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BANKING SECTOR COMPETITION IN HONG KONG -- MEASUREMENT AND EVOLUTION OVER TIME

Key Points:

- *The operating environment of the banking sector in Hong Kong has undergone major changes in recent years, including regulatory liberalization, technological progress and industry consolidation. These developments could have significant implications for competition in the industry.*
- *Competitive conditions in the banking industry and their evolution over time are of interest to policymakers responsible for monetary and financial stability. While competition could lower financial intermediation costs and contribute to improvement in economic efficiency, it could reduce market power and profitability of banks, weakening their ability to withstand adverse developments.*
- *The empirical analysis based on the Panzar-Rosse approach suggests that the banking sector in Hong Kong is highly competitive. Notwithstanding significant changes in the operating environment of the banking sector in recent years, preliminary evidence indicates that competitive pressures have been largely maintained. However, with bank consolidation expected to continue, the competitive conditions in the sector should be reviewed from time to time.*

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I. INTRODUCTION

The operating environment of the banking sector in Hong Kong has undergone major changes in recent years, including regulatory liberalization, technological progress and industry consolidation. These structural developments could have implications for competitive conditions in the sector. Competition could lower financial intermediation costs and contribute to improvements in economic efficiency. However, excessive competition could reduce market power and profitability of banks, weakening their ability to withstand adverse developments. It is important for policymakers to know the extent of competition in the sector and how it has evolved over time.

While relaxation of regulations and advances in technology tend to enhance competition in the banking system, the effect of consolidation may depend on prevailing market settings. Following the banking sector consultancy study in 1998, the Hong Kong Monetary Authority (HKMA) has gradually removed several barriers to competition, including regulated interest rates, branching restrictions for foreign banks, limited access of restricted licence banks (RLBs) to the Real Time Gross Settlement (RTGS) system, and certain market entry criteria to the banking sector. Technological advancement also enhanced competition by eliminating geographical barriers and facilitating product innovations. Meanwhile, bank consolidation has resulted in increased market concentration. The effects of the Asian financial crisis, an ongoing process of consolidation of international banks, declining global interest rates, weak credit demand and a very sharp decline in property prices have created ongoing pressures for mergers and acquisitions in the Hong Kong banking sector.

This paper studies the evolution of competitive conditions in the banking sector in Hong Kong, providing insights into the overall effects of these structural developments. Section 2 discusses market liberalization measures implemented by the HKMA since 1998 and the general trend of bank consolidation. Section 3 examines common measures of market concentration, and presents an empirical assessment of competitive conditions over time in the banking sector based on the Panzar-Rosse approach. Section 4 concludes.

II. MARKET LIBERALIZATION AND BANK CONSOLIDATION

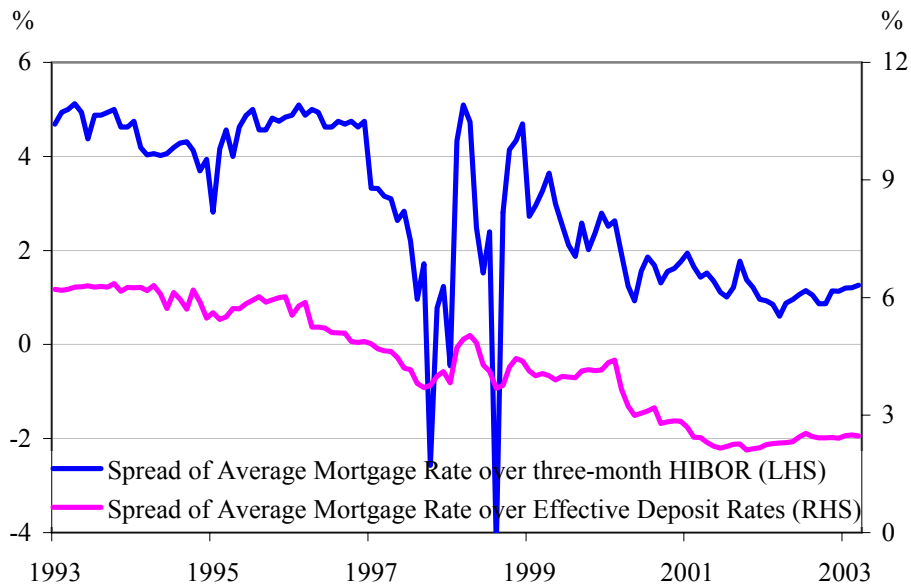
1. Market Liberalization

Following the 1998 banking sector consultancy study, the HKMA has implemented a number of regulatory reforms to improve market efficiency and competition. In particular, several measures of market liberalization were implemented, including deregulation of the remaining Interest Rate Rules (IRRs) in 2001, the granting of RLBs access to the RTGS system since 1999, the removal of branching restrictions for foreign banks in 2001, and the relaxation of market entry criteria in 2002. With the completion of interest rate deregulation in July 2001, all types of deposit rates are determined by competitive market forces.¹ In view of RLB's increased settlement needs, they have been permitted to access the RTGS system since 1999. To provide a level playing field for local and foreign banks, the restriction on the number of branches and offices for foreign banks was relaxed from one building to three buildings in 1999, followed by a complete removal of this restriction in 2001. Separately, the market entry criteria have been relaxed since 2002 to attract a broader range of domestic and international financial institutions to conduct banking business in Hong Kong. These included reducing the asset size criterion for foreign banks and relaxing the criteria for locally incorporated RLBs and deposit-taking companies to upgrade to licensed bank status.

There are signs of increasing competition in the banking sector. The margins for mortgage loans have declined from about 450 basis points (bps) above the effective deposit rate and 300 bps above three-month HIBOR prior to the Asian financial crisis, to 250 bps and 100 bps respectively in early 2003 (Chart 1).² The lower margins of banks reflect heightened competition in the sector, in a low interest rate environment with sluggish loan demand.

¹ Progressive deregulation of IRRs has taken place in phases since 1994. The final phase of deregulation in July 2001 covered all current and savings accounts.

² The effective deposit rate is the average of interest rates on demand, savings and time deposits, computed under certain assumptions on the maturity distribution of deposits.

