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AN ACCOUNT OF THE METHODS FOR USE TO DERIVE CONSTANT PRICE VALUE ADDED IN SERVICES IN HONG KONG

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A. INTRODUCTION

In Hong Kong, annual Gross Domestic Product (GDP) estimates using both the expenditure and production approaches are compiled. Quarterly GDP estimates, however, are compiled only using the expenditure approach.

2. As in most developed economies, there has been a structural change in Hong Kong's economy towards services. In 1980, some 64% of the GDP came from the service sectors including distribution, catering, transport, communication, financing, insurance, business services and miscellaneous services. By 1992, this share has increased to 86%.

3. Of particular interest is the relationship between the opening up of the China economy and the structural change of Hong Kong's economy. By 1987 and 1988, when the investment environment in China had become more and more attractive, it became a popular trend for local manufacturers to set up production units in China and contracting some of the existing local manufacturing work (that which is more labour intensive) to the production units in China through outward processing arrangements. By now, such relocation has become widespread across different industries. In some situations, all manufacturing processes in the factory have been moved to China, leaving only such essential functions as orders processing, sourcing and design with the local firm; and the local firm no longer operates as a manufacturing unit. In other situations, the manufacturing firm retains in its local operation processes which require greater skill and employment of more advanced technology, or diversifies to the production of some high-end products.

4. As a result, the following changes have taken/are taking place:

(a) There is a significant decline in the total local employment in the various manufacturing industries.

(b) The activities that remain locally are by and large those high-end production processes and supporting activities such as purchasing, marketing, accounting, etc.

(c) The local manufacturing sector requires fewer and fewer operatives, but more technicians and computer experts are required to provide technical support to the upgraded manufacturing processes. A gradual shift of the manufacturing work from the blue-collar type to the white-collar type is therefore taking place.

(d) For firms which have relocated all production processes to China and taken up such supporting activities as design, planning and sourcing locally, they no longer function as a manufacturing entity (which by definition should be engaged in real production work) but rather as a trading firm.

(e) On the other hand, as computer and other advanced technologies are being introduced to the manufacturing industries, the demand for specialized technical support services grows. More and more firms specializing in providing such high-tech support services have been opened.

(f) In short, notwithstanding that total employment in the manufacturing industries has declined significantly over the past years, it is likely that Hong Kong is in fact expanding as a manufacturing base providing support to manufacturing activities in the South China region.

The manufacturing related services, including such support activities as design, planning and sourcing, and such specialized activities as computer aided design, computer aided manufacturing and other technical services, are therefore developing with greater and greater significance to Hong Kong's economy. These services involve the application of advanced technology; demand high level human resources; and require continuous support in high level training.

5. The growing significance of services in Hong Kong's economy has called for a cross-the-board enhancement in service statistics. Increasing efforts are being put in this area of work in the Census and Statistics Department, Hong Kong. In particular, statistical methods for compiling constant price value added in services will be reviewed both intensively and extensively. This paper gives a brief account of the methods currently attempted in Hong Kong to derive constant price value added statistics under the production approach.

B. SUMMARY OF APPROACHES

6. As in most other countries, various alternative approaches have to be developed to serve as proxies for the conceptually most preferred method of double deflation. The approach of double deflation, though produces conceptually more accurate estimates, require extensive data not only on outputs and their prices but also those on inputs. The data currently available in Hong Kong are not yet sufficient for this purpose yet.

7. The methods currently used in Hong Kong to compile constant price value added in services under the production approach are summarized in Annex 1. They can be broadly classified into two types, as follows:

(a) Extrapolation -- An output volume index compiled using an appropriate method is employed as an extrapolator to derive the constant price value added in the current year from that in the base year. The basic formula is

VAC = VAB x Q

where VAC denotes the constant price value added in the current year;

VAB denotes the constant price value added in the base year; and

Q denotes the output volume index to be used as the extrapolator.

