FEATURE ARTICLE

The influence of US and Mainland shocks on Hong Kong's short-term interest rates

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This study analyses the significance of unexpected macroeconomic developments on the Mainland in determining Hong Kong money market interest rates after controlling for the influences of US variables. It finds that although US shocks still dominate, Mainland shocks have become more important in accounting for the unexpected fluctuations in HIBOR in recent years. While the HIBOR-LIBOR spread is expected to be confined within a band that reflects the width of the Convertibility Zone of the Linked Exchange Rate system, Mainland shocks could exert a significant influence on the actual size of the spread.

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, therefore, to be significantly affected by macroeconomic developments on the Mainland. 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 appear 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 article presents the results of a study that analyses how Hong Kong's interest rates have been affected by unexpected Mainland macroeconomic developments and compares the relative importance of US and Mainland shocks.[1] The article is organised as follows. The next section 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. The third section then presents econometric evidence obtained from a seven-variable vector auto-regression (VAR) model. The final section concludes.

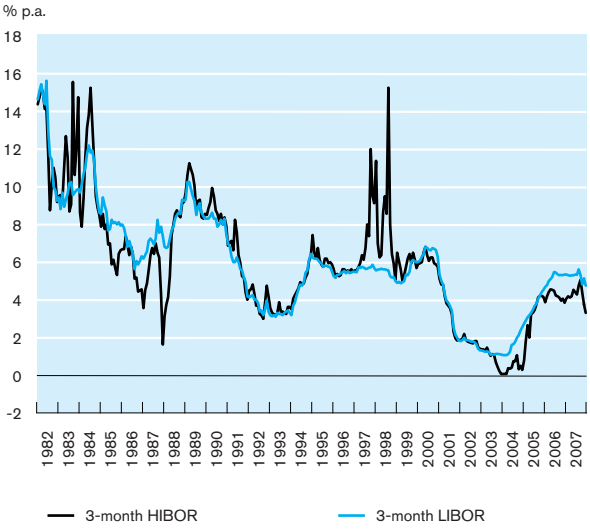
[1] For more details, see He, Leung, and Ng (2007).

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 have occurred because of various shocks.

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, the Asian financial crisis sparked the largest positive interest rate spread in Hong Kong's history. Recently, Mainland factors seem to have been the main explanation behind large movements in the interest rate spread. In particular, the negative spread from September 2003 to May 2005 appears to have been associated with the 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.

CHART 1
Movements of Hong Kong and US interest rates



Note: Month-end data.
Source: HKMA.

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	The market considered the official rate under-valued the Hong Kong dollar.
3	May 1985 - Feb 1986	-269 bps	The US dollar declined rapidly.
4	Jan 1987 - Feb 1987	-263 bps	The US said it could not accept large trade deficits with the newly industrialised countries.
5	Nov 1987 - Feb 1988	-575 bps	US and European governments criticised Hong Kong's LERS.
6	Oct 1997 - Sep 1998	+969 bps	Hong Kong was hit by the Asian financial crisis and short-term interest rates soared due to currency speculation.
7	Sep 2003 - May 2005	-227 bps	Market speculation 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.
Sources: 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 appears 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. 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 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[2] 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 this 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 deviate from zero without compromising the credibility of the exchange rate regime.

The introduction of a strong-side Convertibility Undertaking in May 2005, in addition to 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, suggesting 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 has 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 the null hypothesis that there is no long-run equilibrium relationship between HIBOR and LIBOR, and that the interest rate spread is not a stationary process cannot be rejected. 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 a co-integration relationship between HIBOR and LIBOR, the VAR specification is an appropriate model to summarise the data patterns.

[2] The weak-side Convertibility Undertaking moved from 7.80 to 7.85 when the three refinements were introduced in May 2005.

Statistical description of data using a VAR model

Mainland 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 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 on 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 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.[3]

[3] 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.

