



**HOW DO MACROECONOMIC DEVELOPMENTS IN MAINLAND CHINA
AFFECT HONG KONG'S SHORT-TERM INTEREST RATES?**

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Abstract

This paper studies the significance of Mainland-related shocks in determining Hong Kong money market interest rates after controlling for the influences of US variables. Analysis using a vector auto-regression model suggests that an unexpected rise in the Mainland policy interest rate, or a higher-than-expected growth in Mainland output or money supply, in general produces a positive and hump-shaped effect on the three-month HIBOR. Forecast error variance decomposition shows that US shocks still dominate, but Mainland shocks have become more important in accounting for the unexpected fluctuations in HIBOR in recent years. A historical decomposition shows that from autumn 2003 to spring 2005 the large negative spread between HIBOR and LIBOR was mainly due to Mainland factors. Thus, while the HIBOR-LIBOR spread is expected to be bounded inside a band that reflects the width of the Convertibility Zone of the Linked Exchange Rate system, Mainland-related shocks could exert a significant influence on the actual size of the spread.

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Keywords: Hong Kong; HIBOR; Linked Exchange Rate system

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The views and analysis in this paper are those of the authors, and do not necessarily represent the views of the Hong Kong Monetary Authority.

Executive Summary:

- *Under the Linked Exchange Rate system (LERS), Hong Kong dollar interest rates should track US interest rates closely. But increasing financial integration between Hong Kong and Mainland China has raised the possibility that Mainland-related factors might exert greater influence. This paper studies the significance of Mainland factors in determining Hong Kong's interest rates after controlling for the influences of US factors.*
- *Given the specific institutional features of the LERS, which encompasses a Convertibility Zone with Convertibility Undertakings on both sides of the zone, the Hong Kong Interbank Offered Rate (HIBOR) and the US dollar London Interbank Offered Rate (LIBOR) are expected to have a complex relationship. While HIBOR may not diverge significantly from LIBOR, the differential does not have a tendency to revert to zero or a constant mean. This allows for the possibility of persistent influences by Mainland-related factors on HIBOR.*
- *The response of HIBOR to a particular shock relating to the Mainland is theoretically ambiguous, depending on the relative impact on the demand for and supply of Hong Kong dollars that reflect the prevailing macroeconomic and market conditions, as well as investor sentiment. For example, a positive output shock could be indicative of improved earnings of Mainland companies. This may induce increased investments in their stocks on the Hong Kong market and the resultant higher demand for Hong Kong dollars relative to supply could raise the short-term HIBOR. On the other hand, a positive output shock on the Mainland could signal a build-up of overheating pressure and affect market sentiment negatively. This could lead to reduced investments in Mainland-related stocks on the Hong Kong market and a lower demand for Hong Kong dollars relative to supply, prompting a decrease in the short-term HIBOR.*
- *Analysis using a seven-variable vector auto-regression (VAR) model suggests that an unexpected rise in the Mainland policy interest rate or higher-than-expected growth in Mainland output or money supply in general produces a positive and hump-shaped effect on the three-month HIBOR. Forecast error variance decomposition shows that US shocks still dominate, but Mainland shocks have become more important in accounting for the unexpected fluctuations in HIBOR in recent years. A historical decomposition shows that from autumn 2003 to spring 2005 the large negative spread between HIBOR and LIBOR was mainly due to Mainland factors.*
- *With the introduction of the three-refinements to the LERS in May 2005, the*

HIBOR-LIBOR spread should be bounded inside a band that reflects the width of the Convertibility Zone of the Linked Exchange Rate system. The findings of this paper imply that Mainland-related shocks could exert a significant influence on the actual size of the spread within the band.

- *This paper should be seen as a preliminary step towards a better understanding of the forces that determine short-term interest rate movements in Hong Kong. Further work is needed to understand the channels of transmission of Mainland-related shocks that affect the demand and supply of funds in the Hong Kong dollar interbank market.*

I. INTRODUCTION

Economic integration between Hong Kong and Mainland China has gathered pace in recent years and economic links through bilateral trade, foreign direct investment, and tourism have increased substantially. With over 130 H-share and red-chip companies listed on the Hong Kong Stock Exchange accounting for about half of the total market capitalisation, Mainland companies have become more influential in affecting market sentiments and fund flows in Hong Kong. Hong Kong's monetary conditions seem to be significantly affected by Mainland's macroeconomic developments in recent years. For example, the persistently negative spreads of the Hong Kong Interbank Offered Rate (HIBOR) against the corresponding US dollar London Interbank Offered Rate (LIBOR) in 2003-2005 appeared to have been the result of large fund flows into the Hong Kong dollar market, driven by market expectation that the Hong Kong dollar might appreciate along with the renminbi. Mainland-related shocks therefore seem to be more readily transmitted to Hong Kong through the financial channel.

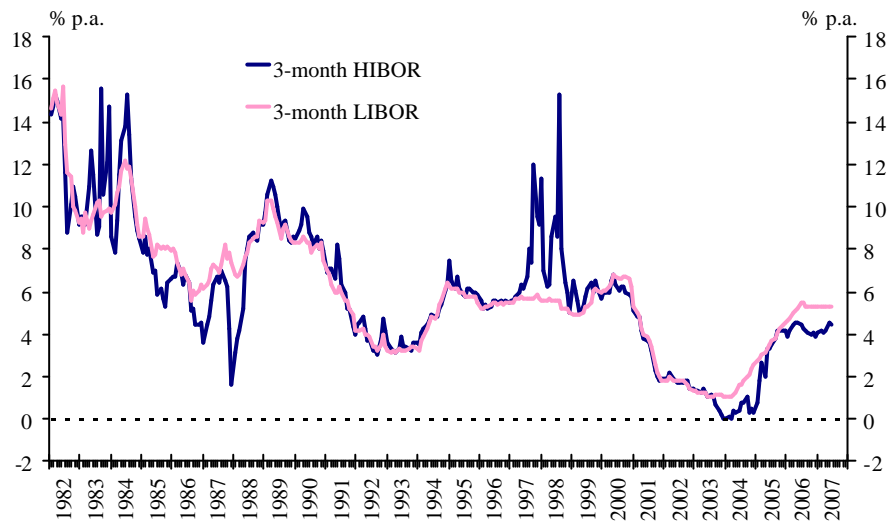
But under the Linked Exchange Rate system (LERS), Hong Kong's exchange rate is fixed against the US dollar within a narrow range, and Hong Kong dollar interest rates should be broadly aligned with US dollar interest rates. So the US factors in theory should have a dominant effect on Hong Kong's monetary conditions.

