ANALYSIS OF INFLATION IN HONG KONG *

Different indices used to measure underlying inflation give different pictures of the typical change in the prices facing consumers. Each index has its advantages and disadvantages. It is important to distinguish between inflation in tradable goods and non-tradable services; the former has generally been considerably lower and aligned with that in the US, as would be expected given the exchange rate link, while the latter has been boosted by Hong Kong's strong productivity growth and recent structural changes.

Measuring inflation

Inflation is the growth rate of the general level of prices. This differs from the related concept of changes in the 'cost of living', which is likely to grow somewhat more slowly as people substitute other goods for those whose price has risen rapidly (See Box A for details).

A number of measures of consumer price inflation are compiled in Hong Kong. The most commonly discussed is the Consumer Price Index (A). This measures the average change in the prices of a basket of goods and services typical of a household whose monthly expenditure is between around $4 000 and $16 000, which covers about half the households in Hong Kong. It is compiled by the Census & Statistics Department checking approximately 40,000 price quotations on goods and services from 3,500 outlets each month and weighting them based on household spending patterns, which are updated by surveys every five years. This measure grew by 6.4 per cent between June 1995 and June 1996 and it is this 'headline' number which is most commonly cited as Hong Kong's inflation rate in the media.

There are other measures of consumer price inflation. The Consumer Price Index (B) is calculated in a similar manner to the CPI(A) but refers to the spending patterns of households with expenditure between $16 000 and $30 000, which represent almost a third of households. The Hang Seng CPI refers to those households with expenditure between $30 000 and $60 000, which represent about a tenth of households. The 'Composite CPI' is a weighted average of the three CPIs.

Table 1 and Chart 1 show that the various measures of consumer price inflation in Hong Kong

Table 1:
Average inflation rate

	1990-95	1981-95
CPI (A)	9.3	8.1
CPI (B)	9.4	8.1
Hang Seng CPI	9.9	9.0
Composite CPI	9.5	8.4

grow at similar rates and reflect similar trends over the medium term. There can be variations over shorter periods. For example, between July 1994 and July 1995 the CPI(A) grew by 8.5% while the Hang Seng CPI grew by 10.1%. This was mainly because housing rents, which as Table 2 shows have a larger weight in the Hang Seng than in the CPI(A), grew particularly rapidly over this period.

For a selection of CPI components, the percentage change over the twelve months to January 1994, to February 1994, to March etc. was calculated. The standard deviation of these percentage growth rates is given in Table 3. Products affected by the weather, such as fresh vegetables, have particularly volatile prices, as indicated by the high standard deviation.

Does the CPI understate increases in the cost of living?

People often assert that the official inflation rate understates the true increase in the cost of living; for examples of economists saying this see Biers (1995). Even if wrong, this is perhaps understandable. Items whose price goes up suddenly are more likely to be noticed than prices which have remained steady for a long period. Everyone

Chart 1
CPI Measures (% change over year ago)
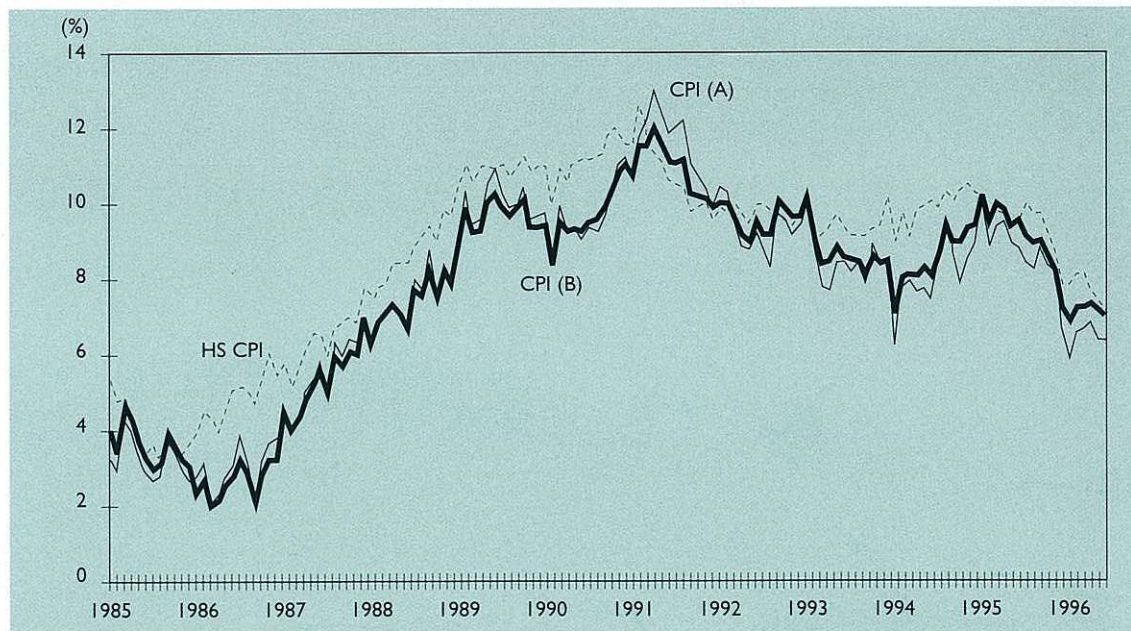
Table 2:
Weights in Various CPI Measures

	CPI(A)	CPI(B)	Hang Seng	Composite
Fresh foods[1]	10.53	6.06	3.47	6.79
Meals away from home	20.43	18.99	14.15	18.16
Other foods	6.34	4.32	2.76	4.55
Housing	25.34	28.18	34.00	28.83
Fuel and light	3.37	2.16	1.50	2.36
Alcohol & tobacco	2.06	1.18	0.77	1.35
Clothing & footwear	5.12	6.95	8.04	6.66
Durable goods	4.34	5.85	6.31	5.49
Miscellaneous goods	6.03	6.44	5.79	6.14
Transport	7.17	7.57	8.79	7.77
Miscellaneous services	9.27	12.30	14.42	11.90

(1)   Defined as fresh sea products, pork, beef, live poultry, fresh vegetables and fruits, dairy products and eggs.
Source: Census & Statistics Department, *CPI Report April 1996*
Base Year: Oct 94-Sept 95=100.

is aware of the rapid rises in the prices of certain items but sometimes forget that home computers, CD players, cellular phones, and long distance phone calls have become dramatically less expensive, or that the price of taking the tram has barely changed for a number of years.

Furthermore, the CPI reflects *average* spending patterns. People who spend a higher share of their income on those goods whose prices have grown more rapidly will face a larger average price rise. The half of the community who have faced a higher inflation rate than the average are more likely to comment than the half who have faced a lower rate.

The Census & Statistics Department compiles the CPI using internationally accepted procedures. Some studies on other economies suggest that for a number of technical reasons (described in Box A)

Chart 2
CPI Inflation and Asset Price Inflation (% change over year ago)
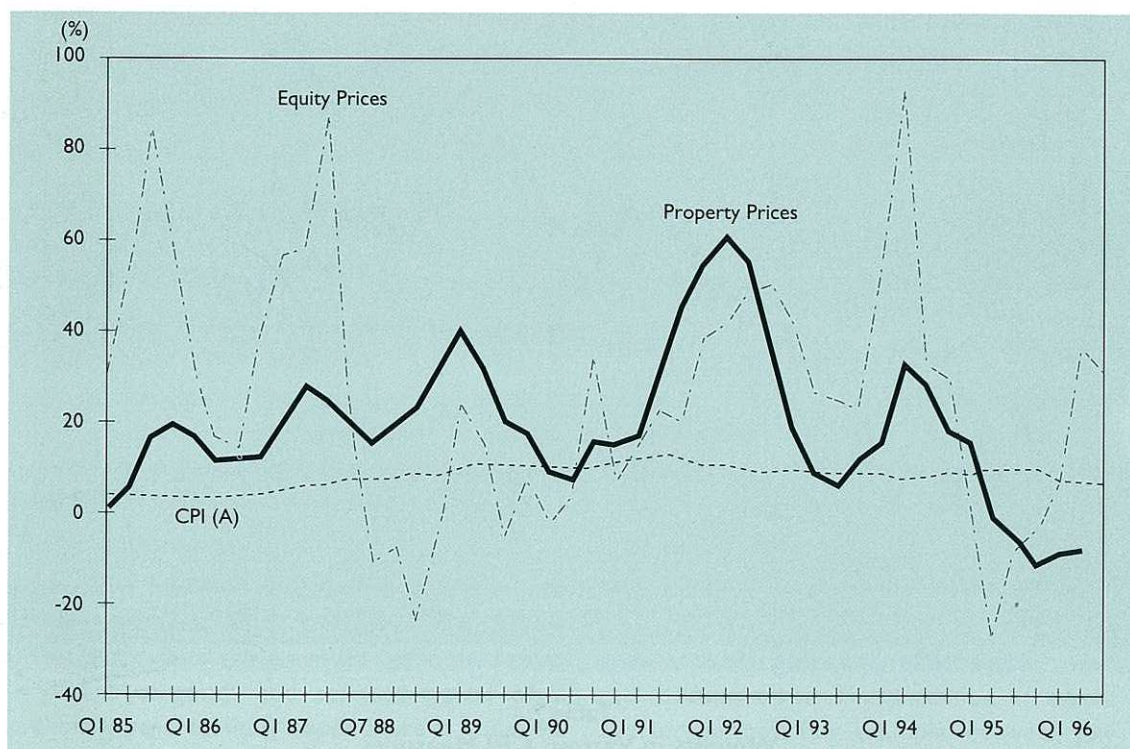
official inflation rates are likely to overstate increases in the cost of living. It is hard to be precise about the extent of overstatement. Other things being equal, the more frequent reweighting of the CPI in Hong Kong should make the overstatement less than in the US. Our guess is that the overstatement in Hong Kong could be in the order of $\frac{1}{2}$ to 1%.

