Volume Title: Deregulation and Interdependence in the Asia-Pacific Region, NBER-EASE Volume 8

Volume Author/Editor: Takatoshi Ito and Anne O. Krueger, editors

Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-38674-0

Volume URL: http://www.nber.org/books/ito_00-1

Conference Date: June 19-21, 1997

Publication Date: January 2000

Chapter Title: Deregulation, Profit, and Cost in Commercial Banking: The Case of Hong Kong

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Chapter URL: http://www.nber.org/chapters/c8485

Chapter pages in book: (p. 305 - 325)

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Deregulation, Profit, and Cost in Commercial Banking
The Case of Hong Kong

Yum K. Kwan and Francis T. Lui

10.1 Introduction

Although Hong Kong is often regarded as a classic showcase of the laissez faire economy, the intervening hand of the government is clearly visible in some of its most important sectors. In utilities, public transportation, securities, and housing, the markets are highly regulated. The recent process of democratization has also created significant political pressure to introduce even more regulations in these and other sectors. Nevertheless, between late 1994 and early 1995, a process of deregulating the interest rate cap was imposed by the Hong Kong Association of Banks (HKAB).

The study of deregulation in Hong Kong's banking sector is of interest for several reasons. First, before the deregulation, the HKAB was a powerful cartel, but afterward, its members had to engage in more fierce competition. This shift provides an opportunity for comparing the behaviors of banks operating under different market structures. Second, the transition from monopoly to competition often increases risks and reduces profits. These could cause failures of more vulnerable banks, as happened in the United States after the interest rate deregulation of the early 1980s. On the other hand, Hong Kong's transition has been relatively fast and successful. The banks appear to have absorbed the policy shock smoothly. Analyzing the experience of Hong Kong may shed light on the conditions

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The authors thank Takatoshi Ito, Moon-Soo Kang, and Chung-Shu Wu for useful comments on an earlier draft of this paper. They are also grateful to Jim Wong of the Hong Kong Monetary Authority for help in getting some of the data.

that are needed for a stable transition. Third, having 183 fully licensed banks and with 85 of the world's top 100 banks being represented, Hong Kong is one of the largest international centers of banking. In 1995, its daily foreign exchange trading surpassed that of Switzerland to become the world's fifth most active (Carse 1995a). Events happening in such a major center may have long-lasting effects on the world's financial markets.

The main objectives of this paper are to analyze how Hong Kong banks have optimally responded to the interest rate deregulation and why it has so far not caused any bank failures. To do this, we shall present the arguments in several steps. In section 10.2 we provide the general background of the deregulation of 1994–95. In section 10.3 we present some crude indicators of the banks' new strategies. Section 10.4 discusses the methodology that we use to decompose the changes in the banks' cost and profit functions into (1) the effects of bank-initiated responses to the new regulatory structure and (2) the effects of changes in the external environment. Separating these two effects is important because we can then assess how much of the success is due to luck and how much is due to banks' optimizing behaviors. The empirical results based on this methodology are presented and interpreted in section 10.5. Section 10.6 uses a simple capital asset pricing model (CAPM) to estimate the changes in the risks of banks that are listed on Hong Kong's stock market. This is necessary for completing the argument because risk management is one of the instruments that banks can use to mitigate the impact of deregulation. Finally, concluding remarks are made in section 10.7.

10.2 Institutional Background

The banking cartel in Hong Kong can be traced back a hundred years. In 1897, the Exchange Banks' Association (EBA) was established. It could only be joined by authorized banks, which used it as a forum for fixing banking charges and agreed rates of buying and selling foreign exchange. However, the rules were not mandatory, but similar to a gentlemen's agreement (Ghose 1995).

In the early 1960s there was a cutthroat interest war among the banks in Hong Kong. Some British banks decided to raise the deposit interest rate by 1 percentage point. It was widely interpreted by Chinese banks as an attempt to monopolize the market (*Far Eastern Economic Review,* 22 April 1965). The EBA proposed to form an agreement among all banks, whether they were members of the association or not, for a uniform interest rate structure. After a prolonged process of negotiation and pressure, an agreement materialized in July 1964. There would be no interest paid for demand and seven-day-notice deposits. Interest rates for savings and time deposits of less than one year were to be determined by the EBA.

Loans and advances were not regulated, but it was against the Money Lenders' Ordinance of 1911 to charge an interest rate of more than 60 percent per annum. The agreement was mandatory. Banks contravening it would be denied access to clearinghouse facilities and barred from interbank exchange and fund dealings (Ghose 1995). It is sometimes believed that the agreement at that time probably saved some small banks from collapse (e.g., see Jao 1992, chap. 26).

The EBA was replaced by the Hong Kong Association of Banks in 1980. The Hong Kong Association of Banks Ordinance made this a statutory body, and its rules were legally binding. Bankers were no longer required to observe the rules of the Money Lenders' Ordinance and could lend at any interest rate. A set of rules on maximum interest rates for different types of deposits and minimum bank charges were laid down. Decisions on the maximum base rates were made by the Committee of the HKAB, in consultation with the financial secretary of the Hong Kong government. Banks were free to offer lower rates. Deposits of at least HK$500,000, foreign currency deposits, time deposits of fifteen months and longer, and deposits taken by unincorporated banks were exempted (Ko 1991).

