HONG KONG MONETARY AUTHORITY

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KEY PRICE INDICATORS AND INFLATION IN HONG KONG

Key points:

- *The GDP deflator has declined by a larger rate than the Composite Consumer Price Index (CCPI) in recent years. An understanding of sources of the difference and their significance is useful for assessing the current inflationary/deflationary pressures and the outlook. This is particularly important at a turning point where one indicator may point to price increases while another continues to decline.*

- *Two factors may be at work. First, the GDP deflator has a wider coverage of goods and services than the CCPI. Secondly, by construction, the CCPI tends to overstate while the GDP deflator understates increases in the general price level. The discrepancy widens as the weighting structure becomes increasingly outdated over time. The analysis suggests that such discrepancies were limited in the past few years, as both indices were re-based only recently to the base year of 2000.*

- *The relatively rapid rate of decline in the GDP deflator is thus mainly attributable to the difference in coverage. In particular, the decline in 2003 was contributed mainly by a decrease in the investment deflator and deterioration in the terms of trade.*

- *Looking ahead, investment prices are expected to be supported by the pick-up in the property market and increasing economic activity. However, the terms of trade are likely to deteriorate further, in view of the rise in commodity prices in the world market. On balance, the GDP deflator is expected to continue to decline in the near term, but the gap between changes in the two price indicators should narrow.*

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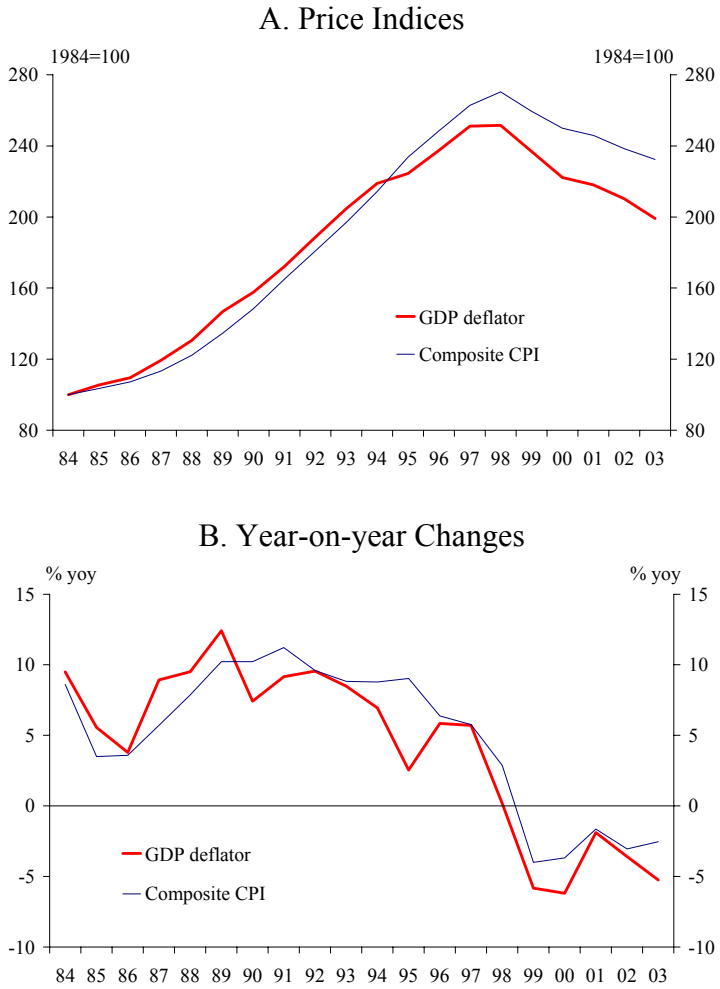
I. INTRODUCTION

The GDP deflator—defined as the ratio of nominal GDP to real GDP—is a broad measure of overall price level in an economy. In Hong Kong, the GDP deflator and the Composite Consumer Price Index (CCPI) have shared a similar trend in the past two decades. However, there has been a growing discrepancy between the two since the mid-1990s, with the GDP deflator consistently growing slower or decreasing faster than the CCPI (Chart 1A&B). For example, while the decline in the headline CCPI slowed from 3% in 2002 to 2.6% in 2003, the decline in the GDP deflator accelerated from 3.6% to 5.3%. Looking ahead, the Government projects the GDP deflator to decline by 2.5% in 2004, compared with no change in the CCPI.

Chart 1. GDP Deflator and Consumer Prices



Source: Census & Statistics Department.

