HONG KONG MONETARY AUTHORITY

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HONG KONG MORTGAGE RATE SETTING – AN ALTERNATIVE REFERENCE RATE?[1]

Key Points:

- *The HKMA has completed a research study on the setting of mortgage rate by Authorized Institutions (AIs). The purpose of the project is to consider whether in an environment of intensive competition and, until recently, abundant liquidity in the banking system, the AIs have adequately taken into account their long term cost of funds in setting their mortgage rates. The study also compares the Best Lending Rate (BLR) with other alternative mortgage reference rates to consider which one(s) would enable AIs to better track their cost of funds in determining the interest rate for residential mortgage lending. The results are presented in this paper.*

- *The use of BLR as the reference rate for setting mortgage rates has been adopted by banks for many years. However, such a practice is not necessarily conducive to banks' management of interest rate risk, as the movement of BLR may deviate significantly from banks' cost of funds.*

- *In times when Hong Kong Interbank Offered Rates (HIBORs) and time deposit rates rise faster than BLR (typically during an interest rate hike cycle or when the risk premium of the Hong Kong dollar over the US dollar widens), the interest margin of banks' existing mortgage portfolios would be squeezed. This may lead to a material decline in banks' earnings and may impact on banking and financial stability. The market conditions during late January to April 2005 demonstrate vividly such risk.*

- *Drawing on overseas experience, several local interest rates, including the 3-month HIBOR, the effective deposit rate or EDR (a weighted average rate for demand, savings and time deposits), the composite rate (a weighted average rate of 3-month HIBOR and EDR), the Base Rate of the HKMA and the yield of the 3-year Exchange Fund Note (EFN), are examined in order to assess their relevance as alternative reference rates.*

- *The assessments are made by evaluating the appropriateness of each rate based on criteria of importance to consumers and factors relevant to banks. Together with other factors, the two key criteria for the assessment are (i) the stability of mortgage rates over time which is regarded as important by both borrowers and AIs, and (ii) conduciveness to interest rate risk management which is important for banking stability.*

- *A comparative analysis suggests that the composite rate is probably the best as it reflects closely the cost of funds of most AIs and is more stable than the 3-month HIBOR and the yield of EFN. The use of some "smoothing out" arrangements could further enhance the stability of the rate.*

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[1] The analysis of this paper covers the market situation up to May 2005, and uses data up to that month.

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EXECUTIVE SUMMARY

OBJECTIVES

The objectives of this paper are to:

(a) review the practice of setting mortgage rates in other jurisdictions;
(b) discuss alternative reference rates to the BLR that may be considered for setting Hong Kong's mortgage rates; and
(c) propose a way forward.

BACKGROUND

The use of Best Lending Rate (BLR) as the reference rate for setting mortgage rates has been adopted by banks for many years. However, such a practice is not necessarily conducive to banks' management of interest rate risk, as the movement of BLR may deviate significantly from banks' cost of funds.

In times when Hong Kong Interbank Offered Rates (HIBORs) rise faster than BLR (typically during an interest rate hike cycle or when the risk premium of the Hong Kong dollar over the US dollar widens), the interest margin of banks' existing mortgage portfolios would be squeezed. This may lead to a material decline in banks' earnings and may impact on banking and financial stability.

The market conditions during late January to April this year demonstrate vividly such risk. Intense competition drove down the mark-ups of effective mortgage rates relative to the BLR to as low as around minus 3 percentage points by January 2005, which was made possible by the extraordinary low funding cost, with HIBOR being at an unusually deep discount to LIBOR of about 200 bps. However, with US interest rates rising and as funding cost increased faster than the BLR in subsequent months, the margin on loans priced on the previously very low funding cost came under pressure.

Simulation results of our study show that such a squeeze of margin could be tangible. For instance, based on the market situation and data up to January 2005, under the scenario where US interest rates rise by 120 bps in the twelve months from February 2005 and the risk premium of Hong Kong dollar over the US dollar reverts back to its normal level (i.e. HIBORs rise to close to the level of their US counterparts), the net mortgage margin for loans financed by a mix of customers' deposits would be materially curtailed, while loans financed purely with interbank placements would become loss-making assets of banks.

Indeed, the reduction of the interest rate margin has already been taking place since January 2005, with HIBOR3 rising by 190 bps, but BLR only by 45 to 70 bps.[2] For the mortgage portfolios that banks acquired during January 2005, the margins for HIBOR-financed loans has been reduced by 125 bps. For those financed by customers' time deposits or a mix of customers' demand, savings and time deposits, their margins have also been reduced by 17 bps and 7 bps respectively. Further reductions may be expected if the above scenario continues to materialise.

The issue has become particularly noticeable since early April this year, with some banks starting to quote different BLRs in order to preserve the interest margin of their existing portfolios amid rising interbank rates. There are concerns that the different BLRs among banks may cause confusion to mortgage borrowers.

In view of the above, there have been calls to consider the merits of adopting an alternative reference rate (to the BLR) for the setting of the mortgage rate.

THE ANALYSIS

A brief survey shows that the practice of setting mortgage rates varies among countries. In the US and Japan, fixed rates mortgage loans are more common, while in the UK, Switzerland and Australia variable rates are more popular. When the mortgage rates are adjustable, the reference rates chosen are commonly the interest rates which reflect banks' cost of funds. They are either tied to the Treasury bond or a cost of funds index, like that in the US, or they are adjusted in line with the policy rates of the central banks, like that in the UK (the base rate of the Bank of England) and Australia (the cash rate of the Reserve Bank of Australia).

Drawing on overseas experience, several local interest rates are examined in order to assess their relevance as possible reference rates for the setting of mortgage rates in Hong Kong, including

[2] The interest rates are monthly average rates, covering data up to May 2005. Using daily data, HIBOR3 was in fact at par with LIBOR by the end of May 2005.

3-month HIBOR (HIBOR3):	The rate of interest offered on Hong Kong dollar loans by banks in the interbank market for a 3-month period
Effective deposit rate (EDR):	The average interest rate on demand, savings and time deposits offered by selected banks weighted by the deposit composition of the entire banking sector. EDR is currently calculated by the HKMA for research purposes[3]
Composite interest rate of HIBOR3 and EDR (composite rate):	The average interest rate of HIBOR3 and EDR weighted by the amount of interbank borrowings and the deposit composition of the entire banking sector. The composite rate is currently calculated by the HKMA for research purposes[2]
Base Rate of the HKMA (Base Rate):	The interest rate the HKMA charges licensed banks when they approach the Discount Window for overnight liquidity
Yield of the 3-year Exchange Fund Note (EFN3):	The official mid-yield fixing of the 3-year benchmark Exchange Fund Note

The assessments are made by evaluating their appropriateness based on criteria of consumers' requirements and factors relevant to banks.

(i) From borrowers' point of view, they would prefer a reference rate that is stable and with a low level of volatility. This is important as borrowers normally have a steady monthly income and would like to limit fluctuations in their monthly mortgage payments. In addition, it should be market-determined, simple, transparent and easy to understand. To avoid confusion, there should be only one such rate in the market and for all banks.

(ii) From banks' point of view, important criteria for a good reference rate are that it should closely represent (and move in line with) banks' cost of funds, and there should exist efficient hedging instruments, so that on the whole the use of such reference rate helps banks in their interest rate risk management. In addition, the factors relevant to customers are also relevant to banks.

[3] The method of calculation is explained in Annex III.

Administrative simplicity is an important factor to be considered by banks. The criteria that the rate should be unique, simple and easy to understand would help banks in their daily operation, in particular in their dealing with customers. At the same time, a mortgage rate with lower volatility would help reduce repayment risk of customers.

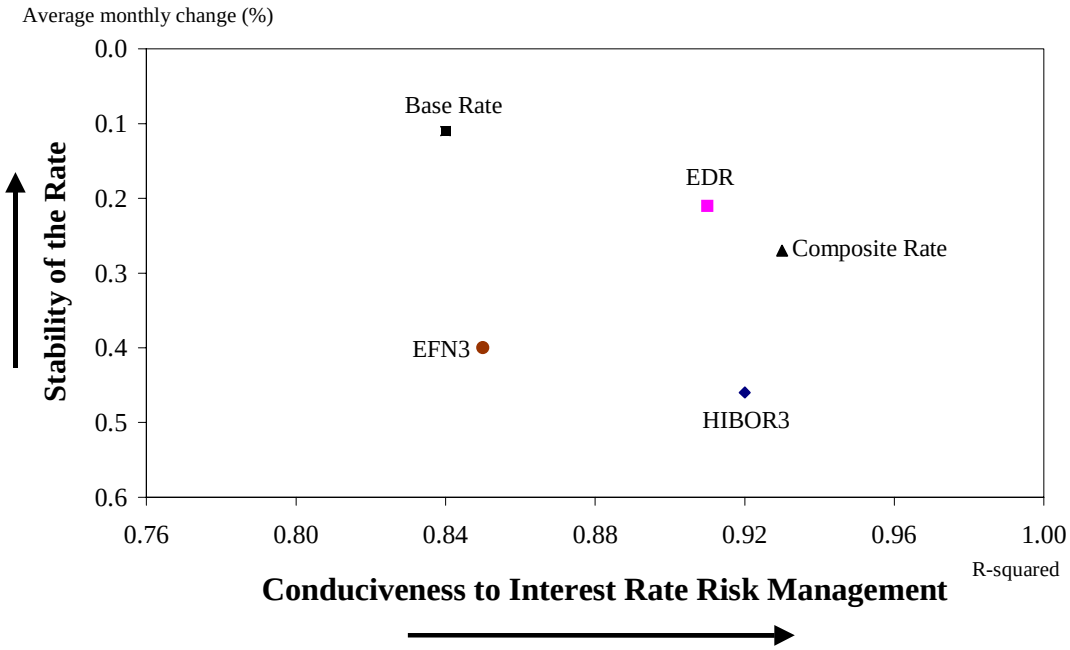
To the extent that the use of an alternative reference rate will benefit banks' risk management, it would result in reductions in credit and management cost. Through competition, some of this gain would be passed through to customers in the form of lower mortgage rates.

Based on our econometric analysis and qualitative assessments, the merits and drawbacks of the alternative reference rates under study are highlighted below. In the selection of an appropriate reference rate, these merits and drawbacks should be carefully assessed and weighted against each others. A balance will have to be struck between the requirements of customers and banks.

	Merits	Drawbacks
HIBOR3	• One single rate for all banks and relatively well known to the public • Completely market determined. • Simple, transparent, and easy to understand. • It is a good measure of banks' short-term cost of funds at the wholesale level. • The availability of exchange-traded and OTC derivative instruments also enhances its conduciveness to risk management.	• It has a higher volatility, in terms of both the average monthly changes and the frequency of changes, as compared with most other reference rates.
EDR	• Only one single rate for all banks, which is largely market determined. • A good measure of the short-term cost of funds at the retail level. However, in terms of desirability per interest rate risk management, it is not as good as the composite rate and HIBOR3. • Less volatile than the composite rate and HIBOR3.	• Data collection and calculation are required. Nevertheless, as the HKMA is currently compiling EDR for research purposes, only a small amount of additional work would be required. • The concept is not difficult to understand, but it is more complex than the others. • No direct hedging instruments are available.
Composite Rate	• Only one single rate. • Largely market determined. • It offers the best measure of banks' cost of funds (better than HIBOR3 and EDR) as it represents the funding cost of an average bank with mixed funding sources. • Although no complete hedging instruments are available, partial hedging can be done for the HIBOR element of the rate. The close approximation to cost of funds also reduces the need for hedging. • Volatility less than HIBOR3, but larger than EDR.	• The same drawbacks as EDR.
Base Rate	• A unique and transparent standard rate. • The lowest volatility among the alternative rates under study.	• Its movements mainly reflect changes in the US policy rate. As the liquidity condition in Hong Kong and the US may at times be different, it may not be a good measure of banks' funding cost. • The rate is downwardly rigid, barred by the level of Fed Funds target rate, but with no cap on upward adjustment. • Less well known to customers.
EFN3	• Similar to HIBOR3, it is unique, market determined, and has direct hedging instruments available.	• Similar to HIBOR3, it has a higher volatility. • It is not as good a measure of banks' funding cost as HIBOR3, EDR or the composite rate. • Less well known to customers.

Using a two-dimensional chart, we illustrate the relative positions of the five alternative reference rates in terms of the two major criteria - their stability and conduciveness to interest rate risk management. Note that the scale (or unit) used to plot the chart is arbitrary as the relative weights of the criteria are not known. The chart shows that the ranking of the five rates is clear in terms of each of the two major criteria. However, their ranking based on the combined performance of the two criteria is not easy to determine, although some rough ideas can still be obtained from the chart. In the complete analysis, other factors including the criteria of being simple, transparent and easy to understand, as well as administrative simplicity, should also be considered. The weights given to each of the criteria in the evaluation of the suitability of the alternative reference rates can be drawn from industry experience.

Ranking of the Reference Rate in terms of
Stability and Conduciveness to Interest Rate Risk Management



Notes:
1. Stability is measured by the volatility of the reference rate, which is defined as the average monthly changes (in absolute term) in the reference rate from January 1997 to April 2005, including the Asian financial crisis period (as shown in Table 2). The lower the volatility (or the lower the average monthly change), the higher the stability, and vice versa.
2. Conduciveness to interest rate risk management is measured by the goodness of fit of the regression using the specific rate to explain the actual mortgage rate (measured by the adjusted R-squared as presented in Annex IV). The higher the R-squared, the higher the conducivenesses to interest rate risk management, because the reference rate would track the funding cost more closely.

It is noted that mortgage products with reference rates other than BLR are currently being offered in the market. However, they are not as popular as BLR. This may be due to: i) their high volatility in the past, ii) the lack of standardisation in terms of product features and price fixing, and iii) the lack of promotion and low transparency of the products.

