REAL INTEREST RATES IN HONG KONG

By mid-1999, nominal interest rates in Hong Kong had dropped substantially from last year's peaks, yet inflation had fallen even further. As a result, some conventional measures of real interest rates rose to unprecedented levels. There are several problems with common measures of real interest rates, however: they rely on backward- versus forward-looking measures of inflation; they employ inflation indices that may not accurately measure current market prices; and they are measured over short-term as opposed to long-term horizons. Beyond these definitional problems, the theoretical linkages between real interest rates, asset prices, and economic activity are often misunderstood.

This article discusses these issues and presents a measure of the long-term expected real interest rate that shows a significantly different picture from conventional measures. This long-term rate fell significantly from peaks in 1998 through mid-1999, as nominal bond yields declined, while underlying long-term inflation expectations were relatively stable. Looked at from this perspective, the observed recovery in asset markets over this period is not as surprising as conventional measures of real rates would suggest.

INTRODUCTION

The high level of real interest rates is often viewed as a barrier to recovery in Hong Kong. Despite declines in nominal interest rates from the peaks reached last year, deflation has pushed up commonly cited measures of real interest rates to unprecedented levels. In the face of such high real interest rates, a durable recovery in asset prices or economic activity is thought to be unlikely. Indeed, some observers perceive a significant risk that the economy could fall into a deflationary spiral, leading to prolonged stagnation.

There is no doubt that, both in theory and practice, real interest rates are an important determinant of aggregate demand. Appropriately measuring real interest rates and assessing their relationship to asset prices and real activity, however, is a complicated issue that involves a number of subtle but important distinctions. The inflation component, for instance, should reflect a forward-looking measure of expected inflation, as opposed to the backward-looking measures commonly used. In addition, the prices of assets such as property, stocks, and capital goods depend on expectations of real interest rates over the longer term, while observers commonly focus on short-term real rates. Finally, the dynamic interactions between real interest rates and asset prices are often misunderstood. A rise in real interest rates does not, in theory, lead to an ongoing decline in asset prices. Rather, asset prices drop immediately, and subsequent recovery is possible even though the level of real interest rates may appear to remain high.

This paper reviews the evidence on real interest rates in Hong Kong. The next section presents the definition of the real interest rate that is commonly used by analysts, and examines its behaviour over the recent past. We then analyse real interest rates from a conceptual perspective. In light of this analysis, several pitfalls with conventional views on real interest rates are discussed. A methodology for constructing long-term inflation expectations is then described, and the associated long-term real interest rate is presented. Finally, we assess the relationship between long-term real interest rates and activity.

CONVENTIONAL MEASURES OF REAL INTEREST RATES

Real interest rates are normally constructed by subtracting observed "headline" CPI inflation from a short-term nominal interest rate. Such a measure is shown in Chart 1 for Hong Kong, where the nominal interest rate is 3-month HIBOR and inflation is past 12-month growth in the composite CPI. Nominal 3-month HIBOR stood about 5½% in June of this year, down sharply from the peaks of over 10% observed last year. Nevertheless, the associated measure of the real interest rate rose steadily from slightly negative levels in early 1997 to almost 9½% as of June. Compared with the troughs in 1992-93, the real interest rate has increased by over 14 percentage points. Almost all of this swing is attributable to declines in the inflation component of the real rate, as opposed to higher nominal interest rates. Clearly, the plausibility of this path for real interest rates depends importantly on the appropriateness of lagged CPI growth as an inflation measure.

Beyond these measurement issues, analysts often assume a mechanical and direct relationship between the real rate shown in Chart 1 and economic activity. This is reflected in the view that high real interest rates will cause activity and asset prices in Hong Kong to decline further in the period ahead, undermining prospects for recovery.

A mechanical link of this type, however, is belied by the longer-term historical experience, as well as developments since late last year. The upper panel of Chart 2 graphs the short-term real interest rate against real GDP growth. During 1991-96, when real interest rates were significantly negative, actual growth averaged just over 5%, broadly in line with estimated potential growth. At the same time, CPI inflation trended down. A naive view of the relationship between real interest rates, growth, and inflation would be hard-pressed to explain this episode: a period of sustained negative real interest rates of several percentage points would normally be expected to lead to significant economic overheating and spiralling inflation. As the real interest rate began to rise in 1996-97, growth in activity actually accelerated temporarily, before dropping sharply in the first half of 1998 as the Asian crisis intensified.