Chart 1. Mortgage Lending Margins

Sources: HKMA and CEIC.

2. Bank Consolidation

Consolidation in the banking industry has been a global trend. The number of merger and acquisition deals in the 13 countries covered in the Group of Ten (G10) report more than doubled, with the total value surging by about eight-fold during the 1990s (BIS, 2001).³ This has resulted in a significant number of large and complex global banking groups.

The primary motives of mergers and acquisitions are cost savings and revenue enhancement. Bank consolidation can not only facilitate cost reductions through economies of scale, economies of scope, more efficient allocation of resources and the elimination of duplicate branches, but also enhance revenue through larger firm size and wider business scope.⁴ In addition, environmental factors such as deregulation, technological progress, globalisation and shareholder pressure to improve performance have also encouraged bank consolidation (BIS, 2001). Nonetheless, these gains are not cost-free as difficulties can arise from reorganising management, merging institutional cultures, and integrating data and other operational systems (Hawkins and Mihaljek, 2001). There are also concerns that bank consolidation may create large institutions that are seen as too big to fail.

³ The 13 countries include Australia, Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Spain, Sweden, Switzerland, the United Kingdom and the United States.

⁴ The G10 report states that there is weak evidence of cost reduction arising from increased size, except in the case of smaller banks.

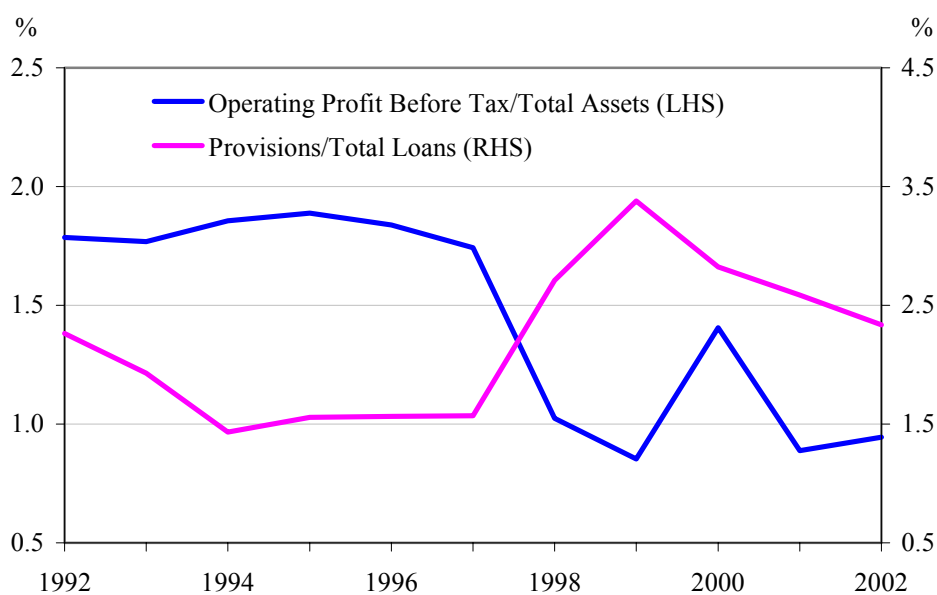
Lagging major industrial countries that have experienced a high level of merger and acquisition activity in the banking system during the 1990s, bank consolidation has gained momentum in Hong Kong only in recent years. The family ownership of local banks and the absence of significant economic pressure for mergers in Hong Kong may have hindered the pace of consolidation in the past.⁵ In addition, the large banks in Hong Kong already have substantial market shares and are generally not anxious to expand further, except to take advantage of increasing business scale in certain areas (HKMA, 2001). The downturn in economic activity, high unemployment and bankruptcies, weak loan demand, and a very sharp fall in property prices have contributed to a decline in bank profitability since 1998 (Chart 2).⁶ Such difficult operating conditions have increased pressure for bank consolidation to improve performance through economies of scale and diversification, especially for some smaller banks to build size through mergers and acquisitions to maintain their competitiveness. Consolidations and strategic repositioning of global banks have also resulted in a reshuffling of their operations in Hong Kong. In addition, the relaxation of requirements for Hong Kong incorporated banks to access the Mainland market under the Closer Economic Partnership Agreement (CEPA) has prompted cross-border mergers and acquisitions.⁷

A number of bank mergers and acquisitions have taken place in Hong Kong in recent years. These activities have gained momentum since 2001 (Table 1). Notable deals include the consolidation of the ten member banks of the Bank of China Group into the Bank of China (Hong Kong), which has been listed on Hong Kong's stock exchange since July 2002, and the merger of DBS Kwong On Bank, Dao Heng Bank and Overseas Trust Bank into DBS Bank (Hong Kong) Ltd. in 2003. In addition to mergers and acquisitions between large- and medium-sized banks, there are more deals involving smaller banks, as well as overseas banks or financial institutions acquiring small local banks as a gateway to the Mainland market. The general trend towards bank consolidation is expected to continue in Hong Kong.

⁵ In contrast to other Asian economies, profitability of local banks had been satisfactory prior to and during the Asian financial crisis, with an average annual profit growth of 15% from Hong Kong operations between 1992 and 1997. During the Asian financial crisis, most banks in Hong Kong remained profitable and locally incorporated banks as a whole maintained a high capital ratio of over 18%, with none of them requiring official support (HKMA, 2001).

⁶ An empirical study finds that the decline in bank profitability in Hong Kong is mainly driven by adverse macroeconomic conditions (HKMA, 2003).

⁷ The agreement on the CEPA between the Mainland and Hong Kong was signed at end-June 2003, with most of the initiatives becoming effective from 1 January 2004. It covers three areas—trade in goods, trade in services, and trade and investment facilitation. Hong Kong banks will be subject to a lower asset requirement of US\$6 billion for the establishment of branches in the Mainland, compared to the US\$20 billion requirement for foreign banks. The requirement for the setting up of a representative office before establishing a joint venture is removed for Hong Kong banks. For mainland branches of Hong Kong banks to conduct RMB business, the minimum requirement for business operation in the Mainland has been reduced to two years. In addition, the profitability assessment of Hong Kong banks is based on the overall profitability situation of all branches in the Mainland, instead of individual branch.