This raises the question of what explains the discrepancy and whether it will likely to continue in the future. Understanding the sources of the difference and their significance is useful for assessing the underlying inflationary/deflationary pressure in the economy. Technically, it also sheds light on medium-term projections of nominal GDP growth, which has important implications for the outlook of the Government's fiscal position. For example, if the discrepancy is systematic and the pattern of slower GDP deflator growth continues, a moderate CPI inflation of 1-2% per year would imply price stability by the measure of GDP deflator.

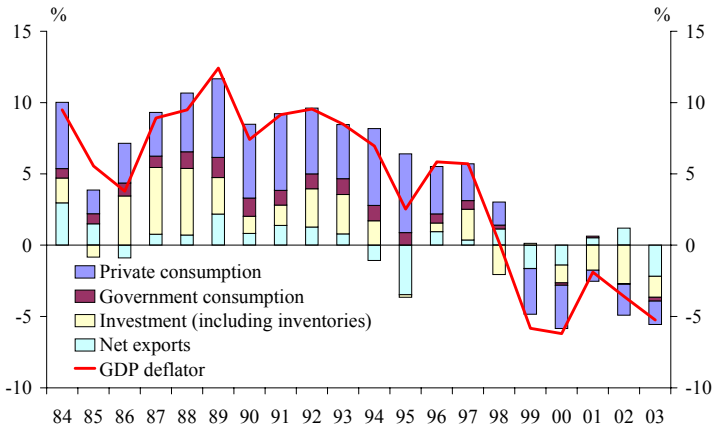
This note considers the differences in coverage and index formulas, which are two factors that contribute to the discrepancy between the two price indicators. The GDP deflator covers a much wider range of goods and services, including investment spending and external trade, which are not covered by the CPI. The significance of the coverage difference is examined in the next section. Section III considers the biases associated with the different index formulas. While the CPI measures the cost of a fixed basket of goods and services that does not vary over a specified period of time, the basket of goods and services included in the GDP deflator may differ from year to year. To illustrate the significance of the index bias, an alternative measure of GDP deflator based on a chain-weighted method is provided. The latter has been adopted by a growing number of advanced economies including the US. The final section provides concluding remarks.

II. COVERAGE DIFFERENCES

The CCPI has roughly the same coverage as the private consumption expenditure component (PCE) of the GDP deflator, but the latter covers also prices of investment, government spending and net exports of goods and services. As a result, the movement in the GDP deflator is affected by price variations associated with both the domestic and external demand factors. A decomposition by the main components suggests that the decline in the GDP deflator in recent years was mainly attributable to declines in the PCE and investment deflators (Chart 2). For example, of an average decline of 4.5% per year in the GDP deflator during 1999-2003, the investment deflator contributed 1.4 percentage points, while the PCE deflator explains 2.2 percentage points. In particular, declines in the deflators for building and construction expenditure and

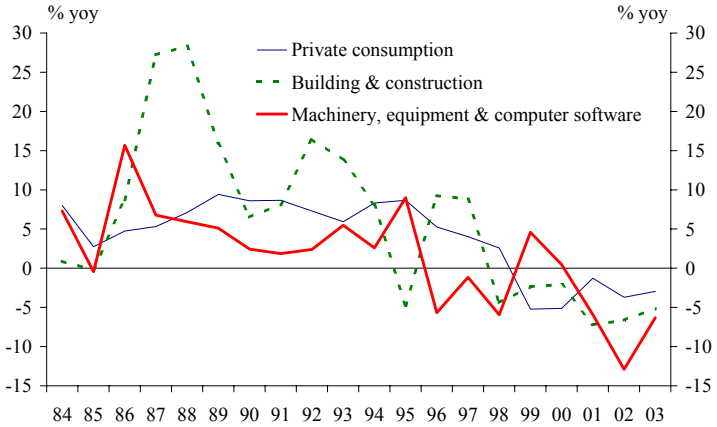
machinery, equipment and computer software spending accelerated by an average of 6.3% and 8.4%, respectively in 2001-03, compared with decreases of 2.6% and 2.4% in the PCE deflator and the headline CCPI (Chart 3). The sharper declines reflect the sluggish property market, as well as weaker import prices, which in part were associated with the strength of the US dollar during the period.

Chart 2. Contributions of Broad Components to Change in the GDP Deflator



Source: Staff estimates.