Asset price inflation

It is sometimes suggested (for example, by Goodhart (1995) who draws on Alchian and Klein (1973)) that, at least conceptually, an inflation index measuring changes in the purchasing power of money and suitable for being the focus of policy should not only include the price of current consumption but also asset prices. (As Chart 2 and Table 4 show, such prices are far more volatile than consumer prices.)

While many central banks keep an eye on asset prices as well as consumer prices, to our knowledge no central bank bases policy on such an index. Indeed, as far as we know, no official statistics agency even compiles such an index. Given the lack of official asset price indices and the

Table 3:
**Selected CPI(A) Components:
Variability of Growth Rates**

Standard deviation of annual % growth rates (January 1994- June 1996)

Fresh vegetables	19.7
Women's clothing	5.9
Men's clothing	2.3
Meals away from home	1.3
Bread etc	1.1
MTR fares	0.7
Total CPI	0.9

difficulty of calculating appropriate weights, the idea is not pursued further here.

Measures of underlying inflation

The 'headline' inflation rate tends to jump around quite a lot. For example, it was almost 10% in August 1994, dropped to under 8% two months later, was back over 10% in January 1995 but under 9% the following month. The main cause of this was variations in fresh food prices, in turn
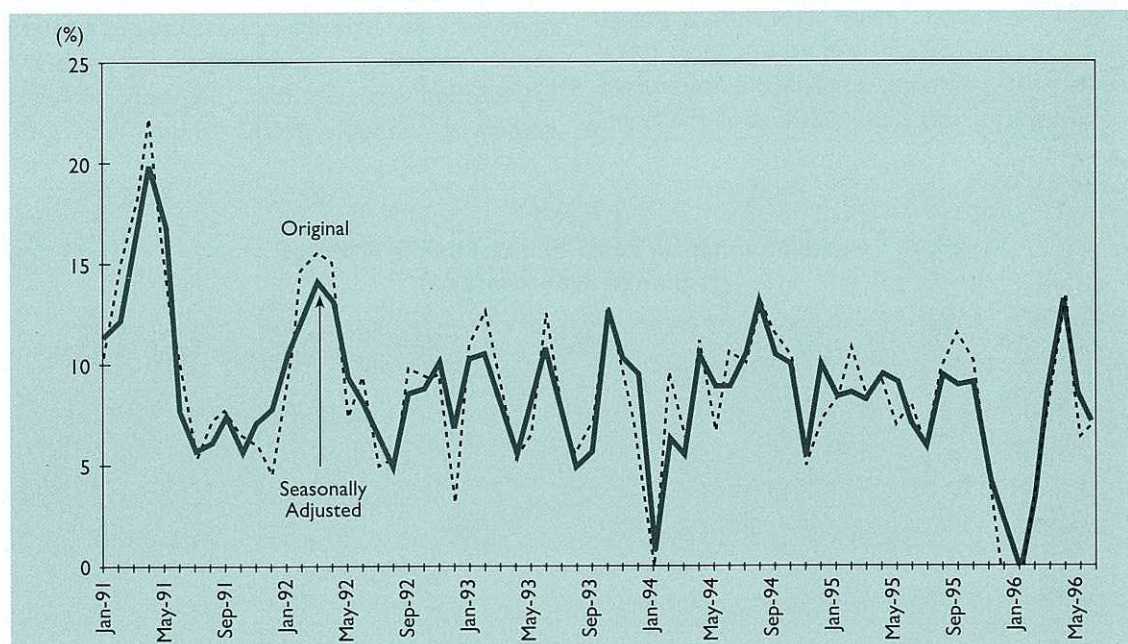
Table 4:
Volatility of Prices

Standard deviation of quarterly on-year-ago percentage changes, 1987-95.

	Consumer prices	Equity prices	Property prices*
Hong Kong	1.8	29.7	30.3
Japan	1.3	23.5	9.4
Malaysia	1.2	29.4	n.a.
Singapore	1.0	21.5	18.3
Taiwan	1.5	75.5	33.0
Thailand	1.4	41.7	24.5

* Offices in major cities. Source: Richard Ellis Ltd.

Chart 3
CPI (A) – 3 Month % Change Annualised

Base Year: 1989/90 = 100

reflecting weather conditions in China, and movements in the calendar month in which Lunar New Year falls.

These problems are even more severe if inflation is measured over a shorter time period. Annualising a few months' movements in the CPI magnifies the effect of these influences. Unlike Christmas, which is always in the same calendar month, Lunar New Year moves from year to year and therefore its impact is difficult for a seasonal adjustment process to capture. Annualised CPI movements have been especially volatile in 1991, 1994 and 1996 when Lunar New Year was unusually late. (Chart 3)

For detecting changes in trends or calculating real interest rates and so forth, it is more useful to have a measure that abstracts from some of this 'noise'.

One possibility is to take a moving average of the inflation rates. Chart 4 shows this does produce a smoother series but it has the disadvantage that observations are lost at each end

of the series. As it is usually the latest rate that is of most interest this is a significant drawback. Furthermore, the choice of averaging period is somewhat arbitrary; a short period leaves in more volatility, a longer period hides turning points.

A more sophisticated version of this procedure, which does not lose the most recent observations, is to apply a smoothing technique such as the Hodrick-Prescott filter to the inflation rates. The filter calculates a trend series Y* which minimises the following expression;

$$\sum_{t=1}^{T} (\ln Y_t - \ln Y^*_t)^2 + \lambda \sum_{t=2}^{T-1} [(\ln Y^*_{t+1} - \ln Y^*_t) - (\ln Y^*_t - \ln Y^*_{t-1})]^2$$

where the choice of λ determines the smoothness of the trend series. The value chosen for this parameter is analogous to the choice of averaging period in the moving average; a low value leaves in more volatility, a higher value hides turning points. In Chart 5 we use 1600 for the parameter as this is the value most commonly used in the literature.[2] One drawback of this approach is that the trend

series will be revised each time a new observation is added. The downtrend now evident in early 1995 would probably not have been present at the time.

Another commonly used approach is to exclude the most variable items or those regarded as not representative in some way, perhaps because they have been influenced by a one-off change such as a tax rise or some other government policy. It is hard to decide which items should be excluded.[3] Probably the most common exclusions are food and energy prices. Chart 6 shows that for Hong Kong excluding food from the CPI generates a series that is less volatile but has been consistently higher than overall inflation in recent times.

There are a number of problems with this approach. First, it generates the suspicion that the items excluded have been chosen to get a particular result; "excluding those items whose price rose a lot, inflation was quite low". Secondly, while totally removing certain items from the CPI is