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)	▪ 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	▪ 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)	▪ 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)	▪ 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.)	▪ 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)	▪ Money aggregate M2 is one of the intermediate targets of the Mainland's monetary policy. It is widely observed by 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 initially

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

We use the model to trace the response of HIBOR to an unexpected one-standard-deviation increase in the current value of one of the US and Mainland variables, assuming that this "shock" returns to zero in subsequent periods and no further shocks occur for all other variables.

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 2):

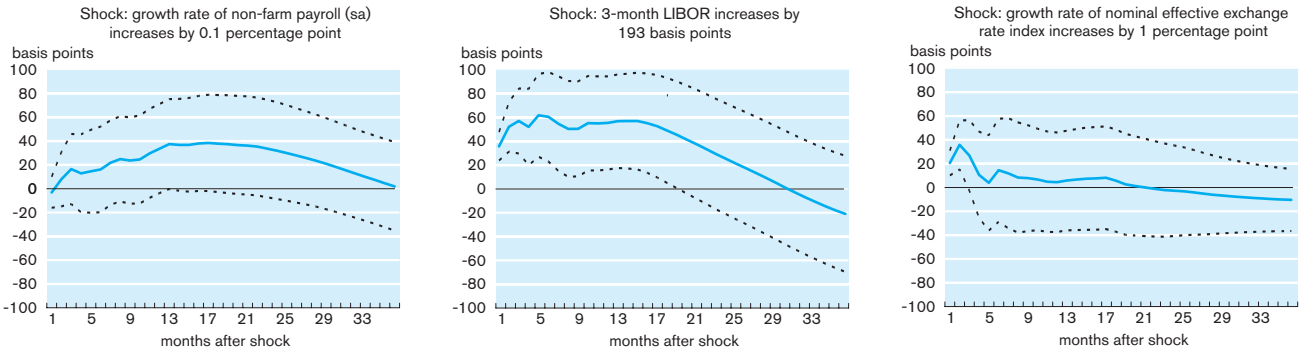
- **Non-farm payroll.** Faster-than-expected growth in US non-farm payroll leads to a positive and hump-shaped response of the three-month HIBOR, with maximal impact after 17 months. However, this response (solid line) is not significantly different from zero, as evidenced by the wide standard error 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). 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 impact declines near to zero.

CHART 2

Response of three-month HIBOR to US shocks



Note: The response (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 3) 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 thereafter becomes close to zero. This result is possibly due to offsetting economic forces at work. 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.

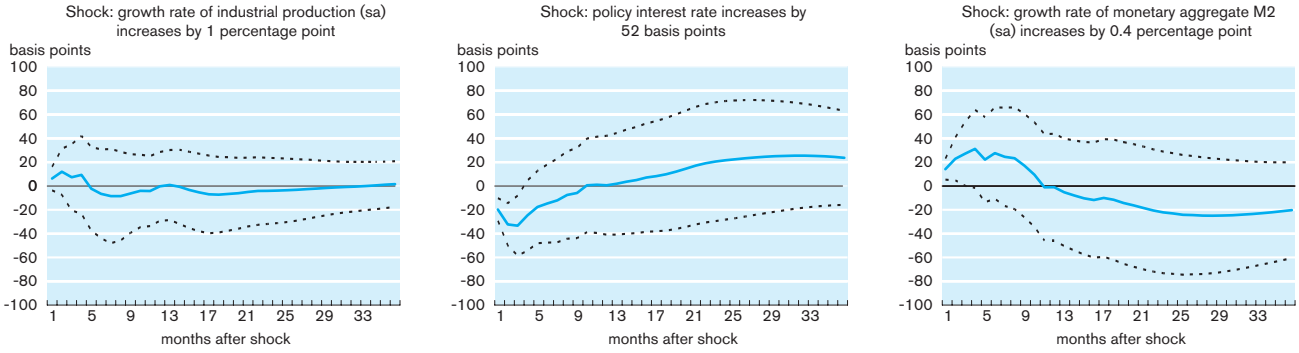
- **Monetary aggregate M2.** Faster-than-expected growth in monetary aggregate M2 leads to a positive and hump-shaped response of the three-month HIBOR, with maximal impact in the fourth month. The positive impacts are short-lived, with statistically significant response within the first two months. Ten months after the initial shock, the response turns negative and gradually converges to zero in the long run.

