and 38 basis points respectively in the same quarter. Consequently, while a rise in LIBOR would have little effect on the lending spread, an increase in the risk premium would reduce it both in the short and long run.

In summary, for the period under study, a rise in the interest rate differential was found to reduce net interest margin owing to a relatively low pass-through to the asset side of the banks' balance sheet. On the other hand, changes in the US interest rate had little impact because of an equal pass-through to both the lending and deposit rates.¹⁰

IV. NET CHARGES FOR PROVISIONS

A rise in the market interest rate may affect asset quality by raising borrowing costs and the risk of default, thereby increasing the net charge for provisions. The latter (as a ratio to total assets) seemed to be closely related to the classified-loan ratio (Chart 6).

CHART 6
Classified Loans and Net Charges for Provisions



To examine the impact of changes in interest rates on loan quality, a Vector Autoregression (VAR) model was constructed in order to capture the interaction among economic variables.¹¹ Specifically, the VAR contains 3-month HIBOR, real GDP growth, inflation, and the classified-loan ratio as a measure of loan quality.¹² The estimated specification suggests that the interest rate has a significant impact on the classified-loan ratio. An increase in 3-month HIBOR by 105 basis points would raise the classified-loan ratio by around 0.5 percentage point at its worst. The impact of the shock reaches its peak in five quarters, but gradually diminishes thereafter (Chart 7).

V. CONCLUSION

The pre-tax profit of retail banks has been primarily driven by movements in the net interest margin and the net charge for provisions. This article examines the impact of changes in the interest rate on the performance of the banking sector in Hong Kong. To this end, the Hong Kong dollar interbank interest rate was decomposed into the corresponding LIBOR and the spread over LIBOR (which captures the risk

⁹ For details, see HKMA (2003).

⁹ The effective deposit rate was computed as the average of the interest rates on demand, savings and time deposits. As the banking statistics classify deposits by remaining maturities, certain assumptions were made regarding the maturity distribution.

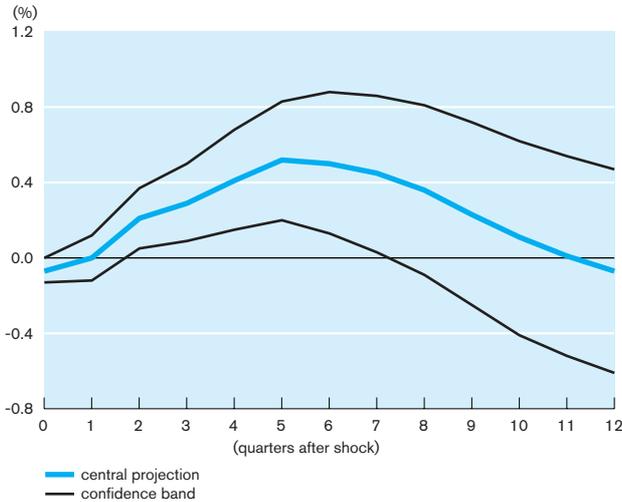
¹⁰ Caution is required in interpreting the estimates. It is possible that when interest rates are already at very low levels, further declines in the US interest rate may squeeze the net interest margins of banks as the deposit rate approaches zero.

¹¹ For details, see HKMA (2003).

¹² It is noted that an increase in HIBOR would worsen asset quality, regardless of whether the increase is attributable to a rise in LIBOR or in the risk premium.

CHART 7

Response of the Classified-Loan Ratio to a Rise of 105 Basis Points in the Interest Rate (with 95% Confidence Bands)



premium of the Hong Kong dollar). The empirical estimates show that during the period under study, a rise in the spread squeezed the net interest margin and worsened asset quality. In contrast, an increase in the US interest rate had little impact on the net interest margin. This was attributable to an equal pass-through of changes in US interest rates to the best lending rate and the effective deposit rate, leaving an unchanged intermediation spread. On the other hand, the pass-through of the interest rate differential to the deposit rate was much larger than to the lending rate, leading to a narrowed intermediation spread.

APPENDIX

DECOMPOSITION OF NET INTEREST MARGIN

The net interest margin (*nim*) is defined as net interest income in relation to interest-bearing assets, and net interest income represents the difference between interest income and interest expenses.¹³ Specifically,

$$\begin{aligned}
 nim &= \frac{in - ie}{ia} \\
 &= \underbrace{\frac{in}{ia} - \frac{ie}{il}}_{\text{net interest yield}} + \underbrace{\frac{ie}{il} \cdot \left(1 - \frac{il}{ia}\right)}_{\text{endowment effect}} \\
 &= \text{net interest yield} + \text{endowment effect}
 \end{aligned}$$

where: *in* denotes interest income, *ie* interest expenses, *ia* interest-bearing assets and *il* interest-bearing liabilities

Hence, the net interest margin represents the sum of the net interest yield and the endowment effect. The latter captures the impact of the part of credits that are financed by equity instead of deposits. Its size, however, is likely to be small relative to the net interest yield.

Note that the net interest margin applies to the stock of assets instead of new loans and deposits. Thus, it largely reflects past decisions on the pricing of credits and deposits; and their adjustments to market conditions are likely to be slow. The spread of a representative lending rate over a deposit rate would be a more responsive proxy for intermediation margins, because they are less affected by the outstanding amount of credits and deposits.

¹³ This approach follows ECB (2000).

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