Against this backdrop, this paper analyses how Hong Kong's interest rates have been affected by Mainland macroeconomic developments and compares the relative importance of US and Mainland shocks. The paper is organised as follows. Section 2 recapitulates some historical episodes of large interest rate movements in Hong Kong, analyses the statistical properties of the spreads between HIBOR and LIBOR, and discusses their implications for model selection. Section 3 presents econometric evidences obtained from a seven-variable vector auto-regression (VAR) model. The final section concludes.

II. NARRATIVE DESCRIPTION OF HISTORICAL DATA

Short-term interbank interest rates in Hong Kong have broadly tracked their corresponding US dollar rates since the establishment of the LERS (Chart 1). Although the differential between the three-month HIBOR and the three-month LIBOR has been fluctuating around zero most of the time, temporary or somewhat persistent deviations did occur due to various shocks (Chart 2).

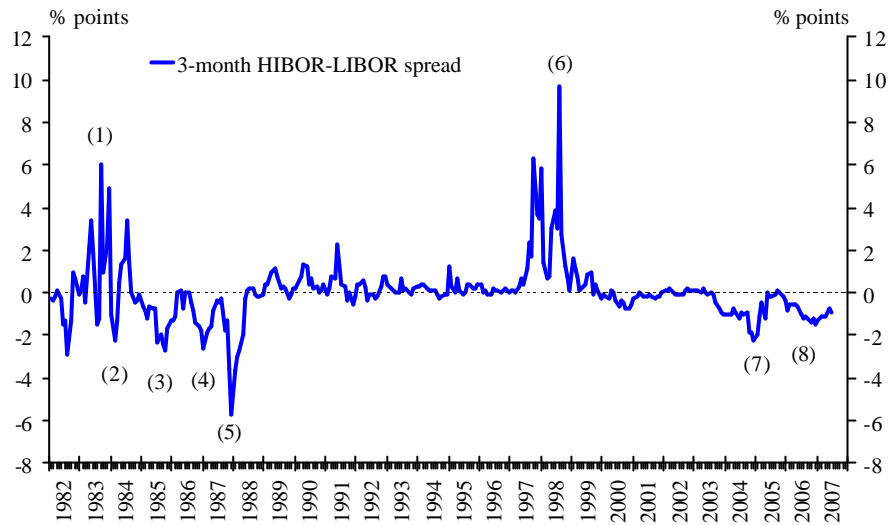
Chart 1: Movements between Hong Kong and US interest rates



Note: Month-end data.

Sources: HKMA.

Chart 2: Historical movements of interest rate spread



Notes: Month-end data. The numbers in the bracket refer to the episodes of extreme interest rate spreads discussed in Table 1.

Sources: HKMA.

Table 1 shows periods of large interest rate spreads and the major causes of the deviations. Movements in the US dollar exchange rate were a major driver of the interest rate spread in the early periods of operation of the LERS. Shortly after the return of Hong Kong to Chinese sovereignty in 1997 came the Asian financial turmoil, during which Hong Kong witnessed the largest positive interest rate spread in history. Recently, Mainland-related factors seemed to have been the main explanation behind large movements in the interest rate spread. In particular, the negative interest rate spread from September 2003 to May 2005 appeared to have been associated with expectation of renminbi appreciation, while the widening of the negative interest rate spread in 2006 was attributable to vibrant activity in initial public offerings (IPO) of H-shares.

Table 1: Historical episodes of interest rate spreads

	Period	Maximum/minimum 3-month HIBOR-LIBOR spread	Reported cause of spreads
1	Sep 1983 – Oct 1983	+600 bps	The depreciation of the Hong Kong dollar, under the then free floating regime, was made worse by speculative attacks and by the escalating crisis of confidence over the future of Hong Kong.
2	Feb 1984 – Mar 1984	-225 bps	Market considered that the official rate under-valued the Hong Kong dollar.
3	May 1985 – Feb 1986	-269 bps	US dollar declined rapidly.
4	Jan 1987 – Feb 1987	-263 bps	US said it could not accept the large trade deficits with the newly industrialized countries.
5	Nov 1987 – Feb 1988	-575 bps	US and European governments criticized Hong Kong's LERS.
6	Oct 1997 – Sep 1998	+969 bps	Hong Kong was struck by the Asian financial crisis and short term interest rates shot up due to currency speculation.
7	Sep 2003 – May 2005	-227 bps	Market speculations about Hong Kong dollar appreciation alongside the renminbi after the G7 Communiqué to urge greater exchange rate flexibility in Asian countries. Prolonged weakness in the US dollar.
8	Jan 2006 – Dec 2006	-149 bps	Ample interbank liquidity made the interbank rate persistently low. This partly reflected capital inflows associated with vibrant H-share IPO activities.

Note: Interest rate spread figures are based on month-end data. See also Chart 2.
 Source: HKMA; Jao and King (1990).

Despite these notable episodes of large deviations of HIBOR from LIBOR, a cursory look at the data appears to suggest that such deviations were temporary and there was a tendency for the spread to revert to zero. In other words, there appeared to have been a long-run equilibrium relationship between HIBOR and LIBOR, or technically speaking, they were co-integrated. However, the relationship between the two has been more complicated than long-run co-integration given the institutional features of the LERS.

Prior to the introduction of a weak-side Convertibility Undertaking in September 1998, the fixed exchange rate of HK\$7.8 per US dollar applied only to cash notes, and in principle, there was nothing in the institutional design of the system that would prevent a large and persistent deviation of Hong Kong dollar money market interest rates from the US dollar counterparts. The Government had to intervene frequently in the foreign exchange and the money markets to ensure that the spread was contained (Latter, 2007).