Chart 3. Deflators of Major Domestic Demand Components

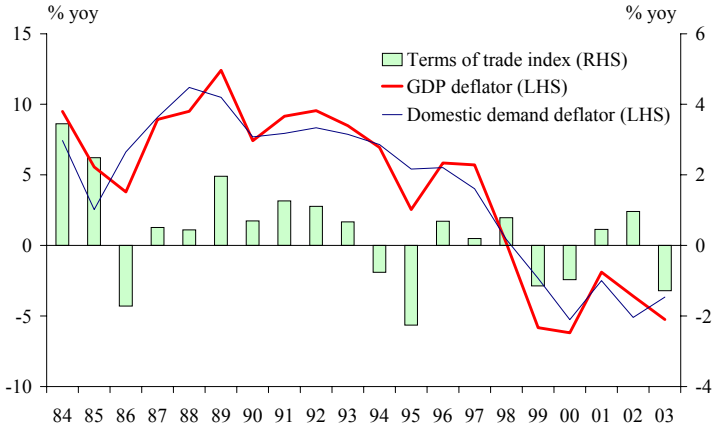


Source: Census & Statistics Department.

External conditions also influences the GDP deflator via changes in the terms of trade—that is, the relative movements of export and import prices. For example, in 1999, 2000 and 2003, the GDP deflator decreased by a larger extent than the domestic demand deflator owing to deterioration in the terms of trade (Chart 4). In particular, the rise in import relative to export prices is estimated to have contributed about two percentage points to the decline in the

GDP deflator in 2003. Nevertheless, both Charts 2 and 4 show that movements in the terms of trade and thus their impact on the GDP deflator tend to be volatile and they change directions frequently. This is not surprising considering the fluctuations in global commodity prices and the major exchange rates. The implication is that changes in the terms of trade are unlikely to be a lasting source of the difference between the GDP deflator and CCPI, and best seen as a short-term and temporary factor.

Chart 4. GDP and Domestic Demand Deflators and the Terms of Trade



Source: Census & Statistics Department.

III. INDEX FORMULA

The different index formulas based on which the GDP deflator and CCPI are compiled may also contribute to the diverse movements in the two indices. While the CCPI is a Laspeyres index which has an upward bias, the GDP deflator is a Paasche index that tends to understate price increases (Box 1). An indication of the index bias is that while the PCE deflator has roughly the same coverage as the CCPI, its rate of change is lower than that of the CCPI in most of the past two decades (Chart 5).[1]

[1] PCE also covers spending by Hong Kong residents abroad, which accounts for about 10% of PCE. Thus, change in the PCE deflator also reflects developments in consumer prices of other economies.

Box 1. Biases of Different Index Formulas

To aggregate the price level of a basket of commodities and services, two major formulas are widely employed—Laspeyres index and Paasche index. The former is averaged from individual prices using the quantity weights fixed at the base year, while the latter uses weights of the current period. Specifically, the respective index formulas are:

$$\text{Laspeyres price index: } \frac{\sum p_t q_o}{\sum p_o q_o}, \qquad \text{Paasche price index: } \frac{\sum p_t q_t}{\sum p_o q_t}$$

where p and q are prices and quantities of individual commodities and services respectively, and t and o refer to the current and base periods respectively. These two types of indices usually give rise to biases towards opposite directions. Specifically, Laspeyres index has an upward bias, while Paasche index has a downward bias.

The difference can be illustrated by a simple numerical example of a hypothetical two-commodity economy consisting of only two types of goods: food and PC. We define that the price indices of both food and PC are "100" at the base year and assume that one unit each is consumed in that year. We further assume that the price and unit of food consumed are unchanged thereafter, and the price of PC declines by half every year while the quantity consumed doubles each year. The aggregate price levels based on the above two index formulas are shown in Table A1.

Table A1. Numerical Example of Price Index Formulas

	Base year	Year 1	Year 2	Year 3
Price of Food	100	100	100	100
Price of PC	100	50	25	12.5
Quantity of Food	1	1	1	1
(Weight)	(0.5)	(0.33)	(0.2)	(0.11)
Quantity of PC	1	2	4	8
(Weight)	(0.5)	(0.67)	(0.8)	(0.89)
Laspeyres index	100	75	62.5	56.3
(% change)		(-25)	(-17)	(-10)
Paasche index	100	66.7	40	22.2
(% change)		(-33)	(-40)	(-45)

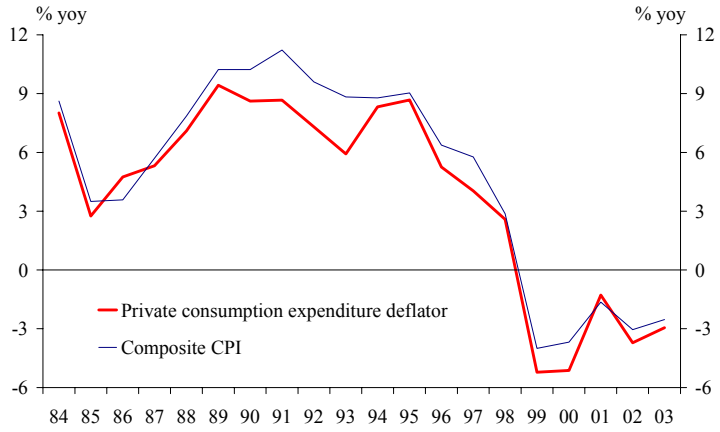
Source: Maiko Koga (2003).

