



## ANALYSIS ON THE DETERMINANTS OF HIBOR-LIBOR SPREADS

### **Key Points:**

- *The US Fed has increased the target range for the federal funds rate since 2015, but HIBORs have not closely followed. As a result, the HIBOR-LIBOR spreads have generally widened. The overnight HIBOR in particular stayed close to zero, resulting in a much wider negative HIBOR-LIBOR spread than their longer-tenor counterparts. Against this backdrop, this paper studies the determinants of the HIBOR-LIBOR spreads and helps provide a conceptual understanding of the underlying mechanism.*
- *Conceptually, HIBOR-LIBOR spreads are affected by interest rate arbitrage under the design of the Linked Exchange Rate System, with a larger HIBOR-LIBOR spread inducing arbitrage activities to narrow the spread subsequently. During the process, if the Hong Kong dollar spot exchange rate touches the Convertibility Undertakings (CUs) and banks trigger the CUs, the Aggregate Balance will change. Since the Aggregate Balance is a key determinant of the level of HIBORs, arbitrage activities, through eventually changing the Aggregate Balance to a certain level, provide a fundamental force that drives the HIBOR-LIBOR spreads. On the other hand, HIBOR-LIBOR spreads could also be affected by a host of transient forces from domestic interbank liquidity conditions, Hong Kong dollar exchange rate and fund flows, as well as risk factors.*
- *We estimate an autoregressive model to examine the effect of different drivers on the HIBOR-LIBOR spreads for different tenors empirically. In general, we find that the spreads did have a tendency to narrow over time, partly reflecting the force of arbitrage. Tighter interbank liquidity conditions as indicated by*

*higher Hong Kong dollar loan-to-deposit ratio as well as higher risk premium are found to be associated with an increase in the HIBOR-LIBOR spreads. More Hong Kong dollar inflows as suggested by higher equity market return in Hong Kong relative to the US as well as Hong Kong dollar exchange rate appreciation expectations tend to reduce the spreads. The foreign exchange operation by the Hong Kong Monetary Authority (HKMA) could also decrease the spreads, but this relationship became much weaker after the global financial crisis due in part to super abundant interbank liquidity and interest rates reaching the zero bound.*

- *Our model can help explain why the HIBOR-LIBOR spreads could fluctuate in the absence of any change in the Aggregate Balance or foreign exchange operations by the HKMA. For example, decomposition results from our model show that the recent fluctuations in term HIBOR-LIBOR spreads were driven by swings in Hong Kong dollar-US dollar exchange rate expectations amid a stable Aggregate Balance, although ad hoc factors including year-end funding demands also played a role.*

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<p>The views and analysis expressed in this paper are those of the authors, and do not necessarily represent the views of the Hong Kong Monetary Authority.</p>
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## I. INTRODUCTION

The US Fed began to normalise its policy interest rates in late 2015. Since then, the Federal Open Market Committee has raised the target range for the federal funds rate three times to 0.75–1% from 0–0.25%. While the US dollar LIBORs broadly trended up in tandem with the US policy interest rates, upward pressures on the Hong Kong dollar HIBORs were more restrained amid super abundant interbank liquidity in the local banking system.<sup>1</sup> This raises questions on what determines the HIBOR-LIBOR spreads in the short and medium run, even though under the Linked Exchange Rate System (LERS), HIBORs and LIBORs tend to move together in the long run.

In this paper, we attempt to dissect the fundamental drivers of the HIBOR-LIBOR spreads and provide a conceptual understanding of the underlying mechanism. We consider drivers such as interest rate arbitrage activities, interbank liquidity conditions, Hong Kong dollar exchange rate and fund flows, and risk factors. Estimation results reveal that these drivers have explanatory power over the HIBOR-LIBOR spreads, and can help explain why HIBOR-LIBOR spreads could fluctuate even without any change in the Aggregate Balance. The results also confirm that the negative impact of HKMA's foreign exchange operations on the HIBOR-LIBOR spreads in normal times disappeared after the global financial crisis (GFC).

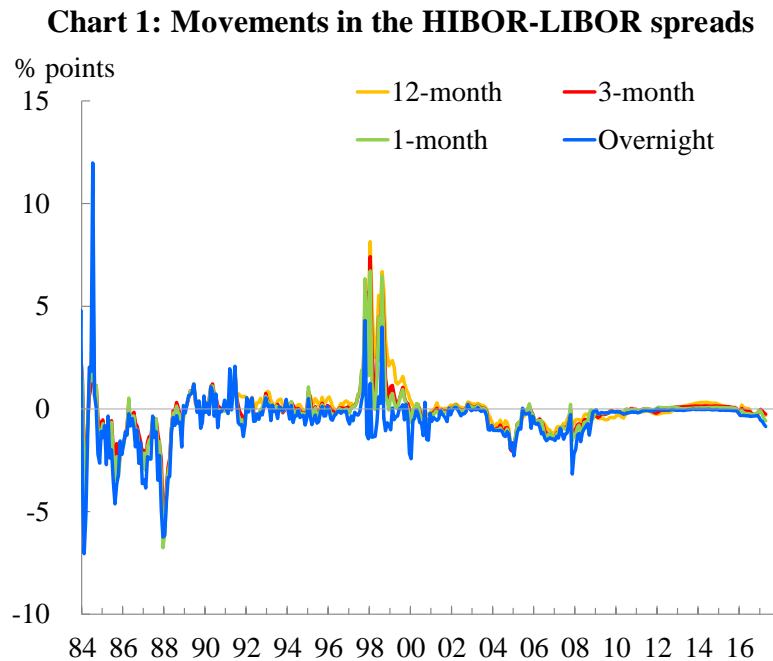
The rest of the paper is organised as follows. Section II reviews the developments in the HIBOR-LIBOR spreads over time. Section III examines the potential factors driving the interest rate spreads. Section IV estimates an autoregressive model of interest rate spreads and discusses the implications of the empirical findings. The final section provides some concluding remarks.