Chart 2. Profitability and Provisions of Banks in Hong Kong

Source: HKMA.

Table 1. Recent Consolidations in the Banking Industry in Hong Kong

Year	Industry Consolidation
2000	Standard Chartered Bank acquired Chase Manhattan's credit card and retail bank business. The Industrial and Commercial Bank of China acquired Union Bank of Hong Kong.
2001	The Bank of East Asia merged with United Chinese Bank. The merger of ten member banks of the Bank of China Group (including Bank of China, China and South Sea Bank, China State Bank, Hua Chiao Commercial Bank, Kincheng Banking Corporation, Kwangtung Provincial Bank, National Commercial Bank, Po Sang Bank, Sin Hua Bank, and Yien Yieh Commercial Bank) into a locally incorporated bank, the Bank of China (Hong Kong). The merger of the Hong Kong branches of the Fuji Bank, The Dai-ichi Kangyo Bank and the Industrial Bank of Japan. The Development Bank of Singapore acquired Dao Heng Bank.
2002	The Bank of East Asia acquired First Pacific Bank. CITIC Ka Wah Bank acquired the Hong Kong Chinese Bank.
2003	Wing Hang Bank acquired the Chekiang First Bank. The merger of DBS Kwong On Bank, Dao Heng Bank and Overseas Trust Bank into DBS Bank (Hong Kong) Ltd.

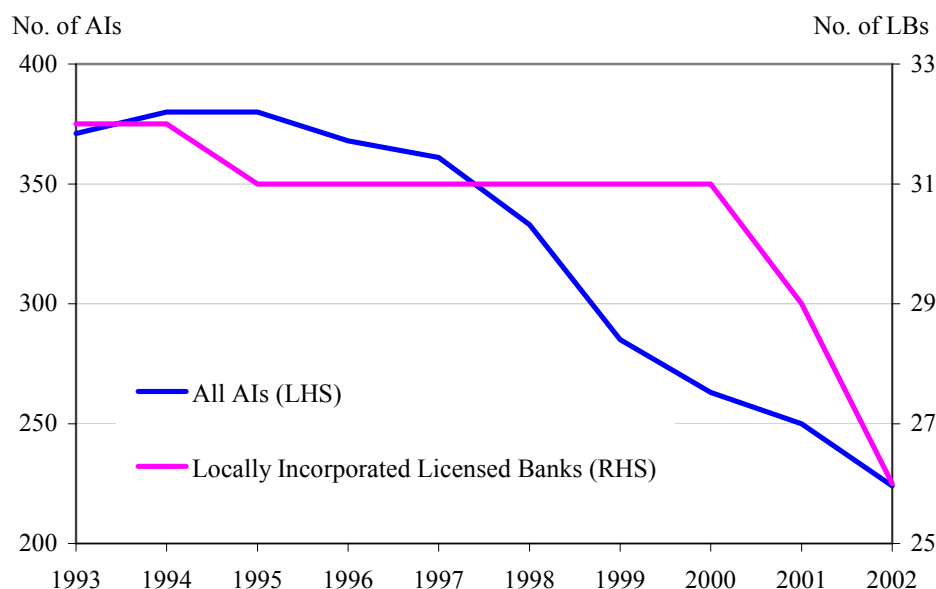
Source: HKMA.

III. COMPETITIVE CONDITIONS IN THE BANKING SECTOR

1. Indicators of Market Structure

There are several common indicators of market structure, including the number of banks, k-bank concentration ratios and the Herfindahl-Hirschman Indices (HHI).⁸ Such indicators postulate a positive relationship between market concentration and market power — fewer and larger firms (higher concentration) are more likely to engage in anti-competitive behaviour (Bain, 1951). The simplest measure of market concentration is the number of banks in the market. From 1997 to 2002, the number of AIs in Hong Kong reduced by about 38 percent, from 361 to 224 (Chart 3). The decline is largely a result of consolidation of overseas banks and restructuring of foreign parent banks experiencing financial difficulties. In particular, bank consolidation in Europe has led to a reduction in the number of foreign banks and their related deposit-taking companies in Hong Kong. More importantly, the restructuring of Japanese and other Asian banks following the Asian financial crisis has resulted in the consolidation and withdrawal of their overseas operations in Hong Kong. The consolidation of locally incorporated licensed banks has also speeded up in recent years, partly owing to the difficult operating environment, with the number of banks decreasing from 31 at end-2000 to 26 at end-2002 (Chart 3).

Chart 3. Number of Authorized Institutions



Source: HKMA.

The k-bank concentration ratios and HHI also indicate an increase in market concentration in the banking sector in recent years. While the k-bank concentration ratios have been high in Hong Kong compared with most of the developed countries, they showed a sharp increase from 2001, largely reflecting merger and acquisition activity (Table 2). The market share of the five and ten largest banks in deposits and loans increased by about 15 percentage points from 2001 to 2002 (Charts 4 and 5). This is mirrored by the sharp rise in the HHI (Chart 6). These indicators show that the banking sector in Hong Kong appears to have a high and increasing degree of concentration, with potentially substantial room for market power by large banks.