Because the Hong Kong dollar has been pegged to the U.S. dollar at the rate of 7.8 since 1983, interest rates of the former are heavily influenced by the latter. Throughout the 1980s and 1990s, the inflation rate in Hong Kong has been significantly higher than that in the United States. This has created a negative real interest rate situation in Hong Kong for a prolonged period.[1] The public has from time to time pressed for the removal of the "interest rate rules" outlined above. For example, a report issued by the Consumer Council (1994) argued that the spread between the prime rate and the regulated savings (or time deposit) rate was on average about 1.7 percentage points higher than those in other countries. The spread between the prime and the unregulated interbank lending rate was closely in line with international standards. The Hong Kong Monetary Authority (HKMA), the de facto central bank of Hong Kong established in 1993, finally decided to deregulate the interest rate cap in several phases.

On 1 October 1994, the HKMA removed the interest rate cap on all relevant time deposits of maturity more than one month. There was no deregulation of current and savings account deposits. On 3 January 1995, those with a maturity of over seven days were also deregulated (Carse 1995a). The HKMA originally planned to implement the third phase on 1 April 1995. This would have covered Hong Kong dollar time deposits fixed for more than twenty-four hours. However, the short-term volatile environment caused by the Mexican crisis and the Barings collapse

1. This is one of the reasons why the proportion of M3 in foreign-currency-denominated assets has been staying at the high level of over 40 percent. Foreign currency deposits are not subject to the interest rate cap (see Jao 1992, chap. 26).

changed the mind of the HKMA. It decided to defer the third phase so that a review of the situation up to the end of June could be done (HKMA 1995). The review led to the conclusion to move one more step. Time deposits of seven days were deregulated. Further deregulation was not entirely off the agenda, but for practical purposes the current program had come to an end. Over 99 percent of time deposits covered by the former interest rate rules had been deregulated.

The HKMA seemed to be cautious in implementing the steps. Fearing that the deregulation could reduce banks' profits by too much, it did not do anything to current and savings deposits. Time deposits of less than seven days' maturity remained regulated so that there would be no destabilizing migration from current and savings deposits to short-term time deposits. The basic problem faced by the HKMA seemed to be how the cap could be removed safely. This concern was based on the belief that the possible erosion of profits could lead banks to take excessive risks that would weaken their positions in times of major external shocks. However, it was judged that the market had absorbed the deregulation well (Carse 1995a). Banks had become more active sellers of their products rather than passive providers of services. More innovations such as electronic and card products were introduced in the competitive and riskier environment (Carse 1995b).

It should also be noted that after the establishment of the HKMA, banks have been required to disclose more of their financial information. This may be important for the public because there is no insurance for bank deposits in Hong Kong. The disclosure requirement has also probably restrained banks from taking positions that are too risky.

10.3 Some Anecdotal Evidence

In this section, we present and discuss some summary statistics that compare banks' situations before and after the deregulation. The purpose is to offer an illustration of the effects of removing the interest rate cap. This also serves to motivate the more rigorous analysis in the later sections of the paper.

Table 10.1 contains appropriate sample means derived from annual data for twenty-four locally incorporated banks before and after the deregulation.[2] Since the deregulation program started in October 1994 and ended a few months later, as an approximation we have taken 1993–94 as the before-deregulation period and 1995–96 as the after-deregulation period. Item 10 of table 10.1 shows that the average real profit rate, which is defined here as the difference between total income (excluding exceptional

2. Data are from annual reports of the banks and from Hong Kong Bank (various issues). Also see the discussion of data in section 10.4.

Table 10.1 Summary Statistics of Cost, Income, and Rate of Profit (per thousand dollars)

	Before Deregulation: 1993–94		After Deregulation: 1995–96		Growth Rate (%)	
1. Income from service charges/TA	10.21		10.16		−0.49	
2. Interest income/TA	54.31		68.2		25.6	
Interest income/loans		108.57		126.4		16.4
Loans/TA		522.21		559.12		6.88
3. Exceptional items/TA	2.21		0.8		−63.8	
4. Total income/TA	66.73		79.16		18.6	
5. Operating cost/TA	14.26		12.67		−11.2	
6. Interest cost/TA	30.87		43.98		42.5	
Interest cost/deposits		36.31		51.88		42.9
Deposits/TA		848.38		846.85		−0.18
7. Bad debt provisions/TA	1.42		1.78		25.4	
8. Total cost/TA	46.33		58.42		26.1	
9. Net interest/TA (2 − 6)	23.45		24.22		3.29	
10. Profit rate (1 + 2 − 5 − 6)	19.39		21.71		12	

Note: TA = total assets.

items) and total cost (excluding bad debt provisions), divided by the value of total assets, actually increased by 2.32 percentage points after the interest rate was deregulated. Why did the deregulation, which was meant to take away the monopoly power of the HKAB, fail to lower the profit rate?

Inspection of item 6 readily shows that (real) average interest cost went up from $30.87 per $1,000 of total assets to $43.98. This was an increase of 42.5 percent, confirming the expectation that the more competitive environment forced banks to pay a much higher interest cost. Banks, however, tried to cut operating cost, where there was an 11.2 percent decline.

On the income side, interest income went up from $54.31 to $68.20. The absolute value of this change was almost the same as the corresponding change for interest cost. This implies that the interest rate spread remained relatively stable despite the increase in interest cost. The entries in item 9 support this remark. Closer examination of item 2 suggests that the ratio of interest income to total assets went up for two reasons. One was that banks were able to earn more interest income per unit of loans lent out. The other was that banks tried to lend out more loans.

We should recall that the interest rate rules did not apply to banks' lending interest rate, which was determined in the competitive market even before the removal of the interest rate cap. Why could banks earn more interest after the deregulation? One hypothesis is that banks became more aggressive and less discriminating in offering loans. The result would be an increase in risk. Item 7 shows that bad debt provisions increased by 25.4 percent. This is consistent with the hypothesis that bank risk rose.