Relative importance of US and Mainland shocks

The relative importance of different shocks in causing the unexpected changes in HIBOR can be analysed using the statistical tool of (forecast error) variance decomposition. This method allows us to calculate the percentage of the variance of the error made in forecasting HIBOR due to unexpected changes (shocks) in the US and Mainland variables at different time horizons.

CHART 3

Response of three-month HIBOR to Mainland shocks



Note: The response (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.

As shown in Table 3, US shocks dominate, while Mainland shocks are relatively less important in explaining the forecasting errors 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: three 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.

TABLE 3
Relative importance of US and Mainland shocks in explaining the forecast errors of the 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

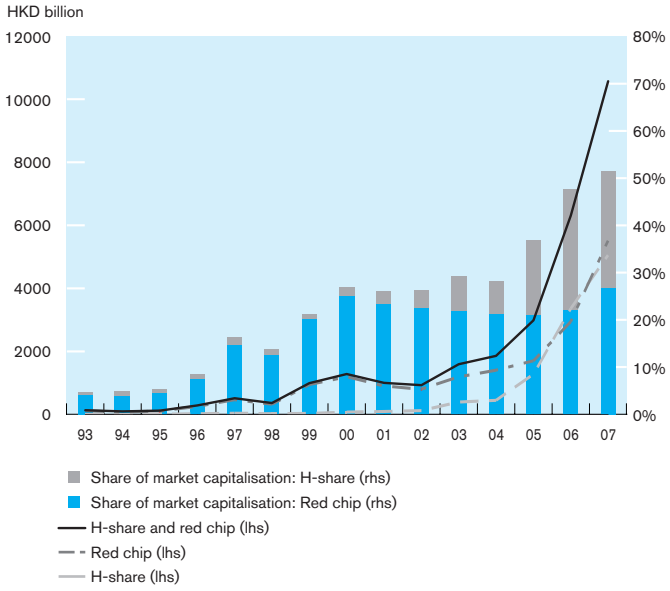
Note: The sample period is between September 1998 and December 2006.
Source: HKMA staff estimates.

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 the dynamic response, which indicate that the impacts of Mainland shocks are statistically significant only in the short run.

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

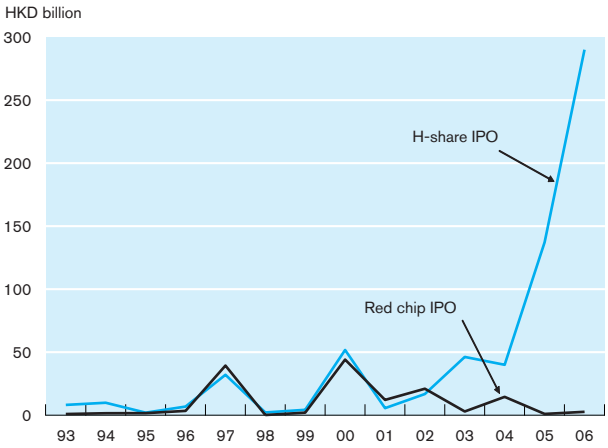
One potential problem with the above analysis is that the relationship between the variables has changed in recent years as financial integration between Hong Kong and the Mainland has gathered pace. The significance of Mainland shocks in causing unexpected changes in HIBOR is likely to have become more prominent in the recent past. Market capitalisation of the H-shares and red chips has increased substantially since 2001 (Chart 4), reaching $10.6 trillion at the end of December 2007, accounting for 51% 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 5).

CHART 4
Market capitalisation of China-related stocks (Main board)



Source: Hong Kong Exchanges and Clearing Limited.