Chart 4
Headline Inflation and 3 Month Moving Average
(% change over year ago)
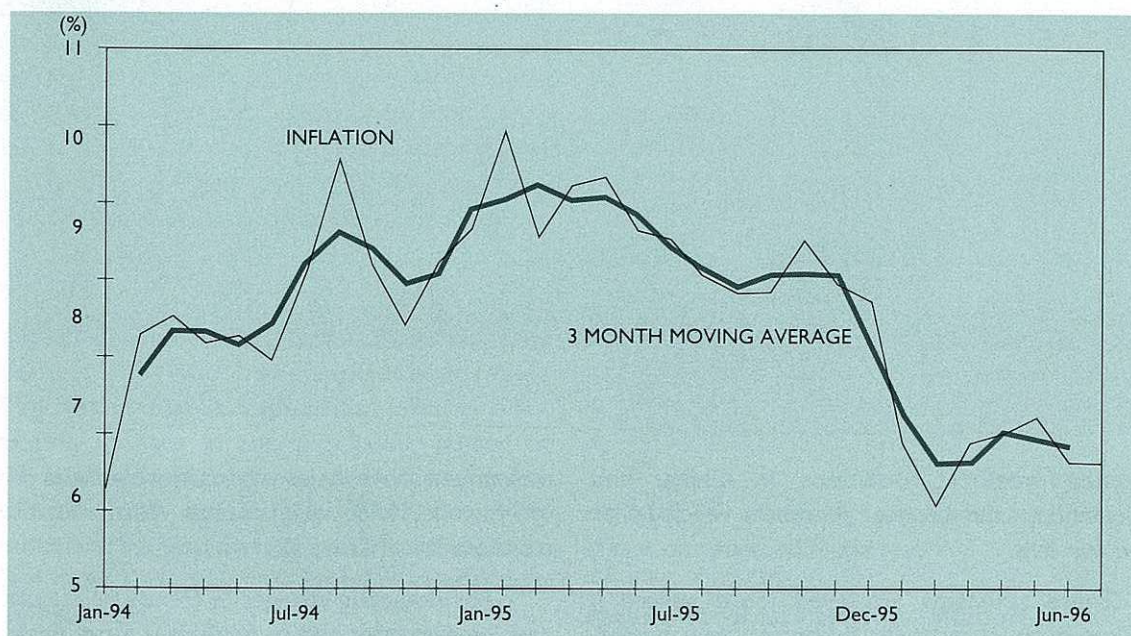
(2)   The filter was introduced in Hodrick & Prescott (1980). The choice of 1600 for the parameter value was defended by Kydland & Prescott (1990) but criticised by Canova (1993).

(3)   At various times, various countries have excluded food, mortgage interest payments, other credit charges, other housing costs, health insurance, health services, petrol, heating oil, postal and telephone charges, electricity, motoring charges, public transport fares, education, clothing, holiday travel and accommodation, child care, pharmaceuticals, local government rates, alcohol, tobacco, timber and the impact of indirect tax and subsidy changes and exchange rate movements.

Chart 5
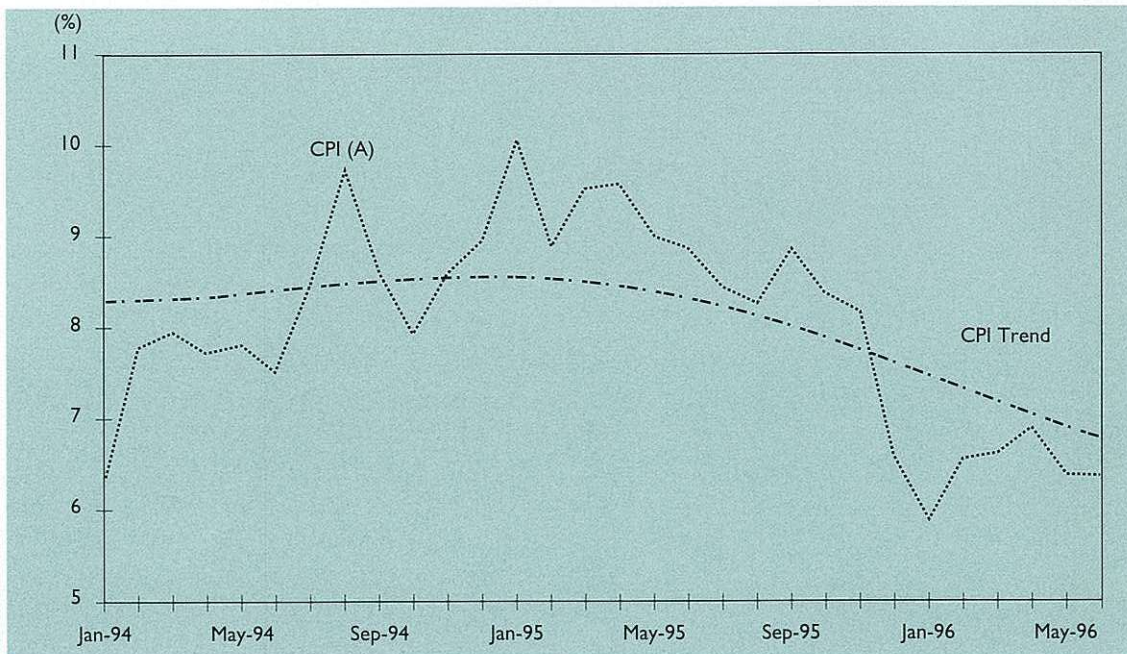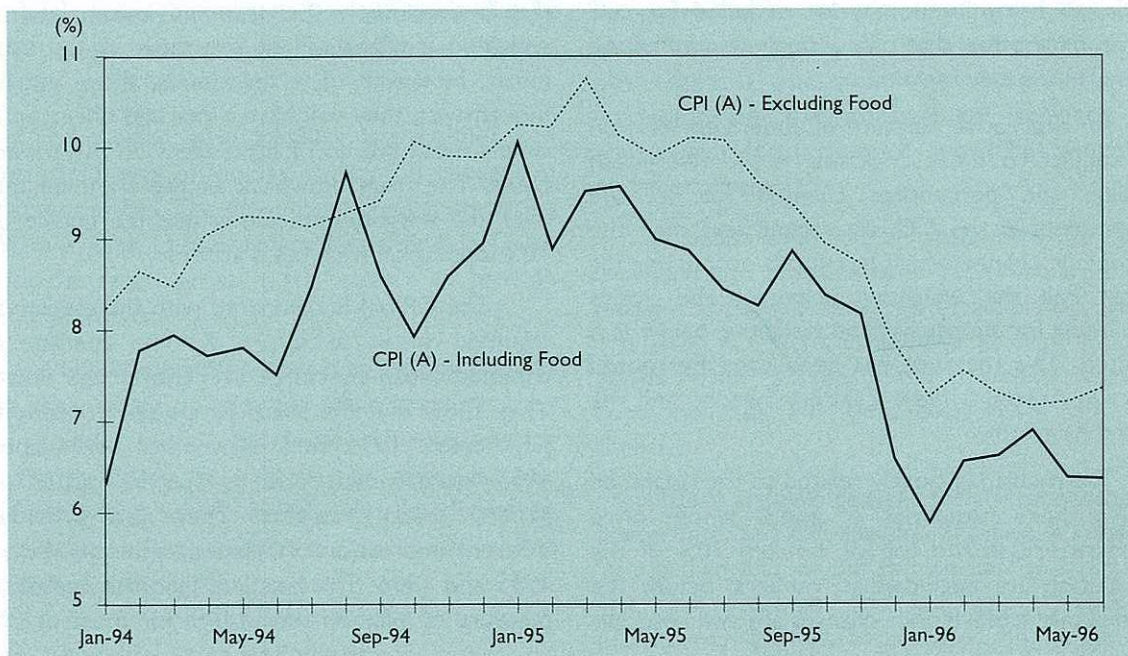### Inflation & CPI Trend (% change over year ago)

Chart showing CPI (A) dotted line and CPI Trend dash-dot line. Y-axis (%) from 5 to 11. X-axis from Jan-94 to May-96.

Chart 6
Inflation – Excluding and Including Food
(% change over year ago)

Chart showing CPI (A) - Excluding Food dotted line and CPI (A) - Including Food solid line. Y-axis (%) from 5 to 11. X-axis from Jan-94 to May-96.

straightforward, trying to exclude the effect of a tax change or exchange rate movement may involve judgement or the use of model-specific results. Thirdly, the approach only excludes those items which in the past have been subject to erratic supply shocks, not those which may be in the future. Fourthly, it removes not only the volatility of the excluded items but also their trend

Chart 7
Inflation – Mean, Median & Trimmed Mean
(% change on year ago)
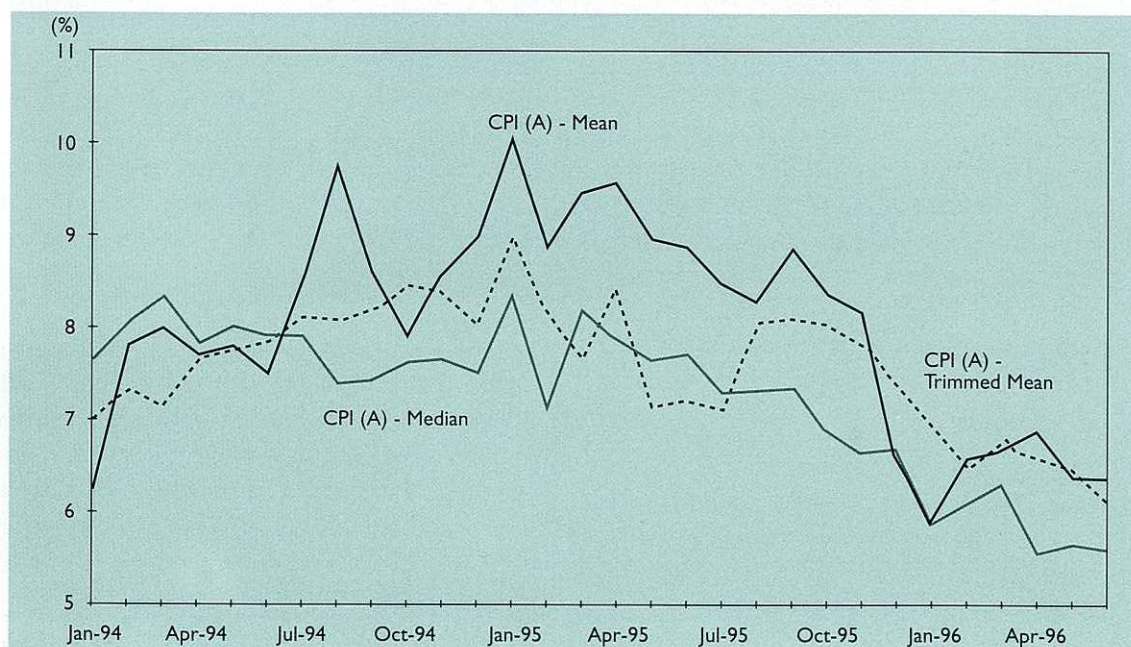
growth, which may bias the underlying series. Finally, so many items may be excluded for one reason or another that only a small amount of the original index may remain.