Table 10.2 **Assets of Banks in Hong Kong (million 1990 HK dollars)**

	Before Deregulation: 1993–94	After Deregulation: 1995–96	Growth Rate (%)
Average	60,952	70,611	15.8
Maximum	870,436	871,246	0.09
Minimum	1,185	1,507	27.2

All the items in table 10.1 are expressed in units per $1,000 of total assets. The table does not tell us whether banks succeeded in attracting more deposits. If this happened, the value of banks' total assets would increase. Table 10.2 shows that the average size of banks went up by 15.8 percent in real terms in the second period. This scale effect, together with the increase in profit rate, would raise total profits by almost 30 percent. The story of Hong Kong's interest rate deregulation cannot be described as one involving erosion of profits.

The above discussion must be regarded as illustrative only. One can always argue that the changes in income, cost, and profit were due to unexplained shocks in the environment rather than to banks' optimal responses to the deregulation. To isolate the effects of the deregulation, we must use better methods. Section 10.4 develops a method to address this problem, and the results are discussed in section 10.5. The method, however, cannot be used to assess the changes in risk. The simple CAPM of section 10.6 can fill the hole in the analysis.

10.4 Profit and Cost Functions

10.4.1 Profit Function

We study the evolution of the industry's operating profits by estimating a translog profit function with three inputs (labor, capital, and deposits) and two outputs (loans and banking services). Variable definitions can be found in table 10.3.

With outputs measured positively and inputs negatively, the profit function is defined as

$$\pi(p) = \max\{p'x : x \in T\}, \tag{1}$$

where p and x are 5×1 vectors of input-output prices and quantities, respectively, and T is the production possibility set representing the collection of technologically feasible input-output bundles. See Diewert (1982) for theoretical discussions of the profit function. Empirically we adopt a translog specification

Table 10.3 Variable Definitions

Variable	Name	Definition
p_1	Price of labor	Salaries and employee benefits divided by number of employees
p_2	Price of capital	Occupancy and fixed asset expenditures divided by net book value of fixed assets
p_3	Price of deposits	Interest expenses plus other operating expenses (unrelated to labor and capital) divided by total deposits including certificates of deposit
p_4	Price of loans	Interest income divided by loans (advances + trade bills − provisions)
p_5	Price of services	Operating income divided by total assets
π	Profits	Interest income + operating income − interest expenses − operating expenses

$$(2) \quad \ln \pi = \beta_0 + \sum_{i=1}^{5} \beta_i \ln p_i + \frac{1}{2} \sum_{i=1}^{5} \sum_{j=1}^{5} \beta_{ij} \ln p_i \ln p_j, \qquad \beta_{ij} = \beta_{ji}.$$

See Lau (1978) and Jorgenson (1986) for surveys of the empirical literature; recent applications to banking can be found in Hancock (1991), Berger, Humphrey, and Pulley (1996), and Humphrey and Pulley (1997), among many others. From the definition in equation (1) it follows that a profit function must be linearly homogeneous in prices, a property that translates into a set of restrictions among the parameters of the translog profit function:

$$(3) \quad \sum_{i=1}^{5} \beta_i = 1, \qquad \sum_{j=1}^{5} \beta_{ij} = 0, \qquad i = 1, \ldots, 5.$$

Upon differentiating the profit function with respect to prices, Hotelling's lemma implies a set of input-output share equations

$$(4) \quad S_i = \beta_i + \sum_{j=1}^{5} \beta_{ij} \ln p_j, \qquad i = 1, \ldots, 5,$$

where

$$(5) \quad S_i \equiv \frac{p_i x_i}{\pi} = \frac{p_i}{\pi} \left(\frac{\partial \pi}{\partial p_i} \right) = \frac{\partial \ln \pi}{\partial \ln p_i}, \qquad i = 1, \ldots, 5.$$

The five share equations in (4) are dependent because the shares add to one by construction; one of them has to be dropped in estimation. Dropping the last share equation, substituting equation (3) into equations (2) and (4) to eliminate the parameters associated with the last price, and appending random disturbances to the remaining equations, we obtain a five-equation system ready for estimation:

$$(6)\quad \ln\left(\frac{\pi}{p_5}\right) = \beta_0 + \sum_{i=1}^{4}\beta_i \ln\left(\frac{p_i}{p_5}\right) + \frac{1}{2}\sum_{i=1}^{4}\sum_{j=1}^{4}\beta_{ij}\ln\left(\frac{p_i}{p_5}\right)\ln\left(\frac{p_j}{p_5}\right) + \varepsilon_0,$$

$$S_i = \beta_i + \sum_{j=1}^{4}\beta_{ij}\ln\left(\frac{p_j}{p_5}\right) + \varepsilon_i, \qquad \beta_{ij} = \beta_{ji}, \qquad i = 1,\ldots,4.$$

Assuming normally distributed disturbances, a fully efficient maximum likelihood estimate (MLE) can be obtained by Zellner's iterated seemingly unrelated regression (ISUR), with the cross-equation restrictions enforced in computing the residual covariance matrix at each iteration. Moreover, the MLE is invariant with respect to the choice of which share equation to drop. For example, we would obtain the same result if the first share equation, rather than the last one, was dropped.