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<sup>1</sup> HIBOR and LIBOR stand for Hong Kong Interbank Offered Rates and London Interbank Offered Rates respectively.

## II. MOVEMENTS IN THE HIBOR-LIBOR SPREADS OVER TIME

In theory, under the LERS, HIBORs and LIBORs should move together in the long run. A reality check also reveals that, since the establishment of the LERS in October 1983, interbank interest rates in Hong Kong have broadly tracked their corresponding US dollar rates. Consequently, the HIBOR-LIBOR spreads have been fluctuating around zero most of the time (Chart 1).



Sources: CEIC and HKMA.

That said, deviations between HIBORs and LIBORs did occur due to various factors (Chart 1).<sup>2</sup> In the 1980s, the HIBOR-LIBOR spreads were fairly volatile and the US factors (e.g. movements in the US dollar) were reportedly a major driver of the interest rate spreads in the early periods of the operation of the LERS. Stepping into the 1990s, the spreads appeared to have fluctuated more tightly around zero until the Asian financial crisis when the spreads shot up under

<sup>2</sup> See also Genberg, He and Leung (2007). They argued that, under the covered interest rate parity condition, the current width of 1000 pips of the Convertibility Zone could accommodate an interest rate spread of around 130 basis points, assuming that the transaction cost is zero.

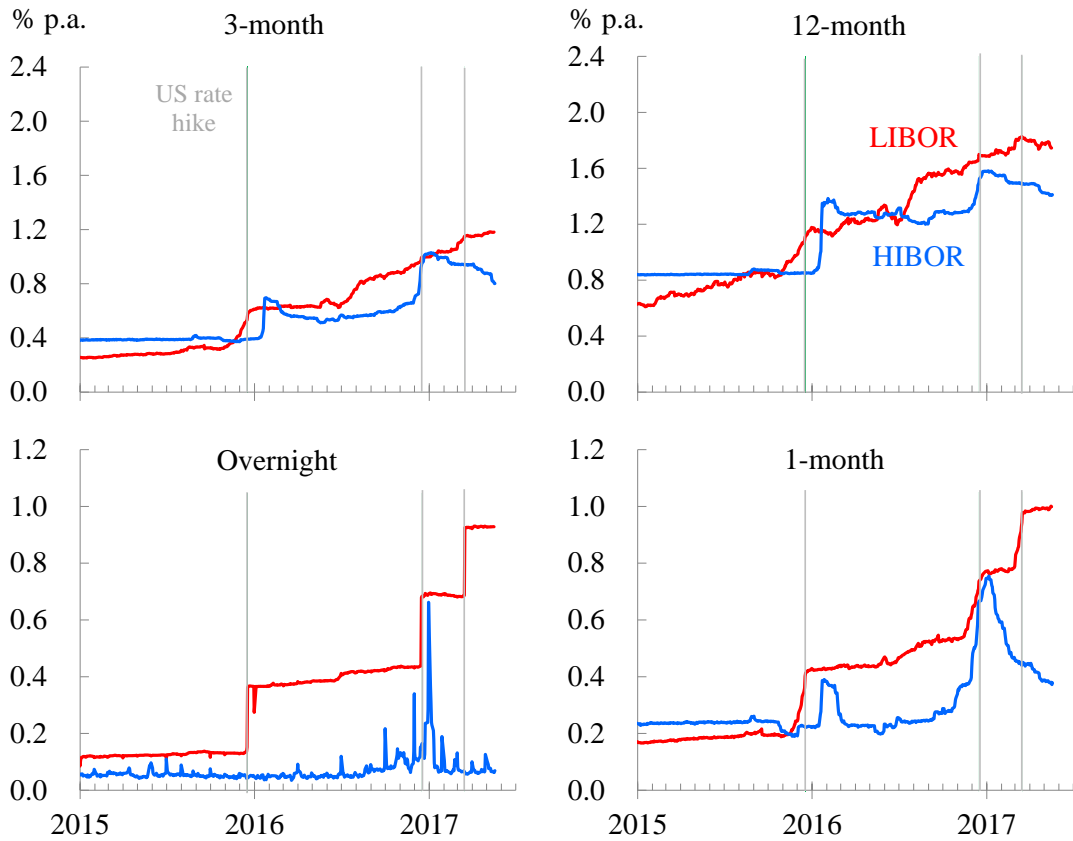
the currency attack of the Hong Kong dollar and the resultant rise in the currency risk of the Hong Kong dollar. In the 2000s, negative spreads became more prevalent and at times persistent, and Mainland-related factors (e.g. renminbi appreciation expectations) were found to have exerted greater influences.<sup>3</sup> After the GFC, the unprecedented ultra-low interest rate environment tended to compress the spreads to around zero.

**More recently, as the US Fed began to normalise its policy interest rate, the negative HIBOR-LIBOR spreads generally widened despite occasional increases in HIBORs** (Chart 2). Specifically, the LIBORs for all tenors broadly moved up in line with the US policy interest rates. On the other hand, the term HIBORs saw stepwise increases in January and December 2016, before falling back somewhat in early 2017. Meanwhile, the overnight HIBOR largely stayed close to zero despite the brief and sharp increases near end-2016. As a result, the HIBOR-LIBOR spreads have generally widened from the compressed levels during 2009–2015, with the negative overnight interest rate spread widening the most to over 80 basis points in May 2017 (Chart 3).