By using the Laspeyres index formula, price indices of food and PC are averaged for each period at the fixed ratio of 1:1. Although the rate of decline in PC prices stays constant at 50% per year, the index level becomes smaller over time. Hence, changes in PC prices have increasingly smaller effects on the overall index. This explains why the year-on-year rate of decline of the Laspeyres index diminishes each year.

On the other hand, in the Paasche index, the relative weight of PC to food increases substantially from 1:1 in the base year to 8:1 in year 3. Contrary to the Laspeyres index, the influence of PC on the aggregate price level becomes increasingly significant, as its weight increases. Thus, the year-on-year rate of decline rises each year.

In this example, the different index formulas give a drastically different picture of the degree of aggregate price changes, with the Laspeyres index indicating a 10% decline while the Paasche index showing a 45% drop by year 3.

Chart 5. Private Consumption Expenditure Deflator and the CCPI



Source: Census & Statistics Department.

The CCPI is aggregated from price indices of individual commodities and services using the weights fixed at the base year.[2] One major drawback of this type of index is that it fails to measure the effect of shifting demand in response to relative price changes, which is known as the

[2] The weights are based on the household expenditure patterns derived from the *Household Expenditure Survey*. In line with international practice, the expenditure weights and the base period are updated every five years. Currently, the base period is October 1999-September 2000.

"substitution bias". A drop in the relative price of a commodity or service tends to stimulate demand for that commodity or service. The CCPI tends to overstate the rate of change in the aggregate price level, as it gives higher-than-actual weights to commodities and services with relatively high prices.

The deflators for the GDP and its components are Paasche indices. They are compiled as averages of sub-component deflators using their current relative shares in GDP as weights.[3] Thus, the movements in these deflators can be distorted by shifts in the composition of output. As consumers tend to shift their purchases from goods and services with relatively high prices to those with relatively low prices, the GDP deflator, in an extreme case, may decrease, even though the prices of individual goods and services increase. In other words, the GDP deflator has a downward bias and tends to understate the actual rate of increase in prices.

To assess the potential significance of the downward bias in the GDP deflator, a chain-weighed GDP price index is computed. Specifically, a chain-weighted Fisher Ideal Index, which is defined as a geometric mean of a Laspeyres index and a Paasche index, helps eliminate the effect of compositional shifts by using weights at both the current and previous periods.[4] The chain-weighted index is compiled based on the broad sub-components of GDP such as building and construction, costs of ownership transfer, and machinery, equipment and computer software in gross domestic fixed capital formation, because of the lack of data on a more dis-aggregated basis.[5] Thus, the computation is best used for illustrative purpose only, as a proper measure of the chain-weighted real GDP and the deflator should be constructed using much more dis-aggregated data.