The underlying technology of production can be inferred from the dual profit function. The Hicks-Allen partial elasticity of transformation can be obtained by differentiating the profit function and applying Hotelling's lemma:

$$(7)\quad \eta_{ij} \equiv \frac{\pi\pi_{ij}}{\pi_i\pi_j} = \frac{\pi}{x_i x_j}\frac{\partial x_i}{\partial p_j} = \frac{\pi}{x_i x_j}\frac{\partial x_j}{\partial p_i},$$

where π_i and π_{ij} denote, respectively, the first and second partial derivatives with respect to the subscripted prices. The demand (supply) elasticity of input (output) x_i with respect to p_j can be easily calculated, given η_{ij} and share S_j:

$$(8)\quad \varpi_{ij} = S_j\eta_{ij} = \frac{p_j x_j}{\pi}\frac{\pi}{x_i x_j}\frac{\partial x_i}{\partial p_j} = \frac{\partial \ln|x_i|}{\partial \ln p_j}.$$

For the translog function form,

$$(9)\quad \eta_{ij} = 1 + \beta_{ij}/S_iS_j, \qquad i \neq j,$$

$$\eta_{ii} = 1 + \beta_{ii}/S_i^2 - 1/S_i.$$

The translog specification allows a convenient decomposition of profit growth attributed to changes in parameters and prices. Let $\pi(p;\beta)$ and $\pi(p^*;\beta^*)$ be the profit functions for two periods, with price vectors p and p^* and parameter vectors β and β^*, respectively. Consider the identity

$$(10)\quad \frac{\pi(p^*;\beta^*)}{\pi(p;\beta)} = \left[\frac{\pi(p^*;\beta^*)}{\pi(p^*;\beta)}\frac{\pi(p;\beta^*)}{\pi(p;\beta)}\right]^{1/2}\left[\frac{\pi(p^*;\beta^*)}{\pi(p;\beta^*)}\frac{\pi(p^*;\beta)}{\pi(p;\beta)}\right]^{1/2}$$

$$\equiv A \cdot B.$$

The left-hand side (in logarithm) is the growth in profit when (p, β) changes to (p^*, β^*). The right-hand side is a decomposition into marginal effects. The logarithm of A is the average of the two hypothetical cases in which β changes to β^* with prices held constant at p and p^*, respectively. This is the profit growth due to parameter change alone. Similarly, the logarithm of B is the growth in profit due to price change. Using the translog profit function, it is possible to further decompose the four marginal effects. Let $\ln p_k^* = \ln p_k + \Delta \ln p_k$ and $p_j^* = p_j$ for $j \neq k$. It is straightforward to check that

$$(11) \quad E_k(p,\beta) \equiv \frac{\ln \pi(p^*;\beta) - \ln \pi(p;\beta)}{\Delta \ln p_k} = \beta_k + \frac{1}{2}\sum_{j=1}^{5} \beta_{kj} \ln p_j,$$

which is a discrete approximation to the profit elasticity with respect to p_k. Thus

$$(12) \quad \ln \pi(p^*;\beta) - \ln \pi(p;\beta) = \sum_{i=1}^{5} [E_i(p^*,\beta)\ln p_i^* - E_i(p,\beta)\ln p_i],$$

which is a sum of marginal contributions from each of the five prices, with the parameter held constant at β. Similarly,

$$(13) \quad \ln \pi(p;\beta^*) - \ln \pi(p;\beta) = (\beta_0^* - \beta_0) + \sum_{i=1}^{5} [E_i(p,\beta^*) - E_i(p,\beta)]\ln p_i,$$

where $[E_j(p, \beta^*) - E_j(p, \beta)]\ln p_j$ can be interpreted as the jth input-output component of the profit growth due to parameter change, with prices held constant at p.

10.4.2 Cost Function

To study further the impact of deregulation on the cost side, in particular the industry's average cost curve, we estimate a translog cost function with three inputs (labor, capital, and deposits) and one output (loans) of the form

$$(14) \quad \ln c = \beta_0 + \sum_{i=1}^{3} \beta_i \ln p_i + \frac{1}{2}\sum_{i=1}^{3}\sum_{j=1}^{3} \beta_{ij} \ln p_i \ln p_j + \beta_Y \ln Y + \sum_{i=1}^{3} \beta_{Yi} \ln p_i \ln Y + \frac{1}{2}\beta_{YY} \ln^2 Y.$$

Analogous to the profit function case, cost share equations are generated by applying Shephard's lemma and combined with the cost function to form a three-equation system estimated by ISUR, after imposing homogeneity restrictions and dropping the last cost share:

$$(15)\quad \ln\left(\frac{C}{p_3}\right) = \beta_0 + \sum_{i=1}^{2}\beta_i \ln\left(\frac{p_i}{p_3}\right) + \frac{1}{2}\sum_{i=1}^{2}\sum_{j=1}^{2}\beta_{ij}\ln\left(\frac{p_i}{p_3}\right)\ln\left(\frac{p_j}{p_3}\right)$$
$$+ \beta_Y \ln\left(\frac{Y}{p_3}\right) + \sum_{i=1}^{2}\beta_{Yi}\ln\left(\frac{p_i}{p_3}\right)\ln\left(\frac{Y}{p_3}\right) + \frac{1}{2}\beta_{YY}\ln^2\left(\frac{Y}{p_3}\right) + \varepsilon_0,$$

$$S_i = \beta_i + \sum_{j=1}^{2}\beta_{ij}\ln\left(\frac{p_j}{p_3}\right) + \beta_{Yi}\ln\left(\frac{Y}{p_3}\right) + \varepsilon_i, \qquad \beta_{ij} = \beta_{ji}, \qquad i = 1,2.$$

The average cost curve (in logarithm) is obtained by simply subtracting ln Y on both sides of the total cost function (14). Notice that the curvature of the average cost curve is determined by β_{YY}, which is the second derivative of the logarithmic average cost function with respect to ln Y. The cost curve is U-shaped if β_{YY} is positive. Analogous to the profit function case discussed above, the translog specification admits a detailed decomposition of average cost growth attributed to changes in parameter values and input prices. In other words, we decompose the upward or downward shifting of the average cost curve into a number of contributing sources. Since the average cost curve depends on the output level, we choose its minimum as a benchmark by which the shifting of the curve is assessed.