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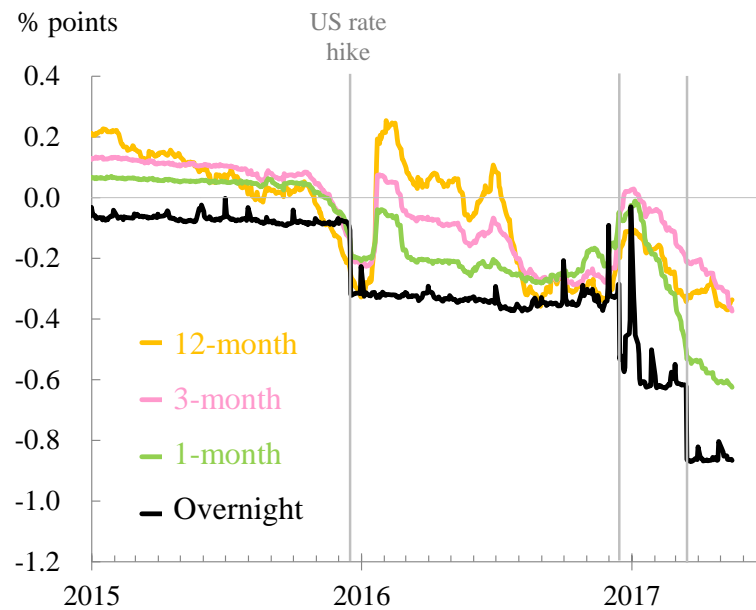
<sup>3</sup> See He, Leung and Ng (2007) for more details.

**Chart 2: The response of HIBORs and LIBORs to US interest rate hikes**



Sources: CEIC and HKMA.

**Chart 3: Recent developments in HIBOR-LIBOR spreads**



Sources: CEIC and HKMA.

### III. DETERMINANTS OF HIBOR-LIBOR SPREADS

**In general, HIBOR-LIBOR spreads are affected by four categories of interacting factors including (a) interest rate arbitrage activities, (b) domestic interbank liquidity conditions, (c) Hong Kong dollar exchange rate and fund flows, and (d) risk factors** (see Chart 4). To illustrate:

- A larger interest rate gap may induce arbitrage activities consistent with the automatic interest rate adjustment mechanism under the LERS so as to narrow the interest rate gap subsequently.<sup>4</sup> During the process, if the Hong Kong dollar exchange rate touches the Convertibility Undertakings (CUs) and banks trigger the CUs, there will be changes in the Aggregate Balance and hence interbank liquidity conditions. Since the Aggregate Balance is a key determinant of the level of HIBORs, arbitrage activities would provide a fundamental force that drives the HIBOR-LIBOR spreads.
- Even without arbitrage activities, the interest rate spread could fluctuate due to several transient factors:
  - The spread could be affected by variations in domestic interbank liquidity conditions alone. For instance, higher Hong Kong dollar loan-to-deposit ratio could raise liquidity pressure in the interbank market and affect HIBORs.
  - The Hong Kong dollar exchange rate or fund flows could also influence the HIBOR-LIBOR spreads.<sup>5</sup> Under the uncovered interest rate parity

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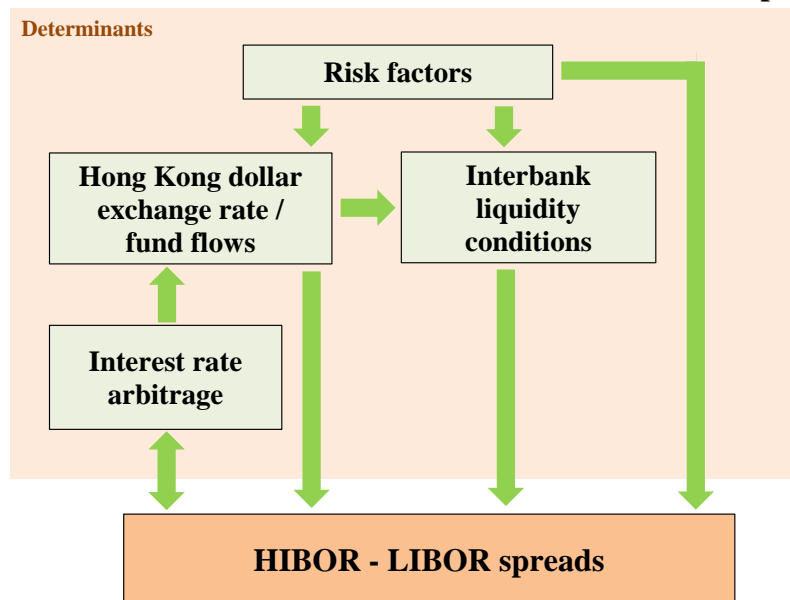
<sup>4</sup> Under the Currency Board system, the stability of the Hong Kong dollar exchange rate is maintained through an automatic interest rate adjustment mechanism. When there is a decrease in demand for Hong Kong dollar assets and the Hong Kong dollar exchange rate weakens to the convertibility rate, the HKMA stands ready to purchase Hong Kong dollars from banks, leading to a contraction of the Monetary Base. Interest rates then rise, creating the monetary conditions conducive to capital inflows so as to maintain exchange rate stability. Conversely, if there is an increase in the demand for Hong Kong dollar assets, leading to a strengthening of the exchange rate, banks may purchase Hong Kong dollars from the HKMA. The Monetary Base correspondingly expands, exerting downward pressure on interest rates and so discouraging continued inflows.

<sup>5</sup> In this paper, the Hong Kong dollar fund flow is interpreted in a broad sense. It includes fund flows into or out of the currency board (namely, changes in the Monetary Base) as well as fund flows into or out of the non-bank private sector whose counterparty is the banking sector and the currency board combined.

conditions, the spreads should be linked to the expectation of the movement in the Hong Kong dollar exchange rate against the US dollar. Besides this direct channel, more Hong Kong dollar inflows could lead to a triggering of the strong-side CU, resulting in looser domestic interbank liquidity conditions. This in turn drives the HIBORs down and temporarily widens their spreads with the LIBORs.