**Table 2. Bank Concentration Ratios
(In percent)**

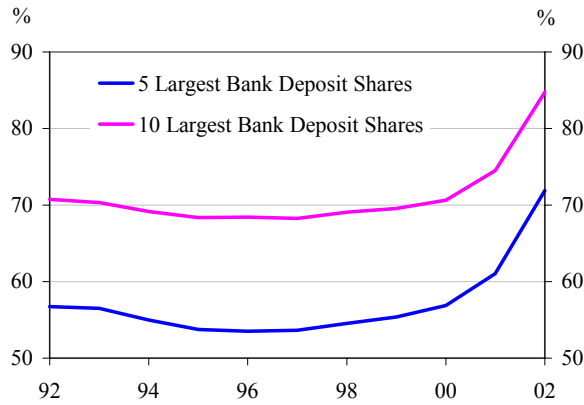
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Hong Kong											
<i>Largest 5</i>	56.7	56.5	55.0	53.7	53.5	53.6	54.5	55.4	56.9	61.1	71.9
<i>Largest 10</i>	70.8	70.3	69.1	68.4	68.4	68.3	69.1	69.6	70.6	74.5	84.8
Other Economies											
<i>Largest 5</i>											
United States	15.1	15.9	16.5	16.7	19.9	20.6	26.2	26.6	n.a.	n.a.	n.a.
Canada	63.6	70.2	73.0	73.4	74.2	77.8	77.7	77.1	n.a.	n.a.	n.a.
Japan	30.7	30.2	30.3	29.5	29.2	31.0	30.9	29.8	n.a.	n.a.	n.a.
Germany	18.0	17.0	15.2	15.8	17.4	19.1	18.8	n.a.	n.a.	n.a.	n.a.
United Kingdom	n.a.	n.a.	n.a.	43.6	55.3	43.2	35.2	n.a.	n.a.	n.a.	n.a.
<i>Largest 10</i>											
United States	21.2	23.0	24.2	25.2	28.9	29.3	35.6	36.7	n.a.	n.a.	n.a.
Canada	85.5	90.5	93.5	94.4	94.8	95.7	95.4	94.9	n.a.	n.a.	n.a.
Japan	53.0	51.8	51.7	51.0	50.6	52.3	51.0	48.8	n.a.	n.a.	n.a.
Germany	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	n.a.	n.a.	n.a.	61.5	65.6	58.9	58.9	n.a.	n.a.	n.a.	n.a.

Sources: HKMA and G10, 2001.

Notes: Bank concentration ratios are measured by the market shares of the largest banks in deposits. The banking sector in Hong Kong refers to retail banks, which include all the locally incorporated banks plus the local offices of a number of large foreign banks.

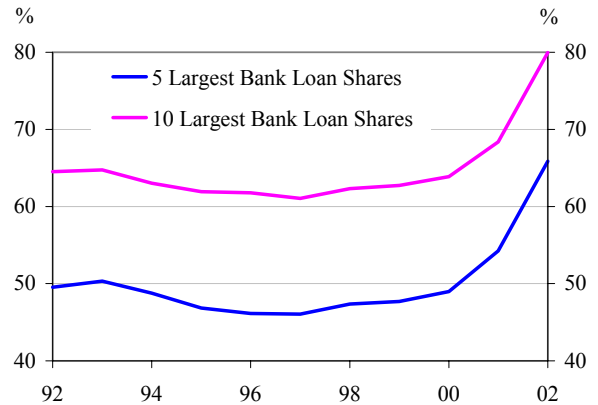
⁸ The HHI is the sum of the squared market shares of deposits or loans of all the banks in the market, ranging from zero to one. A large number of banks, each with a small market share, produce an HHI close to zero. A monopolist bank with 100 percent of market share produces an HHI of one.

Chart 4. Deposit Market Shares of the Largest 5 and 10 Banks



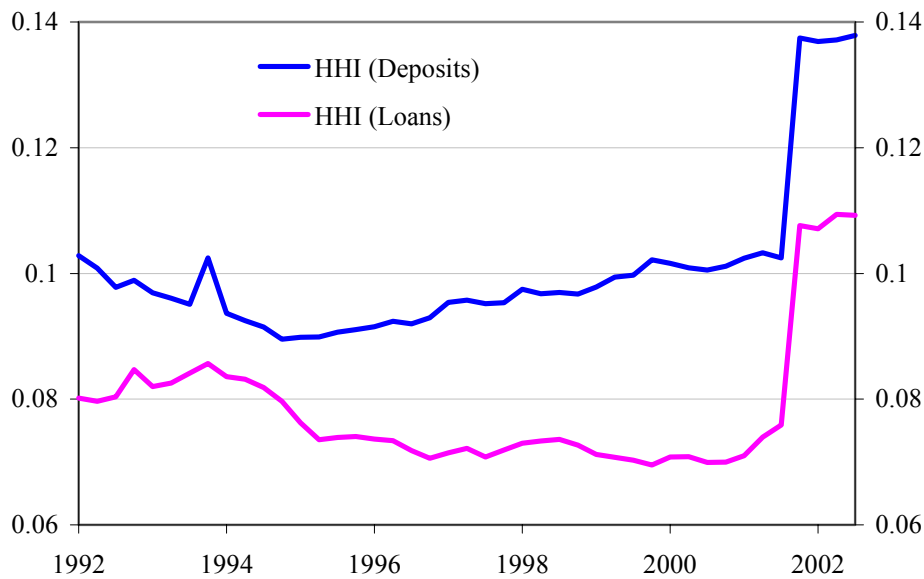
Source: HKMA.

Chart 5. Loan Market Shares of the Largest 5 and 10 Banks



Source: HKMA.

Chart 6. Herfindahl-Hirschman Indices



Source: HKMA.

However, these standard measures of market concentration can only serve as crude indicators of competitive conditions in the banking sector. While the number of banks ignores the distribution of business volume among banks, k-bank concentration ratios only take into account the market shares of a small number of large banks. The HHI stresses the importance of larger banks by assigning them a greater weight than smaller banks (Bikker and Haaf, 2001). The empirical evidence on the positive relationship

between market concentration and the exercise of market power is mixed (Cetorelli, 1999). For a contestable market with no barriers to entry, banks may not be able to exploit market power even in a highly concentrated market due to the threat of potential competition (Baumol, 1982; Nathan and Neave, 1989).⁹

2. Econometric Assessment

As traditional indicators of market structure rely on the indirect inferences of market concentration and market power, we conduct an empirical analysis based on the Panzar-Rosse approach to directly assess competitive conditions in the banking sector. It estimates the sum of elasticities (H statistic) of a firm's revenue with respect to input prices in a reduced form revenue equation. The measure is grounded in the idea that competitive firms are price takers and must pass through cost changes to customers, while a monopoly can vary output to maximize profits in the face of higher input prices.