An alternative measure of underlying inflation not subject to these criticisms is the (weighted) median; the percentage changes for all the components in the CPI are ranked and then the percentage change which has goods accounting for almost half the weighting above it and goods accounting for almost half the weighting below it is selected. This measure has been used by central banks in Australia, New Zealand, Sweden and the United Kingdom.[4]

The median is closely related to the "trimmed mean"; those categories of goods whose price increases are in the top or bottom 10% of the distribution are excluded as 'outliers' before the mean is calculated. If price changes are symmetrically distributed (such as in a 'normal' or 'bell curve' distribution) then the trimmed mean (and the weighted median) will be the same as the simple mean. However, if a few items show extreme movements, they will have a marked effect on the simple mean but no or little effect on the trimmed mean. The main drawback of the trimmed mean over the weighted median is that the choice of a 10% lopping off each tail is arbitrary.[5]

The CPI(A) is compared with the median and trimmed mean in Chart 7. The median and trimmed mean measures are clearly less volatile. They show that the sharp jumps up in inflation in July/August 1994 and November 1994-January 1995 were mostly due to specific rather than general price pressures. They also provide a different impression of inflationary behaviour over 1995 and 1996. The headline (and the annualised) measure of inflation stayed high for most of 1995,

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(4)   Some work by Roger (1994,1995) concludes this is "the most attractive of the mechanical measures of underlying inflation" in New Zealand. There has been some tendency for the weighted median to be consistently lower than the mean CPI. This may be due to some prices (perhaps particularly those set by or requiring sanction by government) tending to be kept constant for a long while and then jumping up in a single month. The large infrequent adjustments will be downplayed by the median. The median had been advocated as a measure of inflation as long ago as Fisher (1911), albeit more for its ease of calculation.

(5)   Roger (1995) drops the top and bottom 5%, Bryan and Cecchetti (1993) drop the top and bottom 7.5% and Reserve Bank of Australia (1994) drop the top and bottom 15%.

Chart 8
**CPI (A) – Median & Mean
Monthly % Changes**
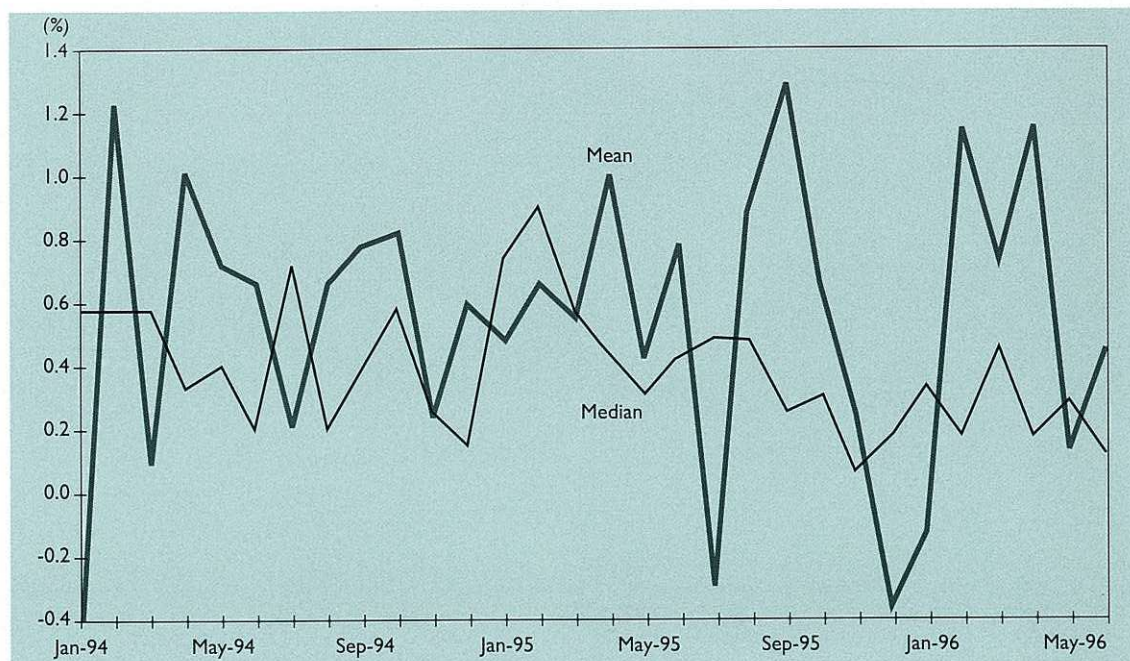
fell sharply in December 1995 and January 1996 and subsequently increased. The median, and to a lesser extent, the trimmed mean, show inflation trending down from early 1995.

The median also provides a smoother and more useful way of looking at monthly changes in consumer prices. The downtrend in inflation during 1995 is evident in the median data shown in Chart 8 but the mean series is too volatile to provide useful information.

While one would not wish to replace the CPI with the median or trimmed mean measure, they do provide useful additional information for detecting trends in inflation as they develop. Understanding what drives inflation, however, requires making other distinctions between aspects of inflation in Hong Kong.

One economy, two inflations

There are noticeable differences in the inflation rates of the tradable (mostly goods) and non-

tradable (mostly services) sectors in Hong Kong. As an indicative illustration, Chart 9 compares growth in the prices of the most unambiguously non-tradable elements of the economy (consumption expenditure on services and government consumption expenditure) with those of traded goods.

A similar effect can be observed if the CPI(A) is divided into those components which are mostly tradable and those mostly non-tradable (Chart 10). The effect is less stark however as even imported goods have a substantial domestic service component by the time they reach the shop shelves.

There are two reasons for this phenomenon, one generic and one specific. The first is known as 'productivity bias' or the 'Balassa-Samuelson effect'.[6] The basic idea is that the opportunities for productivity growth, and hence unit labour cost reduction, are inherently less in services than in manufacturing but, with a flexible labour market, wages must equalise across the sectors. Prices

(6) It was first noted in Balassa (1964). Officer (1976, p546) cited examples of the argument being supported by such luminaries as Johnson, Kindelberger and Maddison. For a recent empirical study illustrating the effect see De Gregorio, Giovanni and Wolf (1994) and for an application of the idea to Hong Kong see Goodhart (1993).

Chart 9
Inflation in Traded Goods and Non-tradable Services
Annual % Change
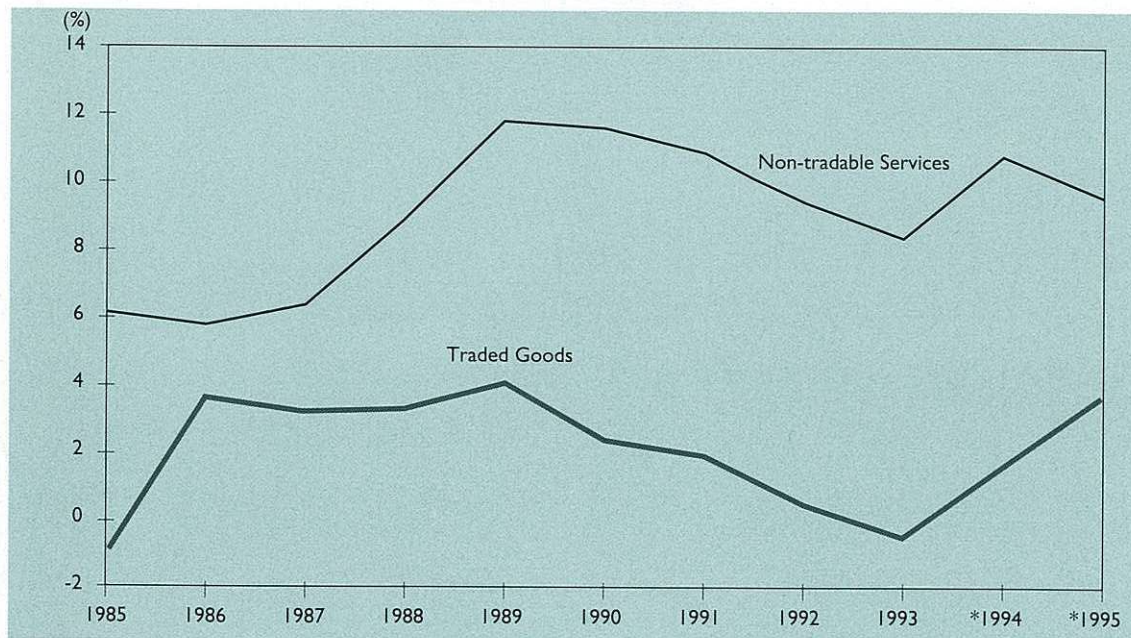
therefore rise more rapidly in the non-tradable than tradable sector. Another way of thinking of this is that as economies become more affluent real wages rise. As wages are a larger part of the cost of services than goods, this implies an increase in the relative price of services.