If any of the above rates is chosen to be the alternative reference rate, smoothing methods may be employed to reduce its volatility. This is quite important for both the borrowers and the banks. Borrowers will be skeptical about the use of a reference rate that could fluctuate widely within a short period of time, such as during the Asian financial crisis when, for example, the composite rate rose by 7.3 percentage points, from 6.1% on 9 September 1997 to 13.4% on 23 October 1997, and HIBOR3 surged correspondingly from 7.3% to 25%, an increase of 17.8 percentage points. On a one-month average basis, on the other hand, the composite rate only rose by 1 percentage point, from 6.3% in September to 7.3% in October 1997, and HIBOR3 increased from 7.5% to 10%, up by 2.5 percentage points. The "smoothed" reference rate can be used as the standard reference rate, which would be made public on a pre-determined regular basis (for example monthly or quarterly). If the one-month average is used, the reference rate for the current month would be calculated based on the average of the daily rates of the previous month. The new reference rate would be announced on the first day of the current month and would be applicable for the pricing of new mortgage loans and the re-pricing of existing mortgage loans in banks' mortgage portfolios throughout the month.

To further reduce the frequency of mortgage rate adjustments so as to improve borrowers' acceptance to the chosen reference rate, a rule may be adopted so that a change in the mortgage rate would be made only if the reference rate changes by more than a prescribed amount, for example, by more than 25 bps. To illustrate this, by assuming the composite rate is used as the mortgage reference rate and the above rule is adopted, the number of instances that the mortgage rate would need to be changed from January 2001 to April 2005 would be 12 times based on the monthly average reference rate. This compares with 15 actual adjustments in the BLR during the same period.

On the other hand, it may be desirable to have contingency arrangements in place, under which the composite rate can be adjusted before the regular rate fixing date, if necessary, such as when interest rates move drastically. The conditions for activating such arrangements should be clearly specified,[4] in addition to the normal rule governing how the rate is adjusted regularly on a monthly basis.

[4] Detailed arrangements should be worked out by the industry, if an alternative reference rate is to be adopted.

To promote such a reference rate, its specific features should be carefully designed in order to increase borrowers' acceptance. In addition, the calculation and fixing of such reference rate should be standardised. Promotion, such as educational campaigns, would need to be made to improve public understanding.

A new reference rate can be introduced either as an alternative or as a replacement for the BLR. Given the need for BLR to continue to be the reference rate for loans made prior to the introduction of a new reference rate, it would be desirable to have the new reference rate introduced to the market along with the BLR. Market forces will determine which rate is better received by borrowers.

WAY FORWARD

Given the widespread use of BLR as a reference rate for mortgage lending and other loan products, and its dominance in existing loan contracts, any change in the pricing method would have far-reaching impacts on the mortgage market. Administratively, it could also be a complex process.

While the HKMA has a supervisory interest in the vulnerability of bank earnings to interest rate risk, it is up to the industry to decide which reference rate to use for mortgage lending. If it is agreed that any of the above rates can be considered as an alternative reference rate, a more complete analysis would be required to assess the cost and benefit for such a move. Such a complete study would require the active involvement of the banking industry. We would be happy to assist in the process, through participating in the discussion and by providing technical support.

If a decision is made to introduce an alternative reference rate, the HKMA is prepared to help ensure its transparency through encouraging the use of a single rate and the standardisation of its calculation and quotation. In particular, if the composite rate is adopted, the HKMA could help by taking up the task of the computation and announcement of the rate, if deemed desirable.

I. INTRODUCTION

Currently, the lending rates for most mortgage loans are set with reference to the Best Lending Rate (BLR). Such a pricing method has been adopted by banks for many years, and it is well received by borrowers. While mortgage products with fixed rates or rates set with reference to Hong Kong Interbank Offered Rates (HIBORs) are also offered in the market, they have not been popular.

It is, however, commonly accepted that the use of BLR as a reference rate for pricing mortgage is not necessarily conducive to banks' management of interest rate risk, as the movement of BLR may in times deviate significantly from the cost of funds. This is particularly the case for those banks which do not have a sufficiently large BLR-related deposit base which is commensurate with their BLR-based lending.[5] In times when HIBORs rise faster than BLR (typically during an interest rate hike cycle or when the risk premium of the Hong Kong dollar over the US dollar widens), the interest margin of these banks' existing mortgage portfolios would be squeezed. Such basis risk is one of the major sources of risk underlying the interest rate risk exposures of banks that are active in mortgage activities. If the level of the basis risk in some banks is high due to the current interest rate environment, this may lead to a material decline in their earnings and may impact on banking and financial stability.

The market conditions during late January to April this year demonstrate vividly such risk. Intense competition drove down the mark-ups of effective mortgage rates relative to the BLR to as low as around minus 3 percentage points by January 2005, which was made possible by the extraordinary low funding cost, with HIBOR being at an unusually deep discount to LIBOR of about 200 bps. However, with US interest rates rising and as funding cost increased faster than the BLR in subsequent months, the margin on loans priced on the previously very low funding cost came under pressure.

Simulation results of our study show that such a squeeze of margin could be tangible. For instance, based on the market situation and data up to January 2005, under the scenario where US interest rates rise by 120 bps in the twelve months from February 2005 and the risk premium of Hong Kong dollar over the US dollar reverts back to its normal level (i.e. HIBORs rise to close to the level of their US counterparts), the net mortgage margin for loans financed by a mix of customers' deposits would be materially curtailed, while loans financed purely with interbank placements would become loss-making assets of banks.[6]

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[5] In this paper, BLR-related deposits refer to retail deposits (such as savings deposit rates) of which the interest rates move largely in tandem with the BLR.

[6] See HKMA Research Memorandum 05-2005 "Interest Rate Risk in the Pricing of Banks' Mortgage Lending".

Indeed, the reduction of the interest rate margin has already been taking place since January 2005, with HIBOR3 rising by 190 bps, but BLR only by 45 to 70 bps.[7] For the mortgage portfolios that banks acquired during January 2005, the margins for HIBOR-financed loans has been reduced by 125 bps. For those financed by customers' time deposits or a mix of customers' demand, savings and time deposits, their margins have also been reduced by 17 bps and 7 bps respectively. Further reductions may be expected if the above scenario continues to materialise.

In addition, since the abolition of the Interest Rate Rules (IRR), banks are free to set their BLR-related deposit rates. To maximise profit, banks may make different adjustments to these deposit rates according to their different balance sheet positions. In the past, BLR set by the major banks which have a large retail deposit base was largely followed by other banks, even if the latter did not have the same retail deposit base.[8] However, more recently some banks have changed their practice, and have raised their BLR independently of the major banks in order to preserve the interest margin of their existing portfolios amid rising interbank rates.[9]

With banks changing their previous practice of making concerted adjustments for their BLRs, there are concerns that the different BLRs among banks may cause confusion to mortgage borrowers. In view of the above, there have been calls to consider the merits of adopting an alternative reference rate (to the BLR) for the setting of the mortgage rate.[10] By drawing on overseas experience and by examining the characteristics of the various local interest rates, this paper investigates the possibilities, and the pros and cons, of the use of these rates as an alternative reference rate.

It should however be stressed that, given the widespread use of BLR as a reference rate for mortgage lending and other loan products, and its dominance in existing loan contracts, any change in the pricing method would have far-reaching impacts. Administratively, it could also be a complex process. Due to the absence of relevant data (such as the cost data), a complete assessment of the cost and benefit of a change is beyond the scope of this paper.

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[7] The interest rates are monthly average rates, covering data up to May 2005. Using daily data, the three-month HIBOR was in fact at par with LIBOR by the end of May 2005.

[8] Although the BLR was not part of the IRR, it was in most cases adjusted along with changes in retail deposit rates. When differences in the movements of BLR and HIBORs emerged, in the trade-off between variability of interest margins and the maintenance of market shares, the smaller banks usually chose to accept a degree of margin variability (sometimes a squeeze in the margin of the existing mortgage portfolios), in order to maintain market shares.

[9] A few small and medium-sized banks raised their BLR by 25 bps in early April amid rising interbank rates, while the three big banks with large retail customers' deposits did not adjust their BLR. Instead, they raised their effective mortgage rates to a level compatible to these small and medium-sized banks by increasing the mark-ups slightly and eliminating cash rebates to mortgage borrowers.

[10] Some banks proposed alternative reference rates which are either based on HIBORs or the Base Rate of the HKMA. However, some other banks still consider that the BLRs should be used as the reference rate.

II. OVERSEAS EXPERIENCE

The practice of setting mortgage rates varies among countries. Tables A1 and A2 of Annex I report the mortgage features of six main developed economies and a number of EU countries respectively. The tables suggest that the mortgage markets in these countries are characterised by different types of mortgage contracts, partly reflecting regulatory differences and partly contracts and conventions established in earlier periods. It should be noted that rather than converging towards a certain type of contracts or mortgage rates, the mortgage markets are characterised by different variations in the products. This has made the "typical" products almost impossible to define.

In Table A1, it is shown that in the US and Japan, fixed rates mortgage loans are more common, while in the UK, Switzerland and Australia variable rates are more popular. When the mortgage rates are adjustable, the reference rates chosen are commonly the interest rates which reflect banks' cost of funds. They are either tied to the Treasury bond or a cost of funds index, like that in the US, or they are adjusted in line with the policy rates of the central banks, like that in the UK (the base rate of the Bank of England) and Australia (the cash rate of the Reserve Bank of Australia). In Germany, the mortgage loans are mostly fixed for at least one year and up to five years, or over five years to until maturity, before being renegotiated. A more detailed description of the use of some of these reference rates for the pricing of mortgage loans in respective countries is given in Annex II.

In other EU countries such as Belgium, Denmark and the Netherlands, mortgage rates are mostly fixed for more than five years to until final maturity. On the other hand, in countries like Greece, Luxembourg, Portugal and Finland, mortgage rates are variable and are renegotiable or tied to market rates after being fixed for less than one year (see Table A2 of Annex I).

III. POSSIBLE ALTERNATIVE REFERENCE RATES: AN EVALUATION

3.1 Some Suggested Criteria

Drawing on overseas experience, we examine a number of local interest rates as possible reference rates for mortgage rate setting, which can serve as alternatives to the BLR. Such possible alternatives include:[11]

[11] The use of similar interest rates of different maturities as reference rates can also be examined. For simplicity, only these rates with the specific maturity as listed are assessed in this paper.

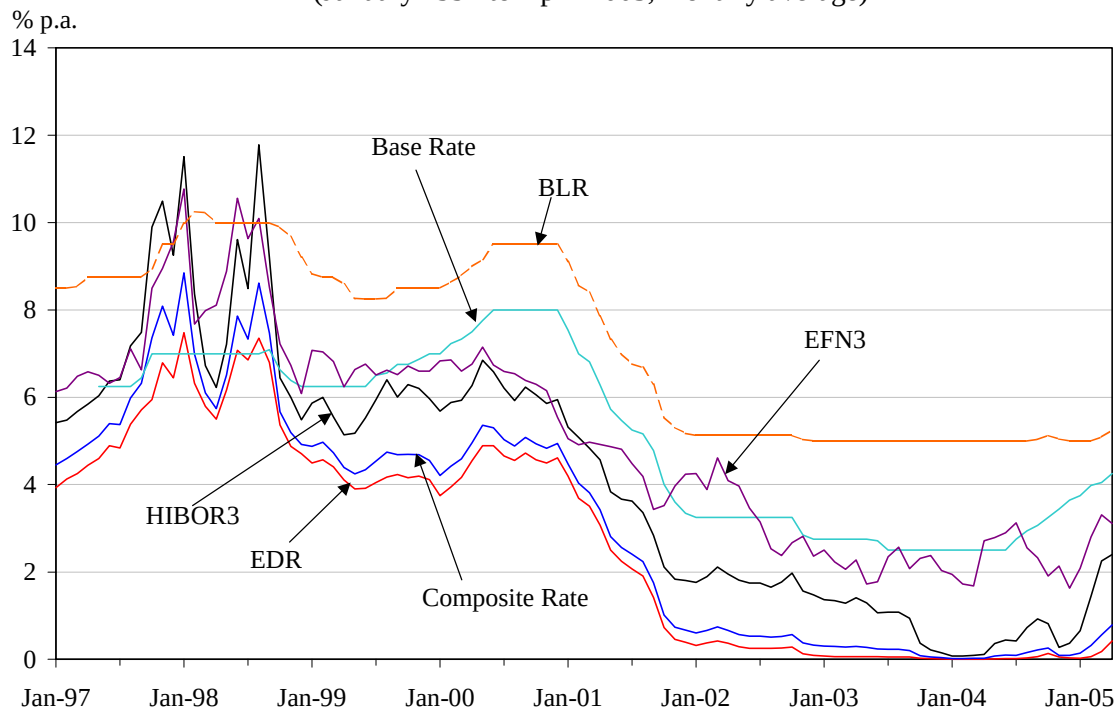
3-month HIBOR (HIBOR3):	The rate of interest offered on Hong Kong dollar loans by banks in the interbank market for a 3-month period
Effective deposit rate (EDR):[12]	The average interest rate on demand, savings and time deposits offered by selected banks weighted by the deposit composition of the entire banking sector. EDR is currently calculated by the HKMA for research purposes
Composite interest rate of HIBOR3 and EDR (composite rate):[13]	The average interest rate of HIBOR3 and EDR weighted by the amount of interbank borrowings and the deposit composition of the entire banking sector.[13] The composite rate is currently calculated by the HKMA for research purposes
Base Rate of the HKMA (Base Rate):	The interest rate the HKMA charges licensed banks when they approach the Discount Window for overnight liquidity
Yield of the 3-year Exchange Fund Note (EFN3):	The official mid-yield fixing of the 3-year benchmark Exchange Fund Note

[12] A detailed discussion of the construction of EDR and the composite rate is given as a technical note in Annex III.