CHART 5
Equity funds raised by China-related companies (Main board)



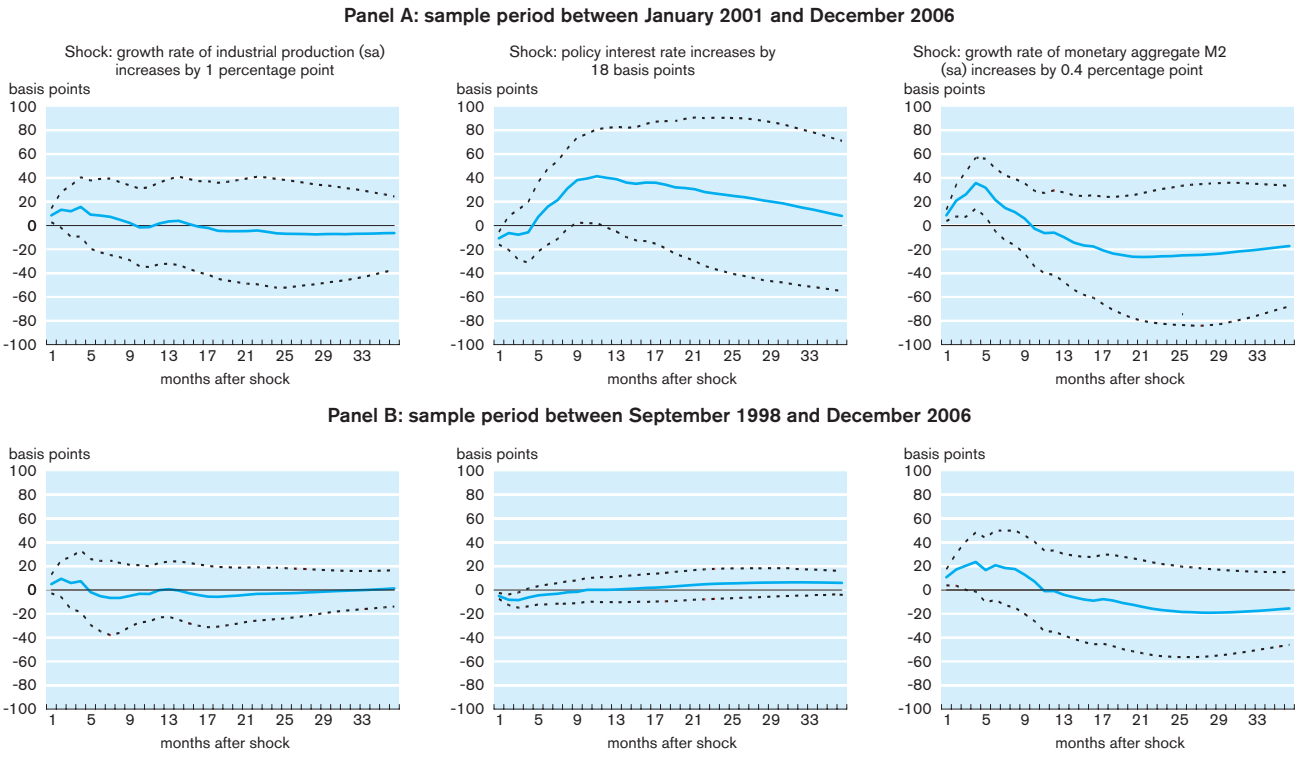
Source: Hong Kong Exchanges and Clearing Limited.

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 H-share market taking off 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 appears to be stronger than in the whole sample (Panel A, Chart 6).[4] 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.

With more pronounced dynamic impacts, the importance of Mainland shocks in explaining unexpected changes in the three-month HIBOR increases considerably for the sample period

CHART 6

Response of three-month HIBOR to Mainland shocks in recent years



Note: The response (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. For ease of comparison, Panel B generates the response using the full sample.

[4] 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.

between January 2001 and December 2006 (Panel B, Table 4). 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). Mainland shocks also now account for almost half of unexpected HIBOR variation in the medium run (18 months), probably due to the stronger positive interest rate effect in this sample period. But the US shocks are still important in explaining unexpected HIBOR developments, especially in the short (three months) and long (36 months) run.