Chart 1
Typical Short-term Real Interest Rate

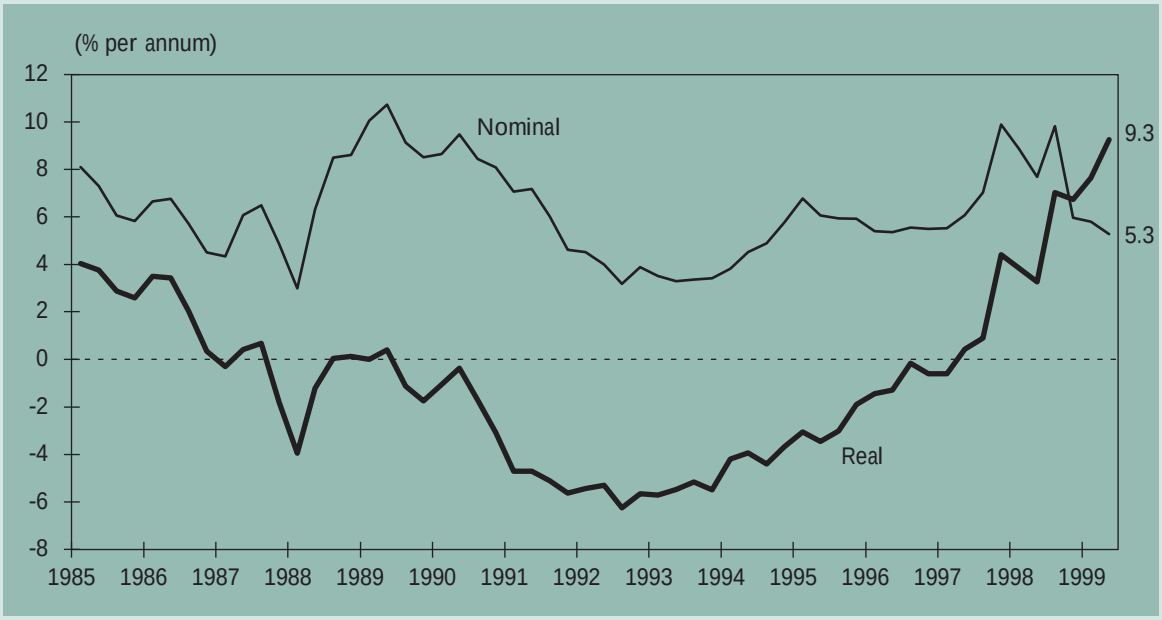


Chart 2a

Short-term Real Interest Rate vs. Real GDP Growth

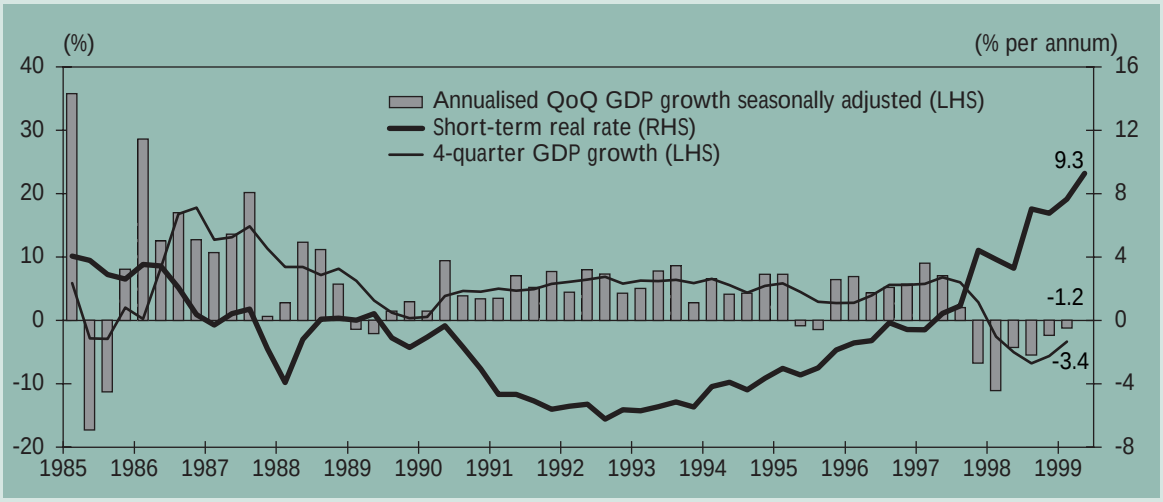
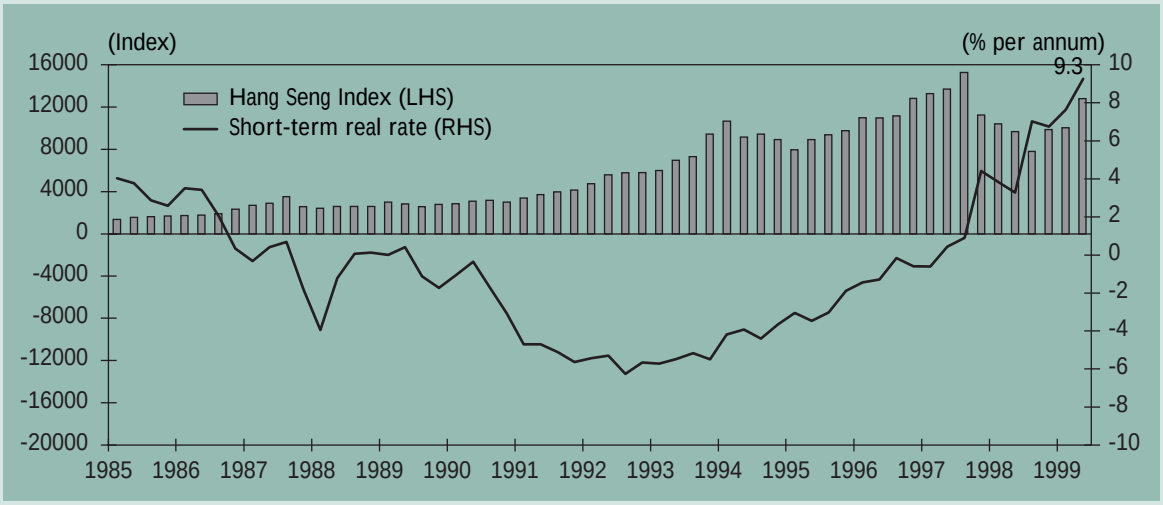


Chart 2b

Short-term Real Interest Rate vs. Hang Seng Index



Since that time, the short-term real interest rate has risen to unprecedented levels. But, rather than leading to an accelerating decline in output, there are signs that activity has started to stabilise. Quarter-on-quarter declines in real GDP on a seasonally-adjusted basis narrowed to 0.6% (quarterly rate) in the fourth quarter of 1998 and 0.3% in the first quarter of 1999.

The relationship between the real interest rate and equity prices is shown in lower panel of Chart 2. Again, it is apparent that there are inconsistencies between the common view and actual developments. Equity prices did rise significantly during the early 1990s, as real interest rates fell to highly negative levels, but there were no indications of a massive bubble in equity markets developing. Even as real interest rates turned around during 1994-97, equity prices continued to rise strongly. While the market fell sharply with the onset of the Asian crisis, there has been a substantial recovery since the third quarter of last year, in spite of further significant increases in the real interest rate as conventionally measured.

This anecdotal evidence casts doubt on the view that there is a direct, mechanical link between conventional measures of real interest rates, economic activity, and asset markets. During some episodes the expected relationship holds, but for others the link appears to be quite weak. This suggests that there are problems with some aspects of the conventional view: either real interest rates are mismeasured; and/or the relationship between economic activity and real interest rates is not as simple as often believed.

CONCEPTUAL ISSUES

In assessing the conventional view, it is useful to first review the theory of why real interest rates affect economic activity. This provides some conceptual guidance on the role of short- versus long-term interest rates, and how inflation expectations should be measured.

Regarding household spending, standard models indicate that real interest rates impact through two channels: wealth effects and intertemporal substitution effects.[1] Wealth effects arise because higher real interest rates lower asset prices, inducing increases in household saving rates. Intertemporal substitution occurs because changes in real interest rates affect the relative cost of purchasing goods now versus later. For example, when the real interest rate falls because expected inflation increases, current spending will increase because it is cheaper to buy goods now than later. Conversely, when prices are expected to decline, spending will tend to be postponed.

How should real interest rates be measured from the viewpoint of intertemporal substitution and wealth effects? In terms of intertemporal substitution, the consumption planning horizon of households may be rather short — say 12-18 months. The appropriate nominal interest rate would then be the applicable savings or borrowing rate over this period, while the inflation rate would be the expected change in the price of consumer goods. It is important to note, however, that the possibilities for intertemporal substitution vary widely across goods — people may well postpone purchases of durable goods, such as cars, if the price is expected to fall, but are much less likely to postpone consumption of nondurables and services. As discussed below, this distinction is important in view of Hong Kong's economic structure, which is heavily weighted in terms of output toward the production of services rather than goods. As a result, intertemporal substitution effects are likely to have only a minor effect on the demand for Hong Kong's output.

Regarding the link between real interest rates and asset prices, forward-looking models suggest that the price of an asset in some initial period (p^0) will be determined by the discounted value of the future stream of income expected to accrue to it (v^e):

$$p^0 = \int v_s^e \, e^{-r(s)} \, ds \, .$$

If we assume that earnings are expected to rise at average rate π over the life of the asset, and the average discount rate is *r,* then the above expression can be represented by the familiar long-term valuation ratio:

$$p^0 = v^0 / (r - \pi) \, .$$

The denominator of this ratio is simply the long-term expected real interest rate, defined as the nominal discount rate adjusted for the expected long-term inflation rate of earnings. By implication, the asset price moves in inverse proportion to the long-term interest rate.

Similarly, business investment is determined by the yield on capital relative to the opportunity cost in the form of the yield on financial assets. These

1 There can be an additional impact through income effects. Higher real interest rates tend to raise household income, as the household sector as a whole is typically a net creditor. This can raise spending, offsetting negative wealth and intertemporal substitution effects. Indeed, theoretically, the impact of higher real rates on consumption is ambiguous given the positive income effect. For individual households, of course, the income effect will depend on their net financial position, and could be negative for households with extensive borrowing. In any event, changes in income from interest rate movements will sum to zero for the economy as a whole, including the corporate and government sectors, as there is a lender for every borrower (assuming net foreign assets are not significant). Thus the *net* income effect will depend on differences in marginal propensities to spend out of income, and is a priori ambiguous.

considerations are embodied in the user cost of capital (u):

$$u = i - \pi + \delta ,$$

where i is the interest rate on a bond with the same life span as the investment goods, π is the expected inflation rate of the goods produced by the asset, and δ is the depreciation rate (we ignore tax considerations). Increases in the user cost will drive up the required rate of return on investment in physical assets, thus depressing investment.[2] As in the case of asset prices, the relevant variables for the user cost formula are the long-term interest rate and the long-term expected inflation rate.