[13] The amount of interbank borrowings is taken from the Monthly Statistical Bulletin and refers to the Hong Kong dollar borrowings by authorized institutions in the local interbank market and abroad regardless of maturity.

Chart 1 shows the movements of these alternative reference rates and the BLR since 1997.

Chart 1. Alternative Reference Rates and BLR
(January 1997 to April 2005, monthly average)



In the evaluation of their appropriateness, several criteria are considered, some of which are highlighted by the drawbacks of using BLR as a reference rate. These criteria can be classified into two groups: criteria from consumers' requirements and factors relevant to banks:

(i) From borrowers' point of view, they would prefer a reference rate that is stable and with a low level of volatility. This is important as borrowers normally have a steady monthly income and would like to limit fluctuations in their monthly mortgage payments. In addition, it should be market-determined, simple, transparent and easy to understand. To avoid confusion, there should be only one such rate in the market and for all banks.

(ii) From banks' point of view, important criteria for a good reference rate are that it should closely represent (and move in line with) banks' cost of funds, and there should exist efficient hedging instruments, so that on the whole the use of such reference rate helps banks in their interest rate risk management.[14] In addition,

[14] Another way of calculating banks' cost of funds is the one adopted by the Federal Home Loan Bank of San Francisco in the US for the calculation of the Eleventh District Cost-of-Funds Index. For details of its calculation, as well as the advantages and drawbacks of the use of such an index, please refer to Annex II and footnote 30.

the factors relevant to customers are also relevant to banks. Administrative simplicity is an important factor to be considered by banks. The criteria that the rate should be unique, simple and easy to understand would help banks in their daily operation, in particular in their dealing with customers. At the same time, a mortgage rate with lower volatility would help reduce repayment risk of customers.

To the extent that the use of an alternative reference rate will benefit banks' risk management, it would result in reductions in credit and management cost. Through competition, some of this gain would be passed through to customers in the form of lower mortgage rates.

3.2 The Evaluation

Based on our econometric analysis and qualitative assessments, the relative features of the possible reference rates, in terms of the various criteria from customers' requirements and banks' considerations, are discussed in this section, and the merits and drawbacks of these rates are illustrated in Table 1 below. The discussions are summarised in Annex IV.

Table 1. Merits and Drawbacks of Alternative Reference Rates

	Merits	Drawbacks
HIBOR3	• There is only one single rate for all banks and it is relatively well known to the public. • The rate is completely market. • It is simple, transparent, and easy to understand. • HIBOR3 is a good measure of banks' short-term cost of funds at the wholesale level. • The availability of exchange-traded and OTC derivative instruments also enhances its conduciveness to risk management.	• It has a higher volatility, in terms of both the average monthly changes and the frequency of changes, as compared with most other reference rates.
EDR	• There is only one single rate for all banks, which is largely market determined, as its calculation includes retail savings and time deposit rates of selected banks. • It is a good measure of the short-term cost of funds at the retail level. However, in terms of desirability per interest rate risk management, it is not as good as the composite rate and HIBOR3. • Less volatile than the composite rate and HIBOR3.	• Data collection and calculation are required. Nevertheless, as the HKMA is currently compiling EDR for research purposes, only a small amount of additional work would be required. • The concept is not difficult to understand, but it is more complex than the others. • No direct hedging instruments are available.
Composite Rate	• Similar to EDR, there is only a single rate for all banks and • It is largely market determined. • It offers the best measure of banks' cost of funds (better than HIBOR3 and EDR) as it represents the funding cost of an average bank with mixed funding sources. • The use of composite rate as a reference rate would reduce banks' mortgage margin variability and help reduce banks' exposure to interest rate risk. • Although no complete hedging instruments are available, partial hedging can be done for the HIBOR element of the rate. The close approximation to cost of funds also reduces the need for hedging. • Its volatility is less than HIBOR3, but larger than EDR.	• It has the same drawbacks as EDR.
Base Rate	• A unique and transparent standard rate. • It has the lowest volatility among the alternative rates under study.	• Its movements mainly reflect changes in the US policy rate. As the liquidity condition in Hong Kong and the US may at times be different, it may not be a good measure of banks' funding cost. • The rate is downwardly rigid, barred by the level of Fed Funds target rate, but with no cap on upward adjustment. • Less well known to customers.
EFN3	• Similar to HIBOR3, it is unique, market determined, and has direct hedging instruments available.	• Similar to HIBOR3, it has a higher volatility. • It is not as good a measure of banks' funding cost as HIBOR3, EDR or the composite rate. • Less well known to customers.

3.2.1 Customers' Requirements

All the possible rates under study have a single rate, and they are either fully or largely market determined. HIBOR3 has the advantage of being completely market determined. It is widely quoted in the market and is relatively well known to borrowers. Unlike HIBOR3 which has a daily fixing provided by The Hong Kong Association of Banks (HKAB), the derivation of EDR and composite rate requires data collection and calculation. Nevertheless, as the HKMA is currently compiling EDR as a routine for research purposes, the additional work required would be moderate. The concepts of these rates are not difficult to understand but they are relatively more complex than the others. Some efforts would be required to explain the calculation of these rates to the borrowers. Both EFN3 and the Base Rate are quoted in the market but they have the disadvantage of not being well known to retail borrowers.[15]

However, in terms of volatility of the possible rates – the most important criterion as far as customers' requirements are concerned – EDR, the composite rate and the Base Rate are clearly superior to HIBOR3 and EFN3. In this study, we assess their relative volatility by comparing the average monthly fluctuations of these rates during specific periods, which is presented in Table 2. It shows that the average monthly variations of HIBOR3 and EFN3, at 0.46% and 0.40% respectively, are significantly larger than that of EDR (0.21%), the composite rate (0.27%) and the Base Rate (0.11%). This is particularly the case during the Asian financial crisis, when the monthly average of HIBOR3 and EFN3 surged to as high as 10% and 8.5% respectively in October 1997, while EDR, the composite rate and the Base Rate only rose to 6%, 7.3% and 7% respectively.

[15] This may change over time as Exchange Fund Notes are now being issued specifically for retail investors.

Table 2. Volatility of Monthly Payment Burden of Possible Reference Rates

	January 1997 to April 2005 (The period including the Asian financial crisis) (%)	January 1999 to April 2005 (%)
Reference rate		
HIBOR3	0.46	0.24
EDR	0.21	0.12
Composite Rate	0.27	0.14
Base Rate	0.11	0.12
EFN3	0.40	0.29
Memorandum item		
BLR	0.10	0.09

Note: Volatility (in %) is defined as the average monthly changes (in absolute term) in the reference rate over the specific period. The higher the figure, the higher the volatility.

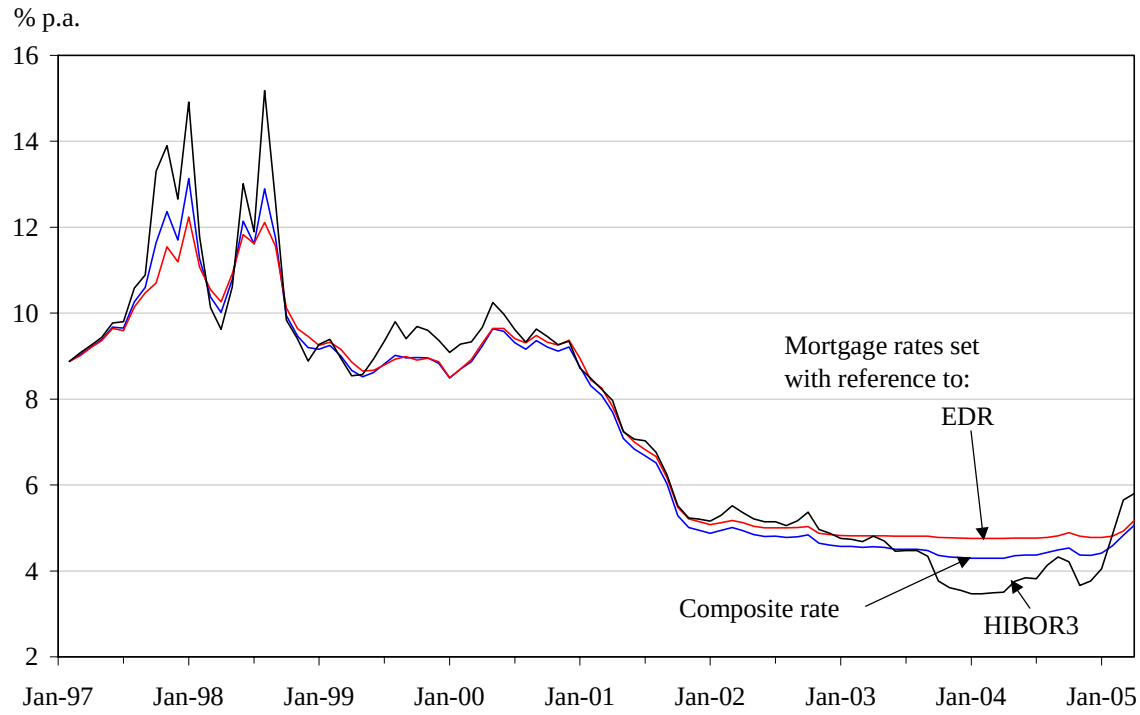
In Table 3, we compare the changes in the alternative reference rates during two particularly volatile periods, September / October 1997 and July / August 1998. We find that in terms of both changes in the monthly average rates and the differences between the highest and the lowest daily rates, HIBOR3 has the largest variations, followed by EFN3 or the composite rate, while EDR and the Base Rate have the smallest changes.

Table 3. Changes in Monthly Average Rates and Differences between Daily High and Low of Reference Rates during Two Particularly Volatile Periods

	Asian financial crisis (October 1997 / September 1997)		Government stock market operation (August 1998 / July 1998)	
	Increase in the monthly average rate (%)	Difference between High / Low (%)	Increase in the monthly average rate (%)	Difference between High / Low (%)
Reference Rate				
HIBOR3	2.5	17.8	3.3	10.5
EDR	0.2	1.5	0.5	1.3
Composite rate	1.0	7.3	1.3	3.9
EFN3	1.9	2.7	0.1	0.5
Base Rate	0.5	0.8	0.0	0.0
Memorandum item				
BLR	0.2	0.8	0.0	0.0

Chart 2A shows the movements of derived mortgage rates since February 1997 based on HIBOR3, EDR and the composite rate for loans priced in January 1997, and Chart 2B presents their relative monthly fluctuations. It is clear that both EDR and the composite rate are more stable than HIBOR3 and have lower monthly fluctuations.[16]

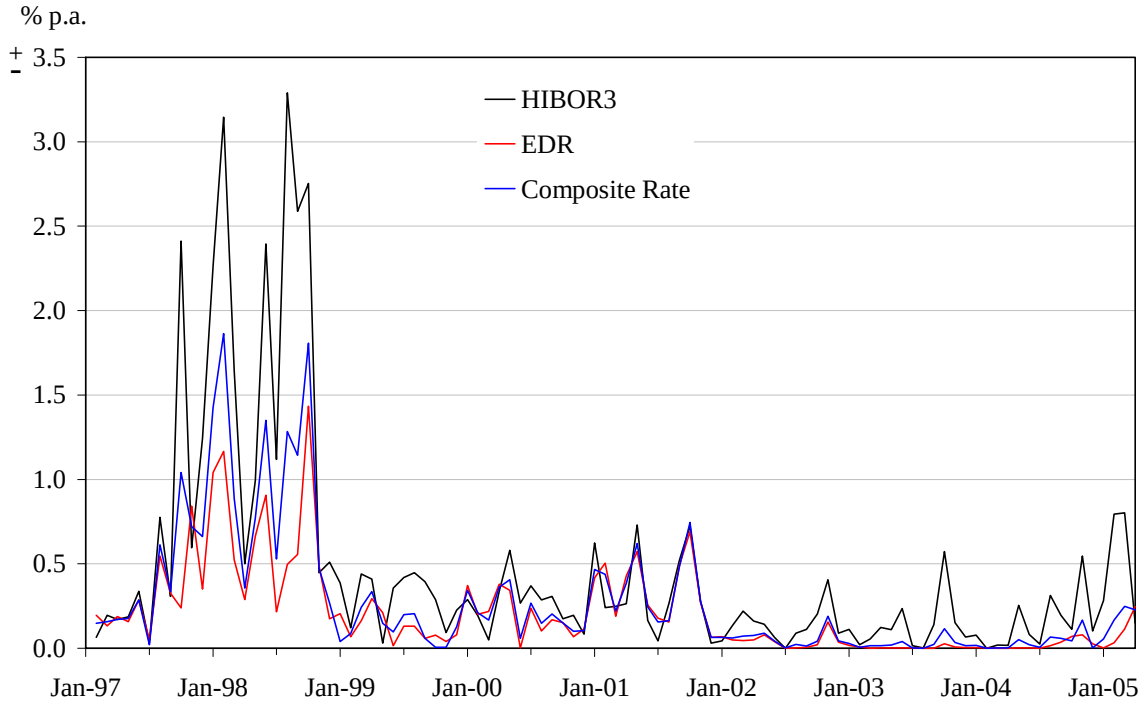
Chart 2A. Mortgage Rates Based on Possible Reference Rates
(for mortgage loans priced in January 1997 with constant mark-ups throughout the remaining contractual period)



Note: The mark-ups of mortgage rate over the reference rates are as follows: HIBOR3 + 3.4%, EDR + 4.8% and Composite rate + 4.3%.

[16] The patterns of derived mortgage rates based on EFN3 and the Base Rate are not shown here. Their relative performances as compared with HIBOR3, EDR and the composite rate are similar to those represented by the figures in Table 2.

Chart 2B. Relative Monthly Fluctuations of Selected Reference Rates
(February 1997 to April 2005, monthly average, in absolute term)



Note: The fluctuations are in terms of monthly absolute changes, which can be an increase or a decrease in the specific month.