10.5 Discussion of Results

We have estimated the three-input two-output profit function discussed in section 10.4 by using 1993–96 panel data for twenty-four of the thirty-one locally incorporated banks in Hong Kong.[3] New regulations on disclosure have made much more data available for this period. Foreign banks are excluded because they do not have to comply with the same disclosure requirements as local banks. Parameters of the profit function are estimated both for the before- and after-deregulation periods. They are reported in appendix table 10A.1. The demand-supply elasticity matrices for the two periods are presented in tables 10A.2 and 10A.3. We shall refer to the set of parameters for 1993–94 as S1 and that for 1995–96 as S2. The Chow test in table 10A.1 rejects the null hypothesis of no structural shift of the parameters.

The structural shift reveals that the banks' responses go far beyond altering input-output proportions. Humphrey and Pulley (1997) summarize three primary responses from banks that explain the deregulation-induced structural change in banks' production technology. The first response is cost offset and cost reduction. The second response is to transfer some of the higher funding cost and interest rate risk to borrowers (via floating-

3. Excluded are mainly investment banks with one or two offices. Their behavior is significantly different from that of the remaining banks, which engage extensively in retail banking.

rate loans) and to purchasers of securities (by securitizing fixed-rate loans). The third response is to expand asset risk in order to reap a higher expected return on loans to a more concentrated, but riskier, set of borrowers. Banks have also become more aggressive in developing and marketing their services (Carse 1995a). The differences between the two sets of parameters therefore reflect the changing strategies of optimizing banks. These banks have to adjust their strategies because the environment is changing.

The profit function formulation assumes perfect competition. Banks are price takers and input-output prices constitute the environment. Deregulation changes the interest rate, which is one of the prices, and therefore affects the environment. We shall refer to the set of prices in the first period as E1 and that in the second as E2.

By having two sets of strategy parameters and two sets of environment variables, we have four different scenarios. We can calculate the profit of an average bank under different scenarios by substituting the four combinations of values into the profit function. We use sample means of the price data for the purpose. Table 10.4 presents the results in a 2×2 matrix. It is readily seen that there is substantial growth in profits ($6.0903 - 5.8088$, the logarithmic difference) by going down the diagonal, or from S1-E1 to S2-E2. This indicates that given the new environment and the new strategies, banks actually made more profits after the deregulation, a phenomenon consistent with what we observed earlier in table 10.1.

The more interesting results are, however, the counterfactual cases of S2-E1 and S1-E2, which isolate the marginal effects of deregulation and banks' responses. Given the new environment E2, if the average bank does not adjust its strategies to S2, then (log) profits will decrease by $5.8088 - 5.5115 = 0.2973$. In other words, the marginal impact of deregulation is to reduce an average bank's profits by about 30 percent. Comparing the two strategies S1 and S2 under the new environment E2, we see that the new strategy is able to raise profits by $6.0903 - 5.5115 = 0.5788$, which more than offsets the erosion in profits due to deregulation. Similarly, one can obtain a second decomposition of observed profit growth by going through the route from S1-E1 to S2-E1 and then to S2-E2. It should be noted that profits in S2-E1 are larger than in S1-E1. There is the question of why the bank chooses S1 rather than S2 when the environment is E1. Such a seemingly suboptimal choice signals that there must be some hid-

Table 10.4 **Average Bank's Profit in Different Scenarios (logarithmic values)**

	E1	E2
S1	5.8088	5.5115
S2	6.4217	6.0903

den cost to adopting S2. In view of the operating characteristics of financial intermediaries, this is likely to be the cost of risk.

To understand better the relative impact of E2 and S2 on banks' profits, we construct another table. In table 10.5, we decompose the growth in profits of an average firm into its sources. The higher interest cost caused a significant decline in profits due to deposits (−0.3282), but this was completely offset by the banks' new strategies on deposits (1.1963). Much of the growth in profits related to the environment was due to income from providing services (0.1428). It is also readily seen from the table that banks also modified their strategies to take advantage of the services component of profits. The increase in profits due to services in the strategies column was 0.7775. Apparently, banks increased their labor and capital costs and mobilized resources away from loans to expand in the market of providing bank services. These include income from commissions and fees derived from foreign exchange trading, credit cards, trading investments, and other types of services. The new strategy seems to be successful and reasonable. When businesses related to the interest rate are negatively affected, competitive banks look for profit opportunities in other areas. The rapid introduction of new banking services in Hong Kong during the past few years is a testimony to the responsive and flexible nature of local banks.

An implicit assumption in deriving table 10.5 is that all the factors of production are variable. It may be argued that since the duration of the period under study is too short, we should not assume that banks are in their long-run equilibrium. An alternative is to treat capital stock as a fixed input factor of production. We can then estimate a short-run profit function in a similar way. This has been implemented, and we find that the results discussed above are robust. To conserve space, we do not provide the details.

Results from estimating the cost function provide us with additional

Table 10.5 **Sources of Profit Growth**

Source	Strategies	Environment	Total
Labor	0.0487	−0.0934	−0.0448
Capital	−0.0764	0.0194	−0.0570
Deposits	1.1963	−0.3282	0.8681
Loans	−1.2133	−0.0550	−1.2683
Services	0.7775	0.1428	0.9203
Residual	−0.1369	0.0000	−0.1369
Total	0.5959	−0.3144	0.2815

Note: The values are logarithmic differences of profits. If multiplied by 100, each entry can be approximated as the part of the profit growth rate that is due to changes in the corresponding factors.