(b) Deflation -- An appropriate price deflator is selected and used to convert the current price value added in the current year to the constant price value added. The basic formula is

VAC = VA ÷ P

where VAC denotes the constant price value added in the current year;

VA denotes the current price value added in the current year; and

P denotes the price deflator to be used.

8. The extrapolation approach requires an output volume index to be used as the extrapolator. The methods used to compile the output volume index include the following:

(i) A physical quantity output index is used.

(ii) A physical quantity input index relating to employment is used as a proxy for output index.

(iii) An output volume index is compiled based on constant price gross output. Deflation of the value of gross output to constant price terms makes use of an appropriate output price index.

(iv) An output volume index is compiled based on constant price input. Deflation of the value of input to constant price terms makes use of an appropriate input cost index.

9. The deflation approach can be similarly further categorized depending on the price deflator used, as follows:

(i) A specially constructed price deflator is compiled to take account of the relatively less homogeneous nature of outputs in certain service industries.

(ii) The price deflator is a price index not for the relevant service but for services closely related. The index used is considered to be a reasonable proxy.

10. In terms of coverage, the extrapolation approach is the more dominant approach. Nearly [three quarters] of the total value added in services are covered by it. Within the approach, the extrapolator used is, in most cases, an output

volume index compiled from gross output value deflated by a relevant output price index. In comparison, either an output volume index compiled from input value deflated by an appropriate input cost index, or a physical quantity output index is less used.

11. Compared with the extrapolation approach, the deflation approach is less often taken. When the approach is chosen, special price deflators are constructed only for a few service industries. In the majority of cases, price deflators for services that are closely related are used as proxies.

12. The following paragraphs discuss the two approaches in more detail.

THE EXTRAPOLATION APPROACH

(i) Use of a physical quantity output index

13. The main use of this method is in the transport sector, where the volume of its outputs can be satisfactorily represented by some suitable physical quantity statistics. Where such physical quantity statistics are found to be suitable, this method is also used in the storage and communication sectors. Major examples of the service industries where this method is used include the following:

Service Industry	Physical Quantity Output Indices Used
Railway	. movements of commercial cargo by railway
Road transport	. passenger journeys
Land freight transport	. number of goods vehicles licensed
Vehicular tunnels	. number of toll paying vehicles passing through
Container terminals	. number of containers in standard capacity unit carried by ocean-going vessels
Water transport to neighbouring cities	. number of passenger arrivals and departures

Service Industry	Physical Quantity Output Indices Used
Inland water passenger transport	. passenger journeys for major operators
	. number of launches and ferry vessels licensed in the case of minor operators
Inland water freight transport	. river trading vessels entered and cleared
International water transport	. movements of commercial cargo by ocean-going and river vessels
Ship brokers	. number of locally constructed vessels by type
	. number of ships imported by type
International air transport	. movements of commercial cargo by air
Storage	. total occupied storage floor area
Radio paging services	. number of radio paging receivers licensed
Other communication services	. number of telephone residential lines in service
	. number of telephone business lines in service
	. outward international telephone traffic
	. public telegraph traffic
	. international telex traffic
	. number of leased circuits
	. internal telex traffic
	. maritime radio telex
	. inland telegrams
	. maritime radio telephone traffic

(ii) Use of a physical quantity input index

14. In cases where a physical quantity output index is difficult to compile because of difficulty in measuring the services involved quantitatively, it may be possible sometimes to take a physical quantity input index as a proxy. The input index used usually relates to employment. In a few cases, the number of establishments is also jointly used.