3.2.2 Banks' Considerations

This section focuses on the criteria regarding interest rate risk management.

(a) A good measure of cost of funds

A reference rate which closely reflects the average funding cost of banks could offer a stable margin for the loan portfolio once the pricing is fixed. As a constant mark-up over such reference rate is guaranteed by the contracts and the movement of such reference rate resembles the cost of funds, such a pricing would be conducive to banks' interest rate risk management.

To test which reference rate has such a property, we examine how each of the rates might have been considered (as cost of funds) in the setting of mortgage rate during the period from January 1999 to April 2005. Using monthly average interest rate data, the assessment is done by a single equation regression analysis which is specified with the average mortgage rate as the dependent variable, and each of these reference rates as the

explanatory variable.[17] The estimation results (presented in Table A6 of Annex V) indicate that the composite rate, as a funding cost proxy, offers the best approximation to the actual mortgage rate, judging form the adjusted R-squared statistic of the regression and the fitted average mortgage rate. This is followed by HIBOR3 and EDR. EFN3 and the Base Rate have a lower goodness of fit and are poor approximations to the funding costs.

These econometric results are largely expected. In the wholesale market, the interbank rate is certainly one of the best measures of cost of funds. It is most widely traded and reflects closely the short-term funding cost of banks, in particular those who do not have a large retail deposit base. In the retail market, on the other hand, for banks which have a large retail deposit base, the most widely quoted funding costs are the savings deposit rates and time deposit rates. To measure the aggregate change in such cost of funds, the EDR is derived, which is defined as the average interest rate on demand, savings and time deposits weighted by the deposit composition of the entire banking sector. However, as most of the banks have a mix of funding sources, the composite rate, which is the weighted average of EDR and HIBOR3, is a better measure of cost of funds than HIBOR3 and EDR.

The Base Rate is the interest rate that the HKMA charges licensed banks when they come to the Discount Window operated by the HKMA, with Exchange Fund paper, at the end of the day when they find themselves short of liquidity. The Base Rate is set mechanically through the use of a transparent formula, which is 150 basis points above the prevailing US Fed Funds Target Rate or the average of the five-day moving averages of the overnight and one-month HIBOR, whichever is the higher. Hence, the Base Rate is automatically determined without any discretion from the HKMA or any banks.[18]

Given this, the Base Rate may at times be not a good measure of banks' funding cost, when the liquidity condition in Hong Kong is different from that in the US.[19] The Base Rate also has the characteristic of being downwardly rigid in particular situations. Specifically, when there is ample of liquidity in the banking system which drives the interbank rates to a low level, banks will enjoy a widening of mortgage margin, as customers will be stuck with the same Base Rate, if there is no policy rate adjustment in the US. On the other hand, when there is a shortage of liquidity in the banking system and the short-term interbank rates rise to a high level, the Base Rate will adjust upward. There is no cap on

[17] In the analysis, the changes in pricing due to competition and changes in operating costs are assumed to be the same under the various scenarios of using different reference rates.

[18] It should be noted that the use of the Base Rate of the HKMA is different from the policy rates of other central banks, such as the base rate of the Bank of England or the cash rate of the Reserve Bank of Australia. In the UK and Australia, their policy rates are used as a monetary policy instrument to influence the short-term interest rates, and thus the interest rate structures in the respective financial markets (see Annex II for a discussion of these policy rates). On the other hand, under the Currency Board system in Hong Kong, the Base Rate of the HKMA mainly follows the interest rate movement in the US.

[19] For example, the Base Rate was raised eight times from June 2004, but the short-term interbank rates fell to their low levels up to early January this year, before rising in the subsequent months.

upward adjustments.[20, 21]

Similar to the Base Rate, EFN3 clearly does not offer as good a fit as the other three rates, suggesting that it probably plays a lesser role in banks' decisions of setting the mortgage rate.

(b) Variability of interest rate margins

To assess how the various reference rates may perform under the criterion of offering a stable interest rate margin, we study possible changes in the margin variability of an actual mortgage portfolio acquired in January 1999, based on monthly average interest rates. Under the scenarios of adopting different reference rates, we examine how the variability of such portfolio's margin may be affected based on the two identified best measures of average funding costs – the composite rate and HIBOR3. The results, as reported in Table 4 and Annex VI, show that on the whole a mortgage rate that is set with reference to a composite rate or HIBOR3 offers lower margin variability, compared with those derived from using other reference rates.

[20] Under extraordinary situations, the Base Rate could rise to a level as high as HIBOR3. This makes mortgage loans using the Base Rate as the reference rate suffer from the same interest rate risk as using HIBOR3 as the reference rate.

[21] This asymmetry works clearly against borrowers. Note also that if the Base Rate is used as a reference rate, any revision of the formula of setting the Base Rate in the future would need to consider the reaction from the mortgage market.

Table 4. Variability of Margin for Banks' Mortgage Portfolio of January 1999[1,2]
(during the period January 1999 to April 2005)

	Average funding costs represented by	
	Composite rate	HIBOR3
Reference rate		
HIBOR3	0.42	0.00
EDR	0.14	0.55
Composite rate	0.00	0.42
Base Rate	0.47	0.64
EFN3	0.64	0.74
Memorandum item		
BLR	0.36	0.72

Notes: 1. The margin is defined as the mortgage rate set with the reference rate plus a mark-up, less the cost of funds proxy.
2. Variability (in %) is defined as the standard deviation of margin during the period January 1999 to April 2005. It measures the average dispersion of margins from its mean level during the study period. The lower the figure, the lower the variability.

A lower margin variability is considered to be a desirable property in banks' risk management, which can be demonstrated especially when there is a sudden change in interest rates that goes against the mortgage margin. Based on monthly average interest rates, Table 5 illustrates how the interest margin of banks' mortgage portfolios may be squeezed when the mortgage rate is set with reference to BLR. By using the pricing data of loan portfolio acquired during January 2005 and the changes in cost of funds through April 2005, we show that the squeezes in the net mortgage margins were more severe when the mortgage rate was set with reference to BLR, than under the scenarios that the mortgage rates were set with reference to the composite rate or HIBOR3.[22]

[22] For a detailed study regarding the derivation of the estimated squeezes in interest margins, please refer to the HKMA Research Memorandum 05-2005 "Interest Rate Risk in the Pricing of Banks' Mortgage Lending".

Table 5. Estimated Squeezes of Interest Margins Resulting from the Recent Rise in Cost of Funds under Different Reference Rates[1,2]
(for banks' mortgage portfolio acquired during January 2005)

	The estimated squeeze compared with the margin in January 2005 (bps)		
	2005		
	February	March	April
(A) Cost of funds represented by the composite rate			
Reference Rate			
(i) BLR	-17	-33	-40
(ii) HIBOR3	63	118	110
(iii) Composite Rate	0	0	0
(B) Cost of funds represented by HIBOR3			
Reference Rate			
(i) BLR	-80	-151	-150
(ii) HIBOR3	0	0	0
(iii) Composite Rate	-63	-118	-110

Notes: 1. The mortgage margin is defined as the mortgage pricing less funding cost, operating cost and credit cost.
2. Positive figures indicate a widening of margin.

(c) Availability of hedging tools

Among the various local interest rates, only HIBOR3 and EFN3 have their derivative instruments traded in the HKEx, although the trading is not very active. As for other local interest rates, no hedging instruments are currently directly available in the market, but for the composite rate, partial hedging for its HIBOR element can be performed. Note that the need for hedging is less if a reference rate that reflects closely banks' funding costs is adopted.

3.2.3 Overall Assessment

Each of the possible reference rates has its own merits and drawbacks. In the selection of an appropriate reference rate, these merits and drawbacks should be carefully assessed and weighted against each others. A balance will have to be struck between the requirements of customers and banks. The weights given to each of the criteria in the evaluation of the suitability of the alternative reference rates can be drawn from industry experience. To illustrate this idea, we focus our assessment based on two major criteria in this section: (i) the stability of the reference rates which is key to customers' acceptance and (ii) the conduciveness to interest rate risk management in terms of whether the rate is a good measure of banks' cost of funds. The ranking of the reference rates based on these two criteria are given in Table 6 below:

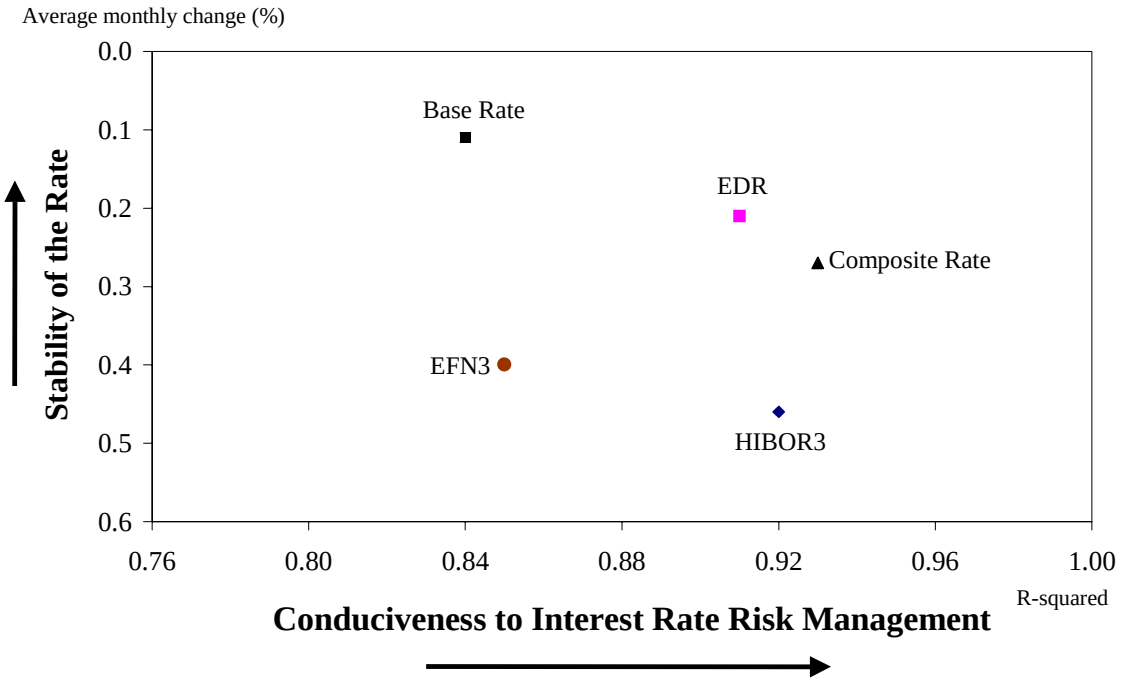
Table 6. Ranking of Possible Reference Rates

Ranking	Major Criteria: Stability of the rate[1]	Major Criteria: Conduciveness to interest rate risk management[2]
High 1	With an average monthly change of 0.11%, *Base Rate* has the lowest volatility among the reference rates.	*Composite rate* offers the best measure of cost of funds for an average bank which has a mix of wholesale and retail funding sources.
2	*EDR* has a slightly higher volatility than the Base Rate. Its average monthly change is 0.21%.	*HIBOR* is a good measure of banks' short-term cost of funds at the wholesale level.
3	The volatility of the *composite rate* is slightly higher than EDR, but less than EFN3 and HIBOR3. The average monthly change in the composite rate during the study period is 0.27%	*EDR* is a good measure of banks' short-term cost of funds at the retail level.
4	*EFN3* is slightly less volatile than HIBOR3. But its average monthly change of 0.4% is higher than other reference rates.	*EFN3* is not a good measure of banks' funding costs.
Low 5	*HIBOR3* has the highest volatility among the alternative rates under study. Its average monthly change over the study period is 0.46%.	*Base Rate*'s movements mainly reflect changes in the policy rate of the US. It may be in times not a good measure of banks' funding costs. In addition, the Base Rate has the asymmetric characteristic that it is downwardly rigid but with no cap on upward adjustment.

Notes:
1. Stability is measured by the volatility of the reference rate, which is defined as the average monthly changes (in absolute term) in the reference rate from January 1997 to April 2005, including the Asian financial crisis period (as shown in Table 2). The lower the volatility (or the lower the average monthly change), the higher the stability, and vice versa.
2. Conduciveness to interest rate risk management is measured by the goodness of fit of the regression using the specific rate to explain the actual mortgage rate (measured by the adjusted R-squared as presented in Annex V). The higher the R-squared, the higher the conducivenesses to interest rate risk management, because the reference rate would track the funding cost more closely.

Using a two-dimensional chart, we illustrate the relative positions of the five alternative reference rates in terms of the two major criteria - their stability and conduciveness to interest rate risk management (Chart 3). Note that the scale (or unit) used to plot the chart is arbitrary as the relative weights of the criteria are not known. The chart shows that the ranking of the five rates is clear in terms of each of the two major criteria. However, their ranking based on the combined performance of the two criteria is not easy to determine, although some rough ideas can still be obtained from the chart. Moreover, in the complete analysis, other factors including the criteria of being simple, transparent and easy to understand, as well as administrative simplicity, should also be considered.

Chart 3. Ranking of the Reference Rate in terms of Stability and Conduciveness to Interest Rate Risk Management



Notes:
1. Stability is measured by the volatility of the reference rate, which is defined as the average monthly changes (in absolute term) in the reference rate from January 1997 to April 2005, including the Asian financial crisis period (as shown in Table 2). The lower the volatility (or the lower the average monthly change), the higher the stability, and vice versa.
2. Conduciveness to interest rate risk management is measured by the goodness of fit of the regression using the specific rate to explain the actual mortgage rate (measured by the adjusted R-squared as presented in Annex V). The higher the R-squared, the higher the conduciveness to interest rate risks management, because the reference rate would track the funding cost more closely.