Under the linked exchange rate system, tradable prices should increase at a similar rate as the US.[7] The correspondence would not, even in theory, be exact as the measure of traded goods in the US will contain a different basket of goods to that in Hong Kong. Further differences will arise as transport costs prevent perfect arbitrage. Chart 11 shows that in practice the relationship has been reasonably close.

In Hong Kong over the past decade the difference in wages growth between the traded goods sector and the services sector has been much less than the difference in productivity growth between them. For example, between 1984 and 1994 average earnings in the manufacturing sector grew at an annual rate of 12.5% and in the

finance sector (including insurance, real estate and business services) by 11.0%. According to Chan (1995) of the Hong Kong Productivity Council, between 1982 and 1992 "real output per worker in manufacturing increased at an average rate of 8% per annum but in services the average rate of increase was 2.3%." Taking these estimates at face value[8], a differential productivity growth of almost 6% per annum would explain much of the difference between goods inflation and services inflation in Hong Kong.

The second factor driving up the relative price of services is specific to Hong Kong's recent experience. The burgeoning growth in southern China has raised the demand for financial and other support services in Hong Kong. In particular, with the limited supply of land in Hong Kong, rents rose rapidly in the early 1990s.

With tradable prices growing at similar rates in Hong Kong and the US, a large rise in the relative price of services in Hong Kong but only a modest rise in the relative price of services in the

(7)   See "Real and Effective Exchange Rates" in the November 1995 issue of the *Quarterly Bulletin* for more details.

(8)   An alternative estimate of productivity growth in manufacturing over this period of 10.4% is given by Census & Statistics Department (1995). While part of the rapid growth in manufacturing productivity may be attributable to compositional change as the less sophisticated parts of the production process are relocated to China, the productivity of those processes remaining in Hong Kong are also likely to have increased rapidly.

Chart 10
CPI (A) – Tradable and Non-tradable Components
(% change on year ago)

Non-tradable
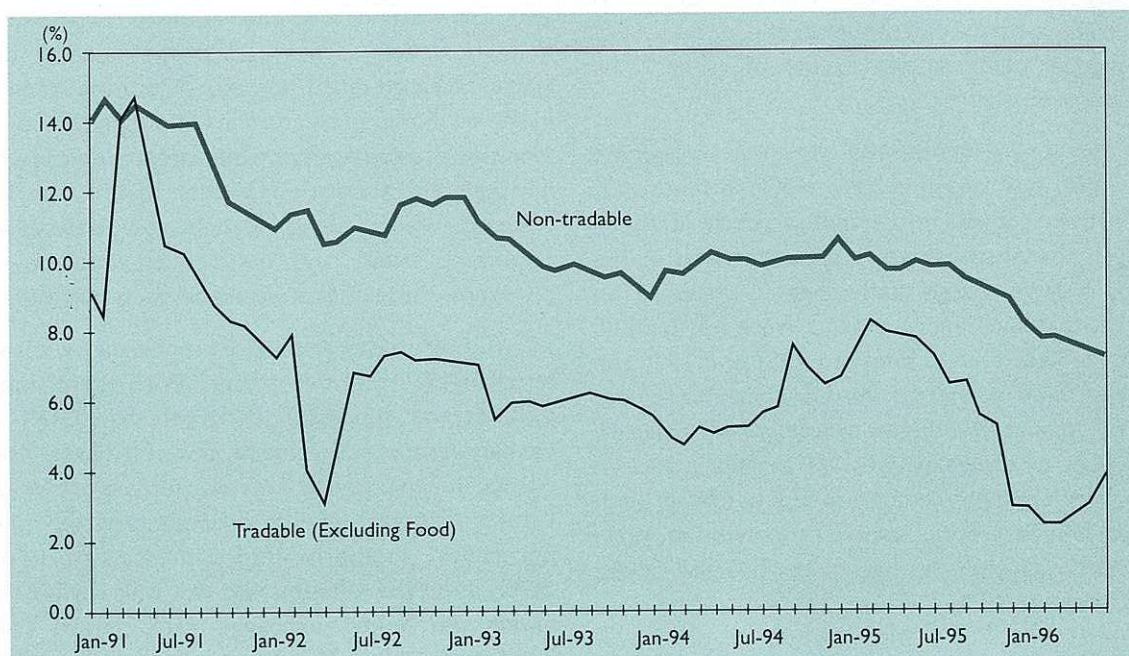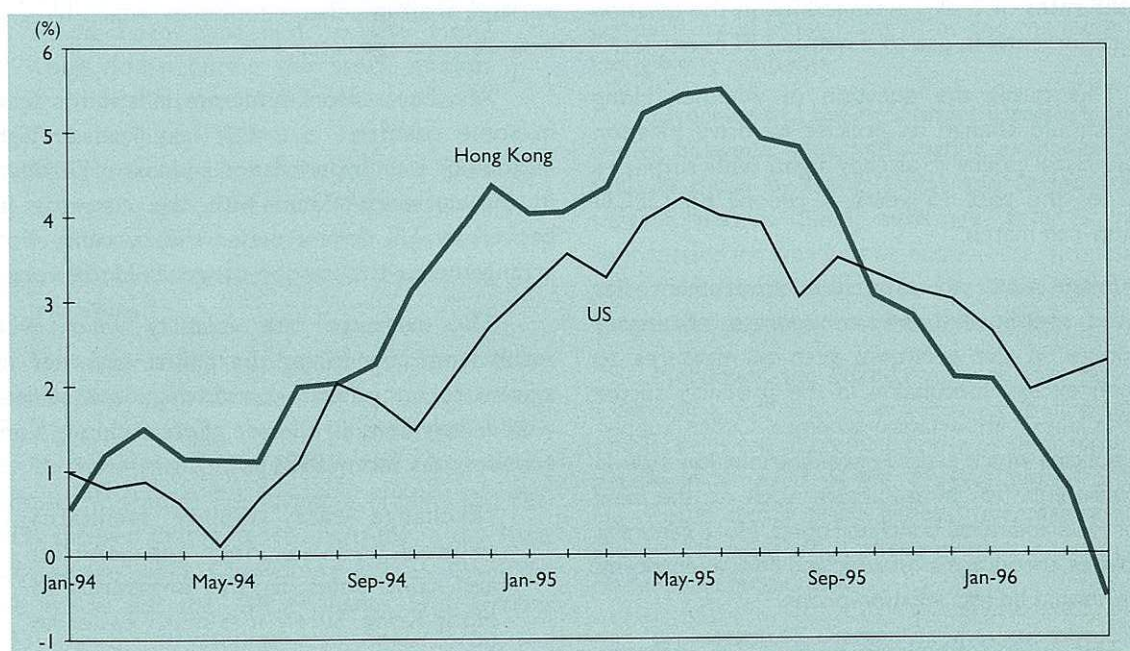
Tradable (Excluding Food)

Jan-91 Jul-91 Jan-92 Jul-92 Jan-93 Jul-93 Jan-94 Jul-94 Jan-95 Jul-95 Jan-96

Chart 11
Comparative Inflation in Traded Goods

Hong Kong

US

Jan-94 May-94 Sep-94 Jan-95 May-95 Sep-95 Jan-96

US implies that the overall inflation rate in Hong Kong will exceed that in the US. (See Box B for an algebraic derivation.) While it is hard to measure all the relevant components exactly, it does seem that a productivity differential in the order of 6% can explain much of the excess of Hong Kong inflation over that in the US.

