Macroeconomic Conditions and Banking Performance in Hong Kong: A Panel Data Study

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Abstract

Using confidential supervisory bank-level data, this paper examines the determinants of banking performance in Hong Kong, with a focus on the impact of macroeconomic developments on the net interest margin and asset quality. The empirical analysis suggests that banking performance is affected by macroeconomic developments with smaller banks being more exposed to changes in economic conditions. The bursting of the property "bubble" also put banks under stress, but property-related loans remained relatively safe assets compared with other types of bank lending.

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1. Introduction

This paper provides a preliminary study of the determination of the net interest margin and the non-performing loan ratio, the arguably two most important measures or determinants of bank profitability, for all 29 retail banks in Hong Kong. This sector does not include banks whose activities are primarily of an offshore or wholesale nature, and is thus representative of the banking business in Hong Kong. The study is based on annual data for the period 1994-2002 that are derived from information collected in the context of the Hong Kong Monetary Authority's (HKMA) supervisory activities. While the data set is rich in some dimensions (for instance, it contains data on many financial and income and expense ratios, such as non-performing loans and net interest margins), for confidentiality reasons it contains no information that would allow us to identify individual banks. Thus, we do not know how large assets a bank has (although we do know if it is "small", "medium"-sized or "large"), how extensive a branch network it has, whether it is domestic or foreign owned etc.

The focus of the analysis is on the extent to which macroeconomic developments affect bank profitability and, in particular, whether that impact differs across banks. The paper is motivated by the fact that the banking sector plays a critical role in the economy. A strong and profitable banking system promotes broader financial stability and increases the economy's resilience to adverse macroeconomic shocks. At the same time, changes in macroeconomic conditions affect banks' performance and financial health. It is therefore of importance for the authorities responsible for the maintenance of financial and monetary stability to quantify the linkages between the macroeconomic developments and the banking sector.

In the case of Hong Kong, this interest is enhanced by the fact that the Hong Kong dollar is linked to the US dollar through a currency board system, which implies that local interest rates are effectively beyond the immediate control of the Hong Kong Monetary Authority (HKMA). While this system has provided a firm nominal anchor to the economy since its introduction in 1983, monetary policy can not be used to guard against large asset price swings. In particular, interest rates can not be adjusted in light of the state of the banking system. The currency board system therefore requires a careful use of regulatory policy and a strict regime of banking supervision. The effectiveness of this policy is evidenced most strikingly by the fact that the banking system remains generally sound despite a fall in property prices of almost 70% since 1998. A thorough understanding of the impact of business cycle movements on bank profitability is therefore of considerable interest.

There are a number of studies on banking performance in Hong Kong, most of which use aggregate data for the banking system. In particular, Shu (2002) examines the impact of macroeconomic conditions on the average asset quality of the banking sector. Peng *et al.* (2003) studies how changes in the Hong Kong dollar risk premium, measured by a widening of spreads between HK dollar and US dollar interest rates, may have influenced banks' aggregate net interest margin and asset quality. Gerlach and Peng (2003) finds that bank lending is closely related to economic growth and fluctuations in property prices, and that regulatory measures have helped limit banks' exposure to the swings in the property market. Two studies, Kwan (2002) and Jiang *et al.* (2003), have used panel data. By estimating cost frontiers, Kwan considers how the cost efficiency of banks is determined by bank characteristics. In a paper closely related to this, Jiang *et al.* (2003) relates bank profitability to macroeconomic conditions as well as bank characteristics. However, with access to public data on listed banks only, it covers a sub-set of the sector. Moreover, it does not include an analysis of any asymmetric effects of changes macroeconomic and financial conditions across banks, because of data limitations.

The rest of the paper is organised as follows. Section 2 provides some stylised facts about the performance of Hong Kong's banking sector in recent years, and its relationship with macroeconomic developments. We show that changes in profitability are closely linked to the net interest margin and to the non-performing loan ratio, which influences banks' provisioning decisions. Section 3 outlines the empirical strategy in modelling determination of these key determinants of profitability. Given that we have data for a cross section of banks for a number of years, we use a panel data approach that is common in studies of banking performance. Section 4 presents the estimation results and analysis. The main findings are that macroeconomic

developments have played a large role in determining the profitability of banks in Hong Kong. Furthermore, the NPLs of smaller banks appear less sensitive, but their net interest margin appears more sensitive, to movements in real GDP than those of larger banks. We also find, perhaps surprisingly, that the NPLs of banks holding more property loans have been relatively insensitive to property prices. Section 5 concludes.

2. Banking performance in Hong Kong: some stylised facts

While work to date has concentrated on studying developments of Hong Kong's banking sector as a whole, the focus of this paper is to explore whether large and smaller banks are affected by macroeconomic conditions to a different extent. For this purpose, the 29 banks are divided into three groups according to their asset size. The first of these groups contains five "large" banks defined as those with assets accounting for more than 5% of the retail bank sector; the second group contains 10 banks with their asset size being between 5% and 1% of the sector; and the small bank group contains 14 banks with an asset size of less than 1% of the sector.