15. Major examples of the service industries where this method is used include the following:

Financing sector

- commodity futures and gold bullion brokers/dealers
- money changers
- foreign exchange brokers/dealers

Insurance sector

- life insurance
- general insurance

Business services sector

- legal services
- accounting, auditing and bookkeeping services
- computer services
- advertising companies/agents
- public relations services
- market research services
- management and business consulting services
- employment agency services
- security services
- interior decoration and designing services
- secretarial, typing and translation services
- machinery/equipment rental services

(iii) Output volume index -- deflating output by output price index

16. Where the outputs of a service industry are too heterogeneous or not easily quantifiable, it may be different to compile physical quantity output or input indices appropriate for use as an extrapolator. In such cases, it may be possible to represent output volume by output value expressed at constant prices. The use of an output price index as the deflator is conceptually most desirable. This is possible in the wholesale and retail trades for most products.

17. For the catering sector, suitable output price indices are in most situations also available. In the transport sector, transport fare indices can be used to deflate passenger transport revenues; car park charge indices to deflate car park revenues; and so on. Similarly, indices of various types of government charges can

be used to deflate the government revenues derived from the corresponding charges. This is summarized below:

Sector	Value of Output	Deflator
Wholesale (for products not predominantly imported)	sales at current prices	relevant components of the consumer price index (CPI)
Retail (all products)	sales at current prices	relevant components of the CPI
Restaurants (various types of eating place)	sales at current prices	the eating out component of the CPI, with breakdowns specific to different types of eating place
Hotels	service receipts and room charges	implicit price deflator for the GDP component of private consumption expenditure on hotel accommodation
Transport		
. inland passenger transport	. passenger revenue	. relevant components of the CPI
. car parks	. car park charges	. relevant components of the CPI
. cargo transport by sea-going vessels	. freight revenue	. price index of overall freight rate
. travel agencies	. tour income	. relevant components of the CPI

Sector	Value of Output	Deflator
Government		
. public car parks	. government revenue from parking charges	. relevant components of the CPI
. civil aviation department	. government revenues from charges on various services provided by the department	. relevant price indices compiled by the department
. marine department	. government revenues from charges on various services provided by the department	. relevant price indices compiled by the department
. general post office	. government revenues from charges on various services provided by the department	. relevant price indices compiled by the department
Stock and share brokers/dealers	stock exchange turnover	the stock price Hang Seng Index .

(iv) Output volume index -- deflating input by input cost index

18. For wholesaling of products that are largely imported, an output volume index can conveniently be compiled by deflating the cost of such products sold by an appropriate input cost index. The input cost index used is the corresponding unit value index compiled from trade statistics. This method is appropriate for the wholesaling of the following products, which are largely imported:

- fuel
- machinery equipment and parts
- raw materials and semi-manufactures

THE DEFLATION APPROACH

(i) Specially constructed price deflators

19. This method is illustrated in the case of trading establishments. Suppose a trading establishment is involved in the import, domestic export and re-export of a certain category of goods. It has also a substantial amount of service receipts from services it provides to other clients. Then the following steps are necessary for the construction of a special price deflator for such firms:

Step 1 : Deflate sales by the relevant re-export unit value index (UVI).

Step 2 : Construct a volume index for deflated sales from step 1.

Step 3 : Construct a Paasche type price index for total trade, weighting the relevant re-export UVI, import UVI and domestic UVI by corresponding current trade values.

Step 4 : Deflate other service receipts by the Paasche type price index derived from step 3.

Step 5 : Construct a volume index for deflated 'other service receipts' from step 4.

Step 6 : Construct a Laspeyres type volume index, weighting the two volume indices derived in steps 2 and 5 by the corresponding trade margin and other service receipts in the base year.

Step 7 : Extrapolate the base year gross output using the Laspeyres type volume index derived from step 6 as the extrapolator.

Step 8 : Compile an implicit price deflator based on the current price gross output in the current year and the same gross output at constant prices (as derived in step 7).

Step 9 : Deflate the current year value added by the implicit price deflator derived in step 8.

20. The above method is used for import/export establishments engaged in trading of various goods. Some adjustments may however be necessary for trading of different goods. For example, if the goods are mainly imported, step 1 will be modified to the deflation of costs of goods sold by the relevant import UVI.