This phenomenon has also been observed elsewhere. For example, few would dispute that productivity growth in the traded goods sector in Japan in the post-war years exceeded that in the US by a large margin and it would generally be thought that such improvements were less marked in the services sector. Between 1951 and 1970 the yen was fixed at 360 to the US dollar. Over this period, Japanese wholesale prices, which measure the prices of tradables, grew at an annual rate of 0.8%, very close to the corresponding 1.0% growth in the US. However, total CPI growth in Japan averaged 5.2% over this period, considerably above the US rate of 2.1%.

Should more be done to fight inflation?

Hong Kong's inflation rate is around the median rate in the world as a whole. However, it is above the OECD's median inflation rate of 2.5% and the rates of 0 to 3% embedded in the inflation targets currently in use by a number of countries.[9]

This raises the question of whether Hong Kong should change its policies to drive inflation lower. Fiscal policy is already tight, with surpluses in 12 of the past 15 years, a record no OECD country can match.

From time to time the government has adopted specific initiatives to address inflationary flashpoints in the economy, such as measures to dampen excess speculation in the property sector and the labour importation schemes. Other 'supply-side' policies which assist in avoiding inflation include improvements to infrastructure such as the new airport and additional container ports. More generally, its policies encourage a dynamic and flexible economy, which should be less inflation-prone.

This leaves monetary policy. The exchange rate link greatly constrains, indeed virtually eliminates, the ability of the Hong Kong authorities to conduct an independent monetary policy; interest rates are effectively set in the US.[10]

The costs of a somewhat higher inflation rate must however be set against the benefits of a stable exchange rate. The costs of inflation identified in the economics literature are discussed in Box C. Many of the costs arise from interaction between inflation and a taxation system that is not fully indexed. With Hong Kong's low salary and corporate taxes, and no tax on interest and dividends, these effects would be quite mild here.

Other costs arise from uncertainty caused by changes in relative prices. With merchandise exports and imports both larger than GDP, the exchange rate is the major price in Hong Kong. Having it, and hence import and export prices, varying more would create greater price uncertainty. In the floating exchange rate period of 1973 – 1983 inflation was not only higher than under the linked exchange rate period (9.6% compared with 7.7%) it was also more variable (the average absolute change in the inflation rate was 3.9 percentage points, compared to 1.8 percentage points under the link). This is illustrated by Chart 12. Inflation in Hong Kong has been less variable than in other economies which have had a similar average rate.

Another reason moderate inflation is feared in some countries is that it may lead to higher inflation or even hyperinflation and loss of confidence in the currency. Again with the currency fully backed by US dollars under the currency board arrangements, this is not a danger in Hong Kong.

The exchange rate volatility which would result from abandoning the linked exchange rate system to concentrate on driving down inflation would likely have an adverse effect on Hong Kong's economy. As Yam (1992) put it;

> "Exchange rate stability facilitates external trade in goods and services, and contributes to the prosperity of Hong Kong. Surely it is much easier to do business when you do not have to worry about currency risks. Exchange

Chart 12
Inflation and Variability of Inflation* (1980-95)
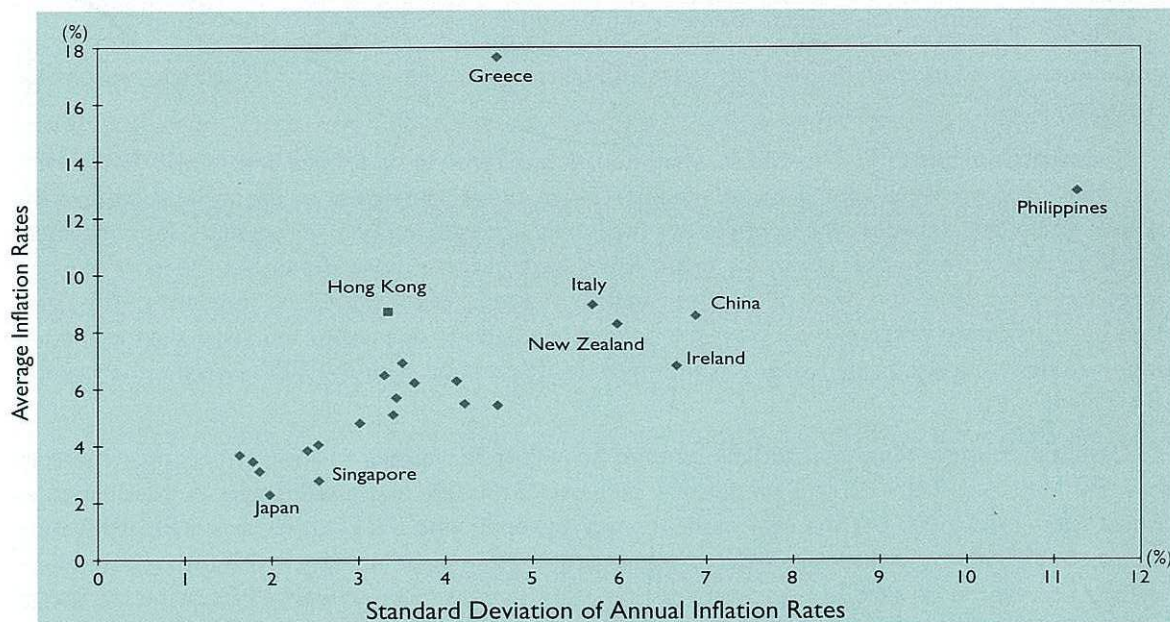
* OECD and East Asia
Correlation Coefficient: 0.67

rate stability is a crucial element for the stability of Hong Kong. Had we just wavered in our determination to maintain exchange rate stability, what would have happened to the Hong Kong dollar during the stock market crash in October 1987, the events in China in June 1989, the Gulf War, the BCCI induced bank runs and the ERM turmoil... we could easily find ourselves in a situation where the exchange rate could move sharply as a result of trivialities."

The adverse impact of exchange rate volatility on trade has been attested to by such eminent groups as the Bretton Woods Commission (1984) and demonstrated in a number of recent econometric studies. For example, Frankel and Wei (1993) showed that it depresses trade in the Asia-Pacific region while Chowdbury (1993) found the same result for the G7 countries and Grobar (1993) for the developing countries. Corbo and Rojas (1995) and Cavallo and Mondino (1995) concluded that exchange rate variability slows economic growth.

A floating exchange rate may well discourage foreign investment, both into and out of Hong Kong, by introducing or exacerbating exchange rate risk. This would over time reduce both the productivity of Hong Kong firms and the income of Hong Kong residents.

Overviews of the economics literature on the choice between fixed and floating exchange rates, such as those by Isard (1995) and Latter (1996), suggest that a fixed exchange rate is more appropriate for small, open economies with flexible prices and labour markets and resilient institutions – a perfect description of Hong Kong. [11]

Moreover, the linked exchange rate provides a discipline and a singular focus for policy that is simple, consistent, credible and well-understood by people in all walks of life. Moving away from the link would create more general uncertainty about the direction of policy, affecting even those making no foreign transactions.

On balance, therefore, the current linked exchange rate regime is more appropriate to Hong Kong's present circumstances than an inflation target. ✸

(11)   See for example McKinnon (1963, p719) where he says "flexible exchange rates become both less effective as a control device for external balance and more damaging to internal price-level stability" as economies become more open.

Box A: Do CPIs Overstate Increases in the Cost of Living?

There are a number of technical reasons why CPIs may overstate the true rate of increase in the cost of living. They have attracted particular attention in the US recently because of the impact any overstatement could have on indexed payments and hence the budget position.[12] The main reasons for overstatement are:

Substitution 'bias'[13]: The CPI is what statisticians refer to as a fixed-weight (or 'Laspeyres') rather than a current weight (or 'Paasche') index. That is, the weights given to the various items in the basket of goods and services whose prices are measured are updated only infrequently. As consumers will tend to substitute cheaper goods for those which have become more expensive, the 'cost of living' will not rise as much as the price of the fixed basket of goods which the CPI is measuring. This 'bias' should be significantly larger in the US where reweighting is done only every ten years than in the UK where it occurs annually. Hong Kong is in an intermediate position with the CPI reweighted every five years.

Quality change bias: Statisticians attempt to adjust for quality changes when they measure prices. For example, if the current model of a car costs $100 000 and a CD player is available as an optional extra for $3 000 but the new model comes equipped with a CD player as a standard feature and costs $105 000, the statisticians would correctly record the price increase as 2% rather than 5%.[14] Invariably however small gradual improvements in quality, such as more powerful PCs or better special effects in action movies, are hard to measure and so price changes are correspondingly overstated. Congressional Budget Office (1994) suggested this might be particularly important for pharmaceuticals in the US. (A partial offset comes from goods and services subject to quality deterioration which is also not measured; examples could include products which do not last as long and poorer service in petrol stations, in shops or on planes. Of course, such judgements may be subjective; views may differ on whether a recording by Leon Lai, Mariah Carey or Oasis is of a lower quality than an old one by Sam Hui, Diana Ross or the Rolling Stones. Reclamation will make the Star Ferry trip shorter and quicker; is this an increase in the unit price or an improvement in quality?) The efforts by Hong Kong statisticians to measure quality changes are likely to be as good as those elsewhere but the extent of quality improvements is arguably a little higher in a rapidly-growing economy so this bias may be slightly higher here.