2.1 Profitability and the macroeconomic environment

To understand the role of macroeconomic factors in accounting for movements in profitability, it is useful to consider the macroeconomic indicators in Chart 1. Following a pronounced expansion in the mid-1990s, the Hong Kong economy fell into a recession as a result of the Asian financial crisis, with real GDP declining by over 5% in 1998. The economy rebounded strongly in 2000, but the recovery ended with the global economic slowdown in 2001. Subsequently, economic activity was generally sluggish notwithstanding strong performance in exports of goods and services. The developments also impacted strongly on the unemployment rate, which rose sharply from 2-3% in the pre-crisis period to 7.3% in 2002. Affected by both cyclical and structural factors, deflation started in 1998, and has persisted for over five years. Since bank loans are in nominal terms, an unexpected decline in the price level will increase the real debt burden, and may therefore affect borrower's ability to repay and hence bank profitability. Furthermore, property prices have declined by over 60% from the pre-crisis peak level, exerting a significantly negative wealth effect on domestic demand. In addition to the impact through general macroeconomic performance, declines in property prices may have affected banks' profitability directly through a number of channels. These include deterioration in the quality of property-related assets such as mortgage loans and reduced demand for credit.

Chart 1 also shows that interest rates rose sharply during the Asian financial crisis, reflecting an increased risk premium.[1] Empirical estimates suggest that the spike in interest rates in 1997-98 reduced banks' net interest margins because of a faster and more complete pass-through to deposit rates than to retail lending rates (Peng *et al.*, 2003). Helped by improved global market conditions as well as by a number of steps (the "seven technical measures") taken by the HKMA to strengthen the currency board system, interest rates stabilised. In recent years they have declined in line with the monetary easing in the US. Despite these developments, real interest rates have remained high by historical standards as a result of deflation, and have partly been responsible for restraining the demand for bank credit.

It should be noted that these difficult macroeconomic developments also coincided with interest rate liberalisation and increased competition in the banking sector that in turn led to changes in the structure of the banking system. Starting from 1994, the HKMA lifted rules on interest rates in stages. The liberalisation program, coupled with the reduced demand for credit, has increased competition among banks, which can be seen from the downward trend in the Herfindahl-Hirschman index (Chart 2A).[2] The increased competition has led to a decline in lending spreads,

[1] Since we plot annual data, the chart does not does not show the sharp increase in interest rates that occurred during the episode of severe speculative pressures in the autumn of 1998.

[2] The Herfindahl-Hirschman index is an indicator of market concentration. It is calculated as the sum of the squares of individual banks' market shares.

particularly in the mortgage loan segment.[3] At the beginning of 1997, 84% of new residential mortgages were contracted at rates above the best lending rate (*BLR*). In contrast, nearly all new mortgage loans were made at rates below the *BLR* by about 2.5 percentage points in 2002 (HKMA, 2002).

2.2 Developments in profitability

As a preliminary to the discussion of profitability below, it is useful to consider what factors contributed, in an accounting sense, to movements in profitability. In accounting terms, profitability can be decomposed as:

$$(1) \qquad \frac{BTP}{TA} = \frac{NI}{TA} + \frac{NII}{TA} - \frac{OV}{TA} - \frac{PROV}{TA},$$

where *BTP* denotes before-tax profits, *TA* total assets, *NI* net interest income, *NII* non-interest income, *OV* overhead and *PROV* loan loss provisioning.

Of the four components, much interest has focussed on the ratio of net interest income to total assets, which is commonly referred to as the net interest margin (*NIM* = *NI/TA*).[4] Chart 2B depicts developments of the overall profitability with its four components. Profitability for retail banks, defined as before-tax profits divided by total assets, fell sharply from around 1.8% during the boom period (1994-1997) to 1% in 1999. It subsequently rebounded and reached about 1.4% in 2002. Variations in profitability appear to have been mainly driven by net interest income and loan provisions. Specifically, NIMs fell significantly in 1997-1998 as the economy contracted and banks' funding costs soared. They recovered moderately between 1999-2000, but the subsequent economic slowdown and intense competition in the sector restrained any further improvement. By comparison, non-interest income (*NII/TA*) and overhead cost (*OV/TA*) have remained relatively stable.[5]

Chart 2B also shows that banks' loan loss provisions (*PROV/TA*) increased considerably in 1998-99 as asset quality deteriorated substantially. The sharp slowdown of the economy and higher borrowing costs caused severe financial difficulties for corporate and individual borrowers. The collapse of a number of large Mainland companies in 1998 exacerbated the situation. Provisions and non-performing loans (*NPL*) declined in 2000-02 (Chart 2C), reflecting a number of factors including the economic recovery in 2000, and a more cautious lending stance by banks. Nevertheless, the NPL ratio remained higher than the pre-crisis levels.

2.3 Bank groups of different sizes

Developments of bank profits also vary across bank groups of different size. Chart 3A shows that while the profitability on average has been quite similar for different banks, the sensitivity of bank profitability to the state of the economy is inversely related to bank size. Thus, during the boom period of 1994-97, small banks were more profitable than larger banks. By contrast, during 1998-2002, when economic conditions were generally weaker, the average profitability declined most in small banks. Although the profitability of smaller banks appears relatively more volatile than that of

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[3] Chart 2A includes a measure of the lending spread, which is calculated as the difference between the rate on new mortgage loans and a (weighted) average of deposit rates.