Table 10.6 **Sources of Average Cost Growth**

Source	Strategies	Environment	Total
Labor	0.0385	0.0157	0.0542
Capital	0.0559	−0.0063	0.0496
Deposits	−0.1303	0.2474	0.1171
Residual	0.0117	0	0.0117
Total	−0.0242	0.2568	0.2326

Note: The values are logarithmic differences of average costs. If multiplied by 100, each entry can be approximated as the part of the growth rate of average cost that is due to changes in the corresponding factors.

information for understanding how banks responded to interest rate deregulation. The data sources for the estimation are the same as those for the profit function. Again we divide the period in two: 1993–94 and 1995–96. Estimates of the parameters are reported in appendix table 10A.4. The Chow test that we perform also rejects the null hypothesis that there is no structural shift in the parameters.

Table 10.6 shows the decomposition of the sources of growth of the industry's minimum average cost. Changes in the environment caused (minimum) average cost to go up by 23.26 percent. The new strategies only reduced cost by 2.42 percent. It appears the banks did not focus too much on cost reduction. Rather, as discussed above, they became more aggressive in expanding their businesses. The single most important factor that raised cost was the interest cost for bank deposits (24.74 percent). Banks were only able to mitigate part of the increase through their new strategies on deposits (−13.03 percent). It is interesting to note that the prices of labor and capital in the environment remained stable, but banks chose to raise these costs further. This phenomenon is consistent with the picture discussed earlier. Banks strategically expanded into the business of banking services, which is input intensive in both labor and capital. The residual term reported in table 10.6 is 1.17 percent. This means that in addition to the changes in the prices of labor, capital, and deposits, there was an unexplained exogenous increase in cost due to other changes in the environment.

Some interesting results on how banks responded to the deregulation can be seen in figure 10.1, which depicts the industry's average cost curves under the four different scenarios mentioned earlier. The cost function of S1-E1 is above that of S2-E1. The banks could have lowered cost by choosing the new strategies even if the deregulation had not occurred. This result also appears in the profit function discussed earlier. It signals that the new strategies associated with expanding bank services raise the risks of the banks.

Another observation from figure 10.1 is that the new strategies appear

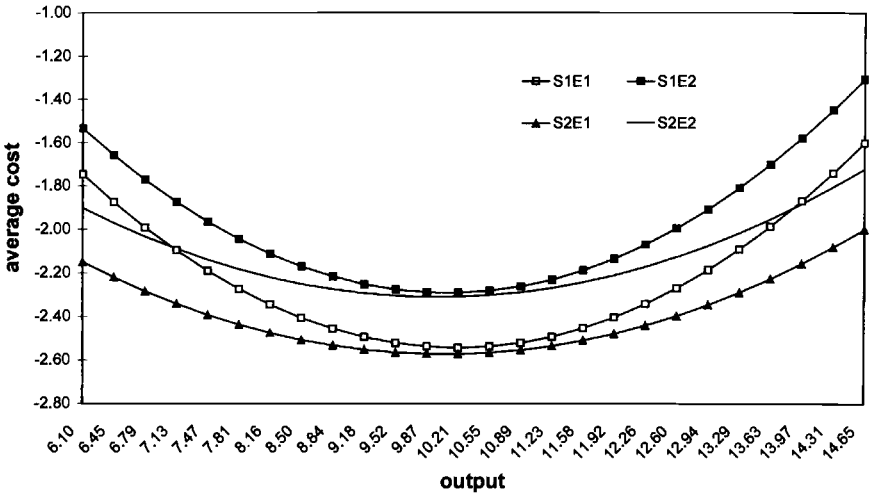

Fig. 10.1 Banking industry's average cost curves

to have flattened the cost curves. This observation is also supported by the statistical test. If the curvature flattens, then the estimate for one of the parameters, β_{yy}, will go down after the deregulation. The result in table 10A.4 supports this hypothesis. The parameter decreases from 0.0949 to 0.0541, and the difference is statistically significant. The flattening of the cost curves can be explained by the fact that competition increased. Banks have recently also engaged in more networking activities among themselves so as to take advantage of any possible economies of scale. The flattening of the cost functions may indicate that banks are moving closer to constant returns to scale.

The main message we get from the empirical results is that banks in Hong Kong seem to be very responsive to changes in the environment and, in this case, the deregulation itself. Their efforts to cut costs did not seem to be successful and they chose the more aggressive strategy of expanding business. We therefore expect their risks to have gone up. To formally test for it, we turn to the next section.

10.6 Changes in Risks

In section 10.5 we only discussed the effects of the deregulation on the costs and profits of the banks. Without knowing what happens to the banks' risks, we cannot conclude that they are better off even when their profits have increased. In what follows, we shall make use of a standard CAPM to find out whether the market believes that the risks of the banks went up after the deregulation (cf. Brooks, Faff, and Ho 1997).

Our estimate of the changes in bank risks is based on the following return-generating process of the CAPM (e.g., see Sharpe and Alexander 1990; Ross 1994):

$$(16) \qquad R_i - R^* = \alpha_i + \beta_i(R_M - R^*) + \varepsilon_i,$$

where R_i is the rate of return of bank i, R^* is the rate of return of a risk-free asset, R_M is the rate of return of a general market portfolio, and ε_i is the random error term associated with bank i. The coefficients α and β can be estimated. If the value of α, also known as Jensen's α, is nonzero, the security of bank i is mispriced. To see whether the market is efficient, we can perform a test for the value of α. The value of β tells us how the market evaluates the risks of the bank. The higher the value of β, the higher the risks associated with the bank.