New product bias: There will be a delay between when new products are available on the market and when they are included in the CPI. Most new products, such as VCRs, CD players and camcorders, have tended to fall in price in the first few years they have been available and their exclusion causes the CPI to overstate inflation.[15] Again this effect will be more marked for countries such as the US which have a long time between reweighting their CPIs. Hong Kong is probably in an intermediate position.

Outlet substitution bias: Consumers are doing an increasing proportion of their shopping in malls rather than at corner stores, and at discount stores rather than department stores. Both these trends enable customers to pay less for the same goods[16] but this switch is not captured by the CPI. It

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(12)   Abraham (1995, p59) comments that "because the CPI is used to adjust such things as social security benefits and income tax brackets, a 1 per cent increase in the index produces an increase in outlays and a decrease in revenues for the federal government which, jointly, add $6.5 billion to the federal deficit".

(13)   The use of the term 'bias' is rather unfair to the statisticians who compile CPIs, as they are trying to measure prices rather than the cost of living.

(14)   In the US car prices rose 313% between 1967 and 1994 but after allowing for quality improvements the car component of the CPI rose only 172%.

(15)   Gordon (1992, p9) gives as examples in the US "the CPI did not introduce autos until 1940, more than two decades after Ford's "Model T" brought the automobile to the average family. Penicillin entered the CPI in 1951, after it had already experienced a 99% decline from its initial price. Air conditioning entered the CPI in 1964, more than a decade after the widespread sale of such products. The pocket calculator entered the CPI in 1978, after it had declined in price about 90% from early models introduced in 1970."

(16)   Assuming they do not consider the (possibly) lower level of customer service to be of any consequence.

therefore will cause an upward bias in the CPI. Anecdotal evidence suggests this effect could be particularly marked in Japan (see Mizuno (1995) for example). A similar effect could arise if an increasing proportion of purchases are made during seasonal 'sales'. If 'interactive' shopping on the Internet becomes more popular, this could also lead to an outlet substitution bias if the prices offered are lower than those by conventional shops. Biers (1995) suggested there may be an offsetting effect in some Asian economies as the CPI basket is not giving sufficient weight to prices in cities, which tend to rise faster than in rural areas.

Other biases: In the U.S. there appear to be specific problems with the compilation of the CPI that give rise to a 'formula bias' (see Abraham (1995, p60)) which the official statistician puts at 0.1% a year. Nakamura (1995) described a rotation bias; if an item is at a temporarily reduced price when added to the sample it enters at an artificially high weight and this weight then applies when the price rises back to its normal level. Fischer (1994) claimed that there is a logarithm bias in the US but it may not apply elsewhere.[17] There have been no claims of such biases in Hong Kong.

The size of these effects have been subject to most study in the US. The results of various studies are summarised below;

Table A1:
Estimates of CPI Bias in the US
(percentage points)

	Substitu-tion	Quality	New Product	Outlet	Other	Total
Braithwait (1980)	0.2					
Diewert (1987)		0.5-1.0				
Manser & McDonald (1988)	0.1-0.2					
Lebow et al (1992)	<0.2	<0.3	<0.5	<0.8		1.0
Bryan & Cecchetti (1993b)						insignificant
Moulton (1993)						0.3-0.4
Aizcorbe& Jackman (1993)	0.1-0.5					
Fischer (1994)	1.0			0.3-0.4	0.3-0.4	1.5-2.0
CBO (1994)	0.1-0.3		<0.1		0.2-0.3	0.2-0.8
Boskin et al (1995) - point	0.3	0.2	0.3	0.2	0.5	1.5
Boskin et al (1995) - range	0.2-0.4	0.2-0.6	0.2-0.7	0.1-0.3	0.3-0.7	1.0-2.7
Nakamura (1995)	0.2	>0.5			0.2-0.3	1.0
Wynne (1995)						0.6-1.0
Diewert (1996)	0.2	0.4-	0.6	0.3-0.4	0.5	1.3-1.7
Klumpner (1996)	0.2	<0.1	<0.1	0	0.1-0.3	0.3-0.5
Shapiro & Wilcox (1996)	0.2	0.25	0.2	0.1	0.25	1.0
Gordon (1996)	0.2-0.3	0.3	0.3		0.3-0.4	1.2

(17) Fischer (1994, p284) claimed this "bias is caused by the practice of recording a decline in price from, say $2 to $1 as a 50 % decline, and a subsequent increase to $2 as a 100% rise. The price of the good would be shown as having risen 50%, even though it has not changed." Mayes and Chapple (1995, p14) pointed out "the bias is only likely to occur in practice if changes are based on percentage changes, rather than the original prices or index numbers, and if fixed weights are used. In New Zealand, at least, index numbers are used in the calculation of the CPI." Shapiro and Wilcox (1996) said it does not occur in the US either.

The results of some studies for other countries are summarised below;

Table A2:
Estimates of CPI Bias Elsewhere
(percentage points)

	Substitu-tion	Quality	New Product	Outlet	Other	Total
Canada						
Fortin (1990)						0.5-1.0
Crawford (1993)	0.1-0.2	<0.2	<0.1	<0.1		<0.5
Japan						
Mizuno (1995)						1.0-2.0
New Zealand						
Brash (1994)						0.5-1.0
United Kingdom						
Cunningham (1996)	0.0-0.1	0.2-0.3	0.0-0.2	0.1-0.3		0.3-0.8

Box B: Productivity Differentials and Inflation

Denoting the growth rate of prices, wages and productivity by p, w and q respectively, tradables and nontradables by the subscripts T and N and foreign variables by *; then if wages are the dominant input;

$$p_T = w_T - q_T \tag{1}$$
$$p_N = w_N - q_N \tag{2}$$
$$p^*_T = w^*_T - q^*_T \tag{3}$$
$$p^*_N = w^*_N - q^*_N \tag{4}$$

Assuming perfect labour mobility across sectors equalises wages then $w_T = w_N = w$ and $w^*_T = w^*_N = w^*$. Then inflation differentials across sectors will be equivalent to productivity differentials. Taking (1) from (2) and (3) from (4) and solving for p_N;

$$p_N = p_T + q_T - q_N \tag{5}$$
$$p^*_N = p^*_T + q^*_T - q^*_N \tag{6}$$

Overall inflation is a weighted average of inflation in the two sectors;

$$p = \theta p_T + (1 - \theta) \, p_N \tag{7}$$
$$p^* = \varnothing p^*_T + (1 - \varnothing) \, p^*_N \tag{8}$$

Then the inflation differential between the two economies is

$$p - p^* = \theta \, p_T - \varnothing p^*_T + (1 - \theta) \, p_N - (1 - \varnothing) \, p^*_N \tag{9}$$

With a fixed exchange rate and arbitrage, tradable inflation should be the same in both economies. Also substituting (5) and (6) into (9) gives

$$p - p^* = (\theta - \varnothing) \, p_T + (1 - \theta)[p_T + q_T - q_N] - (1 - \varnothing)[p^*_T + q^*_T - q^*_N] \tag{10}$$

In certain circumstances this expression simplifies further. If the share of tradables is similar across the two economies so that $\theta = \varnothing$ then (10) reduces to

$$p - p^* = (1 - \theta) \, [(q_T - q^*_T) - (q_N - q^*_N)] \tag{11}$$

That is, the difference in inflation rates is equal to the non-tradable share multiplied by the difference in productivity growth in the tradable sector less that in the nontradables sector.

Box C: The Costs of Inflation

Discussions of the costs of inflation generally distinguish between two types: anticipated inflation and unanticipated inflation. With fully anticipated inflation, expected rates of inflation are embedded into long term contracts, interest rates and payment arrangements but this still imposes costs on the economy. Unanticipated inflation has all the effects of anticipated inflation and more. The purpose of this box is to discuss in general some of the major costs identified in the economics literature.[18] Examples include 'menu' costs, 'shoe leather' costs, costs arising from mixed price signals, distortions due to the tax system, encouragement of short-termism and speculation, and arbitrary and undesirable redistributions of wealth and income.

Menu costs arise as firms adjust their prices whenever their relative prices deviate too far from their optimal levels. With higher inflation this occurs more frequently. Menu costs include not only the costs of changing price labels, re-negotiating contracts (including for wages), informing customers of changes, and so forth but the temporary distortions to relative prices between changes.

Shoe-leather costs refer in a narrow sense to the private costs of people going to banks to withdraw currency more frequently when interest rates are high. More generally they refer to the costs of economising on real money balances (the "Mundell-Tobin effect"). Most quantitative studies suggest this effect is relatively small at low rates of inflation.