[4] The NIM is the ex post spread that differs from the ex ante spread calculated as the difference between the contractual rates charged on loans and rates paid on deposits. The ex post spread is more useful as it controls for the fact that banks with high-yield, risky credits are likely to face more defaults. Other things being equal, higher *NIM*s as a result of, for example, a fall in loan defaults, will increase bank profits, and thus improve the stability of the banking sector. However, a higher *NIM* may also reflect high intermediation costs due to insufficient competition or other institutional characteristics, and thus indicate inefficiency of the system.

[5] The stability of non-interest income and overhead cost at the aggregate level obscures the fact that larger banks may be better able than smaller banks to manage these components in a countercyclical fashion to smooth profitability over time (see below).

larger banks, the striking aspect of Chart 3A is that banks have generally remained profitable in recent years despite the very difficult market conditions.

Decomposition of profitability in the previous subsection suggested that movements in *NIM*s played a large role in accounting for shifts in bank profitability at the sector level. Chart 3B therefore looks at the NIM by bank size, and shows that smaller banks generally maintained higher *NIM*s, but saw the largest declines in *NIM*s after 1997. A number of factors may explain the generally higher *NIM*s for smaller banks. First, they tended to have lower funding costs, as reflected in higher capital bases, and rely more on traditional lending business on the asset side, which led to a relatively high interest income as a share of total income (Table 1). The fact that smaller banks hold more capital should perhaps best be seen as recognition that their higher volatility of profits may be associated with greater riskiness. Secondly, it may be the case that a higher *NIM* is associated with a higher risk profile of loans, which raises operating costs entailed by monitoring and control. The small bank group indeed recorded higher operating costs in the period. The sharp decline in *NIM*s for smaller banks in recent years may reflect the relatively large weight of property-related loans in their portfolio, as lending spreads for mortgage loans declined significantly. Another possibility is that increased competition has required smaller banks to offer higher interest rates to attract customer deposits, and thus reduced their *NIM*s.

Next we turn to the *NPL* ratio. Chart 3C shows that loan quality worsened considerably for all three groups in 1998-2002 relative to 1994-97. Medium-sized banks saw the worst deterioration, and large banks recorded a slightly larger rise in *NPL*s than the small bank group. The bursting of the property "bubble" has probably put asset quality of the sector under significant stress. Banks in all groups had significant exposure to property lending, which accounted for around 50% of their portfolio. Although there was no systematic pattern as to which bank group was more exposed, the degree of exposure to property lending varied across banks. It should be noted, however, that a few factors mitigated the concentration risk associated with large exposure to the property sector. These factors included banks' observance of the HKMA's recommended loan-to-value ratio of 70% for residential mortgages, the low gearing ratio of property developers and the practice of pre-selling a large number of units (IMF, 1999). As a result, the delinquency ratio of residential mortgage loans has remained low relative to that of most other domestic credits.

Chart 3D indicates that noninterest income net of operating cost increased for large and medium-sized banks in 1998-2002 over 1994-97, but declined for the small bank group. This confirms that larger banks have managed to raise noninterest income and reduce operating cost in the recent years to stabilise profits in the face of declining net interest income and increasing loss provisions.

Table 2 further shows the dispersion of profitability, asset quality and the *NIM* across the banks. The cross-bank dispersion of these variables rose in 1998, but started to fall back in 2002.

2.4 Summary

The analysis in this section suggests three broad conclusions. First, overall bank profitability dropped sharply following the Asian financial crisis and, notwithstanding some recovery in recent years, has remained below pre-crisis levels. The reduced profitability is related to relatively difficult macroeconomic conditions and increased competition in the banking sector. Second, bank profitability has been driven mainly by changes in *NIM*s and loan provisions that in turn were determined by asset quality. Third, smaller banks have recorded relatively larger declines in profits, attributable to a sharper fall in net interest margins as well as to rises in operating cost.

3. Empirical framework and methods

In the remainder of this paper, we carry out econometric analysis to examine how macroeconomic and financial conditions may have affected *NPL*s and *NIM*s, the two most important factors affecting bank profits in Hong Kong. Since we are interested in the behaviour of individual banks, it is natural to adopt a panel approach. Below we describe briefly the empirical framework and the estimation method.

Following Demirgüç-Kunt and Huizinga (1999, 2000) and similar studies in this area, asset quality, measured by *NPL*s for bank *i* at time t ($NPL_{i,t}$), is determined as follows:

$$NPL_{i,t} = f(MACRO_t, FIN_t, BANK_{i,t}) + error_{i,t}, \quad (2)$$

where NPL is the ratio of NPLs to total loans. MACRO denotes a set of macroeconomic variables reflecting the state of the economy, *e.g.* economic growth and inflation, FIN includes financial variables such as interest rates and changes in property prices, and BANK contains bank-specific variables such as the asset size and sectoral concentration in lending. In particular, we examine whether shares of property-related and consumer loans affect the NPL ratio.

As there is no reason why the macroeconomic factors and financial variables must have the same impact on all banks, it is of interest to allow for interaction between the different variables used. For example, to test whether the impact varies systematically across banks, we include an interactive term between, on the one hand, the macroeconomic and financial variables, and, on the other, the variable capturing whether it is a small, medium-sized or large bank. We also interact changes in property prices with the share of property-related lending in a bank's portfolio to examine how banks with different exposures to the real estate sector were affected by declines in property prices.