If a bank chose a riskier position after the deregulation, then its β should have gone up. We collect monthly share price data for all banks listed on the Hong Kong stock market for the period from June 1992 to March 1997.[4] Monthly rates of return for every bank can be derived from these prices. The market portfolio rate of return, R_M, is derived from monthly changes in the Hang Seng Index, which tracks Hong Kong's blue-chip stocks.[5] We use the Fed funds rate to derive the risk-free monthly rate of return, R^*. To implement a test for the change in β, we can add to equation (16) a dummy variable (D) with value equal to one from January 1995 to March 1997 and zero before this period:

$$(17) \qquad R_i - R^* = \alpha_i + (\beta_i + \gamma_i D)(R_M - R^*) + \varepsilon_i,$$

The bigger the increase in risks, the bigger the value of γ.

Table 10.7 summarizes the estimations based on equation (17). There are altogether twelve banks listed on the Hong Kong Stock Exchange. We have eliminated one of these, the Hong Kong Bank, because it has very significant overseas profits that are not affected by the interest rate deregulation. The list in table 10.7 is ranked according to the market shares of the remaining eleven banks. Several results emerge from the table.

First, the t-values of Jensen's α for all eleven banks are insignificant. We cannot reject the hypothesis that they are equal to zero. The securities for all the banks appear to have been efficiently priced both before and after the deregulation. This suggests that the economic profits of the eleven banks are all zero, implying that the increase in bank costs due to the deregulation was offset by the banks' efforts to raise revenue. Second, the t-values of β for all the banks are highly significant, which is a reasonable

4. The electronic financial database Extel provides the necessary data (Financial Times 1997).

5. We have properly taken care of dividends and other distributions in computing the rates of return for the banks and the Hang Seng Index.

Table 10.7 **Estimates of Changes in Risks**

Bank	α	β	γ	R^2
Hang Seng	0.4198	0.7592	0.3649	0.634
	0.6	*7.46*	*1.78***	
East Asia	0.3427	0.6874	0.4143	0.582
	0.47	*6.46*	*1.93***	
Dah Sing	0.997	0.5898	1.077	0.373
	0.75	*3.02*	*2.74****	
Dao Heng	0.1801	1.046	0.2263	0.633
	0.18	*4.53*	*0.72*	
HKCB	−0.9063	0.7441	0.1665	0.494
	−0.96	*5.4*	*0.64*	
Wing Lung	0.3344	0.7596	0.2223	0.564
	0.44	*6.78*	*0.98*	
Wing Hang	0.254	0.7184	0.4664	0.452
	0.2	*4.07*	*1.41**	
IBA	−0.589	0.8475	0.592	0.52
	−0.43	*3.99*	*1.63**	
Union	0.988	0.853	0.8637	0.488
	0.81	*4.76*	*2.39****	
First Pacific	0.729	1.0309	0.2022	0.56
	0.56	*5.63*	*0.59*	
Ka Wah	0.076	0.5434	0.7273	0.329
	0.06	*3.12*	*2.07****	

Note: Numbers in italics are *t*-values.

*One-tail significance at the 10 percent level.

**One-tail significance at the 5 percent level.

***One-tail significance at the 2.5 percent level.

result. Third, the *t*-values for five of the γs are significant at the 5 percent or 2.5 percent levels, while two of them are significant at the 10 percent level. Although four of the banks do not have a significant γ, it should be noted that the γs for all eleven banks are uniformly positive in sign. These results do suggest that the market believes that the risks of all the banks increased. Risk changes for some of the banks may not be as strong as for others because their strategies may have been different.

The empirical tests from this section support the hypothesis that banks in Hong Kong were more willing to accept risks after the deregulation. Alternatively, at least the market believes that the more competitive environment will create or has created more risks for the banks. This should be regarded as a trade-off for the increase in profits of the banks.

10.7 Concluding Remarks

In this paper, we have examined the changes in profits and costs of Hong Kong's banking industry after the interest rate deregulation from

late 1994 to early 1995. It is found that the banks in our sample were all efficiently priced and did not make excess profits before or after the deregulation. Our decomposition analysis shows that banks were responsive to changes in the environment. They made significant adjustments in their business strategies. Within the constraints of the banking production technology, banks were relatively unsuccessful in mitigating the erosion in profits by cost reduction. They instead chose to increase profits by expanding their businesses into relatively interest-independent bank services.

In terms of maintaining growth in profits, the strategy was successful. However, we have also found that the risks associated with most of the banks increased after the interest rate cap was removed. Apparently, changes in interest costs induced them to go deeper into a business that they had been less keen about earlier. Probably because of the general financial health of the economy in the sample period, the increase in risks has not brought about any major crisis yet. The absence of an insurance system for bank deposits and the new regulations on disclosure should also have restrained the banks from taking extremely risky positions.

The process of the deregulation was carried out cautiously in several phases. This gave the banks more time to absorb the shocks and cope with the changes. This could be one of the reasons why the transition was relatively smooth even though the Mexican crisis and the Barings incident occurred in the beginning phases of the deregulation. However, from the analysis in this paper, there seems to have been another reason that was more fundamental. Having operated in a free market environment for a long time, the banks were very nimble in finding new opportunities. This ability has been important in the past and most likely will continue to be important for the banks' survival in the future.