IV. CONCLUDING REMARKS

Each of the possible reference rates discussed above has its own merits and drawbacks. In the selection of an appropriate reference rate, these merits and drawbacks should be carefully assessed and weighted against each others. A balance will have to be struck between the requirements of customers and banks. The weights given to each of the criteria in the evaluation of the suitability of the alternative reference rates can be drawn from industry experience.

It is noted that mortgage products with reference rates other than BLR (such as HIBOR) are currently being offered in the market. However, they are not as popular as BLR. This may be due to: i) their high volatility in the past, ii) the lack of standardisation in terms of product features and price fixing, and iii) the lack of promotion and low transparency of the products.

If any of the above rates is chosen to be the alternative reference rate, smoothing methods may be employed to reduce its volatility.[23] This is quite important for both the borrowers and the banks. Borrowers will be skeptical about the use of a reference rate that could fluctuate widely within a short period of time, such as during the Asian financial crisis. The "smoothed" reference rate can be used as the standard reference rate, which would be made public on a pre-determined regular basis (for example monthly or quarterly basis). If the one-month average is used, the reference rate for the current month would be calculated based on the average of the daily rates of the previous month. The new reference rate would be announced on the first day of the current month and would be applicable for the pricing of new mortgage loans and the re-pricing of existing mortgage loans in banks' mortgage portfolios throughout the month.[24]

To further reduce the frequency of mortgage rate adjustments so as to improve borrowers' acceptance to the chosen reference rate, a rule may be adopted so that a change in the mortgage rate would be made only if the reference rate changes by more than a prescribed amount, for example, by more than 25 bps.[25] As an illustration, if we use the composite rate as the mortgage reference rate and adopt the above rule, the number of instances that the mortgage rate would need to be changed from January 2001 to April 2005 would be 12 times

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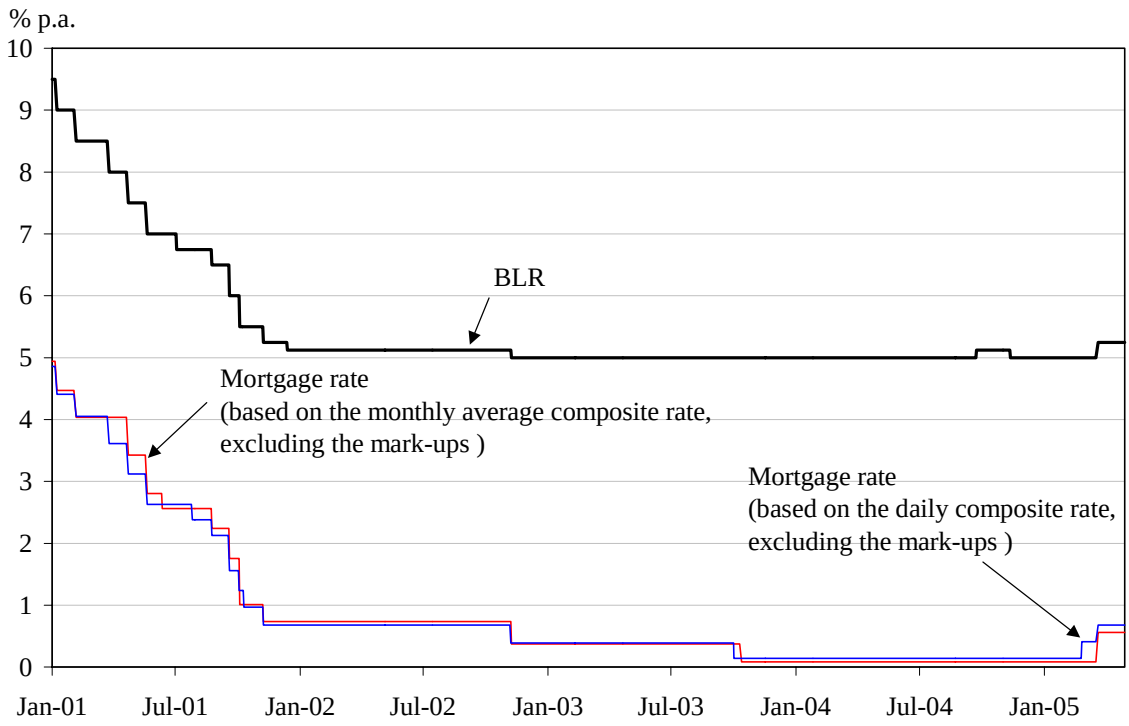
[23] Such as using the monthly or quarterly average of the daily rates.

[24] For example, the monthly average rate in March announced on the first day of April can be used for the pricing of new mortgage loans and the re-pricing of existing loans throughout April.

[25] The change will be assessed on a cumulative basis. For example, if the reference rate increases from 3% in the previous month to 3.24% in the current month, no change will be made on the mortgage rate. However, the mortgage rate will be adjusted when the composite rate increases by cumulatively more than 25 bps, say to 3.3% in the following month. Using a mark-up of 2 percentage points as an illustration, the mortgage rate would be at 5% in the previous month. The rate would not be changed in the current month, but will be raised by 30 bps to 5.3% in the following month.

based on the monthly average reference rate.[26] This compares with 15 actual adjustments in the BLR during the same period (see Chart 4).

Chart 4. Adjustments of the Mortgage Rate (based on a prescribed triggering rule) and BLR*



* Prescribed adjustment rule: a change in the mortgage rate would be made only if the reference rate changes by more than 25 bps.

[26] The mortgage rate would need to be changed by 16 times if the adjustments are made based on the changes in the daily composite rate.

On the other hand, it may be desirable to have contingency arrangements in place, under which the composite rate can be adjusted before the regular rate fixing date, if necessary, such as when interest rates move drastically. The conditions for activating such arrangements should be clearly specified,[27] in addition to the normal rule governing how the rate is adjusted regularly on a monthly basis.

To promote such a reference rate, its specific features should be carefully designed in order to increase borrowers' acceptance. In addition, the calculation and fixing of such reference rate should be standardised. Promotion, such as educational campaigns, would need to be made to improve public understanding.[28]

The new reference rate can be introduced either as an alternative or as a replacement for BLR. Given the need for BLR to continue to be the reference rate for loans made prior to the introduction of a new reference rate, it would be desirable to have the new reference rate introduced to the market along with the BLR. Market forces will determine which rate is more acceptable.

Given the widespread use of BLR as a reference rate for mortgage lending and other loan products, and its dominance in existing loan contracts, any change in the pricing method would have far-reaching impacts on the mortgage market. Administratively, it could also be a complex process.[29]

While the HKMA has a supervisory interest in the vulnerability of bank earnings to interest rate risk, it is up to the industry to decide which reference rate to use for mortgage lending. If it is agreed that any of the above rates can be considered as an alternative reference rate, a more complete analysis would be required to assess the cost and benefit for such a move. Such a complete study would require the active involvement of the banking industry. We would be happy to assist in the process, through participating in the discussion and by providing technical support.

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[27] Detailed arrangements should be worked out by the industry, if an alternative reference rate is to be adopted.

[28] To avoid imposing additional administrative burden on banks, the standard reference rate can be calculated and announced through specific arrangements. Similar to their current practice, banks just need to set a mark-up over this standard reference rate when pricing their mortgage products. This arrangement also facilitates banks in their management of interest rate risk because a standard reference rate is provided and instruments for hedging purpose, such as deposits with interest rates based on the reference rate, can be developed.

[29] There would also be costs for system changes, documentation, public relations, calculation and dissemination of the new reference rate. The cost could be significant if customers are allowed to make a choice to switch their existing contracts (mostly set against BLR) to contracts based on the new reference rate.

If a decision is made to introduce an alternative reference rate, the HKMA is prepared to help ensure its transparency through encouraging the use of a single rate and the standardisation of its calculation and quotation. In particular, if the composite rate is adopted, the HKMA could help by taking up the task of the computation and announcement of the rate, if deemed desirable.

Annex I

Table A1. Selected Developed Countries

	Mortgage rate[1] (% of all new mortgage loans)	Usual length of mortgage (new mortgage loans)	Restrictions on prepayment fees
US	Fixed (74%) Variable (26%, reference rate tied to Treasury bond or cost of funds index, with annual or more frequent adjustments)	30 years / 15 years	No penalty
UK	Variable (72%, rates adjust at discretion of lenders, but tend to move in line with the Bank of England base rate) Mixed (28%)	2 to 25 years	No penalty
Germany	Mainly Fixed or Mixed	Up to 30 years	Compensation payments within the first ten years of contract
Switzerland	Variable (based on the refinancing costs of lenders) or Mixed	Not available	No penalty
Japan[2]	Fixed	Up to 35 years	Not available
Australia	Variable (90%, rates vary according to market rates and the cost of funds, but mostly respond to the monetary policy of the Reserve Bank of Australia) Fixed (10%)	Up to 30 years	Not available

Notes:
1. Fixed: interest rate fixed for more than five years to until final maturity;
   Mixed: interest rate fixed for more than one year and up to five years;
   Variable: after one year, interest rates are renegotiable or tied to market rates or adjustable at the discretion of lenders.
2. The mortgage features in Japan are those of the Government Housing Loan Corporation of Japan, which offers long-term mortgage loans with fixed interests and has a market share of about 40%. Meanwhile, housing loans of long-term fixed interest rate type offered by private financial institutions remain in a small amount (the share of loans with fixed rate over 10 years is about 4 to 5%).

Sources: European Central Bank, Reserve Bank of Australia, OECD, Journal of Housing Research.

Annex I (continued)

Table A2. EU Countries

	Mortgage rate (% of all new mortgage loans)	Usual length of mortgage (new mortgage loans)	Restrictions on prepayment fees
Belgium	F (75%) M (19%) V (6%)	20 years	Maximum three months' interest on remaining amount.
Denmark	F(75%) M(10%) V(15%)	30 years	None
Greece	F(5%) M(15%) V(80%)	15 – 20 years	None
Spain	Mainly V	15 – 25 years	Cancellation commission
France	F/M/O (86%) V(14%)	Over 5 years	Limited to six months' interest
Ireland	V(70%) M(30%)	Not available	None
Italy	F(28%)	10 – 25 years	None
Luxembourg	V(90%)	20 – 25 years	None
Netherlands	F(74%) M(19%) V(7%)	10 years	None
Austria	Not available	Not available	None
Portugal	Mainly V	25 – 30 years	Limited to 1% of the amortised amount
Finland	F(2%) V(97%)	15 – 20 years	Interest rate differential
Sweden	F(38%) M(24%) V(38%)	Not available	None

Note: Fixed (F): interest rate fixed for more than five years or until final maturity;
Mixed (M): interest rate fixed for more than one year and up to five years;
Variable (V): after one year, interest rates are renegotiable or tied to market rates or adjustable at the discretion of lenders;
Other (O): other.

Source: European Central Bank.

Annex II

Reference Rates for Pricing Mortgage Loans in the US, UK and Australia

In the US and Japan, fixed rates mortgage loans are more common, while in the UK, Switzerland and Australia variable rates are more popular. When the mortgage rates are adjustable, they are either tied to the Treasury bond or a cost of funds index, like that in the US, or they are adjusted in line with the policy rates of the central banks, like that in the UK (the base rate of the Bank of England) and Australia (the cash rate of the Reserve Bank of Australia).

In the US, there are several cost of funds indices for pricing mortgage loans. The one that is widely used by mortgage lenders (especially in the West Coast) to set the floating interest rate on adjustable rate mortgage loans is the Eleventh District Cost-of-Funds Index (COFI). The monthly weighted average COFI has been published by the Federal Home Loan Bank of San Francisco since August 1981. COFI is not an interest rate, but a ratio that reflects the interest expenses reported for a given month by the COFI reporting members. The COFI is computed from the book values of liabilities for all insured savings and loan institutions in the Eleventh District (institutions in California, Nevada, and Arizona). These liabilities include money on deposit at the institutions, loans obtained from a Federal Home Loan Bank and money borrowed from other financial institutions. The interest paid on these types of funds is the cost of these funds. The ratio of the dollar amount paid in interest during the month to the average dollar amount of the funds for that month is the weighted average COFI for that month.[30] Mortgage lenders will periodically adjust the interest rate on adjustable rate mortgage loans based on this COFI.

In countries like the UK and Australia with inflation targeting as one of the central banks' core objectives, the instrument of monetary policy is a short-term interest rate that can be closely controlled by the central bank. The relevant interest rate for the UK is the "base rate" and for Australia is the "cash rate". They are also called the policy rates in the sense that they reflect the monetary policy stance of the central banks.

In the UK, the Bank of England (BOE) sets the base rate for its own dealing with the market and that rate then affects the whole pattern of rates set by the commercial banks for their savers and borrowers. For instance, two mortgage loan interest rates that are influenced by the movement of the base rate are the standard variable rate and the base rate tracker. For the standard variable rate mortgage, the lender's variable interest rate charged to

[30] One of the advantages of using the actual dollar amount paid in interest during the month when calculating the COFI is that it reflects more accurately the average funding costs incurred by the reporting institutions. However, it would involve additional information from the reporting institutions and it may further widen the time gap between data collection and the release of the COFI.

existing borrowers is set marginally higher than the base rate, and it usually varies in relation to the increase and decrease imposed by the BOE's base rate. So if the base rate changes, the variable rate will change accordingly (although lenders can also choose not to pass rate changes on to their customers). The base rate tracker is a variable rate mortgage loan where the interest rate is a set amount above (or below) the BOE's base rate for a fixed term period, and so its changes are always in line with (or 'track') changes in the BOE's base rate. The base rate tracker thus removes part of the discretionary elements in the standard variable rate.

In Australia, the cash rate is the market interest rate on overnight funds. The Reserve Bank of Australia (RBA) exercises close control over the cash rate through its financial-market operations, so as to keep the cash rate at or near an operating target decided by the RBA. The cash rate is the rate charged on overnight loans between financial intermediaries. Movements in the cash rate are passed through quite quickly to the whole structure of deposit and lending rates. For example, mortgage and business loan rates tend to move broadly in line with movements in the cash rate. Thus, changes in monetary policy mean a change in the operating target for the cash rate, and hence a shift in the interest rate structure prevailing in the financial system.