Similarly, the *NIM* equation is specified as:

$$NIM_{i,t} = g(MACRO_t, FIN_t, BANK_{i,t}) + error_{i,t}. \quad (3)$$

We consider a number of bank-specific variables that can be divided into three groups: (a) variables capturing the structure of assets and liabilities; (b) variables capturing the structure of income and expenses; and (c) sector concentration. As in equation (2), interactions between *BANK*, *MACRO* and *FIN* variables are allowed.

4. Empirical findings

4.1 Asset quality

Some estimated specifications for the *NPL* equation are presented in Table 3. The sample comprises 27 banks, since the *NPL* series are not available for two banks in the sample. We estimate all equations twice: first with a common intercept and then allowing for fixed effects.[6] The last two lines of the table give the test statistic and the associated p-value for a test for a common intercept.[7] As can be seen, that hypothesis is rejected in all cases. Consequently, we only report results for the fixed effects regressions.

[6] The inclusion of a lagged dependent variable renders both the pooled and fixed effects estimators biased. Although, in our case, the time series dimension is not very small relative to the cross sectional dimension, the bias can still be sizeable (Judson and Owen, 1999). Various methods have been developed to address this issue. Anderson and Hsiao (1981) suggest an instrumental variable (IV) estimation method that will lead to consistent estimates. Arellano and Bond (1991) propose a generalised method of moment (GMM) procedure that is more efficient than that of Anderson and Hsiao (1981). This literature is further generalised and developed by Ahn and Schmidt (1995), Arellano and Bover (1995), and Blundell and Bond (1998) to mention a few. In future work on more detailed data we intend to explore the importance of better estimation techniques.

[7] The test for a common constant for a panel model is often referred to as the test for fixed or individual effects. It is carried out by performing an F-test:

$$F = \frac{(RRSS - URSS)/(N-1)}{URSS/(Obs. - N - K)} \sim F_{N-1, Obs-N-K}.$$

We first estimate the most general specification (Model 1) which encompasses all macroeconomic, financial and bank variables, but does not allow for any interaction. The results indicate that the variables measuring the shares of property-related (PROP SHARE) and consumer (CONS SHARE) lending are not significant. In Model 2, in which we exclude these two variables, all macroeconomic and financial variables are highly significant and have expected signs. Thus, increases in GDP growth (GDP), inflation (INF) and the rate of change of property prices (PROP) all reduce NPLs. By contrast, rises in short-term interest rates (HIBOR) increase NPLs.

While interesting, this model does not allow for any interaction between the macroeconomic/financial variables and bank characteristics. In Model 3 we therefore interact the macroeconomic and financial variables with the bank size, which is arguably the single most important bank characteristic. This general model has a higher adjusted R^2 compared to the two previous models, suggesting that inclusion of the interactive terms improves the fit of the equation. However, a number of variables are not significant. In Model 4, we interact property price inflation with the share of property lending in total loans instead of SIZE. This specification further improves the fit of the NPL model as evidenced by the adjusted R^2, which increases from 0.91 of Model 3 to 0.94. The final specification, Model 5, is obtained by eliminating the two insignificant variables in Model 4. Although the adjusted R^2 of Model 5 falls somewhat, all the remaining variables are highly significant.

Based on the specification of Model 5, a number of observations are worth noting. First, both *GDP* and *GDP*SIZE* are significant.[8] However, since the parameter on the interactive term is negative, the results suggest, perhaps surprisingly, that economic growth reduces *NPL*s of all bank groups, but more so for larger banks. This matches poorly with the earlier observation that asset quality of smaller banks deteriorated more than large banks in recent years. However, small banks differ from large banks in more ways than merely in size, and we return to this issue below.

Secondly, higher inflation also lowers *NPL*s. This may be so because it improves borrowers' ability to meet obligations by eroding the real value of debt burden. Furthermore, under Hong Kong's currency board regime nominal interest rates are closely tied to US interest rates, implying that increases in inflation reduce the real interest rate. Inflation is also positively correlated with the state of the business cycle and might be interpreted as an additional indicator of the state of the economy.

Thirdly, interest rates are positively related to *NPL*s. Declines in interest rates reduce the debt-servicing burden, thereby helping to protect asset quality.

Fourthly, rises in property prices reduce *NPL*s. One would expect that the size of the impact depends on banks' exposures to the real estate sector. Thus, on the face of it, the positive sign on the interactive term between changes in property prices and the share of property lending is surprising, as it suggests that the impact is smaller for a larger exposure. However, an alternative explanation is that property prices should be seen as a measure of general economic conditions (rather than as a indicator specific to the property sector) and that property lending is less sensitive to changes in economic conditions than other types of bank credit.[9] As a result, a given change in property prices will affect a bank's *NPL* ratio less if its property-related lending is relatively large. To see this, suppose that the NPL ratio is determined as:

$$NPL_t = \beta\cdot(1-\omega)\cdot X_t + \delta\cdot\omega\cdot X_t + \ldots, \quad (4)$$

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where:

The restricted model is the pooled regression, while the unrestricted model is the fixed effects model. *RRSS* and *URSS* are the residual sum of squares of the restricted and unrestricted models respectively, *N* is the number of banks, *Obs.* the number of observations, and *K* the number of regressors. If the null hypothesis of a common intercept is rejected, the fixed effects model should be chosen for estimation.