Higher rates of inflation also tend to be associated with greater variation in inflation (Chart 12) and hence more uncertainty about inflation (Chart 13), including uncertainty about how the authorities will respond to it. With unanticipated inflation *price signals* become less effective. It is harder to distinguish between general and relative price shifts. This in turn causes a misallocation of resources. Other nominal information becomes harder to interpret also.

Two common distortions in the *tax* system involve the taxation and deductibility of nominal interest and the taxation of nominal capital gains. The former means that inflation reduces the real after-tax interest rate, which may discourage saving and encourage borrowing. The taxation of nominal realised capital gains reduces the marketability of assets. Furthermore, inflation tends to reduce the real value of depreciation allowances available under the tax system, to an extent depending on the type of accounting methods used, and diminishes the benefits of firms carrying forward nominal losses. These problems will encourage firms to concentrate on short-term projects. Such tax interactions may be the most important of the costs imposed by inflation for many countries.

Inflation leads companies to become wary of entering into long-term contracts and investments with long-lived assets due to the extra uncertainty. Raising longer term finance becomes harder and more expensive, and the real burden of servicing long-term nominal debt contracts is concentrated in the earlier years, exacerbating this tendency towards *short-termism*.

Inflation, particularly if uncertain, also distorts firms' and individuals' behaviour in ways that are hard to quantify. Often periods of high inflation lead firms and individuals to direct their attention away from productive investment towards more *speculative activities*, often involving high gearing.

Inflation, particularly unanticipated inflation, also has arbitrary effects on the *distribution of income and wealth*. It distributes wealth from lenders to borrowers and from workers on fixed pay to employers. (Lower than expected inflation of course works the other way.) Inflation hits particularly hard on those on fixed pensions. The overall impact on the distribution of income will depend on how
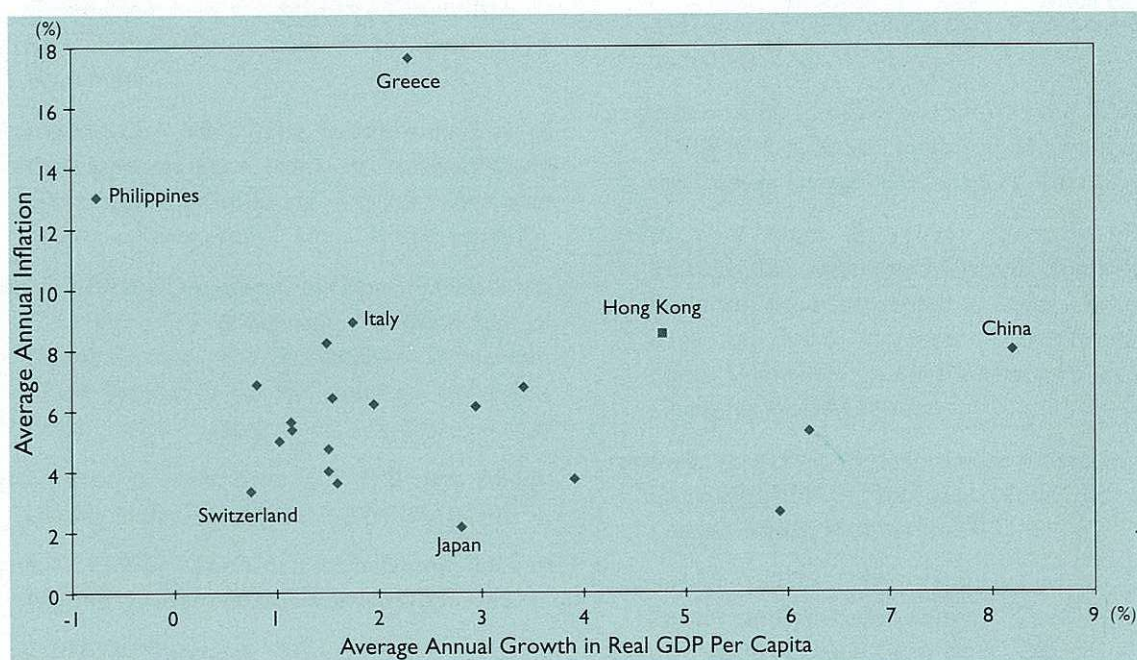
(18) Some good surveys of this topic include Briault (1995), Edey (1994), Fischer (1981, 1986), and OECD (1994). See also the references mentioned therein.

Chart 13
Inflation and Inflation Uncertainty
(mean forecasts and standard deviation of 1997 inflation forecasts for Asian economies)
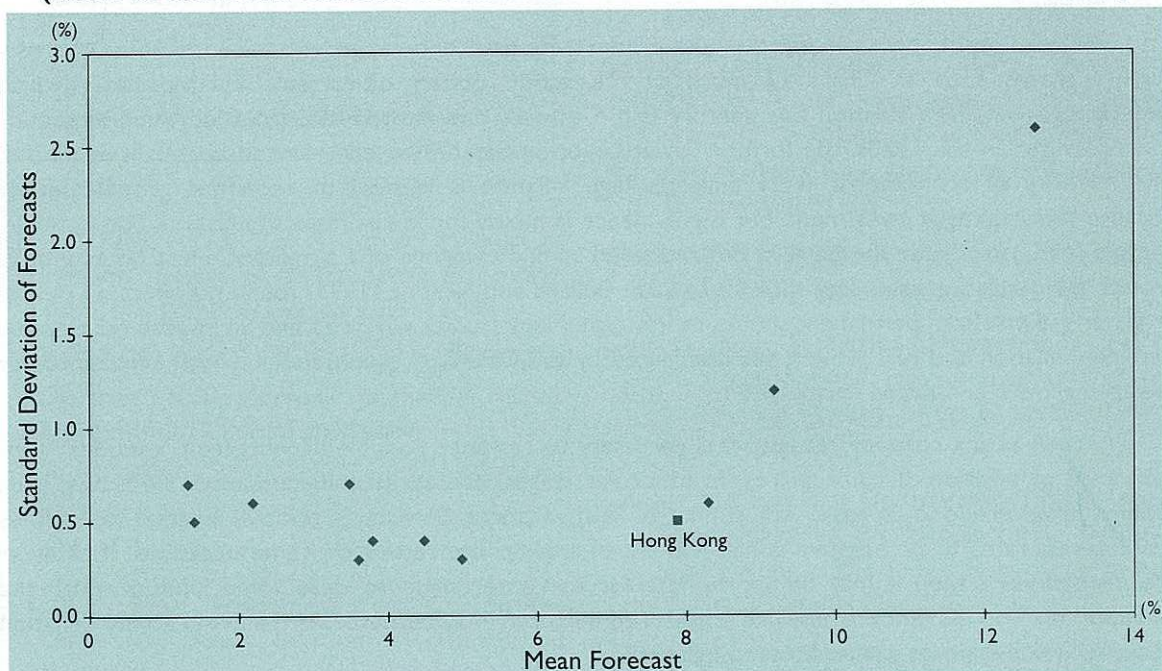
Correlation Coefficient = 0.72

Chart 14
Growth in Real GDP Per Capita* (1980-1995)

* OECD and East Asia
Correlation Coefficient = -0.07

the return to capital is affected by inflation. However, the rich are probably better able than the poor to protect their financial assets against inflation so the effect on the income distribution may well be regressive.

The relationship between inflation and productivity or economic growth is contentious. In cross-section graphs such as Chart 14 much of the action occurs off-camera. The countries which experienced very high inflation this century (e.g. Germany and Austria after World War I, Argentina and Nicaragua in the 1980s, the former Soviet Union in the 1990s) experienced large falls in output. The majority of econometric work suggests high inflation is inimical to economic growth, mainly because it discourages investment, but the evidence is mixed for lower rates of inflation. For example, Barro's (1995) study for the Bank of England failed to find evidence of a significant effect on economic growth from inflation rates less than 10 to 20%. Bullard and Keating (1995) found no effect on output levels or growth from permanent shocks to inflation. Many studies which do find an inverse relationship between inflation and real growth are dominated by the OPEC oil supply shock, which simultaneously lowered growth and raised inflation.[19]

As well as any costs of inflation, it is necessary to consider possible benefits from a modest non-zero rate of inflation. If some prices, in particular wages, are sticky and hard to move down, then modest inflation allows an easier adjustment of relative prices. Similarly, a positive inflation rate allows real interest rates to be negative which may be an appropriate setting on some occasions. If all taxes are distortionary, then it may be appropriate for the government to raise some funds through the "inflation tax" on currency. A positive "measured inflation" may be necessary to avoid a true deflation (Box A), which imposes similar costs to inflation.

(19)   Briault's (1995 p40) cautious conclusion is that "at the broadest level the available evidence supports the view that well-run and well-governed economies with strong and efficient productive structures tend to exhibit both low inflation and high growth, though it is extremely difficult to identify and estimate the separate influence of inflation".

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