TABLE 4

Relative importance of US and Mainland shocks in explaining the forecast errors of three-month HIBOR in recent years

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 H-share) stocks in Hong Kong.

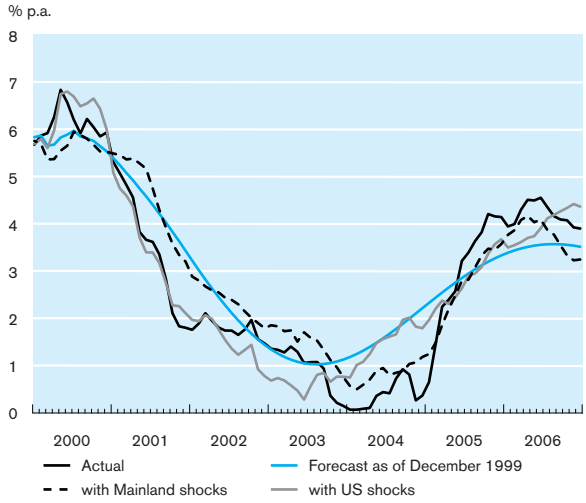
Source: HKMA staff estimates.

Historical decomposition of HIBOR

We conducted a further statistical exercise to break down 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.[5] Charts 7 and 8 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 black line in Chart 7 represents the actual value of HIBOR, and the solid blue 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 solid grey line represents the forecast path plus the effects of the actual shocks to US variables from January 2000 onwards, and the dashed line represents the forecast path plus the effects of the actual shocks to Mainland variables from January 2000 onwards. Chart 8 shows the respective contributions of US shocks, Mainland shocks and Hong Kong domestic shocks to the forecast errors.

CHART 7

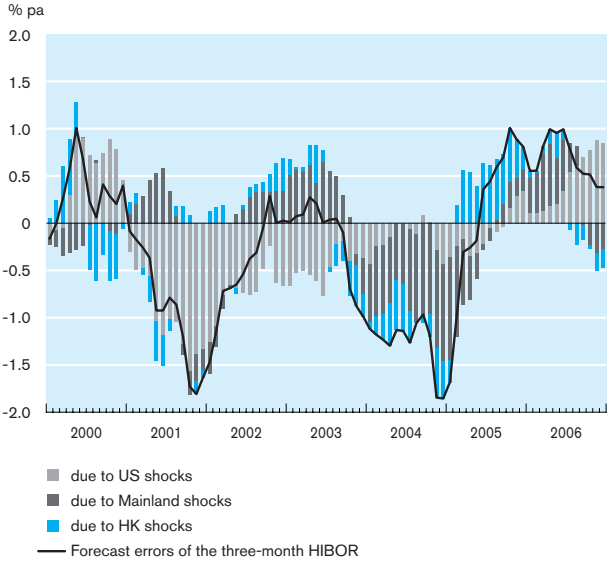
Historical decomposition of 3-month HIBOR



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

CHART 8

Sources of unexpected changes in three-month HIBOR



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

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

The breakdown shows that, between 2000 and 2002, virtually all the unexpected variations in the 3-month HIBOR can be explained by US shocks. Thus, the solid grey line tracks closely the solid black line during that period. However, Mainland shocks accounted for most of the unexpected HIBOR movements during 2003-2005, with the dashed line tracking more closely the solid black 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.

Concluding remarks

This article presents the results of a study that attempted to answer the question of how unexpected 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 due to the fast-growing China-related stocks listed on the Hong Kong stock market.

Despite the increasing importance of Mainland-related shocks, 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, if the Convertibility Zone is credible and if the covered interest rate parity holds, then HIBOR should follow a bounded process. In other words, HIBOR should move within a band defined by the LIBOR and a spread reflecting the width of the Convertibility Zone.[6] The results presented in this article imply that the movement of HIBOR within the band could be increasingly influenced by Mainland shocks.

[6] 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.

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