- On the other hand, risks that are specific to Hong Kong can also lead to higher HIBORs and larger HIBOR-LIBOR differentials both directly and indirectly through their impact on interbank liquidity conditions and Hong Kong dollar exchange rate and fund flows. For example, negative shocks leading to a loss in confidence in the Hong Kong dollar would raise the risk premium and result in a rise in the HIBORs directly. At the same time, it could also lead to the selling of Hong Kong dollars and a tightening of interbank liquidity, thereby increasing the HIBOR-LIBOR spreads.

**Chart 4: Theoretical determinants of the HIBOR-LIBOR spreads**



Source: HKMA staff illustration.



Table 1 lists the indicators of the determinants of the HIBOR-LIBOR spreads that we employ in this study. Based on this table, we review some of these indicators and their graphical relationship with the interest rate spreads in greater details below.

**Table 1: A list of potential variables affecting the HIBOR-LIBOR spreads**

Variables and the sign of their expected effect on the HIBOR-LIBOR spreads (+/-)
<p><u>Interest rate arbitrage</u>                      ( ↑ arbitrage → tendency for HIBOR-LIBOR spreads to narrow)</p> <ul style="list-style-type: none"> <li>• HIBOR-LIBOR spread itself (+ with a magnitude between 0 and 1)</li> </ul>
<p><u>Interbank liquidity conditions</u>                      (Tighter liquidity conditions → ↑ local interbank rates → ↑ HIBOR-LIBOR spreads)</p> <ul style="list-style-type: none"> <li>• Hong Kong dollar loan-to-deposit ratio (+)</li> <li>• HKMA's foreign exchange operation/change in the supply of interbank liquidity (-)</li> </ul>
<p><u>Hong Kong dollar exchange rate or fund flows</u>                      (↑ HKD inflows → ↓ local interbank rates → ↓ HIBOR-LIBOR spreads)</p> <ul style="list-style-type: none"> <li>• Monthly equity returns differential – Hang Seng Index vs S&amp;P 500 (-)</li> <li>• Hong Kong dollar exchange rate expectation – implied volatility for call options minus that for put options (- with depreciation expectation increasing the spreads)</li> </ul>
<p><u>Risk factors</u>                      ( ↑ risks → ↑ local interbank rates → ↑ HIBOR-LIBOR spreads)</p> <ul style="list-style-type: none"> <li>• Standard deviation of daily equity returns – Hang Seng Index vs S&amp;P 500 (+)</li> </ul>

Source: HKMA staff.

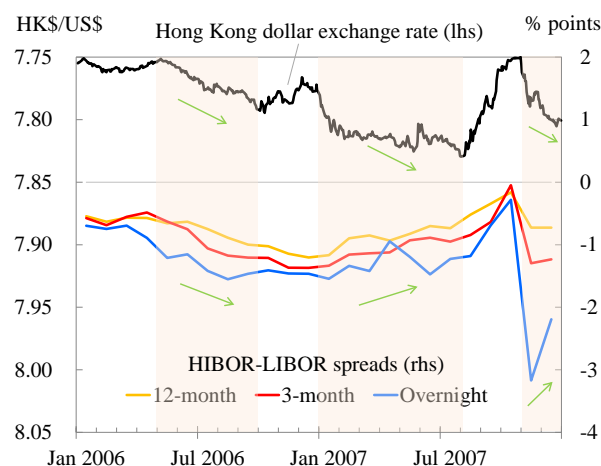
### Interest rate arbitrage activities

**Under the automatic interest rate adjustment mechanism of the LERS, a larger HIBOR-LIBOR spread can induce interest rate arbitrage activities that are conducive to the narrowing of the spreads subsequently.** Such activities, in the narrow sense, feature the triggering of the CUs with corresponding change in the Aggregate Balance.

Experience reveals that when interest carry trade happened, the negative HIBOR-LIBOR spreads did have a tendency to narrow. However, the Hong Kong dollar spot exchange rate would weaken but not necessarily touch the weak-side CU in the short run. According to market intelligence, interest carry trade reportedly occurred during May–September 2006 and January–August and November–December 2007 (Chart 5). One salient feature of these arbitrage activities was the gradual weakening of the Hong Kong dollar spot exchange rate (from 7.75 to around 7.83 at one point), taking advantage of the widening negative HIBOR-LIBOR gaps. Later, the interest rate gap did narrow, albeit at a slow pace.

In light of the experience, our analysis defines interest rate arbitrage activities in a broader sense which do not necessarily involve the triggering of the CUs. In particular, we capture the impact of arbitrage activities on the current HIBOR-LIBOR spreads through including the lagged values of the spreads in our empirical model.<sup>6</sup> If arbitrage activities are present, the coefficient on these lagged values should lie between zero and one, meaning that the spreads have a tendency to narrow over time, other things being equal.

**Chart 5: Reported episodes of interest carry trade in 2006–2007**



Note: The highlighted areas represent periods of reported interest carry trade.

Sources: CEIC and HKMA.

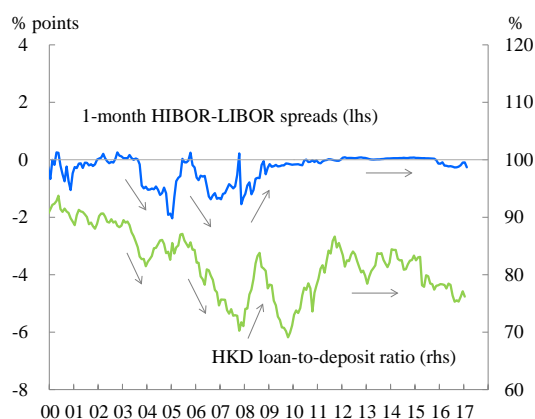
<sup>6</sup> Of course, there could be other factors at work that could lead to this time series property – the persistence of the HIBOR-LIBOR spreads. For example, one could argue that the credibility of the LERS could also result in the convergence of the HIBOR-LIBOR spreads.