As noted above, the length of this "long-term" horizon depends on the life span of the investment. Typical values for depreciation rates on business fixed investment in machinery and equipment, for instance, suggest average economic life spans on the order of 7-10 years. For structures and other property investments, life spans are typically 20 years or more. While it may be difficult to construct long-term real interest rates over such extended horizons, as discussed below, the point to note is that these periods are far longer than those conventionally used to construct real rates.

Beyond the relative cost considerations embodied in the user cost of capital, it is reasonable to assume that business spending also depends on cash flow. Investments by firms that are credit-constrained may well depend importantly on their current income position, in addition to the longer-term profitability of such investment. Higher real interest rates will tend to compress cash flow, as higher nominal rates raise debt-servicing costs and/or lower inflation reduces business receipts. An important point in this context, however, is that increases in the real incomes of lenders to businesses must offset such changes in business cash flows. For instance, if firms borrow from banks and bank deposit rates move in line with lending rates, then the real incomes of bank depositors will rise one-for-one as those of borrowers fall. The net impact on spending then depends on whether the marginal propensity to consume out of income is higher for depositors than borrowers. It is difficult to say *a priori* which effect will dominate. But, in any case, the impact will be a "second-order" effect, the sign of which cannot be established on theoretical grounds alone.

These theoretical considerations lead to the following observations. First, the appropriate measure of inflation used to construct the real interest rate should be based on expected as opposed to past inflation, as the former determines the relative attractiveness of spending now versus later. Second, short-term real interest rates alone are unlikely to have a significant impact on activity in Hong Kong, because intertemporal substitution in spending is primarily relevant for durable goods, of which Hong Kong produces very little. Activity in Hong Kong is much more dependent on asset prices through wealth effects and on business investment, where the relevant concept is a longer-term measure of the expected real interest rate. Third, the effects of changes in real interest rates on the incomes of various economic sectors — households, businesses, and government — sum to zero.[3] To the extent that one group's income falls, another's must rise. The net impact of income effects can be either positive or negative, and in any case is likely to be small.

PITFALLS OF CONVENTIONAL MEASURES

In light of the conceptual discussion, this section identifies five pitfalls with conventional measures of real interest and the distortions they introduce.

Past versus expected future inflation

The use of past inflation can only be justified as a "proxy" for expected inflation in measuring real interest rates, not as the correct concept theoretically. Whether or not past inflation provides a useful guide to future inflation is likely to depend on, inter alia, two considerations: the length of the

2 A similar story can be told via a Tobin's q theory of investment: higher nominal discount rates or lower growth in nominal expected earnings will both reduce the market value of capital relative to its replacement cost, thus reducing investment.

3 This assumes that the economy has no net foreign assets, so that net income effects vis-à-vis the foreign sector are zero. As preliminary balance of payments data for 1997 indicate that net investment income from abroad is relatively small, this assumption appears to be reasonable for Hong Kong.

horizon under consideration; and expectations regarding the monetary policy regime and the longer-term anchor for inflation. Regarding the time horizon, inflation generally exhibits inertia over short periods. Inflation over the past 12 months, for instance, is likely to be a better predictor of inflation over the next 12 months than it is over the next 5 or 10 years. This is because the specific factors that affect near-term inflation, such as demand pressures, wage contracting rigidities, and shocks in commodity markets tend to be autocorrelated at short horizons. At longer horizons, however, this "inertia" fades.

Simple statistical tests confirm this point. Regressing Hong Kong's annual CPI inflation rate on a constant term and its lagged value over the 1985-98 period yields the following results (t-statistics in parentheses):

$$\pi_t = \underset{(0.8)}{0.015} + \underset{(3.2)}{0.742}\ \pi_{t-1} \qquad R^2 = 0.447$$

This points to a significant and strong relationship between the inflation rate last year and this year. How robust is this correlation at longer horizons? Consider the following regression relating the average inflation rate over the subsequent five years to last year's inflation rate:

$$(1/5)\ (\pi_t + \pi_{t+1} + \pi_{t+2} + \pi_{t+3} + \pi_{t+4}) = \underset{(5.9)}{0.088} - \underset{(-0.7)}{0.131}\ \pi_{t-1}$$

$$R^2 = 0.051$$

The picture changes dramatically at a longer horizon – the fit is weak and the coefficient on lagged inflation is negative. Taken literally, this means that the lower is past inflation, the *higher* future inflation would be over the next five years. As discussed above, this result is not surprising given the forces that determine short- and long-term inflation in Hong Kong. For the moment, it serves to underscore that the behaviour of inflation can vary at different horizons.

As for the monetary policy regime, under a floating exchange rate where the authorities have an (implicit or explicit) inflation objective, past inflation may contain useful information about the authorities' desired level of future inflation. In Hong Kong, however, the linked exchange rate system ties domestic inflation to external inflation over the longer term, not to the objectives of domestic policymakers. Under these circumstances, deviations from the longer-term inflation path determined by external conditions are likely to be transitory. Again, this limits the usefulness of past inflation as a guide to future inflation.

This can be illustrated by considering the adjustment process in Hong Kong triggered by the Asian financial crisis. The appreciation of the effective exchange rate of the Hong Kong dollar and the drop in regional activity that have resulted imply the need for compensating cost and price declines in Hong Kong — a process that is well advanced. But this adjustment reflects a one-time change in Hong Kong's price level, as opposed to an ongoing process of deflation. Extrapolating the deflation associated with this temporary adjustment process into continuing expectations of an indefinite deflationary spiral can be highly misleading.[4]

Distortions in measured inflation

Beyond the need to look at expected versus past inflation, published measures of inflation used to construct real interest rates may be distorted. An important issue here, especially in Hong Kong, is the measurement of property rentals. The CPI bases the property rental component on a survey of actual rentals paid by existing tenants. Given that contractual periods may be quite long, this average rental rate may respond only slowly to changes in market conditions. Yet, from a behavioural perspective, what matters in terms of household decisions on whether to consume more services from housing are expectations of marginal rental rates charged for new leases.