[8] As noted above, for confidentiality reasons we only have series of the weighted average asset size for the three groups, and their averages across time are used in calculating the impact of the growth variable.

[9] This accords with our earlier observation that despite declining property prices and weak economic conditions, the default rate of residential mortgage loans has remained low relative to that for most other bank lending.

X_t: changes in property prices

ω: fraction of loans related to the property sector

β: sensitivity of NPLs among non-property loans to property prices

δ: sensitivity of NPLs among property loans to property prices.

The above equation can be re-written as:

(5) $$NPL_t=\beta \cdot X_t + (\delta-\beta)\cdot\omega\cdot X_t + \ldots.$$

This equation suggests that the impact of changes in property prices varies with ω, and is given by $\beta+(\delta-\beta)\omega$. The term $(\delta-\beta)$ captures relative sensitivity (riskiness) of property loans. Specifically, property loans are less risky (sensitive to property price changes) than other types of lending if $\delta-\beta>0$, which is the case for Hong Kong according to our estimates.

4.2 Net interest margin

Table 4 presents estimates of the *NIM* equation. We first include all the *MACRO*, *FIN*, and *BANK* variables (Model 1).[10] As the model is probably overfitted, only *GDP*, *INF* and *NIEXPENSE* (which we interpret as a measure of banks' operating costs) are significant and have the expected signs. Dropping insignificant variables leads to Model 2 in which *GDP*, *INF*, *HIBOR* and *NIEXPENSE* remain important and *HIBOR* also is significant. However, the adjusted R-squared declines, suggesting that this model fits less well. In Model 3 we interact *SIZE* with the *MACRO* and *FIN* variables. This model fit better as indicated by a higher adjusted R^2. All interactive terms in the equation are highly significant, and have the expected signs. This provides strong evidence that the NIMs of smaller banks respond differently to changes in economic conditions than larger banks. Finally, the test statistics in the last row of the table confirm that the fixed effects should be allowed for in estimation.

The estimates of Model 3 indicate that economic growth and inflation lead to higher *NIM*s, probably by reducing *NPL*s as suggested by the earlier estimates. In addition, loan demand is likely to rise in a period of expansion, giving banks more pricing power in lending. In this light, sluggish economic growth and deflation in recent years have contributed to the narrowing of NIMs.

The interactive terms suggest that the effects of macroeconomic developments on *NIM*s vary depending on the size of banks, with smaller banks being more affected. It could be the case that when loan demand increases, smaller banks may be prepared to expand lending more aggressively than larger banks by taking on more risky projects with higher returns.

Changes in interest rates also tend to have asymmetric effects across banks. The interactive term between the interest rate and *SIZE* suggest that smaller banks are more affected by changes in interest rates. One explanation for this finding is that the smaller banks have a higher capital base, which reduces overall funding costs. As a result, the smaller banks can sustain higher *NIM*s when interest rates rise. To test this hypothesis, an interactive term between the interest rate and the capital base variable is added (Model 4). This variable turns out to be significant and of the expected sign.

Finally, operating costs are found to be positively related to the *NIM*. There are two possible explanations. First, banks may be able to pass changes in operating costs onto customers by varying lending spreads. Second, a higher NIM may be associated with a higher risk profile of loans. This in turn raises operating cost entailed by monitoring and risk control.

[10] It is difficult to measure changes in the degree of competition in the banking sector. Some preliminary measures such as asset concentration ratios are tried, but turn out to be insignificant.

5. Conclusion

Using a confidential supervisory bank-level data set, this paper has examined the determinants of banking performance in Hong Kong, with a focus on the impact of macroeconomic developments on NIMs and NPLs. Corroborating earlier studies in the literature, the empirical analysis finds that macroeconomic developments and financial conditions affect banking performance.

A specific focus of the paper was to explore whether bank-specific factors may lead to asymmetric effects of macroeconomic developments across banks. The evidence generally suggests that the NIMs of smaller banks are more, but their NPLs are less, exposed to changes in GDP growth. Understanding the reasons for these differences should be high on the research agenda.

The estimates also suggest that the sharp decline in property prices may have also put banks under stress due to the large exposure to property-related lending. However, property loans appear to be less risky than other types of loans, in that their quality is less sensitive to fluctuations in macroeconomic conditions and property prices. This reflects a combination of factors that mitigate risks associated with property lending, including the HKMA's guideline of a maximum loan-to-value ratio of 70% for residential mortgage loans, and the low gearing ratio of property developers.

This study is preliminary and more work is required. Several extensions seem natural and useful. First, it would be of interest to use quarterly data to obtain a clearer sense of the dynamic responses of bank profitability to movements in real GDP growth and inflation. If real economic growth rebounds in Hong Kong, will banking sector's profitability respond after two, four or eight quarters? The annual data used here are too coarse to permit such an analysis. Second, it would be important to explore which macroeconomic time series have the strongest links to the profitability of the banking sector. While we have used real GDP growth, property prices and CPI inflation in this study, it is possible that other time series (such as unemployment and consumption spending) may be more relevant. Third, it would be desirable to sharpen the estimates by taking into account a greater variety of bank characteristics. For instance, do banks with a large number of branches have higher costs and lower profits? Or do banks with a strong retail network obtain funds more cheaply and have greater profits? In future work we hope to shed some light on these issues.