21. A specially constructed price deflator is similarly produced in the case of banking institutions. The following steps are involved:

Step 1 : Compile a volume index of constant price loans and advances.

Step 2 : Compile an employment index which will also be used as a second volume index for the outputs of banking institutions.

Step 3 : Combine the above two volume indices by simple averaging.

Step 4 : Derive constant price gross output by extrapolating the gross output in the base year, using the combined volume index from step 3 as an extrapolator.

Step 5 : Construct an implicit price deflator based on the current price gross output in the current year and the same gross output at constant prices (as derived in step 4).

Step 6 : Deflate the current year value added by the implicit price deflator derived in step 5.

22. Similarly, special price deflators are constructed for real estate developers and the Housing Authority (the statutory body in charge of public housing in Hong Kong). The steps involved are similar to those set out in the preceding paragraph.

(ii) Price deflators for closely related services

23. The second category of price deflators involves using a deflator that has been derived for services that are considered to be closely related to the service in question. Major examples of this category of price deflators is the use of the price deflator constructed for banking institutions to be proxy deflators also for

- financing leasing companies
- other personal loan, mortgage and instalment credit companies
- pawnshops
- investment and holding companies

24. Other examples in this category also include the use of an average deflator derived from the deflators for various service industries within a sector to act as a proxy for the deflator for the "not elsewhere classified" services in the same sector. As an illustration, the average deflator for bus passenger revenue, tram passenger revenue, railway passenger revenue, taxi fare revenue, public light bus fare revenue, etc. is used as the proxy deflator for "other land passenger transport".

LIMITATIONS AND PROBLEMS

25. It should be noted that the following limitations exist with the methods set out in this paper, which are currently attempted by Census and Statistics Department, Hong Kong to derive constant price value added in services locally:

(a) The use of an output volume index as an extrapolator to derive constant price value added in the current year (based on the value added in the base year) requires that real inputs (i.e. inputs measured at constant prices) bear a constant ratio to real outputs. When this is not the case, using the method to extrapolate base year value added may lead to bias.

(b) Since productivity is changing over time, the use of an input index (e.g. employment index) as a proxy for a conceptually preferred output index for extrapolating base year value added will lead to biased results. As there is likely a long-term upward trend in productivity in most service industries, the use of an input index in the extrapolation approach may bring about a slight downward bias in the real product estimated.

(c) In the deflation approach, where a special price deflator has to be constructed (refer to paragraphs 19 to 22), it should be a Paasche type price index for output so as to give a good approximate for real term value added. However, in practice, only Laspeyres type price indices are available for deflation. This may bring about some bias in the results of the estimates.

26. In the attempt by the Census and Statistics Department, Hong Kong to develop the methodology for deriving constant price value added in services, problems are encountered in two particular areas. First, price deflation for rapidly developing technology products; and second, price deflation for financial intermediation services indirectly measured (FISIM).

27. There are at least two problems associated with the price deflation for such rapidly developing technology products as computer hardware, computer software, and communication products (e.g. paging services). The first problem is that although the unit prices of such products may be increasing, their prices are actually falling having regard to the upgrading that has taken place in the product content. The second problem is that the product cycles for these items are usually short and the products are often phased out rather soon. Theoretically, a hedonic

method taking account of major attributes of the product specifications can be developed. However, in practice, the choice of major attributes of the product and the construction of an appropriate mathematical model have not been easy.

28. FISIM cover services provided by such financial intermediaries as banks and deposit taking companies. The output of FISIM is measured by the interest rate differential, i.e. the difference between the borrowing rate and the deposit rate. FISIM in real terms is generally difficult to understand conceptually. This has made the development of an appropriate deflator even more difficult. This issue is of particular significance to Hong Kong because FISIM accounts for a high proportion (some 7%) of Hong Kong's GDP, much higher than the proportions found in other economies. Different deflation methods used on this component may lead to rather different results for the GDP growth in real terms.