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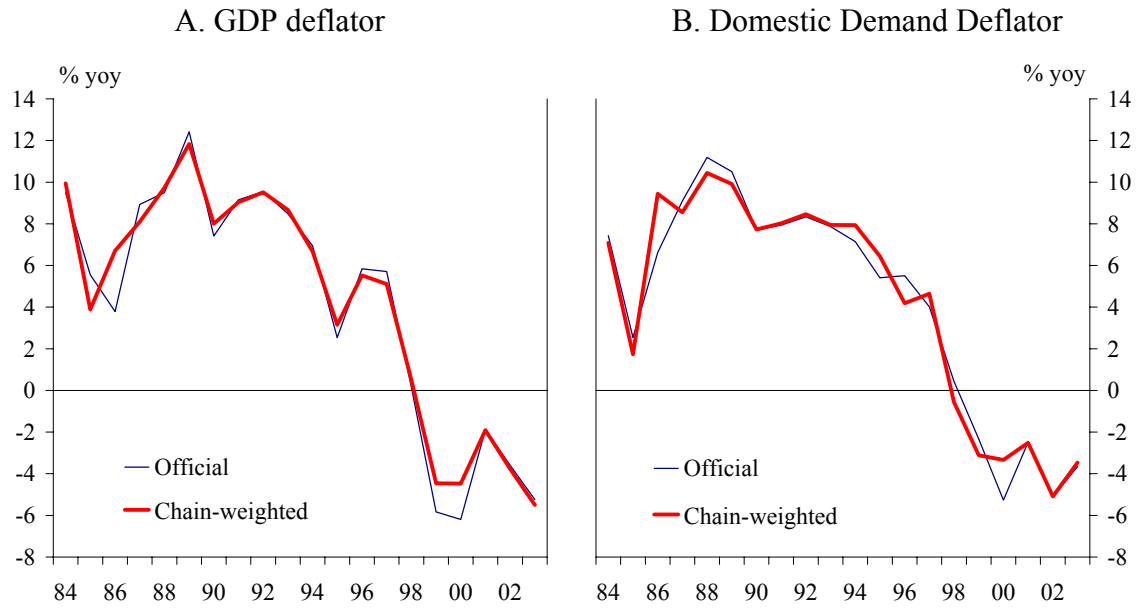
[3] The official real GDP series is compiled using a fixed-base-year constant price method. This method involves using prices in a particular base year, currently 2000, to value expenditure or output in each sector of the economy and aggregate the sectoral constant price values to arrive at an overall real GDP figure. This compilation method is same as that for a Laspeyres quantity index. Therefore, the GDP deflator, which is derived by dividing the nominal GDP by the real GDP, is a Paasche price index according to the property of index formulas.

[4] As the chain-weighted measure is not affected by the choice of base year, the historical trend of real GDP and its deflator do not need to be revised to reflect changing base years, avoiding the associated rewriting of economic history. However, a major drawback of this approach is the loss of additivity for the real GDP components. There are increasing number of advanced economies switching from a fixed-weighted method to a chain-weighted approach in compiling GDP series. For example, the US introduced a chain-weighted Fisher Idea Index of real GDP in 1996. The United Nations' *System of National Account 1993* also recommends moving away from the traditional fixed-base-year constant price estimates towards the chain-weighted measures.

[5] This is an updating of Peng *et al* (2000), which discusses technical issues involved in the estimation.

The rates of changes in the official and estimated chain-weighted GDP deflators are presented in Chart 6. It shows that movements in the two indices have been close since 2001, but the gap was larger in the earlier years. This is because the current GDP series uses 2000 as the base year from 2001 onward, while the base year of 1990 was used before 2001. The bias tends to increase for periods that are further away from the base year, as the shift in the composition of output relative to the base year increases over time. The estimates thus suggest that the effect of compositional shifts on the GDP deflator is insignificant in the recent years. However, this example may underestimate the downward bias in the GDP deflator because it is a weighted average of broad sub-components of GDP. Furthermore, the difference is likely to rise over time before the next re-basing of the GDP statistics.

Chart 6. Official and Chain-weighted GDP and Domestic Demand Deflators



Source: Staff estimates.

IV. CONCLUDING REMARKS

The rate of decline in the GDP deflator has been larger than that of the CCPI in most of the past two decades. This discrepancy can arise from the difference in coverage of these two indices as well as the opposite effects due to the substitution bias in the CCPI and the GDP deflator. The analysis suggests that the larger rate of decline in the GDP deflator in recent years is mainly attributable to the coverage difference. Specifically, the GDP deflator reflects the movements in prices of investment spending and external trade. In particular, price declines in the building and construction expenditure and machinery, equipment and computer software spending have been larger than that of private consumption expenditure in recent years. In addition, the deterioration in the terms of trade (related mainly to the depreciation of the US dollar to which the Hong Kong dollar is linked) also contributed to the decline in the GDP deflator in 2003. Looking ahead, the investment deflator is expected to be supported by the recovery in the property markets, rises in global commodity prices and the weakened US dollar in 2004, but the terms of trade is likely to deteriorate further. On balance, the GDP deflator is likely to continue to grow at a slower rate than the CCPI, although the size of the difference should be smaller than in 2003.

The effect of compositional shifts in the GDP deflator is found to be immaterial in recent years, although they are more significant in the earlier periods. But the bias tends to increase as time moves on and the weight structure in the base year becomes increasingly outdated. This problem can be improved by switching from a fixed-weighted method to a chain-weighted approach.

REFERENCES

Maiko Koga (2003), "Why is the Rate of Decline in the GDP Deflator So Large?", *Economic Commentary*, Bank of Japan, July 2003.

Peng Wensheng, Cynthia Leung and Kelvin Fan (2000), "Is Recent Real GDP Growth Overstated?", internal research memorandum, HKMA, November 2000.