In theory, larger HIBOR-LIBOR spreads should induce stronger arbitrage activities, which in turn help the spreads converge at a faster pace. These dynamics, however, are overshadowed by the notable changes in the regulatory and macroeconomic environment after the GFC. For example, regulatory changes that limit the risk-taking capacity of banks in the post-GFC period may have increased the level of the HIBOR-LIBOR spreads required for the same level of arbitrage activities to take place. These uncertainties pose caveat to the estimated arbitrage dynamics in this paper.

### Hong Kong dollar loan-to-deposit ratio

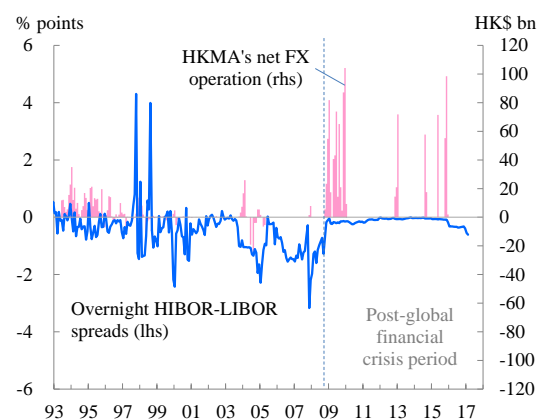
**Interbank liquidity conditions, as measured by the Hong Kong dollar loan-to-deposit (LTD) ratio, appeared to be positively correlated with the HIBOR-LIBOR spreads (Chart 6).** For example, even though the US dollar interest rate is unchanged, tighter domestic interbank liquidity – due perhaps to increased funding needs arising from bank clients’ loan demand – will exert upward pressures on local interbank rates so as to increase the HIBOR-LIBOR spreads. In fact, previous research suggested that HIBORs would initially rise in response to an increase in the LTD ratio, but then return close to their original levels.<sup>7</sup>

**Chart 6: Interest rate spreads and loan-to-deposit ratio**



Sources: CEIC and HKMA.

**Chart 7: Interest rate spreads and HKMA’s foreign exchange operations**



Sources: CEIC and HKMA.

<sup>7</sup> See Wong and Wong (2011). They also suggested that the impact was estimated to be non-linear with an increasingly larger effect when the LTD ratio is higher initially.

Foreign exchange operations by the Hong Kong Monetary Authority

**With the strengthening of the currency board arrangements over the years, the foreign exchange operation by the Hong Kong Monetary Authority (HKMA) has become largely passive, mainly in response to banks' triggering of the CUs.** In particular, after the introduction of the three refinements to the LERS in May 2005, any within-zone foreign exchange operations by the HKMA should only be aimed at promoting the smooth functioning of the LERS (for example, by removing any market anomalies that may arise). In fact, these within-zone operations were infrequent, once each in 25 May 2005 and 23 October 2007, and several times in September and October 2008 owing to the liquidity crunch in the interbank market amid the GFC.

**In any case, the foreign exchange operation by the HKMA could affect the HIBOR-LIBOR spreads through its influence on the supply of domestic interbank liquidity** (Chart 7). An increase in the supply of domestic interbank liquidity caused by the HKMA's foreign exchange operation could have a knock-on effect on HIBORs and therefore decrease the HIBOR-LIBOR spreads. A glaring example can be found in late October 2007 when the HKMA conducted several monetary operations amid tight interbank liquidity due to vibrant initial public offering activities in the local equity market. At that time, the 3-month HIBOR-LIBOR spread turned from a small premium before the operations to a discount of around 150 basis points in November 2007.

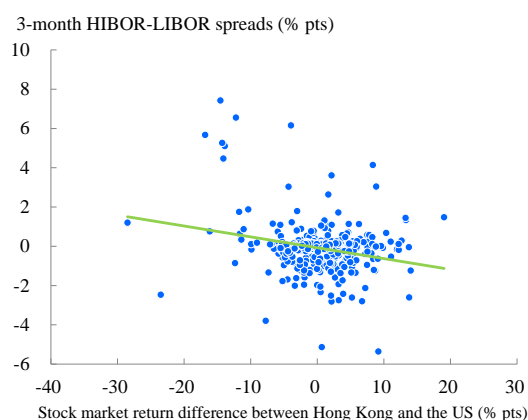
**However, the negative relationship between the foreign exchange operation and the HIBOR-LIBOR spread has become much weaker post-GFC due to super abundant interbank liquidity and interest rates reaching the zero bound** (Chart 7). When the HIBORs and LIBORs are close to zero, it is technically infeasible for the interbank interest rates to decline further when the supply of the interbank liquidity expands following the HKMA's foreign exchange operation. As the post-GFC Aggregate Balance ballooned to a level that was well beyond the usual amount required to oil Hong Kong's efficient real time inter-bank

payment system, the change in the total clearing balances had only limited impact on the HIBORs during this period.

### Equity return differences between Hong Kong and the US

**Different performance between Hong Kong and the US equity markets could generate short term Hong Kong dollar flows of funds that temporarily affect HIBOR-LIBOR spreads.** More specifically, strong appetite for Hong Kong dollar assets tends to induce Hong Kong dollar inflows into the non-bank private sector and help keep the HIBORs relatively low. A simple scatter plot shows that the HIBOR-LIBOR spreads and the difference between the monthly return of the Hang Seng Index and the S&P 500 are indeed negatively correlated (Chart 8).