Annex III

A TECHNICAL NOTE ON THE CONSTRUCTION OF THE EFFECTIVE DEPOSIT RATE AND THE COMPOSITE RATE[31, 32]

Banks in Hong Kong obtain Hong Kong dollar funding from various sources. Broadly speaking, these sources can be categorised by funding from the retail market and from the wholesale market. Retail market funding consists of Hong Kong dollar deposits from non-bank customers,[33] while wholesale market funding includes interbank borrowing from banks in Hong Kong and abroad.[34] The funding costs incurred by banks can be assessed by the interest rates charged on the funding components from the retail and wholesale markets. Table A3 presents the components which make up the average funding of banks and their associated interest rates.

[31] This technical note provides a detailed description on the construction of the effective deposit rate (EDR) and the composite rate. Note that while the actual derivation of the EDR and the composite rate used in the main text of the paper is a simplified version of the methodology described in this annex, the underlying concepts are the same.

[32] Another way of calculating banks' cost of funds is the one adopted by the Federal Home Loan Bank of San Francisco in the US for the calculation of the Eleventh District Cost-of-Funds Index. For details of its calculation, as well as the advantages and drawbacks of using such index, please refer to Annex II and footnote 30.

[33] In this paper, all non-bank customers' deposits, regardless of their size, are classified as retail market funding.

[34] Other funding sources such as the negotiable debt instruments issued by banks and amounts payable under repo are not being considered in the analysis.

Table A3. Major Funding Sources of Banks and Interest Rates

Funding Component[1]	Interest Rate[2]
Retail Market	
Customers' deposits	
Demand deposits	Interest rate on demand deposits is assumed to be zero
Savings deposits	Average savings deposit rate
Time deposits	
No more than 1 month	Average rate for 1-week time deposits
Between 1 and 3 months	Average rate for 1-month and 3-month time deposits
Later than 3 months	Average rate for 6-month and 12-month time deposits
Wholesale Market	
Interbank borrowing	
In Hong Kong	
On demand	Overnight HIBOR
Within 3 months	Average rate of 1-week, 1-month and 3-month HIBORs
Later than 3 months	Average rate of 6-month, 9-month and 12-month HIBORs
From abroad	
On demand	Overnight HIBOR
Within 3 months	Average rate of 1-week, 1-month and 3-month HIBORs
Later than 3 months	Average rate of 6-month, 9-month and 12-month HIBORs

Note: 1. The classification of funding components in customers' deposits and interbank borrowing is based on "Return of Assets and Liabilities of an Authorized Institution".
2. A detailed discussion of the various interest rates is given in the sections below.

Charts A1 and A2 plot the interest rates associated with the different funding components from the retail and wholesale markets.

Chart A1. Interest Rates of Retail Market Funding

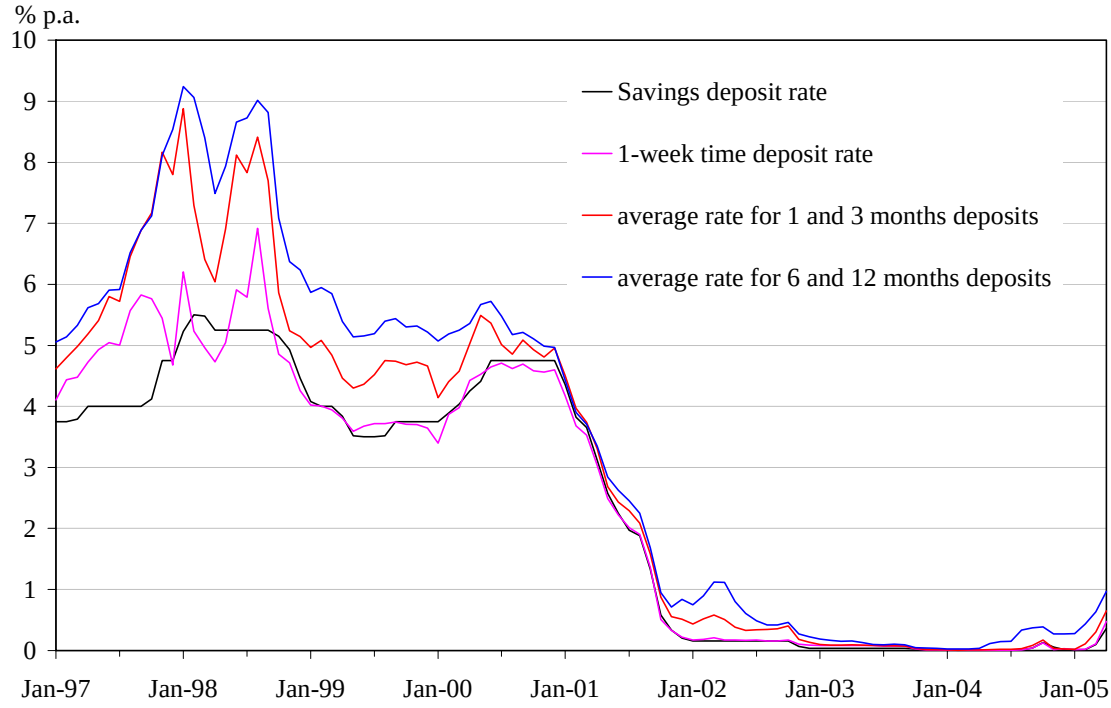
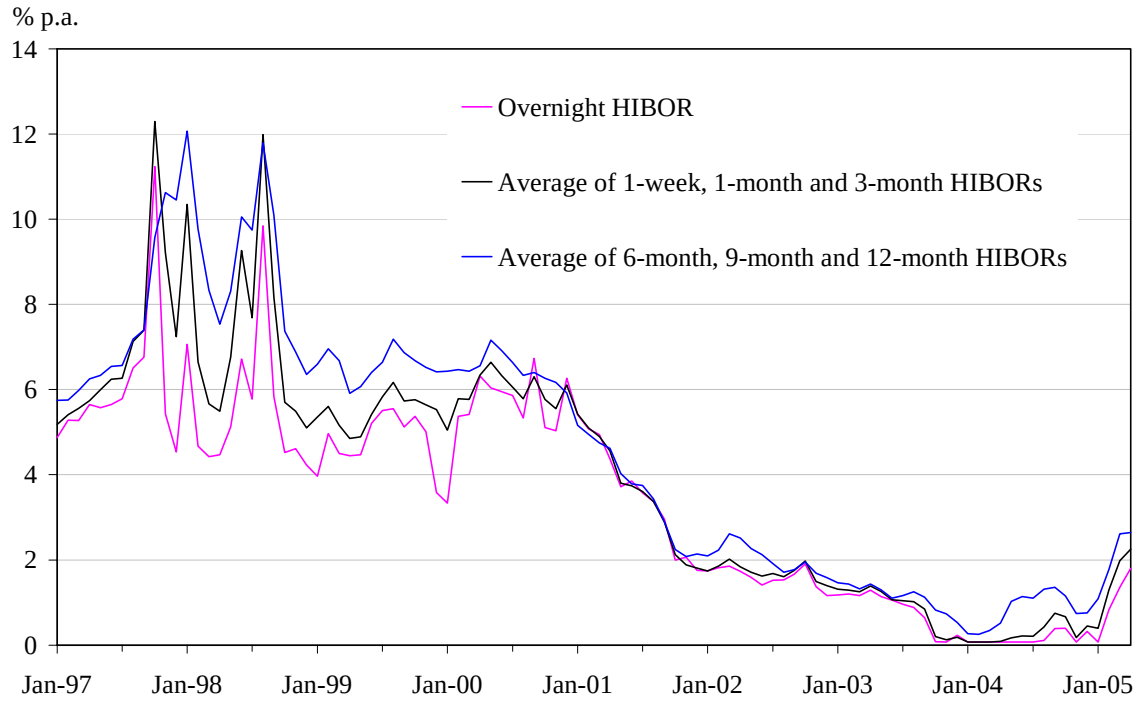


Chart A2. Interest Rates of Wholesale Market Funding



The construction of the effective deposit rate (EDR) and the composite rate makes use of the above mentioned funding components and their corresponding interest rates.

I. Effective Deposit Rate

The EDR is a measure of banks' retail market funding costs. It is defined as the average interest rates on demand, savings and time deposits weighted by the Hong Kong dollar deposit composition of the entire banking sector. As shown in Table A3, the deposit composition of the entire banking sector is as follows:

1. Demand deposits of licensed banks
2. Savings deposits of licensed banks
3. Time deposits of licensed banks, restricted licence banks and deposit-taking companies, which are further classified into three groups based on their maturities:
   - No more than 1 month
   - Between 1 and 3 months
   - Later than 3 months

The interest rates on savings and time deposits of various maturities are the simple period average rates taken from Table 6.4.2 of the Monthly Statistical Bulletin (MSB). Currently, these average interest rates are calculated based on the daily quotations of eight selected banks.[35] On a particular day, the interest rate on savings deposits is the simple average of the quoted savings deposit rates.[36] The group of selected banks can be enlarged to include more banks to improve the representation. Criteria can be established and reviewed for the selection of these banks. For example, a group of banks, which have the largest market shares of deposits and as a whole represent the market, can be selected based on their average deposit sizes over the past 12 months. The group of selected banks can be reviewed annually.

EDR is derived by summing the individual average interest rates on demand, savings and time deposits, weighted by their corresponding shares in the deposit composition as reported to the HKMA at month-end, based on the following formula:

$$\text{EDR} = \frac{\sum CC_i^{rm} \text{ x } IR_i^{rm}}{\sum CC_i^{rm}} \qquad (1)$$

[35] The eight selected banks are HSBC, Hang Seng Bank, Standard Chartered Bank, Bank of China (Hong Kong), Bank of East Asia, DBS Bank, Citibank and Nanyang Commercial Bank.

[36] Note that in this paper, the average interest rates for the groups of banks are the simple averages of their quoted rates. Alternatively, weighted rates can be calculated based on the actual shares of individual banks' deposit base. Note also that for some banks, the quoted interest rates and the interest rates actually offered to clients may differ. When possible, the actual rates should be used in the calculation.

where CC_i^{rm} is the *i* funding component from the retail market, IR_i^{rm} represents the corresponding interest rate of the *i* funding component from the retail market (as shown in Table A3 under the heading "Retail Market") and $\sum CC_i^{rm}$ is the sum of all funding components from the retail market. Table A4 below illustrates the derivation of EDR for a particular month.

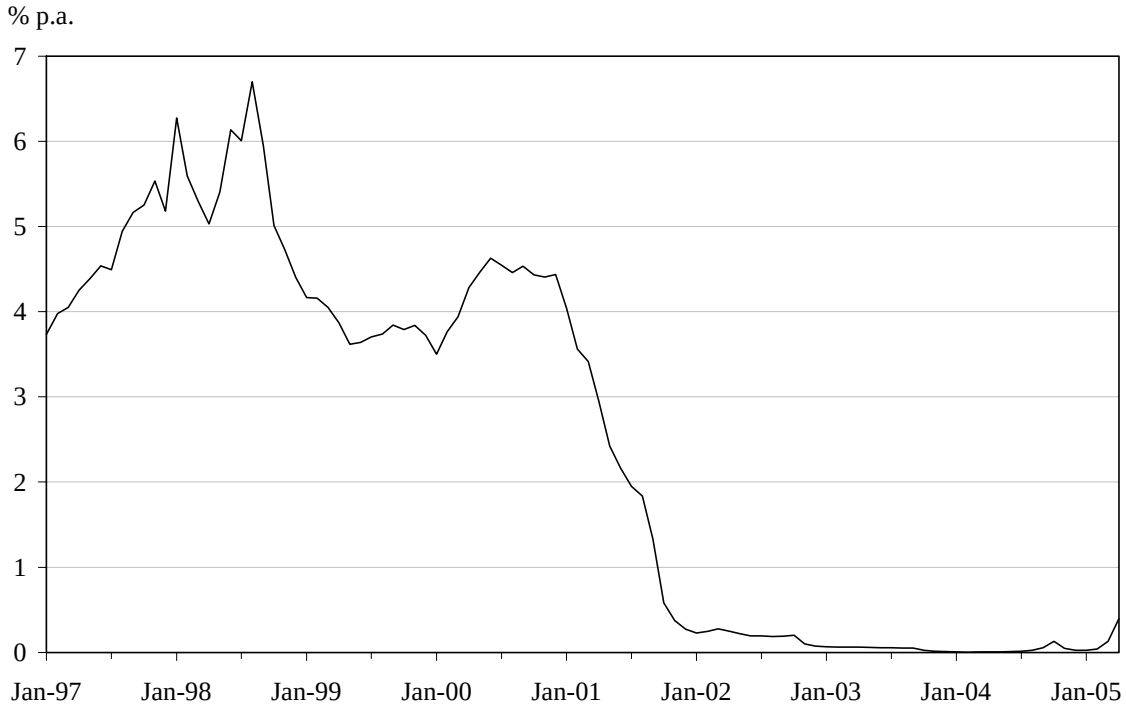
Table A4. Derivation of EDR
(For April 2005)

	Average interest rate of the month (% p.a.)[1] (A)	Deposit composition (month-end outstanding)		Weighted average rate (% p.a.) (A x B)
		HK$ mn.	Share to total (%) (B)	
Demand deposits	0.000[2]	240,117.7	0.12	0.0000
Savings deposits	0.098	953,412.6	0.48	0.0470
Time deposits				
No more than 1 month	0.105[3]	571,608.3	0.29	0.0305
Between 1 and 3 months	0.301[4]	148,776.4	0.07	0.0211
1 months	*0.260*			
3 months	*0.342*			
Later than 3 months	0.630[5]	89,501.4	0.04	0.0252
6 months	*0.460*			
12 months	*0.800*			
			EDR is	**0.1238**

Notes:
1. This is the period average interest rate on the deposits (less than HK$100,000) quoted by the eight selected banks.
2. The interest rate on demand deposits is assumed to be zero.
3. Since there is no breakdown on the deposit composition of less than 1-month time deposits, the interest rate taken is the average 1-week time deposit rate.
4. Since there is no breakdown on the deposit composition of 1-month and 3-month time deposits, the interest rate taken is the simple average rate of 1-month and 3-month time deposit rates.
5. Since there is no breakdown on the deposit composition of time deposits with maturity later than 3 months, the interest rate taken is the simple average rate of 6-month and 12-month time deposit rates.