Appendix

Table 10A.1 **Profit Function**

Parameter	Before Deregulation: 1993–94 ML Estimate	Before Deregulation: 1993–94 Standard Error	After Deregulation: 1995–96 ML Estimate	After Deregulation: 1995–96 Standard Error
β_0	10.6104	0.2564	10.4735	0.2050
β_1	−0.2199	0.1634	−0.3056	0.0999
β_2	−0.0982	0.0403	−0.0758	0.0252
β_3	−2.1803	0.2412	−2.8537	0.2185
β_4	0.5537	0.1979	1.6257	0.1689
β_{11}	−0.3792	0.0835	−0.2491	0.0584
β_{21}	−0.0378	0.0204	−0.0207	0.0133
β_{22}	−0.0575	0.0087	−0.0183	0.0058
β_{31}	0.0641	0.1141	0.3750	0.0939
β_{32}	−0.0783	0.0335	−0.0108	0.0276
β_{33}	−1.5320	0.2420	−0.6824	0.2913
β_{41}	0.3224	0.0963	0.0018	0.0644
β_{42}	0.1207	0.0286	0.0288	0.0188
β_{43}	1.0633	0.1824	0.3169	0.1900
β_{44}	−0.1739	0.2247	0.3477	0.1999
Log likelihood	332.5182		383.3432	
Sample size	48		46	

Note: Using the pooled sample of all 94 observations gives a log likelihood of 655.1992. The likelihood ratio statistic LR = −2(655.1992 − 332.5182 − 383.3432) = 121.3244 rejects the null hypothesis of no structural shift at any reasonable significance level for a χ^2 distribution with 15 degrees of freedom.

Table 10A.2 **Demand-Supply Elasticity Matrix, 1993–94**

−0.7676	−0.0847	−1.9981	2.2811	0.5695
(0.1636)	(0.0400)	(0.2233)	(0.1888)	(0.1215)
−0.2723	−0.7964	−1.3794	2.1528	0.2954
(0.1288)	(0.0551)	(0.2114)	(0.1806)	(0.1095)
−0.5447	−0.1170	−2.0542	2.3449	0.3711
(0.0608)	(0.0179)	(0.1292)	(0.0974)	(0.0665)
−0.3997	−0.1174	−1.5073	1.8531	0.1715
(0.0330)	0.0098)	(0.0626)	(0.0771)	(0.0335)
−0.4621	−0.0746	−1.1048	0.7944	0.8472
(0.0986)	(0.0276)	(0.1981)	(0.1552)	(0.1537)

Note: Entry $(i, j) = \partial \ln x_i / \partial \ln p_j$, where x_1 = labor, x_2 = capital, x_3 = deposits, x_4 = loans, and x_5 = services. Numbers in parentheses are standard errors.

Table 10A.3 **Demand-Supply Elasticity Matrix, 1995–96**

−0.7287	−0.0680	−3.2177	3.2092	0.8050
(0.1531)	(0.0350)	(0.2460)	(0.1689)	(0.1192)
−0.2118	−0.9723	−2.1462	2.9789	0.3514
(0.1091)	(0.0475)	(0.2255)	(0.1538)	(0.1113)
−0.5494	−0.1176	−2.9296	3.0722	0.5242
(0.0420)	(0.0123)	(0.1303)	(0.0850)	(0.0630)
−0.3810	−0.1135	−2.1363	2.3222	0.3085
(0.0200)	(0.0058)	(0.0591)	(0.0622)	(0.0251)
−0.5853	−0.0820	−2.2323	1.8895	1.0101
(0.0866)	(0.0259)	(0.2685)	(0.1537)	(0.1565)

Note: Entry $(i, j) = \partial \ln x_i / \partial \ln p_j$, where x_1 = labor, x_2 = capital, x_3 = deposits, x_4 = loans, and x_5 = services. Numbers in parentheses are standard errors.

Table 10A.4 **Cost Function**

	Before Deregulation: 1993–94		After Deregulation: 1995–96	
Parameter	ML Estimate	Standard Error	ML Estimate	Standard Error
β_0	4.9673	0.7824	3.0198	1.0417
β_1	0.4058	0.0568	0.2258	0.0419
β_2	0.0844	0.0237	0.0174	0.0170
β_Y	0.0761	0.1574	0.4757	0.2029
β_{11}	0.0715	0.0218	0.0689	0.0169
β_{21}	−0.0198	0.0063	−0.0031	0.0046
β_{22}	0.0136	0.0034	0.0055	0.0023
β_{Y1}	−0.0325	0.0055	−0.0169	0.0042
β_{Y2}	−0.0008	0.0024	0.0029	0.0017
β_{YY}	0.0949	0.0160	0.0541	0.0197
Log likelihood	429.1103		456.8197	
Sample size	48		46	

Note: Using the pooled sample of all 94 observations gives a log likelihood of 856.2420. The likelihood ratio statistic LR = −2(856.2420 − 429.1103 − 456.8197) = 59.3760 rejects the null hypothesis of no structural shift at any reasonable significance level for a χ^2 distribution with 10 degrees of freedom.

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Comment Moon-Soo Kang

The Hong Kong Association of Banks cautiously implemented the process of interest rate deregulation in several steps in the 1990s. Kwan and Lui argue that the transition was relatively smooth in Hong Kong. However, their sample period (1995–96) may be too short for them to claim that Hong Kong banks responded optimally to the interest rate deregulation in 1993–94.

Foreign banks are excluded from this study. It would be interesting to investigate how foreign banks responded when local banks raised lending and deposit rates in Hong Kong. The paper does not tell us what happened to local banks' market shares after they raised lending rates.

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The paper argues that local banks expanded into riskier businesses. However, it does not show how much nonperforming loans of local banks increased after local banks adopted new business strategies. When the Hong Kong economy suffers from economic downturns in coming years, local banks may see a considerable increase in nonperforming loans, as Korea has in recent years.

The paper does not tell why local banks in Hong Kong have not been successful in cutting operating costs. Korean commercial banks saw operating profits shrink in recent years when the Korean economy went sour because they could not reduce labor and other operating costs.