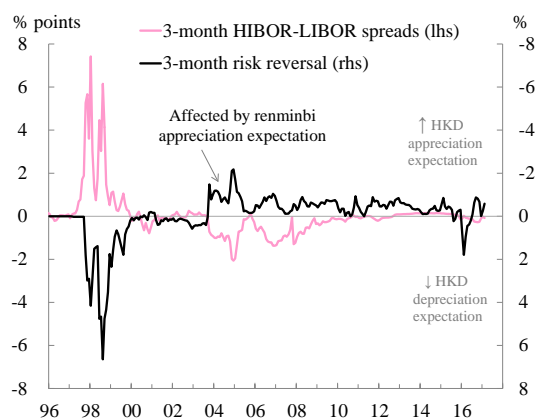
**Chart 8: Interest rate spreads and stock market return differentials**



Note: Data from October 1983 to September 2016.

Sources: CEIC, HKEx and HKMA.

**Chart 9: Interest rate spreads and Hong Kong dollar exchange rate expectations**



Sources: CEIC, JP Morgan and HKMA.

## Hong Kong dollar exchange rate expectation

**Historical evidence indicates that the Hong Kong dollar-US dollar exchange rate expectations appeared to be highly correlated with the HIBOR-LIBOR gaps (Chart 9).**<sup>8</sup> Theoretically, the uncovered interest rate parity postulates that, at equilibrium, the interest rate differential reflects the expected exchange rate movement.<sup>9</sup> For instance, an expected depreciation of the Hong Kong dollar against the US dollar should be compensated by a higher interest rate relative to the US (i.e. an increase in the HIBOR-LIBOR spreads).<sup>10</sup> In reality, expectations that the Hong Kong dollar would be allowed to follow the renminbi to appreciate against the US dollar were an important contributor to the large negative HIBOR-LIBOR spreads emerged during 2003–2005.

## Risk factors

**A large risk premium specific to the Hong Kong economy (e.g. macro-financial risks, etc) could lead to a surge in the HIBORs relative to the LIBORs, and the Asian financial crisis is a point in case (Chart 10).** However, it should be noted that it is the relative change in the risk premium that counts. As an example, during the GFC, both LIBORs and HIBORs shot up due to heightened counterparty credit risks in the interbank markets across the globe so that the movements in the HIBOR-LIBOR spreads were less drastic compared with the movements in the interbank rates. Taking into account coverage and data availability, we use the realised volatility (i.e. standard deviation of daily equity

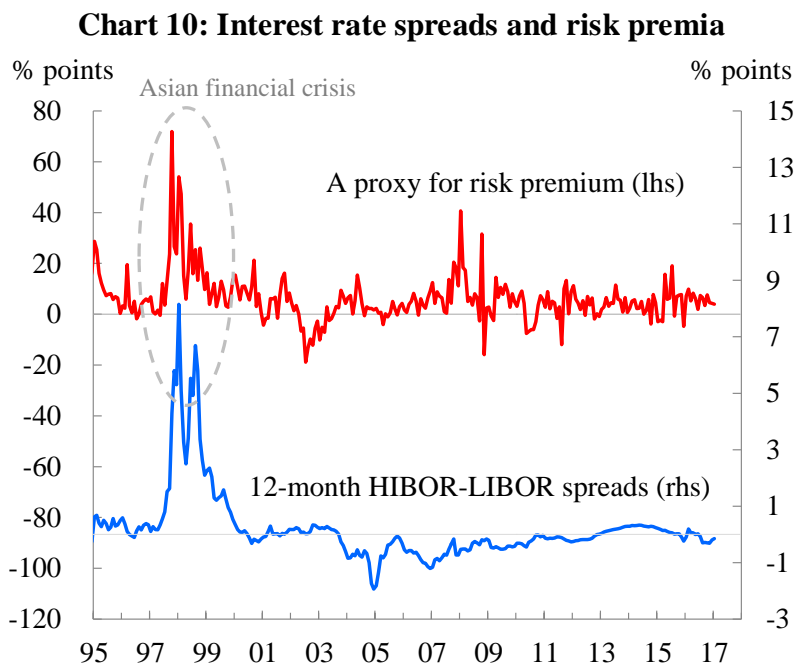
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<sup>8</sup> In this paper, we use the risk reversal, which is a market-based measure calculated from Hong Kong dollar-US dollar currency options, to proxy for these expectations. A positive number is consistent with market participants believing that a significant appreciation of the Hong Kong dollar is more likely than a significant depreciation.

<sup>9</sup> On the other hand, the covered interest rate parity hypothesises that the interest rate spread should be equal to the difference between the forward and spot exchange rates.

<sup>10</sup> However, when interest rates are close to the zero lower bound, there is limited scope for exchange rate expectations to be reflected in interest rate differentials. Cook and Yetman (2014) therefore introduced a new mechanism, based on the central bank balance sheet, which works to bring about equilibrium in currency markets under a fixed exchange rate regime even when interest rates are zero. In essence, an expectation of exchange rate appreciation will cause foreign exchange reserves to swell, increasing the cost to policy-makers of allowing an appreciation and, therefore, lowering the likelihood of the fixed exchange rate being abandoned.

returns) of the Hang Seng Index relative to the S&P 500 Index as a proxy for the risk premium.



Sources: CEIC, HKEx and HKMA.

#### IV. EMPIRICAL MODELS

To examine the effect of the different drivers on the HIBOR-LIBOR spreads, we estimate an autoregressive model with exogenous variables:

$$HLS_t = \alpha HLS_{t-1} + \beta (\text{other variables}_t) + \text{constant} + \epsilon_t$$

where  $HLS_t$  is the HIBOR-LIBOR spread of a particular tenor. Other variables include Hong Kong dollar LTD ratio, net foreign exchange operations by the HKMA, equity market return differences between Hong Kong and the US, risk reversal (i.e. a proxy for Hong Kong dollar expectations)<sup>11</sup> and the risk premium.<sup>12</sup> We also include an interaction term  $Net\ FX\ operation \times Time\ dummy$  to capture the notion that the foreign exchange operation by the HKMA tended to have limited impact on the HIBOR-LIBOR spreads in certain time periods (e.g. post-GFC). The parameter  $\alpha$  measures the persistence of the HIBOR-LIBOR spread, with an expected magnitude between zero and one. The parameter  $\beta$  is a vector of coefficients with expected signs shown in Table 1. The data are monthly and the sample period runs from January 1996 to January 2017.