Note that the interest rates used in the derivation of EDR as reported in the main text of the paper are slightly different from those presented in Table A4. In the main text of the paper, for simplicity, the 1-month time deposit rate is used to proxy the interest rate for deposits with maturity less than 1 month. The 3-month time deposit rate is used to proxy the rate for deposits with maturity between 1 month and 3 months. Chart A3 presents the profile of EDR, as composed based on the calculation method illustrated in Table A4.

Chart A3. EDR



II. The Composite Rate

The composite rate is a measure of banks' wholesale and retail funding costs. It is the average interest rates of HIBOR and EDR weighted by the amount of Hong Kong dollar interbank borrowing from the wholesale market and the Hong Kong dollar deposits obtained from the retail market.[37] As shown in Table A3, interbank borrowing includes the following items: [38]

[37] On the calculation of the composite rate, some banks suggested that other Hong Kong dollar funding should be included such as those Hong Kong dollar funds obtained through Hong Kong dollar / US dollar swaps and, therefore, the weighs of HIBORs in the formula should be upward adjusted. They also suggested that, if the average rate is to be calculated as a weighted average rate by the shares of individual banks' deposit base, there should be an upper bound for the weighs assigned to individual banks, in order to avoid the dominance of the rates quoted by a few banks.

[38] The classification of interbank borrowing is based on "Return of Assets and Liabilities of an Authorized Institution".

1. Amount due to authorized institutions in Hong Kong (MSB Table 4.2), which can be further categorised into:
   - payable on demand and money at call
   - repayable or callable within 3 months
   - repayable or callable later than 3 months

2. Amount due to banks abroad (MSB Table 3.9.1). While the MSB table only shows the total amount, the "Return of Assets and Liabilities of an Authorized Institution" has breakdowns with categories similar to that of the amount due to authorized institutions in Hong Kong.

The interest rates used for the derivation of EDR are discussed in the previous section. The interest rates for various categories of interbank borrowing are the period average of HIBORs taken from the MSB Table 6.3.2. Similar to the derivation of EDR, the average HIBORs quoted by a group of selected banks can be used in the calculation. Alternatively, Hong Kong Dollar Interest Settlement Rates, which are fixed by the Hong Kong Association of Banks, can be used for the calculation of the composite rate.

The composite rate is derived by summing the individual average interest rates on HIBORs, demand, savings and time deposits, weighted by their corresponding shares in the combined interbank borrowing and customers' deposits as reported to the HKMA at the end of each month, based on the following formula:[39]

$$\text{Composite rate} = \frac{\sum CC_i \text{ x } IR_i}{\sum CC_i} \qquad (2)$$

where CC_i is the i funding component from the retail or wholesale markets, IR_i represents the corresponding interest rate of the i funding component (as shown in Table A3) and $\sum CC_i$ is the sum of all components from the two markets. Table A5 presents the derived composite rate for a particular month.

[39] Note that the components and interest rates used in the derivation of the composite rate as illustrated in Table A3 and formula 2 are slightly different from the composite rate reported in the main text of the paper. In the main text of the paper, for simplicity, the 1-month time deposit rate is used to proxy the interest rates for deposits with maturity less than 1 month. The 3-month time deposit rate is used to proxy the rate for deposits with maturity between 1 month and 3 months. In addition, 3-month HIBOR is the interest rate for interbank borrowing, regardless of the repayable periods. Nevertheless, the difference does not affect the analysis in the main text of the paper.

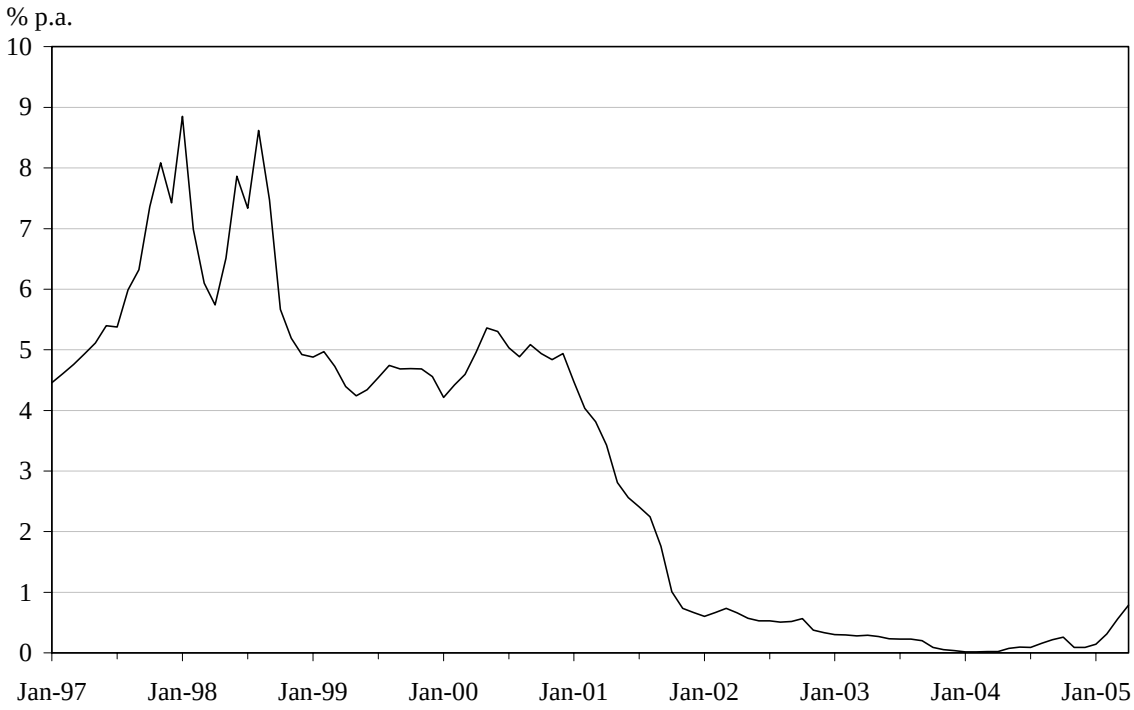
Table A5. Derivation of the Composite Rate[1]
(For April 2005)

Funding components	Amount (HK$ mn.)	Share to total (%) (A)	Interest rate (% p.a.) (B)	Weighted average rate (% p.a.) (A) x (B)
Retail Market				
EDR[2]	2,003,416	0.81	0.12	0.0972
Wholesale Market				
Interbank borrowing				
In Hong Kong (total)	311,205	0.13		
On demand[3]	*33,791*	*0.01*	*1.36*	*0.0136*
Within 3 months[4]	*240,168*	*0.10*	*1.98*	*0.1980*
Later than 3 months[5]	*37,246*	*0.02*	*2.61*	*0.0522*
From abroad (total)[6]	146,241	0.06	2.25	0.1350
On demand				
Within 3 months				
Later than 3 months				
Total funding (retail + wholesale)	2,460,862			
		The composite rate is		**0.4960**

Notes:
1. This table provides an illustration of the derivation of the composite rate which is slightly different from the one composed in the main text of the paper.
2. The EDR is the derived figure in Table 2.
3. The interest rate for interbank borrowing callable on demand is the overnight HIBOR.
4. Since there is no breakdown on interbank borrowing callable within 3 months, the interest rate taken is the simple average rate of 1-week, 1-month and 3-month HIBORs.
5. Since there is no breakdown on interbank borrowing callable later than 3 months, the interest rate taken is the simple average rate of 6-month, 9-month and 12-month HIBORs.
6. The amount of Hong Kong dollar interbank borrowing from abroad is from MSB Table 3.9.1, which is the total amount and no breakdown is available. For illustration, the interest rate is assumed to be the 3-month HIBOR. If breakdowns of interbank borrowing from abroad are available, the specific interest rates should apply to these breakdowns as indicated in Table A3.

From Table A5, it is shown that the shares of customers' deposits, interbank borrowing in Hong Kong and from abroad used for the calculation of the composite rate are 81%, 13% and 6% respectively. Chart A4 illustrates the profile of composite rate.

Chart A4. The Composite Rate



Annex IV

Relative Features of Alternative Reference Rates

	A single rate in the market and for all banks	Simple and transparent	Administrative simplicity	Rate setting: market determined or rule-based	Volatility of monthly payment burden[1]	Desirability per risk management purposes[2]
BLR	Used to be a single rate, but recently banks have started to quote different BLRs	Yes	Simple	Largely market determined	0.10	4
HIBOR3	Yes	Yes	Simple	Market determined	0.46[3]	1
EDR	Yes, compiled by the HKMA	The concept is not difficult to understand, but it is complex than the others	Requires compilation by the HKMA, but only a small amount of additional work would be needed	A weighted average of retail deposit rates which are largely market determined	0.21	3
Composite rate	Yes, compiled by the HKMA	Same as EDR	Same as EDR	A weighted average of HIBOR3 and retail deposit rates, which are largely market determined	0.27	2
Base Rate	Yes	Yes	Simple	Rule-based, not entirely market determined	0.11	5
EFN3	Yes	Yes	Simple	Market determined	0.40	6

Notes:

1. Volatility (in %) is defined as the average monthly changes (in absolute term) in the reference rate over the specific period from January 1997 to April 2005. The higher the figure, the higher the volatility.
2. The ranking is based on the assessments in section 3.2.2. The lower the ranking, the higher the desirability.
3. If the Asian financial crisis period is excluded, the volatility of HIBOR3 (for the period from January 1999 to April 2005) reduces to 0.23, which is compatible to that of other possible reference rates ranging from 0.12 to 0.29 under the same period.

Annex V

A quantitative assessment of the approximation of alternative reference rates as a measure of average cost of funds

With monthly average interest rate data, a simple linear regression model is used to assess the property of the alternative reference rates as a good measure of the average cost of funds in the banking sector. In the analysis, the changes in pricing due to competition and changes in operating costs are assumed to be the same under the various scenarios of using different reference rates. To avoid the wide fluctuation in reference rates during the Asian financial crisis period, which is rare and extraordinary, the regression estimation starts from January 1999 to April 2005. Only the adjusted R-squared statistics are reported.

Table A6. Estimation Results
(from January 1999 to April 2005)
(Specification: Mortgage $Rate_t$ = Constant + Alternative reference $rate_t$)

Alternative Reference Rate	Adjusted R-squared
Composite Rate	0.93
HIBOR3	0.92
EDR	0.91
BLR	0.86
EFN3	0.85
Base Rate	0.84

The following charts show the actual and fitted mortgage rates, based on the above model specification.