Chart 1. Macroeconomic Indicators

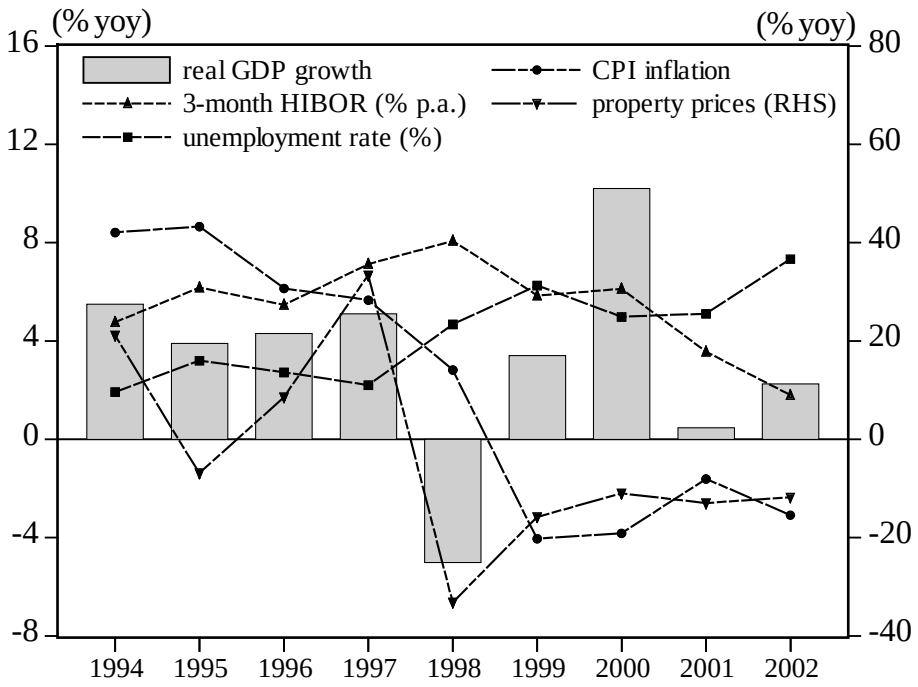
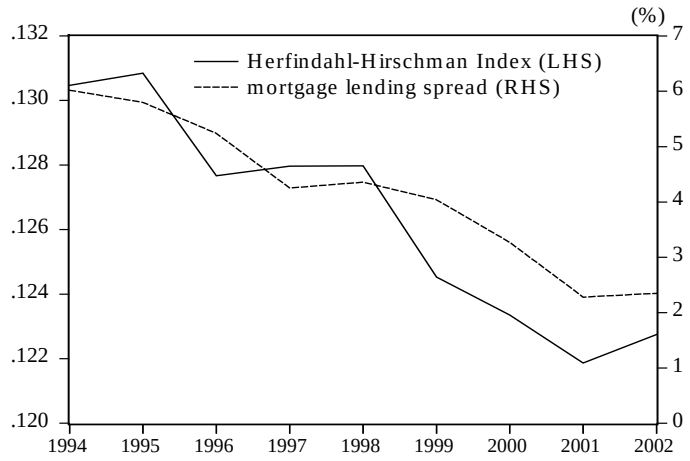
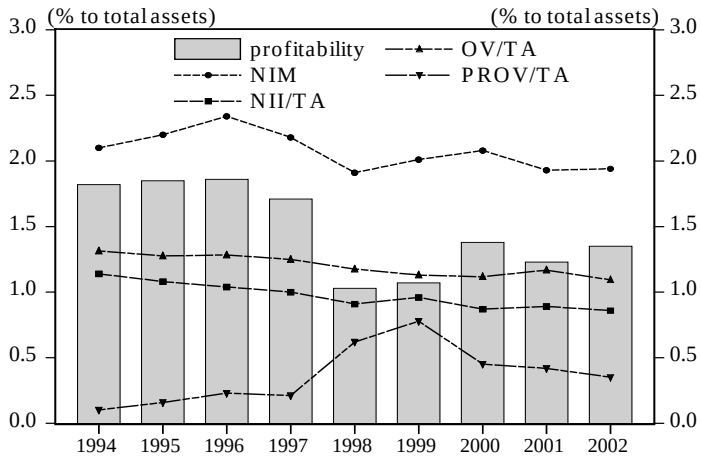