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<sup>11</sup> We used the Hong Kong dollar exchange rate expectation but left out the renminbi expectation as the latter effect is also captured in the former.

<sup>12</sup> Some other variables we have tried but turned out not significant were initial public offering activities in the local equity market, economic growth differential between Hong Kong and its trading partners, etc. We also tried the US dollar nominal effective exchange rate but the impact of this variable is not that noticeable in our sample period (as opposed to 1980s). Our sample period is constrained by the availability of the co-variates.



**Estimation results show that the above-mentioned variables (or indicators) have explanatory power over the HIBOR-LIBOR spreads.** The coefficients in the benchmark models generally have the correct signs and many of them are statistically significant (Table 2).<sup>13</sup> That said, the model for the overnight tenor fits less well (e.g. low R-squared) than those of longer-tenors, with several coefficients being not statistically significant. This suggests that the overnight HIBOR-LIBOR spread may have its own dynamics.

**Table 2: Estimation results from the autoregressive models**

Independent variables	Dependent variables: (HIBOR-LIBOR) <sub>t</sub>			
	Overnight model	1-month model	3-month model	12-month model
(HIBOR-LIBOR) <sub>t-1</sub>	0.43 ***	0.38 ***	0.54 ***	0.74 ***
Net FX operation				
Jan 96–Oct 03	-0.066 ***	-0.089 ***	-0.062 **	-0.046 **
Nov 03–Sep 08	0.0001	-0.002	-0.007	-0.008
Oct 08–Jan 17	0.004 ***	0.005 ***	0.003 ***	0.001
HKD LTD ratio	0.007	0.011 **	0.009 **	0.009 **
Equity return diff.	-0.02 ***	-0.04 ***	-0.04 ***	-0.04 ***
HKD expectation	-0.30 ***	-0.65 ***	-0.28 **	-0.07
Risk premium	0.004	0.015	0.013	0.014 **
Constant	-0.79 **	-1.09 **	-0.84 **	-0.85 ***
<i>Adj. R-squared</i>	<i>0.36</i>	<i>0.78</i>	<i>0.84</i>	<i>0.93</i>

Note: \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level respectively.

<sup>13</sup> Although the “risk premium” is widely regarded as one of the major contributors to the sharp increases in HIBORs (and hence the HIBOR-LIBOR spreads) during the Asian financial crisis, the estimated coefficients on this variable (i.e. the differential in stock market volatility) are not found to be statistically significant in the overnight, one-month and three-month models. This can be due to two reasons. First, the proxy variable may not fully capture the underlying risk premium due to measurement errors or temporal averaging. Secondly, the increases in the risk premium during the crisis period were sometime associated with strong Hong Kong dollar depreciation expectations. As such, the true relationship between the risk premium and the HIBOR-LIBOR spreads might not be captured precisely owing to the problem of collinearity. Having said that, data availability has constrained our choice of proxy variables and some other proxy variables we have tried produced roughly similar results.

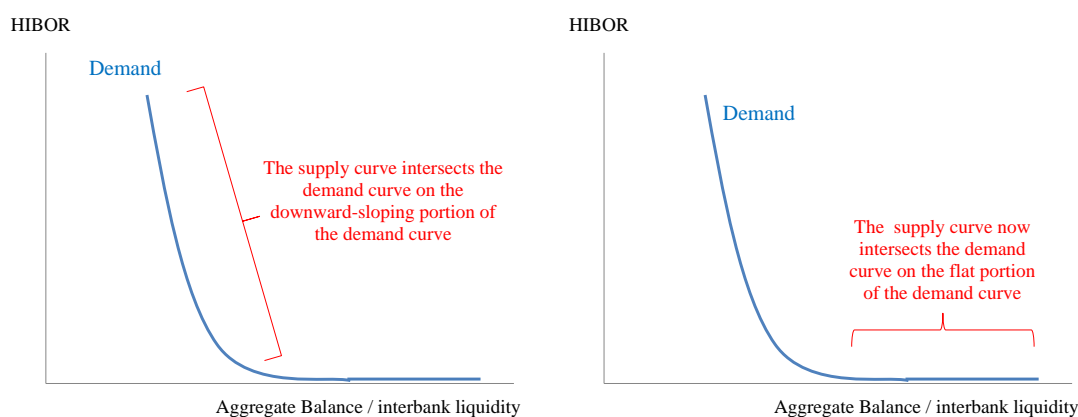
**The estimated coefficients on the lag term of the HIBOR-LIBOR spread suggest that during our sample period, the interest rate spread had a tendency to narrow over time, partly reflecting the force of arbitrage.** Specifically, the coefficients ( $\alpha$ ) are estimated to be between zero and one, meaning that only a portion of the previous month's HIBOR-LIBOR gap would carry over in the current month, other things being equal. Experience during 2006–2007 demonstrates that interest rate arbitrage is one such force that leads to the narrowing of the HIBOR-LIBOR spreads over time. That said, partly because there are other possible forces at work, caution should be taken when interpreting and comparing the size of the coefficients across models of different tenors. For example, a smaller  $\alpha$  estimate for the one-month model does not necessarily imply more interest rate arbitrage activities for that tenor.