The weak-side Convertibility Undertaking introduced an automatic mechanism to ensure that the Hong Kong dollar spot exchange rate would not depreciate beyond HK\$7.8 per US dollar. If this commitment was credible, then the Hong Kong dollar exchange rate would be bounded on the weak side, implying that the HIBOR-LIBOR differential, a proxy for the risk premium required to compensate for the possibility of currency devaluation, would be bounded on the upside. But it does not necessarily imply that the spread would have a tendency to converge to zero (or more generally to a constant value). In fact, it may persistently stay away from zero without compromising the credibility of the exchange rate regime.

The introduction of a strong-side Convertibility Undertaking in May 2005, together with the weak-side Convertibility Undertaking, implies that the Hong Kong dollar spot exchange rate would be bounded on both the strong and the weak sides, implying that the interest rate spreads would be bounded on both the downside and the upside (Genberg, He and Leung, 2007; Hui and Fong, 2007). Again, such a bounded process does

not necessarily mean that the interest rate spread will have a tendency to revert to zero or a constant mean, and HIBOR and LIBOR may not have a fixed long-run equilibrium relationship.

Empirical tests indicate that the null hypothesis that there is no co-integration between HIBOR and LIBOR, and that the interest rate spread is not a stationary process, cannot be rejected (Appendix A). This conclusion has important implications for the selection of the right empirical model to study the relationship between HIBOR and LIBOR. If the two series were co-integrated, then a vector error-correction (VECM) model would be a suitable choice since it would capture both the long-run equilibrium relationship and short-run dynamics. A simple VAR model is subject to specification error because it fails to capture the long-run dynamic convergence of the two variables. However, given the lack of co-integration relationship between HIBOR and LIBOR, the VAR specification is an appropriate model to summarise the data patterns.

III. STATISTICAL DESCRIPTION OF DATA USING A VAR MODEL

Mainland-related shocks can influence Hong Kong dollar interest rates through both the real-sector channel and the financial-market channel, as well as investor and consumer sentiment. The demand and supply of Hong Kong dollars in the money market will react to changes in the expectation of relative returns on assets induced by various Mainland shocks. Equity-related fund flows are particularly sensitive to Mainland-related shocks, as Mainland-related (H-share and red-chip) companies listed on the Hong Kong stock exchange have become a dominant force in recent years.

The response of HIBOR to a particular shock relating to the Mainland, however, is theoretically ambiguous, depending on the prevailing macroeconomic and market conditions, as well as investor sentiment. For example, a positive output shock could be indicative of improved earnings of Mainland companies. This may induce increased investments in their stocks on the Hong Kong market and the resultant higher demand for Hong Kong dollars relative to supply could raise the

short-term HIBOR. On the other hand, a positive output shock on the Mainland could signal a build-up of overheating pressure and affect market sentiment negatively. This could lead to reduced investments in Mainland-related stocks on the Hong Kong market and a lower demand for Hong Kong dollars relative to supply, prompting a decrease in the short-term HIBOR.

We construct a seven-variable VAR model to understand dynamic responses of the three-month HIBOR to Mainland shocks. Among the seven variables in the VAR, three of them are US variables, another three are Mainland variables, and the remaining one is the three-month HIBOR. Table 2 lists the VAR variables and summarises the theoretical impacts they may exert on the three-month HIBOR. The sample period is between September 1998 and December 2006. Through the estimated VAR, plausible shocks can be identified from the estimated statistical residuals. Following Genberg, Liu and Jin (2006), identification of shocks is achieved by exploiting a small-economy assumption: because of the size of the US economy, the US shocks will affect both Hong Kong and the Mainland, but not vice versa; and because of the relative sizes of Hong Kong and the Mainland, Mainland shocks are transmitted to Hong Kong but not the other way round. More technical details of the VAR model are provided in Appendix B.

Table 2: Variables in the VAR model

Variable	Economic Relationship	Theoretical Effect of a Positive Shock on Three-month HIBOR
US non-farm payroll (seasonally adjusted)	<ul style="list-style-type: none"> ● An unexpected stronger employment growth typically signals heightened inflation pressure in the future, which in turn is likely to lead to increases in the US Federal funds target rate and LIBOR, and eventually HIBOR. 	Positive
Three-month LIBOR	<ul style="list-style-type: none"> ● Under the LERS, HIBOR tends to rise or fall with the US dollar counterparts because of arbitrage trades. ● The short-term trends of HIBOR and LIBOR, however, could diverge, but in theory their spreads should be constrained by the width of the Convertibility Zone under a credible target zone regime. 	Positive
US nominal effective exchange rate index (trade weighted)	<ul style="list-style-type: none"> ● A weak US dollar tends to reduce the demand for Hong Kong dollars relative to supply because of expectations of higher inflation in Hong Kong, or to increase the supply of Hong Kong dollars relative to demand because of the expectation that the Hong Kong dollar exchange rate will be revalued, thus putting downward pressure on HIBOR. 	Positive
Mainland industrial production, i.e value added of industry (seasonally adjusted)	<ul style="list-style-type: none"> ● A positive output shock on the Mainland could signal a build-up of overheating pressure and affect market sentiment negatively, reducing the demand for Hong Kong dollars relative to supply and prompting a reduction in the short-term HIBOR (negative effect). ● On the other hand, a positive output shock could be indicative of improved earnings of Mainland companies. This may induce increased investments in their stocks and the resultant higher demand for Hong Kong dollars relative to supply will raise the short-term HIBOR (positive effect). 	Positive or negative
Mainland policy interest rate (a weighted average of one-year nominal lending and deposit interest rates, and the weight is equal to loans/(deposits+loans) for the lending rate and is similarly defined for the deposit rate.)	<ul style="list-style-type: none"> ● A positive interest rate shock could signal tightened liquidity or reduced future earning growth, negatively affecting market sentiment and reducing HIBOR through lower demand for Hong Kong dollars relative to supply (negative effect). ● Alternatively, a positive interest rate shock could indicate that the central bank has taken control of an otherwise unfavourable situation, thereby boosting investor confidence, increasing the demand for Hong Kong dollars relative to supply and raising HIBOR (positive effect). 	Positive or negative
Mainland monetary aggregate M2 (seasonally adjusted)	<ul style="list-style-type: none"> ● Money aggregate M2 is one of the intermediate targets of Mainland's monetary policy. It is widely observed by the market practitioners to gauge the future actions of the central bank as an above-target growth may signal a tightening of monetary policy, reducing the demand for Hong Kong dollars and lowering HIBOR (negative effect). ● Alternatively, a positive money supply shock could point to a recovery from a depressed business environment on the Mainland, thereby boosting investor confidence, increasing the demand for Hong Kong dollars and raising HIBOR (positive effect). 	Positive or negative
Three-month HIBOR		Positive by definition