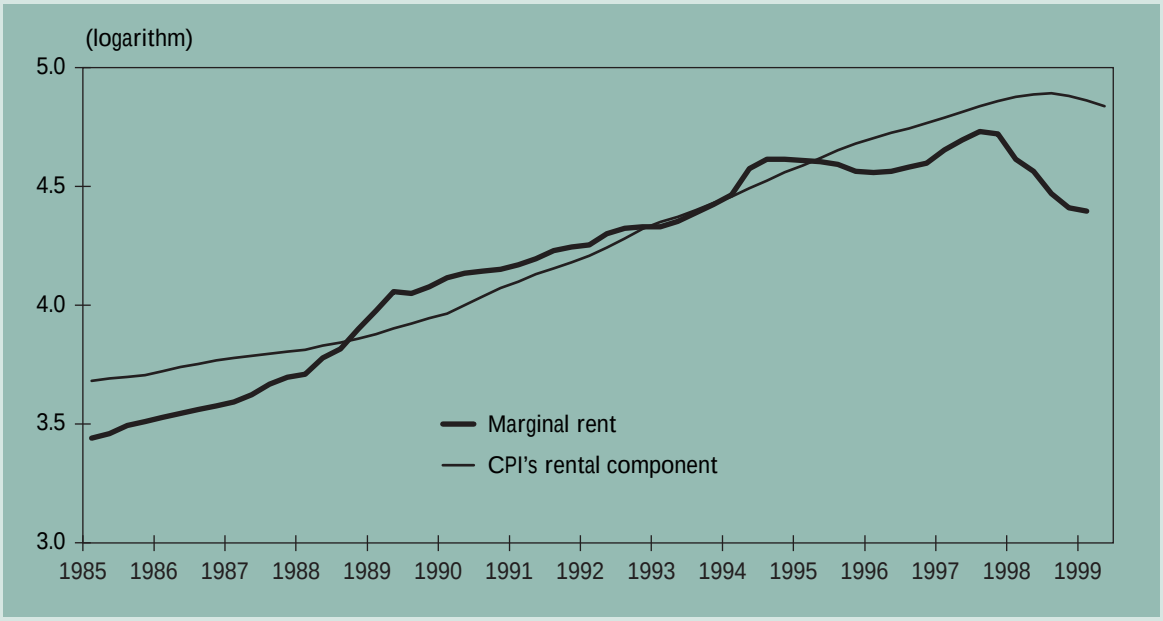
4 It should be noted that a fixed exchange rate regime such as Hong Kong's is likely to be much less vulnerable to a deflationary spiral than is a floating rate regime. This is because, with a fixed nominal exchange rate, falling domestic prices will necessarily raise competitiveness and boost activity over time – a self-stabilising process. Under a floating rate, deflation can be offset by nominal exchange rate appreciation, negating the impact on competitiveness. In these circumstances, there is no inherent mechanism that will end deflation, especially if the economy is in a liquidity trap such that there is no scope for reducing nominal interest rates.

Chart 3 provides an indication of the gap that has recently arisen between the CPI rental component and a measure of market, or "marginal", rental rates in Hong Kong.[5] Market rentals fell by 27% in the fourth quarter of 1998 over the fourth quarter of 1997, while the CPI private rental component (adjusted to exclude the estimated effect of the temporary rates rebate in 1998Q4) actually rose by 2½% over this period. It is evident that the marginal series corresponds much more closely to anecdotal evidence on developments in property markets.[6]

The strengthening in property market conditions in the first half of 1999 was accompanied by signs that residential rentals were bottoming out. Yet it is likely that the CPI rental component will continue to decline for some time to come as average contractual rental rates gradually converge to market rates. This decline in the CPI rental component would suggest that there is an incentive to delay upgrading rental accommodation due to falling prices in the period ahead, whereas prices may already be rising.

An additional issue is the use of consumer prices as the unique measure of inflation for constructing real interest rates. Business investment, which represents a major share of the interest-sensitive component of spending, depends in theory on the expected movement in the price of investment goods. As Hong Kong produces relatively few goods for domestic investment, there is no reason to expect a close relationship between the prices of investment goods and domestic costs, unlike the situation for consumer prices. To the extent that a high proportion of Hong Kong's investment goods come from Japan, for instance, prices are more likely to reflect fluctuations in the yen/dollar exchange rate than domestic factors. Unfortunately, it is difficult to get timely and comprehensive data on investment goods prices. While this complicates the task of empirical analysis, the point remains that consumer prices may not reflect the expected price movements that drive spending.

Chart 3
Property Rentals - Marginal vs. Contractual



5 Market rentals are obtained from quarterly series published by the Ratings and Valuation Department.

6 Indeed, this series may understate the true decline in market rentals in that it does not incorporate the impact of more flexible lease terms. In particular, the increasing availability of "break-lease" options can be viewed as conferring an implicit benefit to tenants that lowers the all-in rental cost.

Short-term versus long-term horizon

Real interest rates are usually constructed using short-term measures of nominal rates and inflation. Yet the real interest rate that is relevant from the point of view of fixed investments or asset prices is much longer term – several years for capital goods and possibly decades for property investments.

Short-term real rates are, of course, easier to construct than long-term rates. But short-term are likely to exhibit much greater volatility, and may also be misleading indicators of the direction of movement of long-term rates. This is particularly true for Hong Kong. Our linked exchange rate system and open capital markets tie Hong Kong's long-term real interest rates closely, over time, to those in the US. Short-term rates, however, can be driven well away from US levels by speculative activity and other transitory shocks in markets. Given that short-term and long-term real rates are being driven by fundamentally different forces, especially in periods of speculative attacks, there is no reason to expect the two to move in unison. Similarly, inflation at short-term and long-term horizons may behave quite differently, as discussed above, implying that short-term inflation may be of little use as a proxy for long-term expectations.

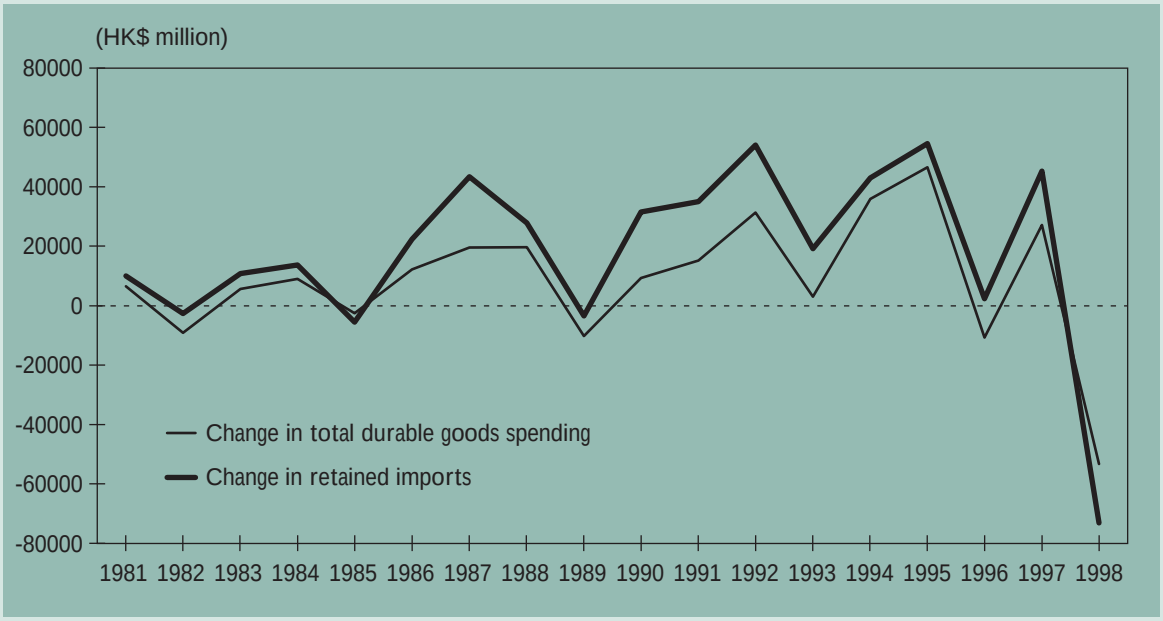
Channels of influence of real interest rates

As noted in the conceptual analysis, short-term real rates can be important from the point of view of intertemporal substitution in consumption. But such effects relate almost exclusively to spending on durable goods. In Hong Kong, almost all durable goods are imported. To illustrate this point, Chart 4 shows the annual changes in total spending on durable goods alongside the changes in retained imports.[7] It is apparent that the relationship is very close. By implication, changes in durables spending will be offset to a high degree by similar changes in imports. While there will still be an effect on domestic output of changes in durables spending due to the impact on retail margins and other markups over import costs, the net effect on activity in Hong Kong will be much smaller than in economies with significant goods-producing sectors.