**Our estimation results confirm that the negative impact of HKMA's foreign exchange operations on the HIBOR-LIBOR spreads in normal times disappeared in the post-GFC periods.** Empirically, we find that the sum of the coefficients on the net foreign exchange operations by the HKMA is roughly equal to zero post-GFC, meaning that the operations in this period had negligible effect on the HIBOR-LIBOR spreads (Table 2). This result lends support to the claim that in the interbank money market, the supply curve now intersects the demand curve on the flat portion of the demand curve so that changes in the supply (e.g. the Aggregate Balance) exert little impact on the HIBOR-LIBOR spreads (Chart 11b). By contrast, in the pre-GFC periods, when the supply curve intersected the demand curve on the downward-sloping portion of the demand curve, the HIBOR-LIBOR spreads were more sensitive to the net foreign exchange operations by the HKMA (Chart 11a).

### Chart 11: Demand for and supply of interbank clearing balances

(a) Before the global financial crisis

(b) After the global financial crisis



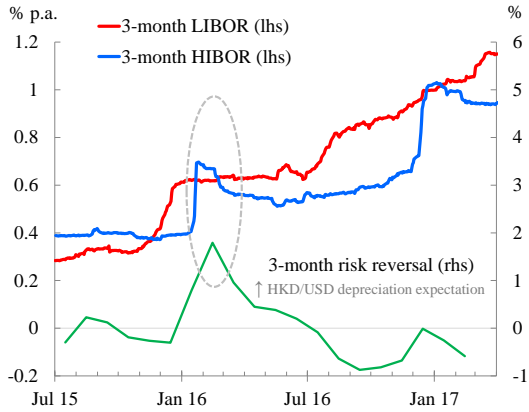
Note: The illustration only represents a simplification of the reality.

Source: HKMA staff illustration.

**Our model can help explain why the HIBOR-LIBOR spreads could fluctuate in the absence of any change in the Aggregate Balance or the foreign exchange operations by the HKMA.** For example, decomposition results from our models suggest that the fluctuations in term HIBOR-LIBOR spreads following the US rate hikes in late-2015 and late-2016 were driven by swings in the Hong Kong dollar-US dollar exchange rate expectations amid a stable Aggregate Balance. In particular, this expectation variable explained over 70% of the predicted increase in the 3-month HIBOR-LIBOR spread in the first two months of 2016 (Charts 12 and 13).<sup>14</sup> Similar decomposition results were found in the December 2016 episode when the HIBOR-LIBOR spreads also increased rapidly, although anecdotal evidence suggests that ad hoc factors including the anticipation of US money market reform and year-end funding demands also had an impact (Chart 14).

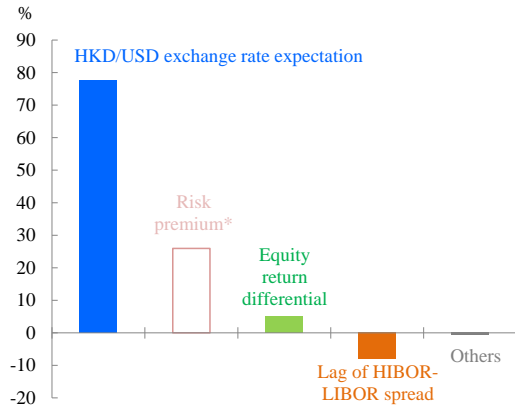
<sup>14</sup> Note that the contribution by the expectation variable would be even higher if we dropped the statistically insignificant variables such as the risk premium.

**Chart 12: The impact of Hong Kong dollar expectations on the recent movements in the HIBOR-LIBOR spreads**



Sources: CEIC, JP Morgan and HKMA.

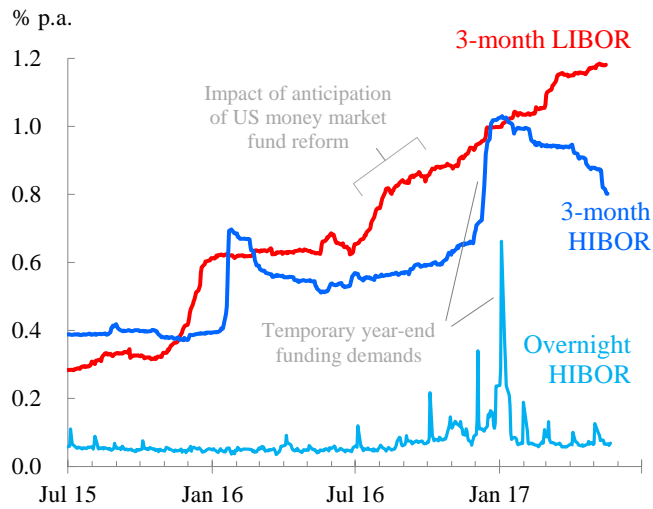
**Chart 13: Contributions to the predicted variations of the 3-month HIBOR-LIBOR spreads during January and February 2016**



\* The coefficient is statistically insignificant.

Source: HKMA staff estimates.

**Chart 14: The effect of ad hoc factors on the recent movements in the HIBOR-LIBOR spreads**



Sources: CEIC and HKMA.

## V. CONCLUDING REMARKS

This paper provides a conceptual understanding of the fundamental drivers of the HIBOR-LIBOR spreads. The size of the HIBOR-LIBOR spreads is found to be affected not only by interest rate arbitrage activities, but also interbank liquidity conditions, Hong Kong dollar exchange rate and fund flows, and risk factors. In particular, although arbitrage activities could narrow the HIBOR-LIBOR spreads, such process does not necessarily feature the triggering of the CUs in the short run and hence the foreign exchange operations by the HKMA. We then apply the model to explain the recent fluctuations of HIBORs despite a stable Aggregate Balance, and illustrate that the term HIBOR-LIBOR spreads were driven by swings in the Hong Kong dollar-US dollar exchange rate expectations, although ad hoc factors including year-end funding demands also played a role.

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