Dynamic effects of US and Mainland shocks on the three-month HIBOR

We use the impulse response function analysis to trace out the model's reaction to a current shock in one of the VAR variables, assuming no further shocks occur for all other variables and in subsequent periods. It establishes the dynamic effects of various shocks on the three-month HIBOR. (Annex B discusses how the shocks are identified using a Choleski decomposition scheme)

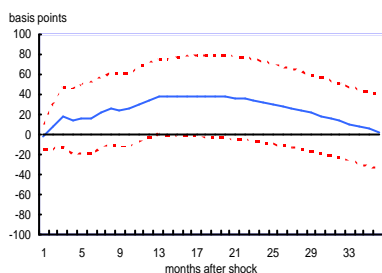
US shocks

The responses of three-month HIBOR to a positive shock in each US variable are in line with the theoretical prediction, but with richer dynamics (Chart 3):

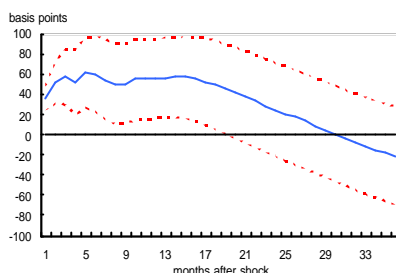
- **Non-farm payroll.** Faster-than-expected growth in US non-farm payroll leads to a positive and hump-shaped response of the three-month HIBOR, with maximal impact after 17 months. However, the impulse response function (solid line) is not significantly different from zero, as evidenced by the wide standard error band (dashed lines), which covers the zero-line.
- **Three-month LIBOR.** The response of the three-month HIBOR to a three-month LIBOR shock is instantaneous, positive and somewhat persistent in the short and medium run (one to 17 months). Moreover, the impacts are significantly different from zero in this period. The positive effect then gradually decreases to zero.
- **Nominal effective exchange rate index.** A greater-than-expected strengthening of the US dollar has a positive impact on the three-month HIBOR. The positive impacts are short-lived, with statistically significant response only in the first two months. Five months after the initial shocks, the impulse response function declines near to zero.

Chart 3: Impulse response functions of three-month HIBOR to US shocks

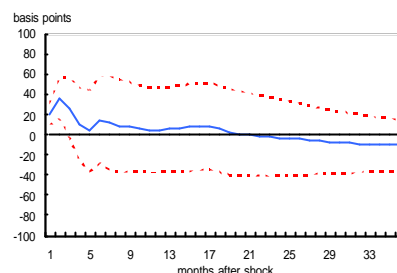
Shock: growth rate of non-farm payroll (sa) increases by 0.1 percentage point



Shock: 3-month LIBOR increases by 193 basis points



Shock: growth rate of nominal effective exchange rate in dex increases by 1 percentage points



Note: The impulse response functions (solid lines) and the standard error bands (dashed lines) are measured in basis points. Each shock value corresponds to one standard deviation of the specific VAR variable. The sample period is between September 1998 and December 2006.

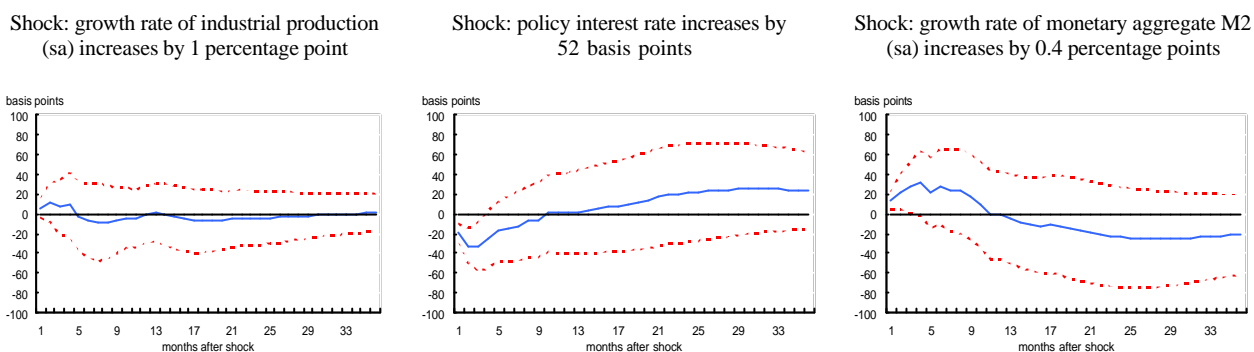
Mainland shocks

The responses of the three-month HIBOR to a positive shock in the Mainland variables (Chart 4) appear sensible and are described as follows:

- **Industrial production.** Stronger-than-expected growth in Mainland industrial production induces a slightly positive response in the three-month HIBOR in the first five months, and the response function thereafter becomes close to zero. This result is possibly due to offsetting economic forces at work. Moreover, the impacts are not significantly different from zero over the specified 36-month period.
- **Policy interest rate.** The dynamic effect of a policy interest rate shock on the three-month HIBOR is negative in the short run (one to nine months), with statistically significant impacts in the first three months. The impacts are positive after nine months but are not significantly different from zero.
- **Monetary aggregate M2.** Faster-than-expected growth in monetary aggregate M2 leads to a positive and hump-shaped response of the three-month HIBOR, with maximal impact in the fourth month. The positive impacts are short-lived, with statistically significant response

within the first two months. Ten months after the initial shocks, the impulse response function turns negative and gradually converges to zero in the long run.