Actual and Fitted Mortgage Rate

Chart A5. Based on the Composite Rate

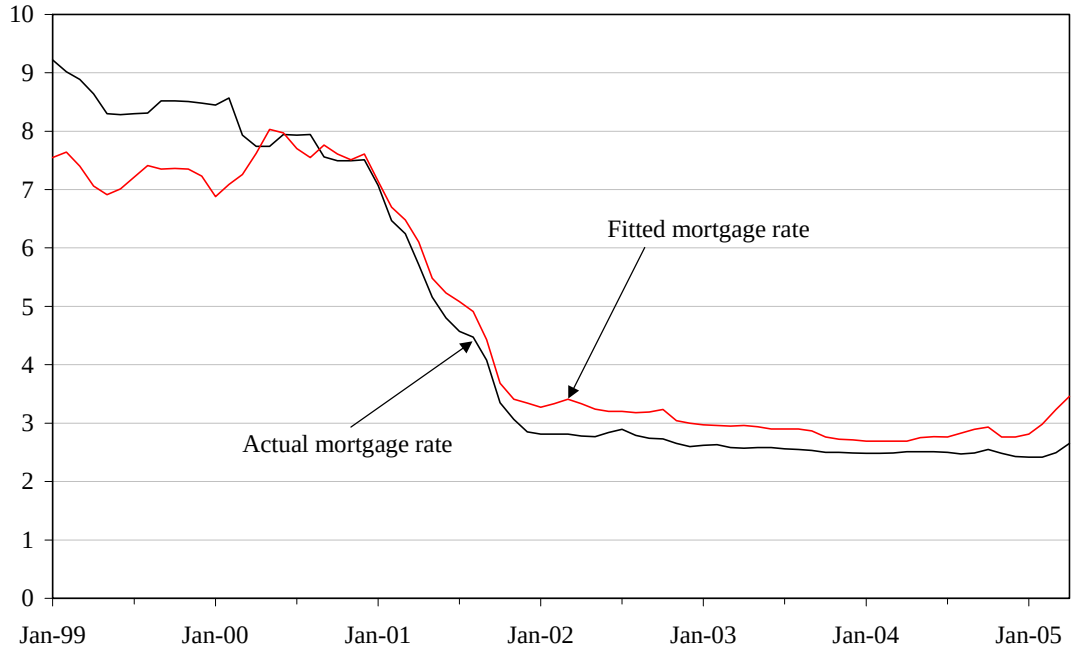


Chart A6. Based on HIBOR3

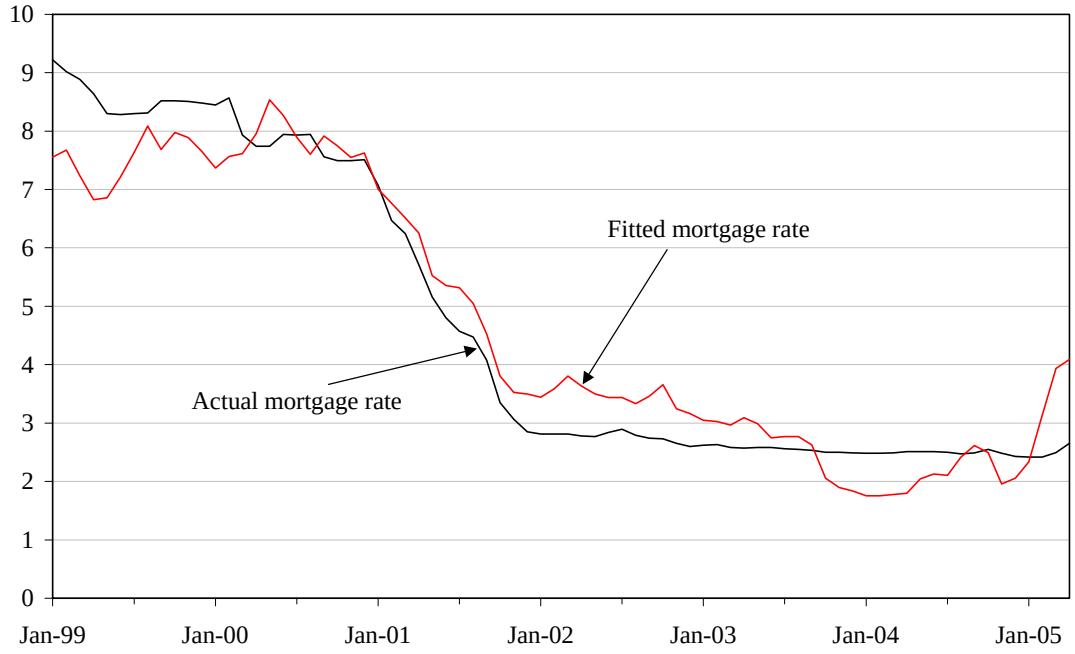


Chart A7. Based on EDR

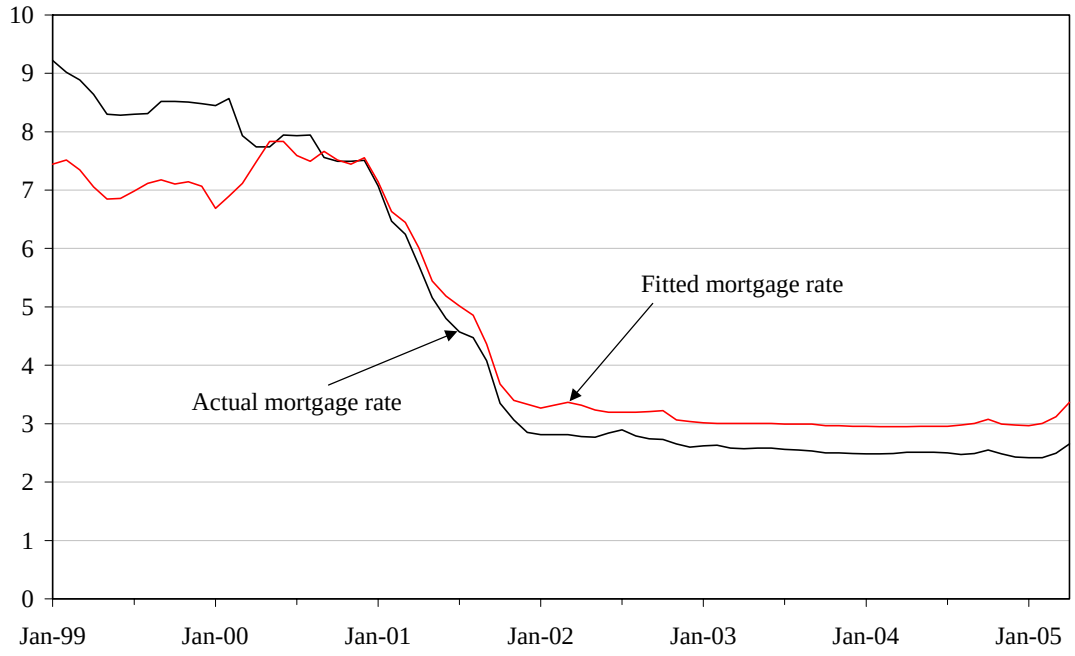


Chart A8. Based on BLR

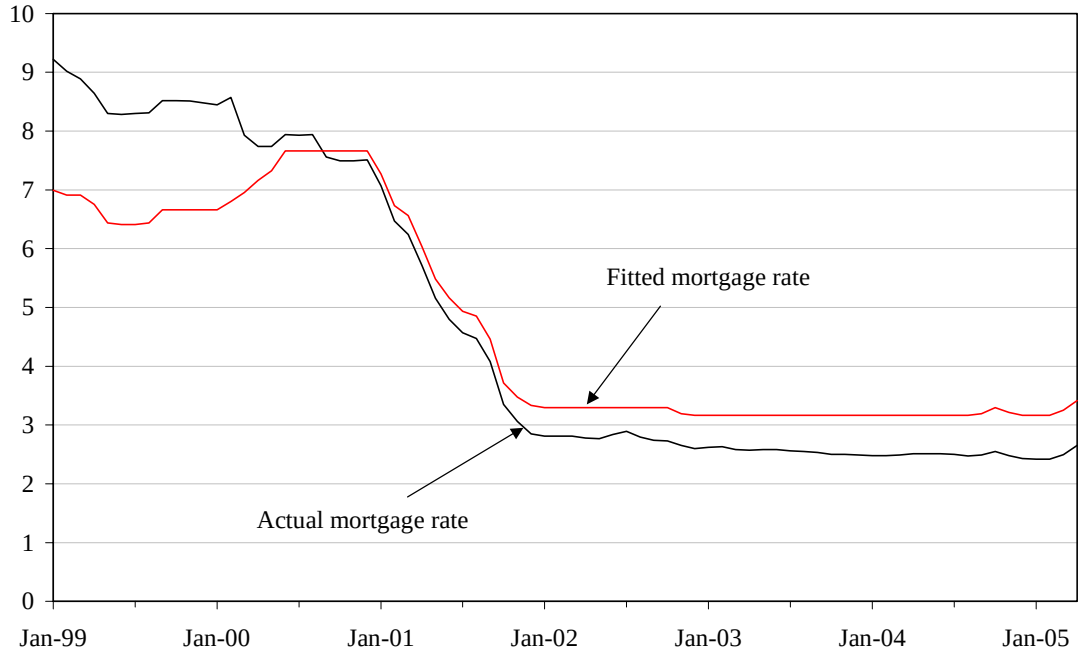


Chart A9. Based on EFN3

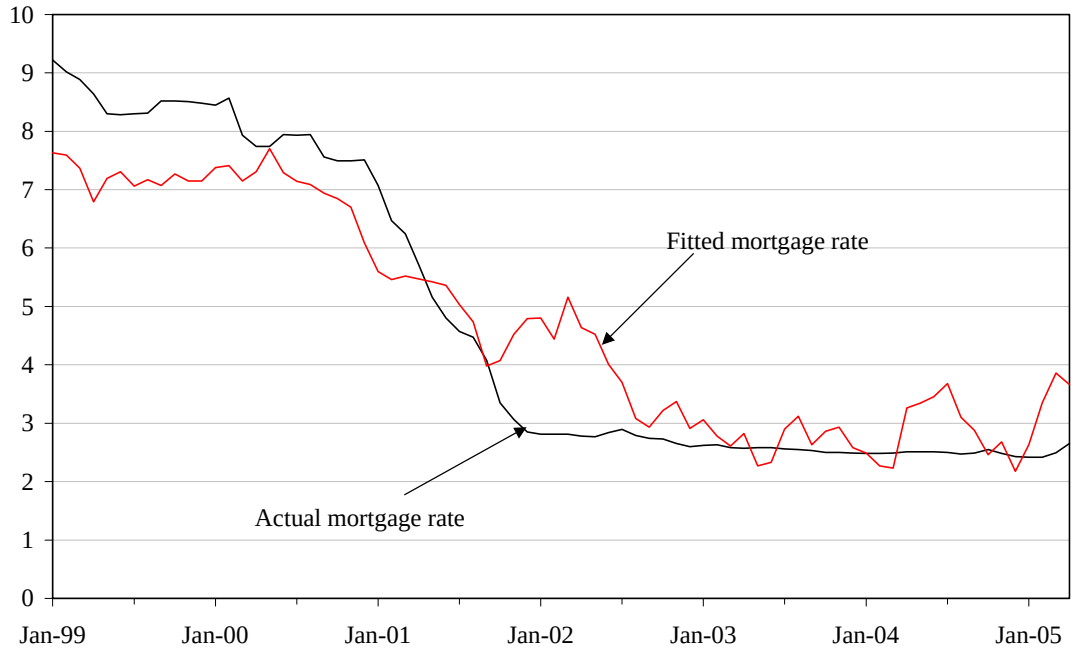
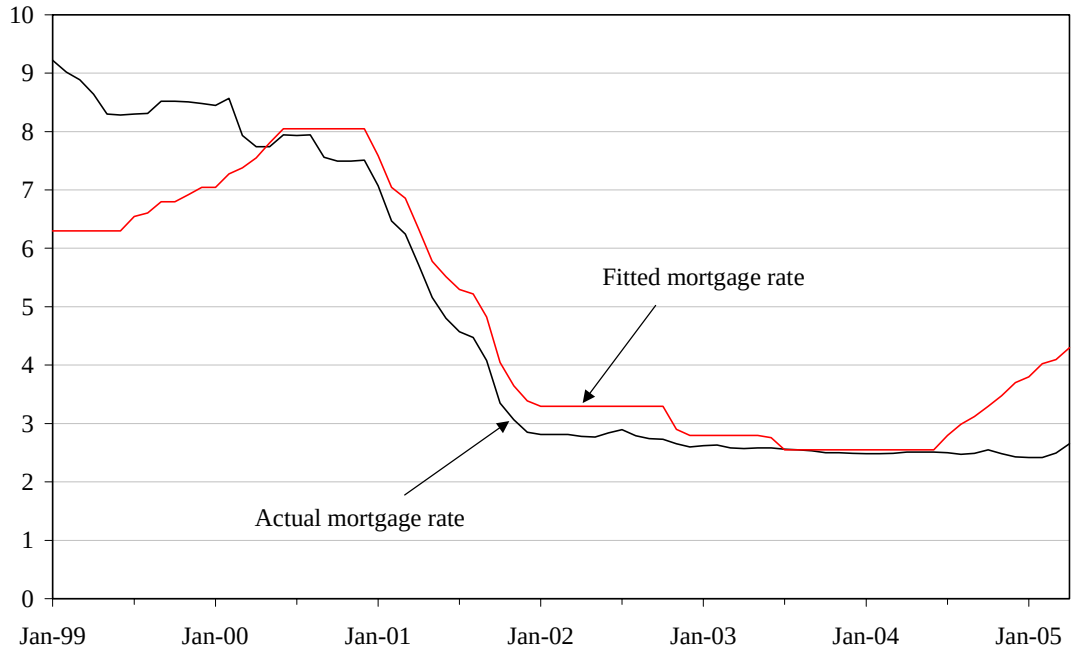


Chart A10. Based on the Base Rate



Annex VI

Simulation of interest margin for the loan portfolio acquired in January 1999 under the scenario of different reference rates

Chart A11. Cost of funds represented by the composite rate

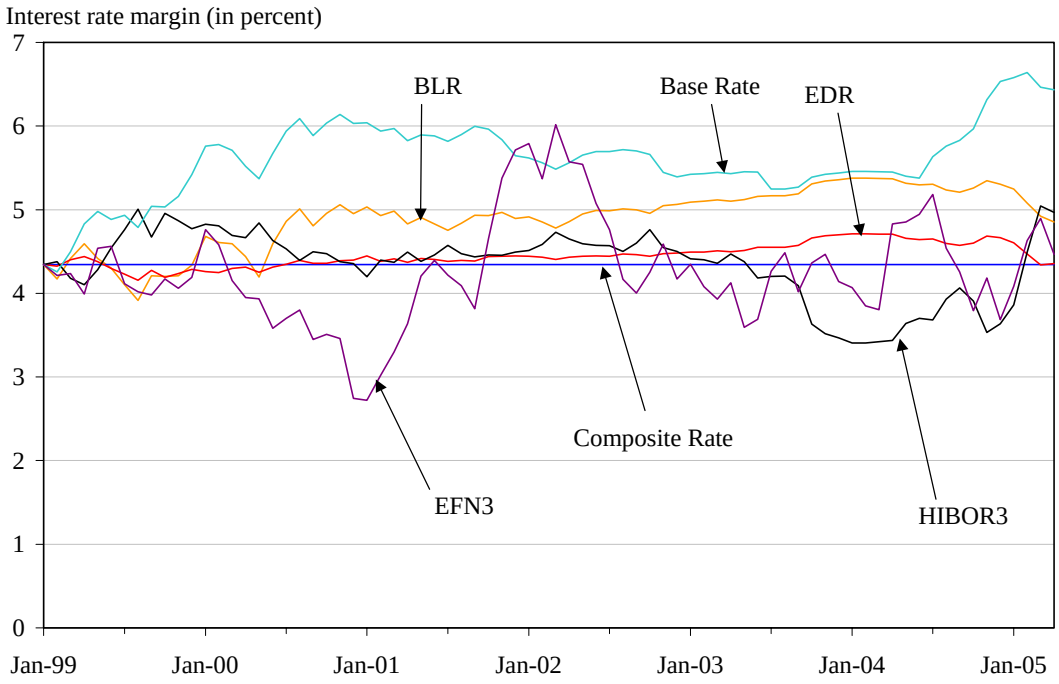


Chart A12. Cost of funds represented by HIBOR3