This leaves wealth effects as the main driving

Chart 4

Annual Changes in Durable Goods Spending vs. Changes in Retained Imports



7 Durables spending includes consumer durables, machinery and equipment, and inventory investment.

force linking real interest rates to activity in Hong Kong. As discussed above, the importance of this channel implies that long-term, not short-term, real rates are of central importance. In addition, looking at asset prices and real interest rates as separate determinants of spending is "double counting", as the influence of real interest rates is already embodied in asset price movements. In other words, estimates of real interest rates convey no additional information about aggregate demand beyond that already embodied in the level of asset prices.

Consider developments from mid-1998 to mid-1999, for example. Asset prices recovered over this period, in spite of sharp increases in conventional measures of short-term real interest rates. To the extent that spending is primarily driven by wealth effects, the rise in short-term real rates (or long-term real rates, for that matter) is irrelevant. What is of key interest is that asset prices recovered, for whatever reason. There may still be a puzzle in relating asset price movements to real interest rates, but this is a separate issue from that of assessing the impact of real rates on economic activity via the wealth effect/asset price channel.

Dynamics of asset prices and real interest rates

A common view of the relationship between real interest rates and asset prices supposes that asset prices fall during periods when real interest rates are high, and rise when they are low. There is a subtle but important problem with this view. In theory, it is the *level* of asset prices – not the rate of change – that depends on the *level* of the (long-term) real interest rate. When real interest rates rise, asset prices do not gradually trend downward in response: in both theory and practice, asset prices "jump" down quickly to a new equilibrium level. Prices can then recover to the extent that interest rates fall back toward the original level. With these dynamics, the direction of asset price movements depends on whether the expected long-term real interest rate is rising or falling, not on whether real rates are high or low.

The relationship between short- and long-term real interest rates can also be problematic in assessing the effects on asset prices. If long-term rates always moved in line with short-term rates, then short-term rates would be a useful guide to the behaviour of asset prices even though they are not the appropriate variable theoretically. But there is no general presumption, theoretically, that long-term rates will generally move in line with short-term rates. In particular, the current level of the long-term rate already reflects market expectations of future short-term rates. To the extent that observed increases in short-term rates have already been expected by markets, there is no reason to expect long-term rates to rise as a result. Similarly, long-term rates can fall even if short-term rates are constant, if the latter are expected to decline in the future. So there is no reason to expect a one-to-one relationship between long- and short-term rates. This implies that changes in short-term real rates will be misleading indicators of asset price movements when such changes have already been incorporated in market expectations, and thus in the existing level of long-term rates and asset prices.

This section has looked at several pitfalls in the construction and interpretation of real interest rates. We examine below an approach to constructing the long-term real interest rate that addresses some of these problems; the subsequent section discusses in more detail the relationship between long-term real rates and economic activity.

ESTIMATING LONG-TERM REAL INTEREST RATES

For most countries, the primary difficulty in constructing long-term real interest rates is the lack of reliable estimates of long-term inflation expectations. In the case of Hong Kong, the absence of a deep and liquid long-term bond market is also problematic. But the introduction of Exchange Fund notes in the early 1990s provides a useful benchmark for assessing the long-term end of the HK$ yield curve. In particular, 5-year notes were introduced in 1994, and 10-year notes in 1996. Since the yield on 5-year and 10-year notes has been similar since their introduction, and given the longer time series for 5-year yields, the latter is used as our representative long-term nominal rate.

For historical purposes, this series has been extrapolated back to the early 1980s by splicing on the yields on 5-year US Treasury notes prior to 1994, adjusted for the average gap between 5-year Exchange Fund paper and US Treasuries during 1994 to mid-1997. This procedure appears reasonable during 1989-94, as there were no sustained differences between HK$ and US$ yields in the inter-bank market during this period. During 1985-88, however, there were episodes where expectations of revaluation of the HK$ led to significant negative interest differentials between HK$ and US$ interbank rates. It is difficult to judge what the behaviour of longer-term rates might have been in this environment. In the event, we have not attempted to adjust the US Treasury yield to incorporate a changing risk premium during this period. Thus, the data for long-term bond yields during the mid-1980s are only suggestive of what market conditions would have been like if there had not been sustained differences between HK$ and US$ rates.

Constructing long-term inflation expectations is more complicated. For some countries, periodic surveys of expectations can be used for this purpose, although continuity of data and the reliability of responses are often problematic. Alternatively, for countries that issue inflation-indexed bonds, the difference between these yields and those on unindexed bonds provides a measure of the break-even inflation rate as perceived by markets. Finally, there are statistical approaches to extract information on expected inflation from observed data.

Given the absence in Hong Kong of long-term inflation surveys and indexed bonds, statistical approaches are used here. Simple variants regress inflation on its lagged values – the predictions of such "backward-looking" regressions are then taken to represent expectations of future inflation. More sophisticated approaches incorporate a greater amount of information and economic structure. For current purposes, we have adopted a structural approach of this type that relies on the adjustment process under the currency board arrangements as an anchor for longer-term inflation expectations.

In particular, with the nominal HK$/US$ exchange rate fixed, competitiveness considerations will tie the price level in Hong Kong to that in the US over the longer term – i.e., prices in Hong Kong will adjust such that the real exchange rate vis-à-vis the US dollar remains consistent with an underlying equilibrium level of competitiveness. Of course, to the extent that structural changes lead to trend changes in the equilibrium real exchange rate, there may be some secular drift between the two price levels.[8] But deviations in Hong Kong's prices from this trend level will tend to be reversed over time.

This adjustment process can be expressed algebraically as follows:

$$\triangle rer = \alpha + \beta\ (rer^*_{t-1} - rer_{t-1})\ , \qquad (1)$$

where $\triangle rer$ is the change in the real exchange rate (in logarithms), and rer^* is the equilibrium real exchange rate. The parameter α picks up the trend factors that may lead to secular changes in rer^*, while β indicates the speed at which the real exchange rate returns to equilibrium. Because the nominal exchange rate is pegged by the currency board arrangements, the change in the real exchange rate will equal the inflation rate in Hong Kong (π^{HK}) less the inflation rate in the US (π^{US}). The above equation can then be rewritten as:

$$\pi^{HK} = \pi^{US} + \alpha + \beta\ (rer^*_{t-1} - rer_{t-1})\ . \qquad (2)$$

Allowing for the presence of some inertia in the inflationary process in Hong Kong (as in other countries), equation (2) is modified to include the presence of lagged domestic inflation on the right-hand side. This gives:

$$\pi^{HK} = \delta\ \pi^{US} + (1-\delta)\pi^{HK}_{t-1} + \alpha + \beta\ (rer^*_{t-1} - rer_{t-1})\ . \qquad (3)$$

8 Factors that could lead to such secular movements in the real exchange rate include the trend rise in the relative price of nontraded goods in Hong Kong, and the increase in external demand for Hong Kong's output associated with rapid growth of the Mainland economy.