Chart 4: Impulse response functions of three-month HIBOR to Mainland shocks



Note: The impulse response functions (solid lines) and the standard error bands (dashed lines) are measured in basis point. Each shock value corresponds to one standard deviation of the specific VAR variable. The sample period is between September 1998 and December 2006.

Relative importance of US and Mainland shocks

While the impulse response function estimates the dynamic effects of shocks on the three-month HIBOR, the method is silent on the relative importance of different shocks in causing the unexpected changes in the HIBOR. Consequently, the (forecast error) variance decomposition is used to gauge the relative importance of US and Mainland shocks. The idea is that forecast error variance of the three-month HIBOR at a particular horizon is decomposed into the components accounted for by different shocks.

As shown in Table 3, US shocks dominate while Mainland shocks are relatively less important in the variance decomposition of the three-month HIBOR. More than 50% of the forecast error variance is accounted for by the US shocks (combining non-farm payroll, LIBOR and nominal effective exchange rate index shocks) at the three reported horizons: 3 months (short run), 18 months (medium run) and 36 months (long run). The Mainland shocks (comprising industrial production, interest rate and monetary aggregate shocks), on the other hand, account for less than a quarter of the variance.

Across different horizons, the contribution of US shocks is the largest over the medium (82.7%) and long (72.8%) run. Mainland shocks (24.5%) and HIBOR shocks (17.1%), however, have their largest contributions in the short run, although US shocks still explain a substantial portion of the variance (58.4%). Overall, these patterns appear to be consistent with the results of impulse response functions, which indicate that the impacts of Mainland shocks are statistically significant only in the short run.

Table 3: Variance decomposition of three-month HIBOR

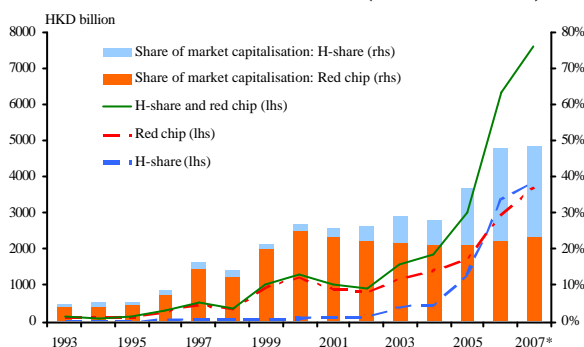
Forecast Horizon (Months)	Forecast Error Variance Decomposition (Percentage Points)		
	US	Mainland	HK (HIBOR)
3	58.4	24.5	17.1
18	82.7	12.6	4.7
36	72.8	22.9	4.3

Note: The sample period is between September 1998 and December 2006.
Source: HKMA staff estimates.

Has the influence of Mainland shocks become more important in recent years?

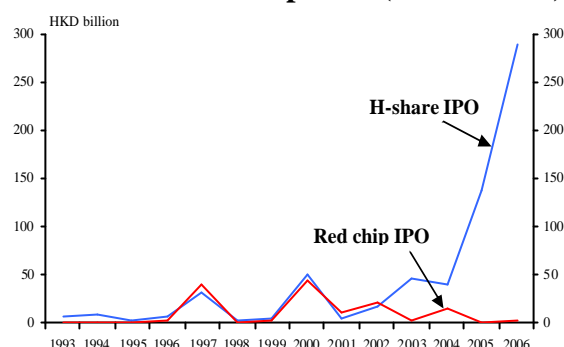
One potential problem with the above analysis is that the relationship between the variables has changed in recent years as financial integration between Hong Kong and the Mainland has gathered pace. The significance of Mainland shocks in causing unexpected changes in HIBOR is likely to have become more prominent in the recent past, since the market capitalisation of the H-shares and red chips has increased substantially since 2001 (Chart 5), reaching \$7.6 trillion at the end of June 2007 to account for 48% of the total market capitalisation on the main board. In addition, funds raised by H-share companies surged to almost \$300 billion in 2006 (Chart 6).

Chart 5: Market capitalisation of China-related stocks (Main board)



* as at the end of June 2007
Source: Hong Kong Exchanges and Clearing Limited.

Chart 6: Equity funds raised by China-related companies (Main board)



Source: Hong Kong Exchanges and Clearing Limited.

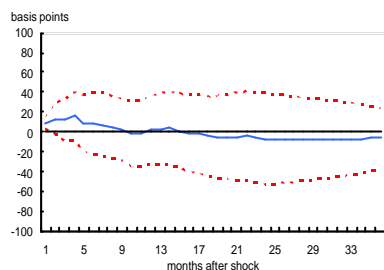
To take this recent development into account, we re-estimate the VAR model by using a sub-sample that covers January 2001 to December 2006. The starting year roughly coincides with the takeoff of the H-share market and should be able to isolate more recent effects of Mainland shocks. In this more recent sub-sample period, the response of HIBOR to Mainland shocks appeared to be stronger than in the whole sample (Panel A, Chart 7).¹ In particular, the initial (one month) positive impact of industrial production now becomes significantly different from zero, and the positive impact of M2 is much larger and more long-lasting (up to six months) than in the whole sample. On the other hand, the impact of policy interest rate has become less pronounced in the short run but more significant in the nine-to-twelve-month period.

¹ Regarding the responses to US shocks, the qualitative results obtained using the recent sub-sample are not substantially different from that using the whole sample.