CONCLUDING REMARKS

29. The methods set out in this paper are currently attempted in Hong Kong to derive constant price value added statistics for services. The results produced by these efforts have however not been entirely satisfactory. Hence, no constant price value added statistics under the production approach are currently published. For certain sectors, the results are not totally reasonable and hence they are practically not suitable for any use, even for reference purpose.

30. In view of the growing significance of services in Hong Kong's economy, particularly the rapid developments relating to manufacturing related services, more research efforts will be put into further development of appropriate methodology for deriving constant price value added in services.

Summary of Methodology Used to Derive Constant Price Value Added in Service Sectors

Methodology	Economic Sectors	
	Distribution and Catering	Transport, Storage and Communication
Extrapolation Approach $(G_o - I_o)V$	(Wholesale, Retail Trade) V : Volume index of sales or inputs, obtained by deflating sales value or cost of goods sold with relevant CPI or UVI. (Restaurants, Hotels) V : Volume index of sales, obtained by deflating sales value or receipts by relevant CPI or PCE price deflator.	(Transport, partly) V : Volume indices of different components, which include numbers of passenger journeys, vehicles licensed, ferry vessels licensed, ships built and imported, containers loaded, or price(incl. CPI)-deflated carriage revenue, tour income, parking fees, etc. (Storage) V : Volume index of occupied storage floor area. (Communication) V : Volume indices of different components, which cover radio-paging receivers licensed, telecommunication services subscribed and CPI-deflated postal output.
Deflation Approach $\frac{G_t - I_t}{P}$	(Import/Export Trades) P : Implicit price deflator for GO, constructed on the basis of its deflated components of sales and other service receipts. These components are deflated by the relevant UVI's.	(Transport, partly) P : Related CPI or implicit price deflator of VA in other subsectors.

Remark : See Legend at the end of the Annex for the meanings of the abbreviations used in the table.

Methodology	Economic Sectors	
	Financing, Insurance, Real Estate and Business Services	Community, Social and Personal Services
Extrapolation Approach $(G_o - I_o)V$	(Financing, partly) V : Volume index based on HSI-deflated stock exchange turnover, or index of no. of persons engaged. (Business Services) V : Volume indices of different components, which include BCI-deflated net value of construction work performed, legal fees, court cases, no. of establishments and no. of persons engaged. (Insurance) V : Volume index based on index of no. of persons engaged.	(Government Services) V : Volume index of establishment of civil servant. (Commercial establishments) V : Volume indices of different components, which include CPI-deflated services receipts, school fees, medical charges, subscription fees, entertainment admission charges, examination fees, etc.
Deflation Approach $\frac{G_t - I_t}{P}$	(Real Estate) P : Implicit price deflator for GO, constructed on a joint basis of deflated rent (deflated by a combined rent index from CPI and R&VD) and REDM at constant price (derived by extrapolation of BCI-deflated gross value of construction work performed). (Financing, partly) P : Implicit price deflator for GO, constructed on the basis of GO at constant price (derived by extrapolating base year GO by volume index obtained from imputed bank service charges)	(Private Non-profit Bodies) P : Price index of payroll per person engaged.

Remark : See Legend at the end of the Annex for the meanings of the abbreviations used in the table.

Legend :

G_o	=	gross output in base year
I_o	=	intermediate consumption in base year
V	=	appropriate volume index as extrapolator
G_t	=	gross output in current year t
I_t	=	intermediate consumption in current year t
P	=	appropriate price index as deflator
CPI	=	consumer price index
UVI	=	unit value index based on trade statistics
PCE	=	the GDP component of private consumption expenditure
GO	=	gross output
VA	=	value added
HSI	=	the Hang Seng Index of stock prices
REDM	=	real estate developers' margin
R&VD	=	Rating and Valuation Department
BCI	=	building cost index