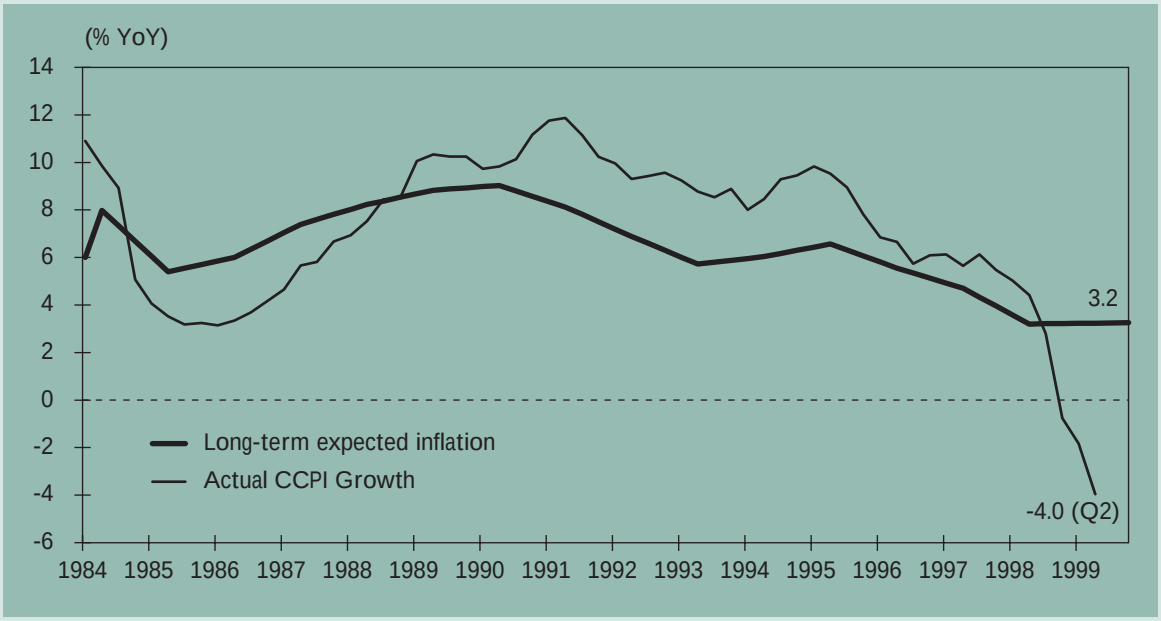
Equation (3) was estimated using annual data from 1984-98. To abstract from temporary factors that can distort the measurement of Hong Kong's underlying inflation rate – including the treatment of the rental component in the CPI – the definition of the CPI used to construct π^{HK} excluded rentals as well as basic food, fuel, alcohol, and tobacco. The results yielded estimates for δ of 0.62, α of 0.018, and β of 0.12, all of which are in line with theoretical expectations and of plausible magnitudes (see Appendix A).

This equation, however, provides estimates only of the current-period inflation rate in Hong Kong conditional on US inflation and the real exchange rate gap. To construct an expected inflation measure extending five years into the future to correspond with the maturity of the long-term bond, this equation must be simulated ahead. This step, in turn, requires additional equations to project the behaviour of US inflation and the real exchange rate. Appendix A discusses estimated equations for these two variables, and joint simulation of the resulting 3-equation model to obtain 5-year ahead forecasts of inflation. In the reduced form of this model, expected inflation depends on four factors: lagged inflation in Hong Kong; current US inflation; the lagged real effective exchange rate; and a constant term to capture secular growth in prices.

The resulting long-term expected inflation series for Hong Kong is shown in Chart 5 along with the actual inflation rate. The broad trends in the two series are similar, although the volatility of the expected inflation rate is lower. This is natural, given that long-term inflation should be inherently more smooth than the current-period rate. Both series trended down during 1990-98, with the declines in expected inflation being due to three factors: lower observed inflation in Hong Kong; the steady decline in US inflation; and the rising real exchange rate, implying lower future inflation to restore competitiveness. It is also interesting to note that the expected inflation series, constructed using only current and past information, appears to be a reasonably good predictor of future realised inflation. This suggests that the techniques used here do not yield implausible estimates for longer-term inflation expectations.

Looking at the situation in mid-1999, observed year-on-year composite CPI growth fell to -4.1% in June, while the Government Economist's projection

Chart 5
Long-Term Expected Inflation vs. Actual CCPI Growth



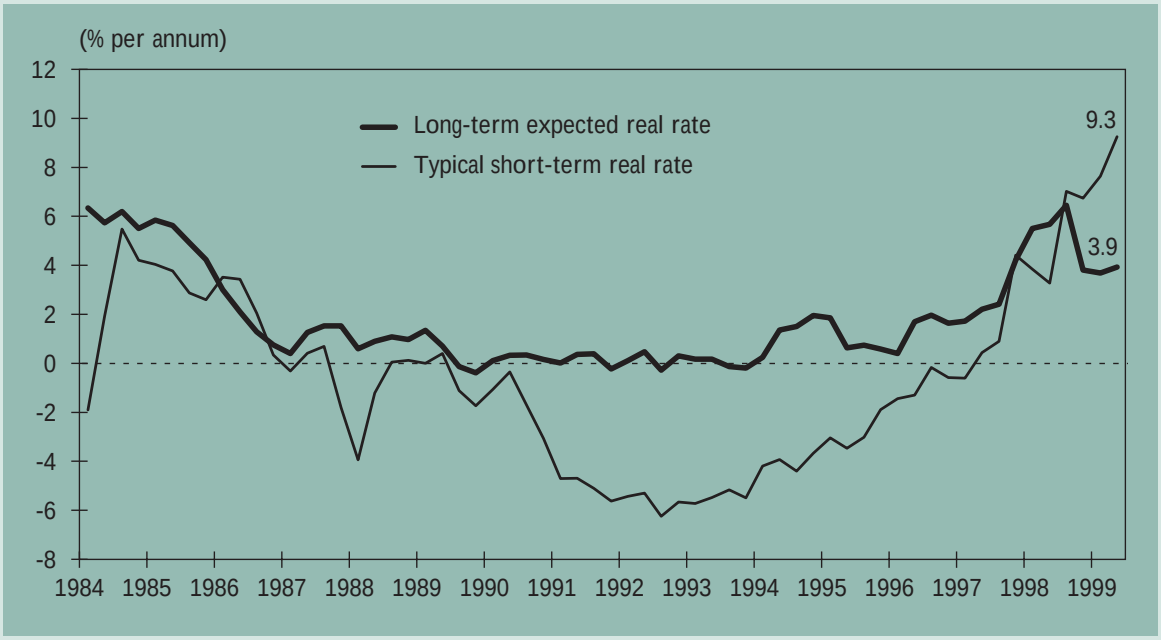
for 1999 as a whole stood at -2.5%. Deflation in the "core" price index used to construct long-term inflation expectations, however, is likely to be more moderate, partly because this measure will not be pulled down by declines in the CPI housing rental component. Adjusted for this factor, it is estimated that core deflation could amount to about 2% in 1999. Long-term expected inflation, in contrast, is estimated at about 3%, similar to the rate in 1998. What explains the large gap between actual and expected inflation? In part it reflects a pick up in US inflation: following growth of 1½% in 1998, US CPI inflation is expected to rise to around 2¼% this year. In addition, the real effective exchange rate has depreciated significantly relative to trend, with a decline of about 8% estimated for 1999 as a whole based on developments through the first half of the year. This decline raises expected future inflation through the channels discussed above. As a result of these factors, plus the impact of secular growth in inflation that is unaffected by current shocks, longer-term expected inflation has been relatively stable.

Deflating the long-term nominal bond yield by this measure of inflation expectations gives the long-term real interest rate shown in Chart 6. A comparison with the short-term real interest rate shows that both rates moved similarly in the mid to late 1980s, declining significantly as inflation rose. There was a sharp divergence in the early 1990s, however, as the short-term real rate fell to -6% in 1992-93, while the long-term real rate remained close to zero. Two main reasons underly this divergence: our estimate of longer-term inflation expectations was about 3 percentage points below the actual inflation rate, and short-term nominal interest rates fell well below long-term rates as US monetary policy was eased aggressively in the face of a slowing economy. Similarly, the long-term real rate was relatively stable while the short-term real rate reversed during 1994-97.