Let R be the revenue function of input prices w and exogenous variables z that shift the revenue function:

$$R = R(w, z)$$

$$H = \sum_i \frac{\partial R}{\partial w_i} \frac{w_i}{R_i}$$

Panzar and Rosse show that the H statistic indicates the nature of market structure under certain assumptions (Table 3).¹⁰ In a monopoly market, H is negative, as an increase in input prices will increase marginal costs and reduce equilibrium output, and subsequently a decline in total revenue given the profit maximization hypothesis. In contrast, in a perfectly competitive market, H is equal to one, as any increase in input prices raises both marginal and average costs and in turn leads to a one-to-one increase in total revenue, without changing the optimal output of banks. This is true since those institutions that cannot cover the increase in input prices will be forced to exit the market. If the market structure is characterized by monopolistic competition, H will be between zero and one, with the total revenue rising less than proportionally to the changes in input prices.

⁹ Bank consolidation in Hong Kong has created a few medium-sized banks, which may be in a better position to compete with existing major banks.

¹⁰ The assumptions include (1) banks are profit maximizing, single product firms facing normally distributed revenue and cost functions; (2) banks produce revenues using labor, capital and intermediated funds (mainly deposits) as inputs; (3) higher input prices are not associated with higher quality services that generate higher revenues; and (4) banks are in long run equilibrium. The single product firm assumption is consistent with the "intermediation" approach, where banks are viewed mainly as financial intermediaries, transforming inputs of labor, capital and deposits into outputs including loans and investments (De Bandt and Davis, 2000). Nonetheless, product differentiation is allowed in the monopolistic competition model (Gelos and Roldos, 2002).

Table 3. Interpretations of the Panzar-Rosse H Statistic

Values of H	Market Structure
$H \leq 0$	Monopoly
$0 < H < 1$	Monopolistic competition
$H = 1$	Perfect competition

Source: Panzar and Rosse, 1987.

The Panzar-Rosse approach has been widely applied to assess competitive conditions in the banking systems of the United States, Canada and Japan since early 1980s, with later work focuses on European countries. Most of these banking systems exhibited characteristics of monopolistic competition (Bikker and Haaf, 2001).

To derive the H statistic for the banking sector in Hong Kong, reduced form revenue equations are estimated, using seasonally adjusted quarterly aggregate data on retail banks for the period of 1992 Q1 to 2002 Q4.

$$\ln \frac{R}{A} = a + b \ln w_f + c \ln w_l + d \ln w_k + e \ln bm \quad (1)$$

All the variables are in natural logarithms. The dependent variable is the ratio of gross revenue (R) to total assets (A). Where gross revenue includes both interest and non-interest incomes. (Hempell, 2002, De Bandt and Davis, 2000, Nathan and Neave, 1989, and Claessens and Laeven, 2003). One noteworthy fact is the growing importance of non-interest income, particularly fees and commissions. While banks in Hong Kong had focused on lending business before the Asian financial crisis, the downward movement in property prices since late 1997, together with weak loan demand and depressed lending margins, have prompted banks to increase their non-interest income, which account for about 30% of total income in recent years (HKMA, 2003).¹¹ The significant drop in gross revenue since 2001 was largely a result of a reduction in interest income, as lending contracted under weak domestic and global economic conditions (Chart 7).

The specifications of explanatory variables in equation (1) are defined as follows (Gelos and Roldos, 2002, De Bandt and Davis, 2000, Molyneux, 1994, Lloyd-Williams and Thornton, 1994). The unit price of funds (w_f) is proxied by the ratio of interest expenses to total deposits (including customer and interbank deposits). It has declined sharply following the Asian financial crisis, largely reflecting declining interest rates (Chart 8). The unit price of labour (w_l) is approximated by the ratio of staff

¹¹ Total income includes net interest income plus non-interest income.

expenses to total assets, which captures the overall intermediation activities undertaken by banks. It has been rising gradually since late 2000, in part owing to the stagnation in the growth of bank assets in a weak economy (Chart 9). The unit price of capital (w_k), proxied by the ratio of other expenses to total fixed assets, is generally higher in recent years compared to the pre-Asian financial crisis level, in part reflecting the expenses on restructuring of distribution channels as well as the development of information technology (Chart 10). The business mix variables (bm), approximated by the ratio of interbank deposits to total deposits or the ratio of customer deposits to total deposits, are included to control for changes in banks' production function (Chart 12).

In addition, we estimate an equation for unscaled gross revenue, with the size effect controlled on the right-hand side (Gelos and Roldos, 2002).

$$\ln R = a + b \ln w_f + c \ln w_l + d \ln w_k + e \ln A + f \ln bm \quad (2)$$

The sum of the coefficients of input price variables, including w_f , w_l and w_k , is the H statistic. With two alternatives for the specifications of the business mix variable in equations (1) and (2), four regressions are estimated.