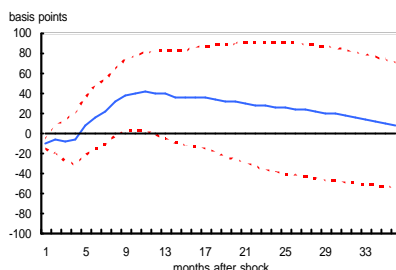
Chart 7: Impulse response functions of three-month HIBOR to Mainland shocks

Panel A: sample period between January 2001 and December 2006

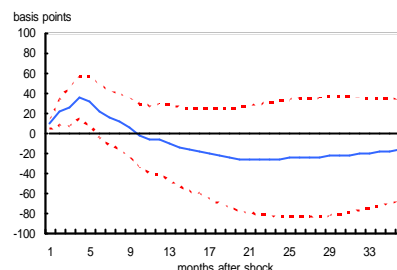
Shock: growth rate of industrial production (sa) increases by 1 percentage point



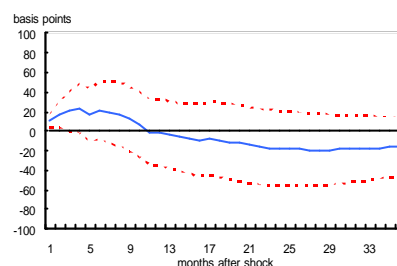
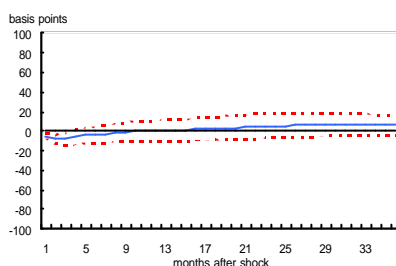
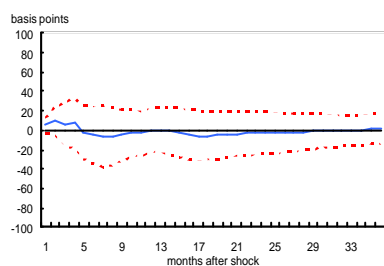
Shock: policy interest rate increases by 18 basis points



Shock: growth rate of monetary aggregate M2 (sa) increases by 0.4 percentage points



Panel B: sample period between September 1998 and December 2006



Note: The impulse response functions (solid lines) and the standard error bands (dashed lines) are measured in basis point. Each shock value corresponds to one standard deviation of the specific VAR variable. For ease of comparison, Panel B generates the impulse response functions using the full sample.

With more pronounced dynamic impacts, the contribution of Mainland shocks to the forecast error variance of the three-month HIBOR increases considerably for the sample period between January 2001 and December 2006 (Panel B, Table 4). In particular, Mainland shocks account for around a third of unexpected HIBOR variation in this period, compared with less than 25% during September 1998 to December 2006 (Panel A, Table 4). Furthermore, Mainland shocks now account for almost half of unexpected HIBOR variation in the medium run (18 months), probably attributable to the stronger positive interest rate effect in this sample period. But the US shocks are still very important in explaining unexpected HIBOR developments, especially in the short (three months) and long (36 months) run.

Table 4: Variance decomposition of three-month HIBOR

Forecast Horizon (Months)	Forecast Error Variance Decomposition (Percentage Points)		
	US	Mainland	HK (HIBOR)
Panel A. Sample period: 1998:09-2006:12			
3	58.4	24.5	17.1
18	82.7	12.6	4.7
36	72.8	22.9	4.3
Panel B. Sample period: 2001:01-2006:12			
3	34.8	33.9	31.3
18	39.4	49.0	11.6
36	44.9	39.0	16.1

Note: The sample period in panel A (the full sample) corresponds to the time when explicit convertibility undertaking was introduced in the LERS. The sample period in panel B sees the growing importance of Mainland-related (predominantly Hshare) stocks in Hong Kong.

Source: HKMA staff estimates.

Historical decomposition of HIBOR

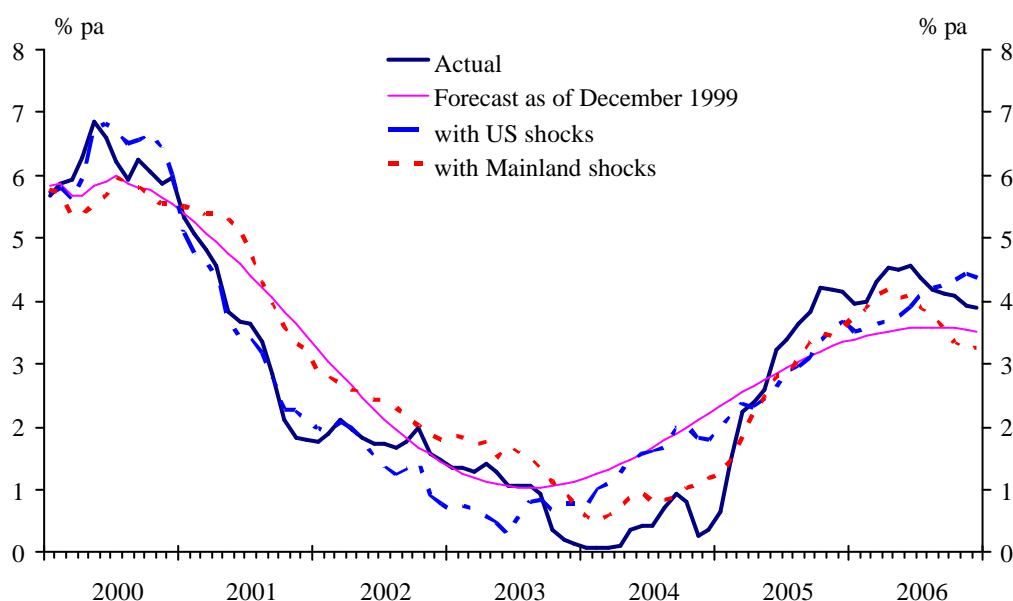
We conduct a further statistical exercise to decompose the in-sample actual value of HIBOR into a part that is forecast on the basis of the estimated dynamics of the VAR system and a part that depends on shocks that have occurred during a particular period of time.² Charts 8 and 9 are designed to shed light on the relative importance of US and Mainland shocks in determining the historical evolution of 3-month HIBOR. The solid dark blue line in Chart 8 represents the actual value of HIBOR, and the solid purple line represents the forecast based on data until December 1999, which effectively means that it is based on the assumption that there will be no shocks from then onwards. The dashed blue line represents the forecast path plus the effects of the actual shocks to US variables from January 2000 onwards, and the dashed red line represents the forecast path plus the effects of the actual shocks to Mainland variables from January 2000 onwards. Chart 9 shows the respective contributions

² Genberg (2003) contains a good explanation of the historical decomposition methodology in a VAR system.

of US shocks, Mainland shocks and Hong Kong domestic shocks to the forecast errors.