Both measures of real interest rates rose sharply when the Asian crisis hit Hong Kong and large spreads emerged between HK$ and US$ interest rates. But there has been a marked deviation in their behaviour since the third quarter of 1998. While the short-term real interest rate continued to rise sharply to reach a high of over 9% by mid-1999, the long-term real interest rate declined over this period, falling to about 4%. While

Chart 6

Long-Term Expected Real Interest Rate vs. Typical Real Interest Rate



this is still relatively high by Hong Kong standards – certainly compared with the experience during 1985-97 – it is not extraordinarily high by the standards of other advanced economies. Furthermore, it represents a significant decline from the peak of about 6½% reached last year.

Of course, this measure of the long-term real interest rate – and especially the expected inflation component – is illustrative, as opposed to definitive.[9] The estimation technique is based on fairly strong assumptions about underlying economic behaviour, and the estimated coefficients themselves are subject to considerable uncertainty, partly due to the relatively short sample period. Other approaches to constructing inflation expectations would yield different results. Our approach also implicitly assumes that the price adjustment process in Hong Kong will not be prolonged. Indeed, the real effective exchange rate has already returned close to its trend level. The possibility cannot be excluded, however, that structural changes in Hong Kong and the region may have influenced the underlying path for the real exchange rate.[10] In such a case, deflation could be more long-lived than assumed above, reducing inflation expectations along with it.

REAL INTEREST RATES AND ACTIVITY

The analysis in the previous section suggests that the long-term real interest rate has fallen significantly since the peaks last year, but remains high by historical standards. What are the implications for asset prices and economic activity in Hong Kong?

It is commonly assumed that the observed relatively high level of real interest rates should be associated with falling asset prices and activity. In contrast, economic theory suggests that the decline in the long-term rate from last year's peaks should lead to a recovery in asset prices and activity. To illustrate the difference between the two views, Chart 7 shows hypothetical paths for asset prices and interest rates under alternative assumptions about the expected path of short-term rates. The top panel illustrates a common view of the impact of an increase in real interest rates. In this case, a rise in the real rate leads to a steady decline in the asset price until the point where the rise in interest rates is reversed, causing asset prices to return to their original level. In contrast, the middle panel presents the time paths for interest rates and the asset price predicted by economic theory when markets are forward-looking and rational. An increase in the short-term real interest rate causes the long-term rate to "jump" up on impact. In response, the asset price declines immediately. As time passes, the long-term rate gradually falls back, assuming that the shock to the short-term rate is expected to unwind in the future. The initial drop in asset prices will similarly reverse, *even though the observed short-term interest rate remains high*.

The purpose of this example is to illustrate that forward-looking expectations are important in understanding the relationship between interest rates and asset prices. This point is underscored by the example in the bottom panel of Chart 7. Here, we assume that the short-term interest rate is expected to rise for a period of time and then gradually decline back to its original level. The long-term interest rate will initially jump, reflecting higher expected future short-term rates, and asset prices will decline on impact. Subsequently, the paths for both the long-term rate and asset prices will resemble those in the earlier example, with the shocks decaying over time. In this case, the asset price actually recovers from the initial decline, *even though the short-term rate is both high and rising*.

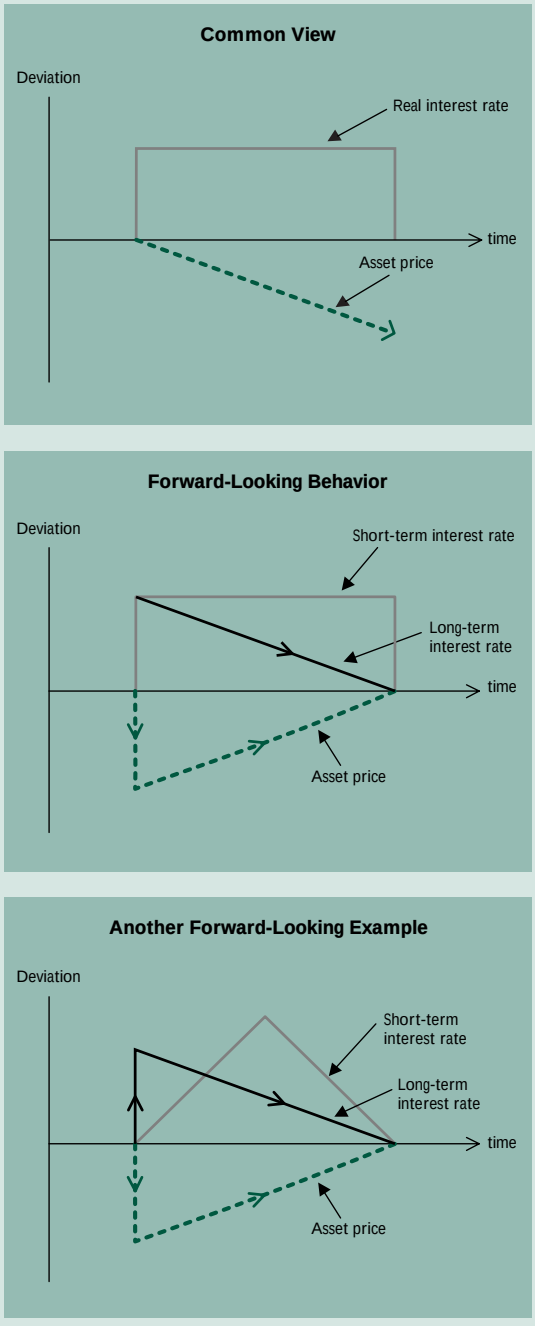
Of what relevance are these stylised examples to the situation faced by Hong Kong? In fact, the shocks to financial markets described above – in particular the second example – are consistent with

9 It would also be desirable to look at long-term real interest rates applicable to different horizons, such as 10-year or 20-year rates. In the event, nominal yields on 10-year Exchange Fund paper have moved similarly to 5-year yields since their introduction, suggesting that the slope of the nominal yield curve is fairly flat at longer horizons. As for expected inflation, using the methodology described here, it would become increasingly stable at longer horizons, as it would be less affected by initial conditions as opposed to trend factors. These considerations would reinforce the qualitative conclusions obtained using 5-year rates.

10 These might include, for instance, greater competition from Mainland ports as shipment points for China's trade, or greater scope for financial intermediaries to relocate to other, less costly centres in the region.