Chart 2. Bank Indicators

A. Market Concentration and Competition



B. Decomposition of Profitability



C. Provisions and NPLs

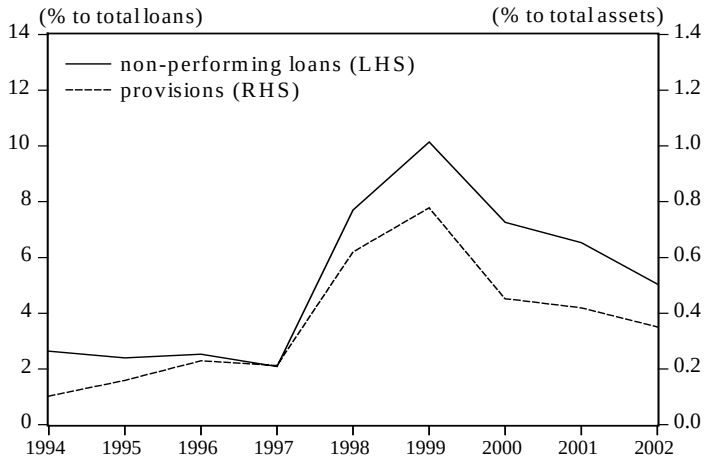
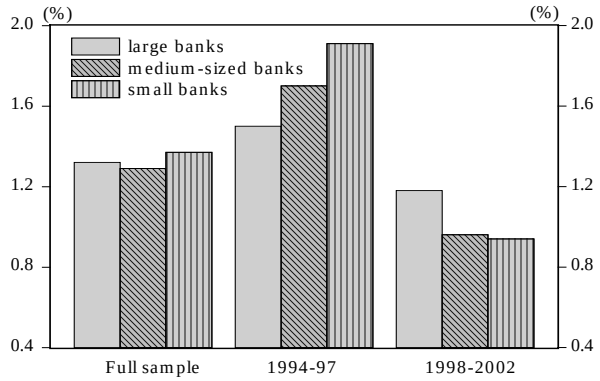
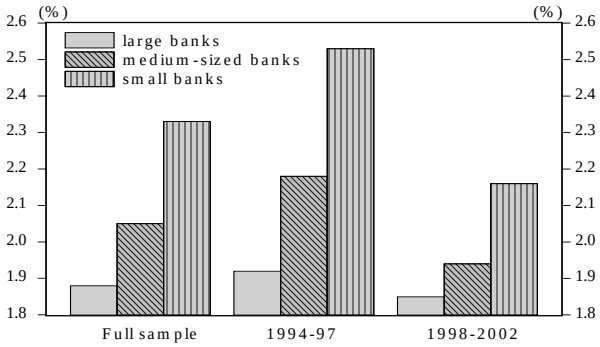


Chart 3. Profitability, NIM, NPLs and Bank Size

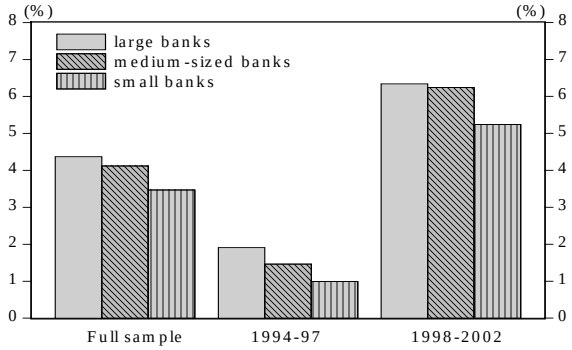
A. Profitability



B. Net Interest Margin



C. Nonperforming Loans



D. Noninterest Income net of Operating Cost

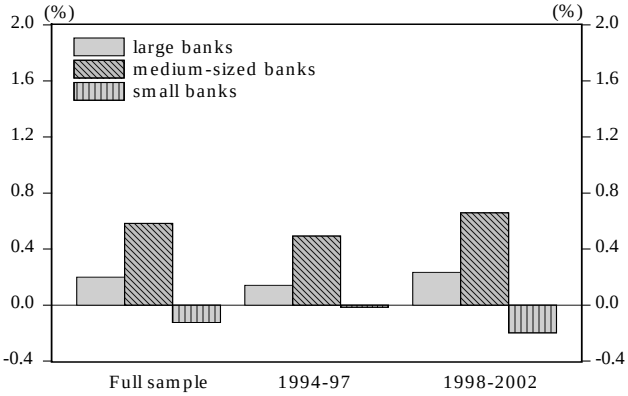


Table 1

Retail Banks' Business Structure (1994-2002)

	All	Large	Medium-sized	Small
Asset Portfolio				
Equity capital/total assets	13	4	10	18
Loans/total assets	46	40	49	46
Deposits/total assets	66	73	67	64
Income and Expense				
Operating expenses/total expenses	25	25	21	29
Interest income/total income	87	85	88	88
Provisions/total loans	2	2	3	2
Lending Portfolio				
Property loans/total loans	50	51	51	48
Consumer lending/total loans	7	7	6	9

Table 2

Dispersion of Profitability, NIMs and NPLs

Bank Specific	Profitability				Net Interest Margin				Non-performing Loans			
Variables	Mean	Sd	Max	Min	Mean	Sd	Max	Min	Mean	Sd	Max	Min
1994	1.9	0.7	3.9	0.5	2.3	0.8	4.6	0.6	1.1	1.1	5.5	0.1
1995	1.9	0.7	3.6	0.6	2.4	0.8	4.3	0.6	1.1	1.0	4.4	0.1
1996	1.8	0.7	3.4	0.3	2.4	0.8	4.8	0.5	1.5	1.2	4.2	0.0
1997	1.8	0.7	3.0	-0.1	2.4	0.8	4.2	0.7	1.3	0.9	3.9	0.1
1998	1.1	0.9	2.7	-0.8	2.2	0.7	3.4	0.7	6.2	5.5	29.0	0.9
1999	0.9	1.0	2.7	-2.8	2.2	0.7	3.4	0.3	8.7	6.6	31.3	0.5
2000	1.4	1.1	6.0	0.2	2.3	1.0	6.8	1.0	6.6	4.1	16.3	0.5
2001	0.9	0.9	2.1	-2.5	2.0	0.5	3.3	0.6	4.7	2.9	12.4	0.6
2002	0.9	0.7	2.3	-1.1	1.8	0.5	3.1	0.8	3.5	1.8	8.5	0.7