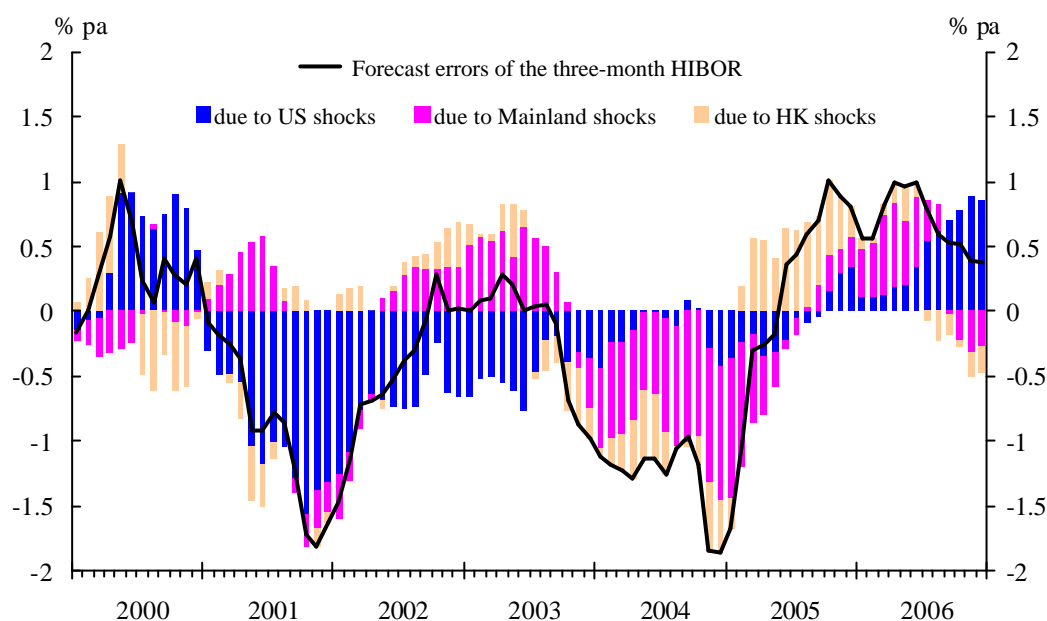
The decomposition shows that, between 2000 and 2002, virtually all of the unexpected variations in the 3-month HIBOR could be explained by US shocks. Thus the dashed blue line tracked closely the solid dark blue line during that period. On the other hand, Mainland shocks accounted for most of the unexpected HIBOR movements during 2003-2005, with the dashed red line tracking more closely the solid dark blue line. This is consistent with the impression that the easing of short-term HIBOR in this period was the result of large speculative fund flows into the Hong Kong dollar market, driven by market expectation that the Hong Kong dollar might appreciate along with the renminbi. In 2006, unexpected HIBOR movements were again mainly due to Mainland factors, reflecting buoyant IPO activities of Mainland firms.

Chart 8: Historical decomposition of 3-month HIBOR



Note: The forecast is based on data until December 1999.

Chart 9: Decomposition of forecast errors of 3-month HIBOR



Note: The forecast is based on data until December 1999.

IV. CONCLUDING REMARKS

This paper has attempted to answer the question of how macroeconomic developments in Mainland China affect Hong Kong's short-term interest rates, after controlling for the US factors. Preliminary results from a simple VAR model show that an unexpected rise in Mainland policy interest rate, or higher-than-expected growth in Mainland output or money supply, in general produces a positive and hump-shaped effect on the three-month HIBOR. The effect of these Mainland shocks has become more prominent in recent years, in part attributable to the fast-growing China-related stocks listed on the Hong Kong stock market.

Despite the increasing importance of Mainland shocks, variance decomposition shows that US shocks still dominate, especially in the medium and long run, in explaining unexpected HIBOR developments. However, the influence of Mainland shocks has been rising, as evidenced by the growing contribution of these shocks to the unexpected variation in HIBOR over more recent times.

With the introduction of the three refinements in May 2005, the determination of the interest rate spread may have undergone a structural change. Under the refined LERS, HIBOR should follow a bounded process. In other words, HIBOR should move within a band defined by the LIBOR and a spread, which reflects the width of the Convertibility Zone.³ This paper implies that movement of HIBOR within the band could be increasingly influenced by Mainland-related shocks.

This paper should be seen as a preliminary step towards a better understanding of the forces that determine short-term interest rate movements in Hong Kong. Further work is needed to understand the channels of transmission of Mainland-related shocks that affect the demand and supply of funds in the Hong Kong dollar interbank market. The analysis would require a structural model, which is an area of further research by the Research Department of the HKMA.

³ Genberg, He and Leung (2007) argue that the spread should be no larger than 127 basis points, if transaction cost is assumed to be zero, given the 1000-pip width of the Convertibility Zone.

**Test for co-integrating relationship between
three-month HIBOR and LIBOR**

Introduction

If LIBOR and HIBOR are co-integrated, the use of VAR instead of VECM could introduce specification errors. This section attempts to test for the presence of co-integrating relationship between the three-month HIBOR and LIBOR.

Formal test results

Econometric evidence does not support a co-integrating relationship between the three-month HIBOR and LIBOR. First, the standard tests of stationarity and unit root give mixed results regarding HIBOR, LIBOR and their spread (Table A1 summaries the results). Secondly, a widely used test for cointegration suggests no cointegrating relationship between the two interest rates.