Chart 7. Gross Revenue

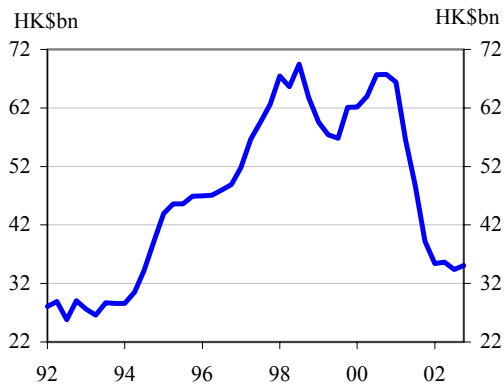


Chart 8. Interest Expenses/Total Deposits

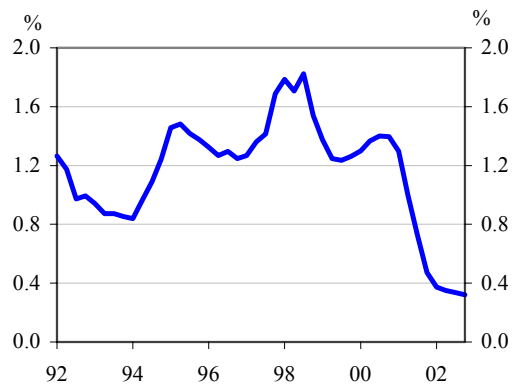


Chart 9. Staff Expenses/Total Assets

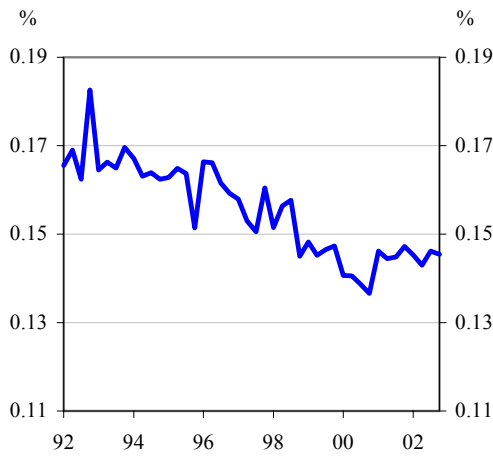


Chart 10. Other Expenses/Total Fixed Assets

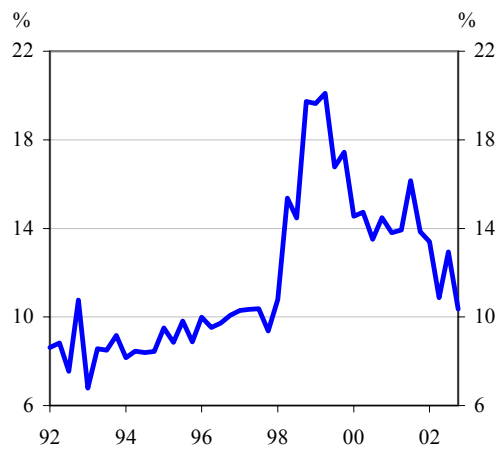


Chart 11. Total Assets

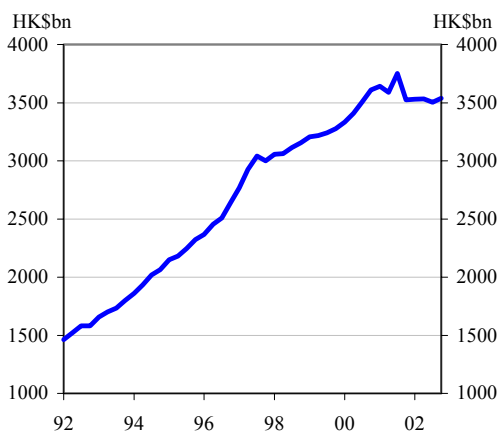
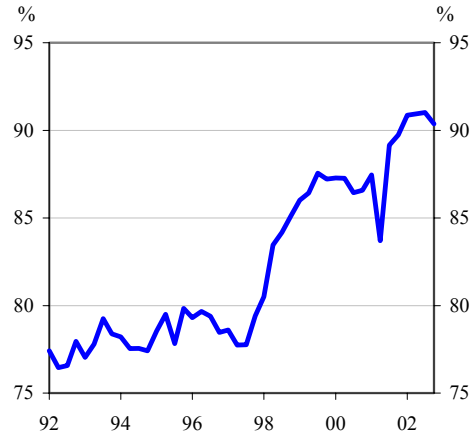


Chart 12. Customer Deposits/Total Deposits



Source: HKMA.

The empirical results suggest that the banking industry in Hong Kong can be characterized by close to perfect competition during 1992-2002 (Table 4).¹² The estimated H statistics of the four models range from 0.85 to 0.98, broadly in line with the results obtained in a previous empirical study.¹³ To test the market structure of the sector, the hypotheses of $H = 0$ and $H = 1$ are tested. We find that $H = 0$ are rejected at the 5% level for all the four models, while $H = 1$ cannot be rejected at the 5% level.

All the coefficient estimates are statistically significant. The coefficients of funding and labour costs are positive, in line with the findings of other developed banking systems. In general, the unit price of funding and labour costs contribute most to the overall factor price elasticity. The coefficient of the unit price of fixed capital is negative, possibly reflecting the payoff of other expenses, such as costs on rationalisation of branch networks and information technology, can only be effective in improving efficiency and in turn increasing revenue in the longer term.¹⁴ Nonetheless, its effect on the overall elasticity appears to be minimal compared to other input prices. The business mix variables are statistically significant. The elasticity of revenue to the ratio of interbank deposits to total deposits is negative, whereas the coefficient of the ratio of customer deposits to total deposits is positive. In addition, the coefficients of the scale variable, total assets, in models (3) and (4) are positive and statistically not different from 1, implying that banks with larger assets have proportionally higher gross revenues.

To assess change in competitive conditions in the banking sector in Hong Kong, a number of tests are conducted. Chow forecast tests indicate possible structural changes from around 2001, coinciding with banking sector reforms and the acceleration of bank consolidation. A dummy variable test with the sample period divided into two sub-periods (pre- and post-2001) rejects the null hypothesis of constancy of the H statistic over the period (Table 5). Furthermore, the estimated H statistic is somewhat lower in the post-2001 period than the previous period, implying that competitive pressures may have slightly eased. Recursive estimates of H statistic show some mixed results in recent years (Chart 13). H-statistic estimates declined during 1999 and 2000, followed by a jump in early 2001, and resumed a downward trend afterwards (except in one model specification where it stayed at a high level after 2001). Nevertheless, the estimates remain close to 1, suggesting that competitions in the sector remain high.

¹² For the H-statistic to be interpretable, the market needs to be in equilibrium for the sample period (Panzar and Rosse, 1987). Our tests show that the banking sector in Hong Kong was in equilibrium during the period under review (Appendix).

¹³ Claessens and Laeven (2003) estimate the competitive nature of the banking systems in 50 countries, including Hong Kong, for the period of 1994-2001, using bank-level data from Bankscope. Their study shows that the H statistic for the banking sector in Hong Kong ranges from 0.47 to 0.86 for the period.

¹⁴ Existing studies find that the sign of the coefficient on the unit price of capital varies by economies and, in most cases, is negligible in the overall factor price elasticity.