Table 3

Determinants of NPLs

(Sample period: 1995-2002)

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
NPL $_{t-1}$	0.33***	0.36***	0.36***	0.33***	0.34***
	(5.34)	(5.89)	(5.90)	(5.71)	(5.88)
GDP $_{t}$	-0.15***	-0.15***	0.59	0.81***	0.82***
	(-4.49)	(-4.84)	(1.54)	(3.24)	(3.14)
*(GDP*SIZE) $_{t}$*	-	-	-0.04**	-0.05***	-0.05***
	-	-	(-1.90)	(-4.02)	(-3.37)
INF $_{t}$	-0.32***	-0.30***	-0.82**	-0.50**	-0.32***
	(-8.19)	(-8.52)	(-2.23)	(-2.03)	(-9.61)
*(INF*SIZE) $_{t}$*	-	-	0.03	0.01	-
	-	-	(1.44)	(0.73)	-
PROP $_{t}$	-0.03***	-0.02***	0.03	-0.13***	-0.12***
	(-3.55)	(-3.50)	(0.27)	(-4.24)	(-4.28)
*(PROP*SIZE) $_{t}$*	-	-	0.00	-	-
	-	-	(-0.54)	-	-
*(PROP*PROP SHARE) $_{t}$*	-	-	-	0.19***	0.20***
	-	-	-	(3.39)	(3.48)
HIBOR $_{t}$	0.55***	0.57***	1.14*	0.83	0.58***
	(10.91)	(11.44)	(1.69)	(1.44)	(13.22)
*(HIBOR*SIZE) $_{t}$*	-	-	-0.03	-0.01	-
	-	-	(-0.85)	(-0.44)	-
PROP SHARE $_{t}$	0.00	-	-	-	-
	(0.01)	-	-	-	-
CONS SHARE $_{t}$	-0.06	-	-	-	-
	(-1.61)	-	-	-	-
Adjusted R^2	0.88	0.89	0.91	0.94	0.92
Number of banks	27	27	27	27	27
Number of observations	209	209	209	209	209
Test for common intercept	1.92	2.08	2.13	2.23	2.37
p-value	[0.01]	[0.00]	[0.00]	[0.00]	[0.00]

Note: t-values are in ( ), p-values in [ ]. *,** and *** indicate that variables are significant at 10%, 5% and 1% levels respectively.

Table 4
Determinants of the Net Interest Margin
(Sample period: 1995-2002)

	Model 1	Model 2	Model 3	Model 4
NIM $_{t-1}$	0.39***	0.38***	0.30***	0.27***
	(6.32)	(6.36)	(5.38)	(4.62)
GDP $_t$	0.02***	0.02***	0.14***	0.12***
	(4.68)	(6.10)	(3.13)	(2.78)
*(GDP*SIZE)* $_t$	-	-	-0.10***	-0.01**
	-	-	(-2.71)	(-2.38)
INF $_t$	0.01**	0.01**	0.15***	0.15***
	(2.41)	(2.93)	(3.60)	(3.69)
*(INF*SIZE)* $_t$	-	-	-0.01***	-0.01***
	-	-	(-3.53)	(-3.59)
PROP $_t$	0.00	-	-	-
	(-0.80)	-	-	-
HIBOR $_t$	0.01	0.04***	0.73***	0.59***
	(1.22)	(4.69)	(7.12)	(5.02)
*(HIBOR*SIZE)* $_t$	-	-	-0.04***	-0.03***
	-	-	(-6.99)	(-5.13)
*(HIBOR*EQUITY)* $_t$	-	-	-	0.18**
	-	-	-	(2.42)
NII $_t$	-0.01**	-	-	-
	(-2.02)	-	-	-
NIEXPENSE $_t$	0.60***	0.56***	0.58***	0.55***
	(7.65)	(7.41)	(8.29)	(7.80)
PROP SHARE $_t$	0.00	-	-	-
	(-0.27)	-	-	-
CONS SHARE $_t$	-0.00	-	-	-
	(-1.05)	-	-	-
Adjusted R^2	0.97	0.96	0.98	0.98
Number of banks	29	29	29	29
Number of observations	232	232	232	232
Test for fixed effects	4.61	4.31	5.06	5.20
p-value	[0.00]	[0.00]	[0.00]	[0.00]

Note: t-values are in ( ), p-values in [ ]. *,** and *** indicate that variables are significant at 10%, 5% and 1% levels respectively.

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List of Variables

Dependent variables

NPL: ratio of classified loans to total loans

NIM: ratio of net interest income to total assets

Macroeconomic variables

GDP: GDP growth

INF: CPI inflation

Financial variables

PROP: changes in property prices

HIBOR: three-month HIBOR

Bank variables

SIZE: logarithm of asset size

EQU: ratio of equity capital to total assets

PROVISION: ratio of provisions to total assets

NII: ratio of non-interest income to total assets

NIREXPENSE: ratio of non-interest expenses to total assets

PROP SHARE: ratio of property loans to total loans

CONS SHARE: ratio of consumer loans to total loans