With the sample period spanning from September 1998 to December 2006, the Augmented Dickey-Fuller test indicates that both the three-month HIBOR and LIBOR are integrated processes at the 1% significance level. However, the KPSS stationarity test shows the reverse: HIBOR and LIBOR are stationary processes. This demonstrates the low power of these unit root tests and the difficulty of empirically confirming whether interest rates are stationary or unit-rooted. Using the Johansen method, both trace test and maximum eigenvalue test indicate no co-integrating relation between HIBOR and LIBOR at the 5% level. Moreover, the HIBOR-LIBOR spread is not stationary and the data do not reject the null hypothesis that the spread is a unit root process.

Table A1: Tests of unit root and stationarity

	3-month HIBOR	3- month LIBOR	Their Spread
ADF unit root test (1% level)	unit root	unit root	unit root
KPSS stationarity test (1% level)	stationary	stationary	non-stationary

Sources: HKMA staff estimates.

Appendix B

Details on the seven-variable VAR model

Vector auto-regression (VAR)

The estimated VAR contains seven variables: US non-farm payroll, three-month LIBOR, US nominal effective exchange rate index, Mainland industrial production, Mainland policy interest rate, Mainland monetary aggregate M2, and the three-month HIBOR.⁴ The sample is composed of monthly data from September 1998 to December 2006. The number of lag is six.⁵ Chart B1 plots the data. The time series (except the interest rates) are transformed into log-difference to ensure stationarity before estimation.

Impulse response function (IRF)

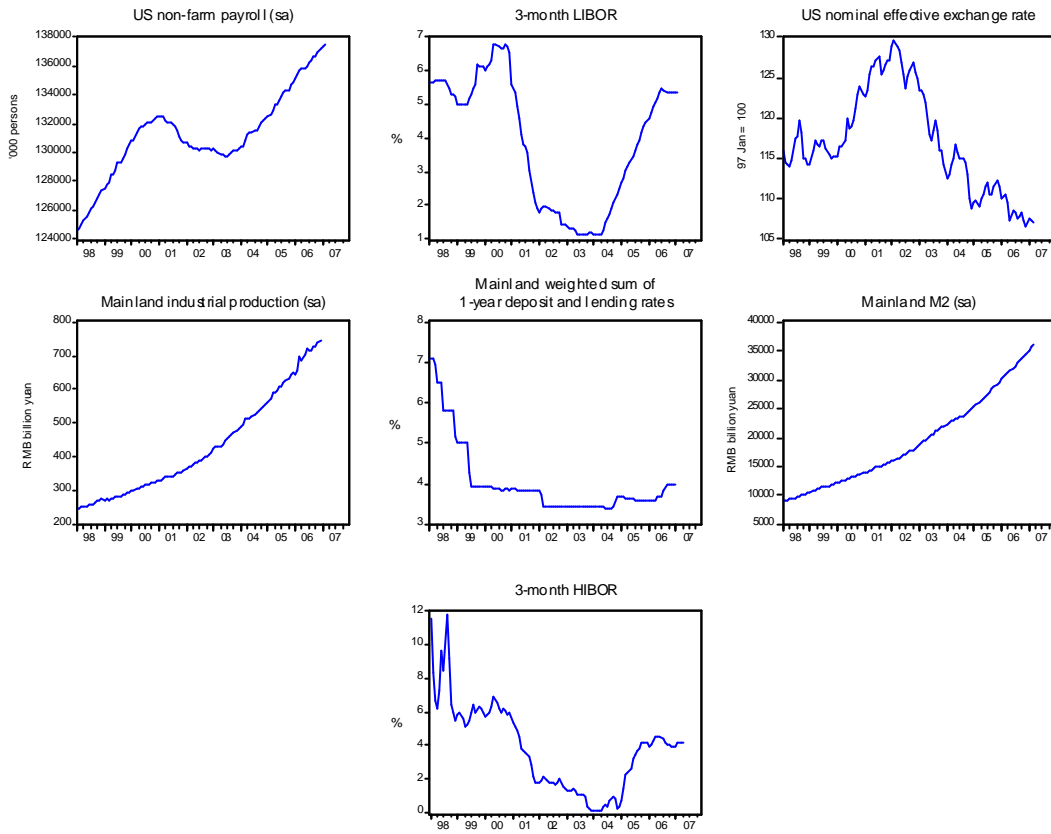
A Choleski decomposition is imposed based on the following ordering: US non-farm payroll, three-month LIBOR, US nominal effective exchange rate index, Mainland industrial production, Mainland monetary policy interest rate, Mainland monetary aggregate M2, and the three-month HIBOR. Implicit in this ordering, it is assumed that, because of the size of the US economy, the US shocks will affect both Hong Kong and the Mainland, but not vice versa. And because of the relative sizes of Hong Kong and the Mainland, Mainland shocks are transmitted to Hong Kong but not the other way round. The variables are ordered in the VAR in such a way that some variables respond contemporaneously to shocks and others do not. For example, it is assumed that the US interest rate responds contemporaneously to US output shocks but not vice versa.⁶

⁴ The number and the choice of variables in the model involve a trade-off. Preferably, all variables that have significant impacts on the three-month HIBOR should be included. This is why indicators of real activities, monetary conditions and policy actions of both the Mainland and the US are incorporated in the model. However, these variables should not be excessive to prevent the model from being over-fitted and the estimation hampered by inadequate observations.

⁵ In fact, mixed results are obtained using information criteria to determine the number of lags. Some researchers recommend including lags covering more than one year to capture seasonal effects. A seven-variable VAR model and a sample size of around 100, however, exclude such a choice. A longer lag structure, though capturing the dynamic interactions more satisfactorily, might risk overfitting the model. As a compromise, lags covering half a year are adopted. Partly as a result of this, the time series are seasonally adjusted where appropriate.

⁶ Whether these assumptions are reasonable or not can be roughly checked by computing the correlation coefficients between the derived shock series. If the underlying assumption is true, the empirical correlation coefficients between different shock series should be low or equal to zero. Empirical results show that this is indeed the case.

Chart B1: Data plots of the VAR variables



Source: CEIC and HKMA staff estimates.

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