Chart 7

Interest Rate - Asset Price Dynamics



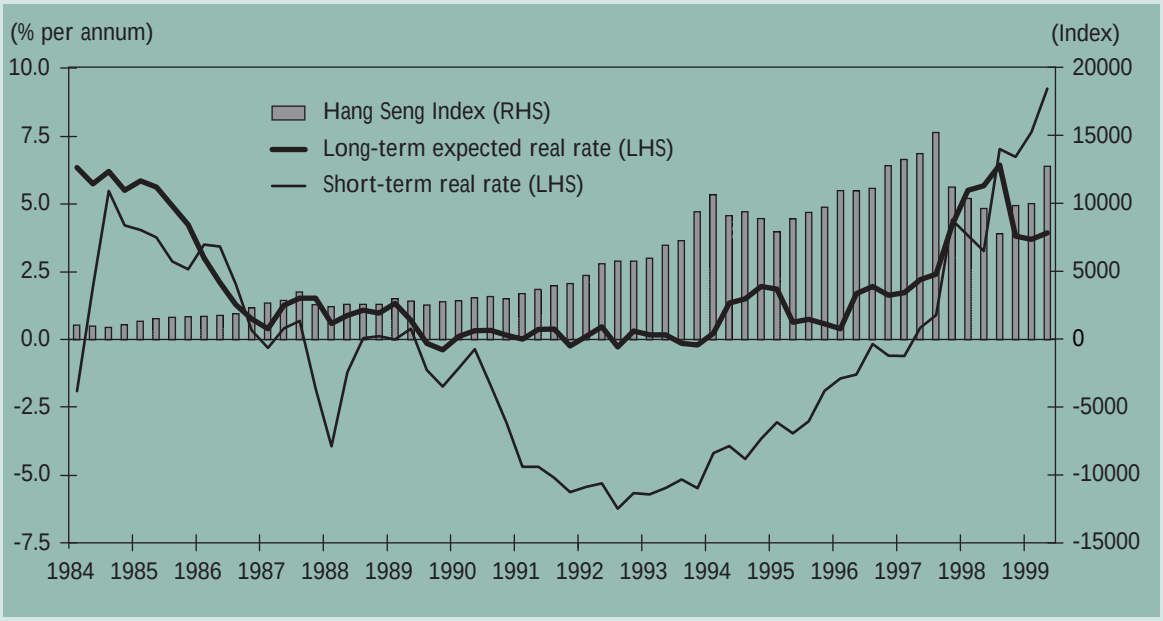
the dynamics of the linked exchange rate system. Consider, for instance, events during the Asian crisis. For Hong Kong, a combination of effective exchange rate appreciation, lower external demand, and a higher risk premium on the HK$ caused a sharp drop in output. A key element of the process of restoring equilibrium under the linked rate consists of a period of falling prices and real exchange rate depreciation. So it is natural that real short-term interest rates will continue to rise, even after the initial shock to the risk premium fades. But this process will not continue indefinitely. As the real exchange rate falls, actual and expected deflation decline, long-term real interest rates drop, and asset prices recover, consistent with the dynamics in the second example. So the theoretical cases are not mere curiosities, but are consistent with generally accepted economic adjustments under the linked exchange rate system.

Turning to actual data, Chart 8 shows the behaviour of real interest rates and equity prices through mid-1999. As global financial turmoil intensified from late 1997 through August 1998, both short- and long-term real interest rates rose, and equity prices plunged. As conditions subsequently stabilised, however, the estimated long-term real rate fell and equity prices recovered, notwithstanding the continuing rise in short-term real rates. This underscores that long-term rates can decline and asset prices recover, even though short-term rates may be high and rising.

Nevertheless, the estimated long-term real interest rate remains high by historical standards. Just as it is important to recognise the shortcomings of conventional measures of real interest rates, one cannot ignore the fact that that financial conditions in Hong Kong remain tight relative to the pre-crisis period. Ultimately, full-fledged recovery can occur when activity elsewhere in the region recovers; exchange rates (including that of the US$) return to more sustainable levels

Chart 8

Real Interest Rates vs. Hang Seng Index



from a medium-term perspective; and the price adjustment process in Hong Kong is completed, implying greater competitiveness and lower real interest rates via more positive inflation expectations.

CONCLUSIONS

This note has discussed some caveats to commonly-held views on the measurement of real interest rates and on their relationship to economic activity and asset prices. While it is encouraging that the concept of real interest rates has become increasingly accepted in popular economic analysis, subtle issues are frequently ignored that nevertheless can have important implications for their construction and interpretation. These include: distortions in measured inflation; the role of expected future inflation as opposed to past inflation; the relevance of long-term as opposed to short-term rates, and confusion about the interaction between real interest rates and asset prices.

All of these issues affect common views on real interest in Hong Kong. While conventional measures of short-term real interest rates continued to rise in the first half of the year, expected long-term rates appear to have fallen from peaks last year. Thus, the associated recovery in asset prices is not as surprising as it would otherwise appear. There is no reason to expect that further increases in short-term real rates will, by themselves, preclude economic recovery

- Prepared by the Research Department

APPENDIX A

CONSTRUCTING LONG-TERM INFLATION EXPECTATIONS

To construct an estimate of long-term inflation expectations, a small model was estimated and simulated of the price adjustment process in Hong Kong. As discussed in the text, the first equation describes the inflation rate in Hong Kong (defined as the change in the log of the composite "core" CPI, π^{HK}) as a function of a constant term, past domestic inflation, current US inflation (π^{US}), and the lagged gap between the trend and actual real effective exchange rate (*rer_gap*). The equation was estimated using annual data over the 1984-98 sample period, with the following results (t-statistics in parentheses):

$$(1)\ \pi^{HK} = 0.019 + 0.380\ \pi^{HK}_{t-1} + 0.620\ \pi^{US} - 0.124\ rer\_gap_{t-1}$$
$$(1.50)\quad (1.40)\qquad (1.90)\qquad (1.30)$$
$$R^2 = 0.600$$

While the coefficients have relatively low t-statistics, they are all of the expected sign and of a plausible magnitude.

The second equation relates growth in the US CPI to past US inflation, as well as the past gap between the core and overall US inflation rate ($\pi^{USCORE} - \pi^{US}$). The inclusion of this lagged gap is intended to reflect the likelihood that disturbances in the "non-core" component of inflation are largely transitory. This yielded the following estimates, where again the coefficients were plausible and of the expected sign:

$$(2)\ \pi^{US} = 0.005 + 0.780\ \pi^{US}_{t-1} + 0.448\ (\pi^{USCORE}_{t-1} - \pi^{US}_{t-1})$$
$$(0.42)\quad (2.76)\qquad (1.00)$$
$$R^2 = 0.400$$

The third equation is a simple error-correction process for the real effective exchange rate (REER). It specifies that the REER will return to its trend level at a geometric rate determined by the lagged adjustment parameter. The estimated parameter suggests that slightly less than one quarter of the lagged gap will be closed in each period:[1]

$$(3)\ \Delta rer\_gap = -0.220\ rer\_gap_{t-1}$$
$$(1.10)$$
$$R^2 = 0.380$$

Simulations of these three equations allow us to trace out the current and future response of domestic inflation to disturbances to lagged domestic inflation, US overall inflation, US core inflation, and the real effective exchange rate. Given a shock to *rer_gap*, for instance, equations (1) and (3) indicate what will happen to π^{HK} both in period $t+1$ and in all future periods. To construct a measure of the impact on future inflation that is consistent with the five-year maturity of the nominal long-term yield, we then average the impact on π^{HK} in the five years following the shock. Given the linearity of the model, this shock-minus-control impact will be independent of the initial values of the variables.

Numerical simulations of this type allowed the construction of a reduced-form equation for future inflation. In particular, the average of five-year ahead inflation can be expressed as:

$$(1/5)\ (\pi_{t+1} + \pi_{t+2} + \pi_{t+3} + \pi_{t+4} + \pi_{t+5}) =$$
$$0.028 + 0.32\ \pi^{HK} + 0.29\ \pi^{US} + 0.13\ \pi^{COREUS} - 0.12\ (rer\_gap)\ .$$

This expression then represents the five-year ahead expectation of inflation used to construct the real interest rate in the text.

Of course, this methodology is illustrative as opposed to definitive. Although they agree with theoretical priors and are plausible in magnitude, the point values of some of the parameters are estimated imprecisely, in part because of the relatively short sample period available since the currency board was established. There are also other approaches to specifying the behaviour of inflation under a fixed exchange rate regime that could yield different results. Nevertheless, the qualitative conclusion that long-term inflation expectations are generally much less volatile than observed year-on-year inflation rates is likely to be supported by a wide range of empirical methodologies.

1 The process by which the real effective exchange rate gap closes is related to the inflation process in equation (1). It would be attractive to integrate the inflation process into the REER adjustment mechanism. In practice, however, there are many other factors at work that affect the REER adjustment path, including external inflation and third country exchange rate movements against the US dollar. It proved more tractable to consider equation (3) as a quasi-reduced form in which the domestic inflation adjustment is subsumed in the coefficient on the lagged REER gap.