In sum, banks in Hong Kong have been operating in a highly competitive environment. The econometric results indicate that notwithstanding marked changes in the operating environment of the banking sector in recent years, the industry remains highly competitive.

Table 4. Empirical Results of the Panzar-Rosse Model for the Hong Kong Banking Sector

Independent Variables	Regression Results			
	Sample Period: 1992 Q1 to 2002 Q4			
	Dependent Variables			
	(A)		(B)	
	Total Revenue/Total Assets		Total Revenue	
	(1)	(2)	(3)	(4)
Constant	-4.988 ** (0.755)	-2.684 ** (0.323)	-4.885 ** (0.756)	-2.242 ** (0.465)
Interest Expenses/Total Deposits	0.503 ** (0.015)	0.516 ** (0.016)	0.506 ** (0.015)	0.519 ** (0.016)
Staff Expenses/Total Assets	0.474 ** (0.122)	0.519 ** (0.118)	0.392 ** (0.140)	0.429 ** (0.135)
Other Expenses/Total Fixed Assets	-0.057 ** (0.028)	-0.060 ** (0.025)	-0.051 * (0.028)	-0.052 * (0.026)
Interbank Deposits/Total Deposits	-- --	-0.105 ** (0.039)	-- --	-0.118 ** (0.040)
Customer Deposits/Total Deposits	0.434 ** (0.214)	-- --	0.499 ** (0.220)	-- --
Total Assets	-- --	-- --	0.962 ** (0.032)	0.960 ** (0.031)
H Statistic	0.920 (0.129)	0.975 (0.127)	0.847 (0.142)	0.896 (0.139)
Test for H=0 (F-Test)	Reject at 5% (p = 0.000)	Reject at 5% (p = 0.000)	Reject at 5% (p = 0.000)	Reject at 5% (p = 0.000)
Test for H=1 (F-Test)	Not Reject at 5% (p = 0.538)	Not Reject at 5% (p = 0.844)	Not Reject at 5% (p = 0.289)	Not Reject at 5% (p = 0.461)
Adjusted R-squared	0.986	0.986	0.993	0.994
DW Statistics	1.625	1.734	1.616	1.713
Number of Observations	44	44	44	44

Source: HKMA.

Notes: Numbers in bracket are standard errors unless specified.

* Significant at the 10 percent level.

** Significant at the 5 percent level.

Table 5. Dummy Variable Test for a Structural Break at 2001 Q1 in H Statistic

Independent Variables	Regression Results			
	Sample Period: 1992 Q1 to 2002 Q4			
	Dependent Variables			
	(A)		(B)	
	Total Revenue/Total Assets		Total Revenue	
	(1)	(2)	(3)	(4)
Constant	-4.279 ** (0.771)	-2.990 ** (0.316)	-3.867 ** (0.789)	-2.350 ** (0.496)
Interest Expenses/Total Deposits	0.507 ** (0.024)	0.512 ** (0.024)	0.538 ** (0.029)	0.539 ** (0.029)
Staff Expenses/Total Assets	0.440 ** (0.110)	0.462 ** (0.109)	0.331 ** (0.125)	0.351 ** (0.126)
Other Expenses/Total Fixed Assets	-0.025 (0.028)	-0.029 (0.026)	-0.015 (0.028)	-0.016 (0.027)
Dum * Interest Expenses/Total Deposits	-0.028 (0.030)	-0.025 (0.030)	-0.056 (0.034)	-0.051 (0.033)
Dum * Staff Expenses/Total Assets	-0.246 ** (0.120)	-0.220 * (0.121)	-0.250 ** (0.117)	-0.230 * (0.119)
Dum * Other Expenses/Total Fixed Assets	-0.190 ** (0.086)	-0.172 * (0.087)	-0.188 ** (0.084)	-0.173 ** (0.085)
Interbank Deposits/Total Deposits	-- --	-0.062 (0.042)	-- --	-0.068 (0.041)
Customer Deposits/Total Deposits	0.241 (0.212)	-- --	0.303 (0.210)	-- --
Total Assets	-- --	-- --	0.938 ** (0.036)	0.941 ** (0.036)
H early	0.922 (0.120)	0.945 (0.120)	0.854 (0.123)	0.874 (0.125)
H late	0.458 (0.229)	0.528 (0.237)	0.360 (0.231)	0.421 (0.240)
Test for change in H (F-Test)	Reject constancy at 5% (p = 0.023)	Reject constancy at 5% (p = 0.043)	Reject constancy at 5% (p = 0.014)	Reject constancy at 5% (p = 0.026)
Adjusted R-squared	0.989	0.989	0.995	0.995
DW Statistics	1.920	1.961	1.955	1.955
Number of Observations	44	44	44	44

Source: HKMA.

Notes: Numbers in bracket are standard errors unless specified.

* Significant at the 10 percent level.

** Significant at the 5 percent level.

Structural break at 2001 Q1, with interactive dummy variables (Dum) on the input price variables that take on the value of 0 from 1992 Q1 to 2000 Q4 and 1 from 2001 Q1 to 2002 Q4.

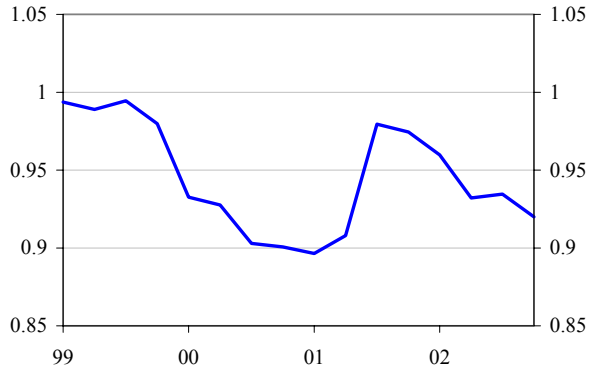
H early refers to the sum of coefficients of input prices.

H late refers to "H early" plus the sum of the coefficients of the interactive terms.

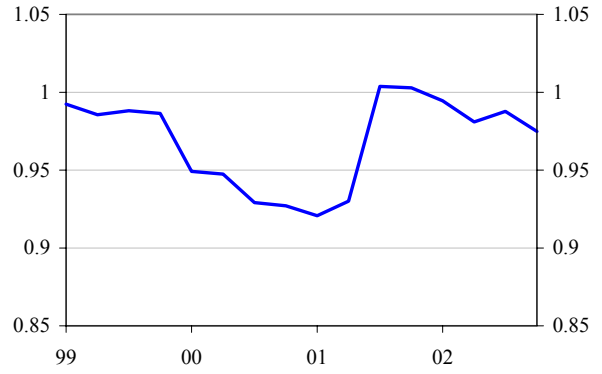
Test for change in H refers to test on whether the sum of the coefficients of the interactive terms is statistically different from zero.

Chart 13. Recursive Estimates of H Statistic

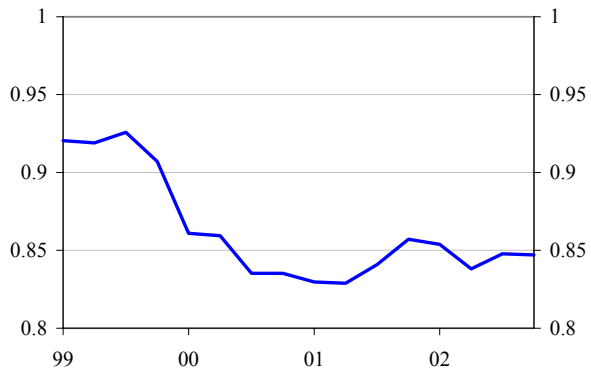
I. Model 1



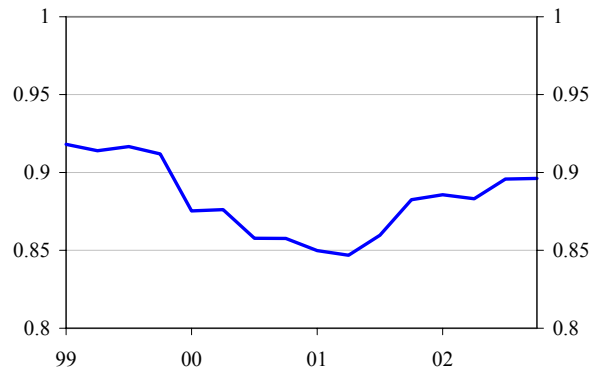
II. Model 2



III. Model 3



IV. Model 4



Note: The H statistic is the sum of the recursive estimates of the coefficients of input prices.

IV. CONCLUSIONS

The empirical study based on the Panzar-Rosse approach suggests that the market structure of the banking sector in Hong Kong can be characterized by perfect competition during 1992 to 2002. This implies that in general the sector exhibits a high level of competition. While there is some evidence that competitive pressures in the sector may have eased somewhat in recent years, the banking sector remains highly competitive. It should, however, be stressed that, as competition is dynamic in nature, conditions that observed over a certain period might not be indicative for another.

A concentrated market can be competitive if it is open to competition (Baumol, 1982). The minimum barriers to new entry with transparent licensing process, significant foreign bank participation and challenges from non-bank financial institutions have helped to maintain a high level of competition in the banking industry in Hong Kong.¹⁵ To further promote competition in an environment subject to the ongoing process of consolidation, improving information flows between customers and banks, such as enforcing transparency rules on products and prices, and the sharing of customer credit data by banks, are helpful (BIS, 2001). Better information flows between customers and banks can not only help improve the access of loans by borrowers, but also enhance banks' credit risk management. The establishment of a commercial credit reference agency and the expansion of the scope of consumer credit data sharing in Hong Kong represent the major steps undertaken in this area.

¹⁵ Of the world's 500 largest banks, 168 had operations in Hong Kong in 2002.

Equilibrium Test

One of the assumptions made in deriving the H-statistic is that the market is in equilibrium during the sample period. To conduct equilibrium test, equations (1) and (2) are estimated by replacing the endogenous variable with the ratio of net income to total assets (return on assets). In equilibrium, the rate of return should not be correlated with input prices (De Bandt and Davis, 2000). Table A shows that $H = 0$ cannot be rejected at the 10% level, implying that equilibrium of the banking industry in Hong Kong prevailed during the period. By contrast, if the market is in disequilibrium, $H < 0$, an increase (decrease) in factor prices will be reflected in a temporary decline (increase) in the rate of return (Molyneux, 1994).

Table A. Equilibrium Test

Independent Variables	Regression Results			
	Sample Period: 1992 Q1 to 2002 Q4			
	Dependent Variable			
	Return on Assets			
	(1)	(2)	(3)	(4)
Constant	-6.382 (4.153)	3.495 * (1.843)	-6.569 (4.228)	2.659 (2.707)
Interest Expenses/Total Deposits	0.130 (0.084)	0.146 (0.094)	0.125 (0.086)	0.140 (0.096)
Staff Expenses/Total Assets	0.771 (0.670)	0.739 (0.671)	0.920 (0.783)	0.909 (0.787)
Other Expenses/Total Fixed Assets	-0.946 ** (0.154)	-0.913 ** (0.144)	-0.958 ** (0.159)	-0.928 ** (0.150)
Interbank Deposits/Total Deposits	-- --	-0.373 (0.225)	-- --	-0.350 (0.234)
Customer Deposits/Total Deposits	2.033 * (1.175)	-- --	1.916 (1.228)	-- --
Total Assets	-- --	-- --	0.068 (0.179)	0.076 (0.179)
H Statistic	-0.045 (0.708)	-0.028 (0.726)	0.087 (0.796)	0.120 (0.812)
Test for H=0 (F-Test)	Not Reject at 10% (p = 0.949)	Not Reject at 10% (p = 0.969)	Not Reject at 10% (p = 0.913)	Not Reject at 10% (p = 0.883)
Adjusted R-squared	0.689	0.688	0.682	0.681
DW Statistics	1.446	1.421	1.423	1.397
Number of Observations	44	44	44	44

Source: HKMA.

Notes: Numbers in bracket are standard errors unless specified.

* Significant at the 10 percent level.

** Significant at the 5 percent level.

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