MSC IN DATA SCIENCE AND BUSINESS STATISTICS
2023-24

STAT 6108 :
Official Statistics and Structural Equation Modelling
Second Term, 2022-2023

PART 1- OFFICIAL STATISTICS
PowerPoint – 3

(See also PPT-3A.
Slide 2 of PPT-3 provides
a relevant remark regarding PPT-3A)

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January/February 2024

Gross Domestic Product (GDP)
Technical standard to follow - -
United Nations :
"A System of National Accounts"

C&SD publication " YYYY Gross Domestic Product"
contains methods and data specific to Hong Kong
(YYYY – 2021, 2020, 2019,…)

….
(Instead of most updated figures, in some of the slides in **PPT-3,**
data before 2019 have been used for illustration.
This is because there were very special circumstances
during 2019 to 2022 in HK such that the figures for those years may
not be reflective of the longer-term situation and trend)

[[**PPT-3A** *provides some updates on the relevant data*
(updated to the latest available ones]]

Gross Domestic Product (GDP)

A. GDP

- *A measure of the total value of production of all resident producing units of an economy in a specific period*
- *GDP at current prices*
- *Per capita GDP*
- *GDP at constant prices*
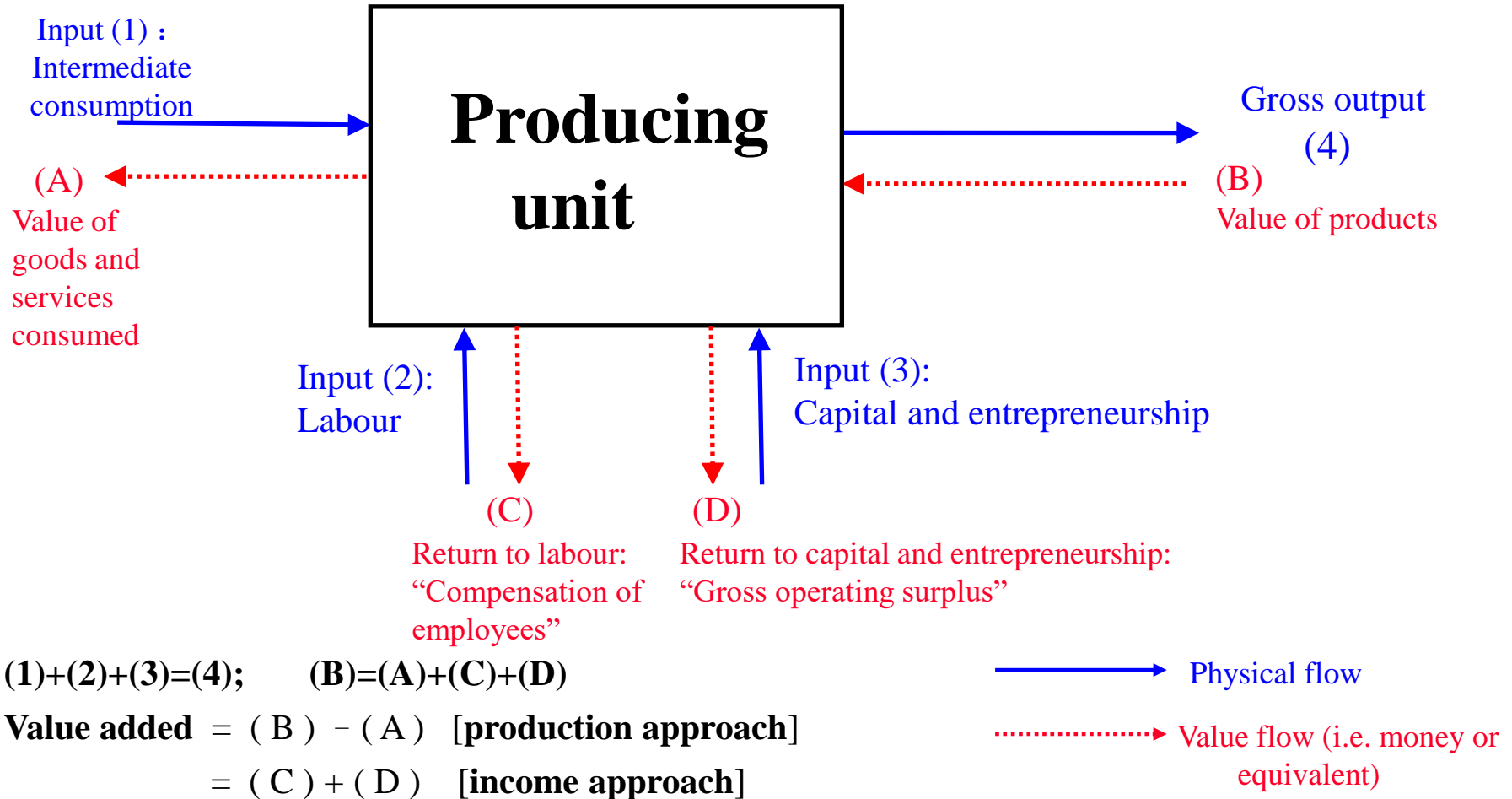 *(latest refinement: "GDP in chained(YYYY) dollars")*

B. Uses

- *Macro-economic analysis*
- *Structural studies of an economy*
- *Economic forecasting*

C. Approaches used in Hong Kong

- *Expenditure approach*
- *Production approach*

GDP by Production Approach and Income Approach

Input (1) :
Intermediate
consumption

Producing unit

Gross output
(4)

(A)

Value of
goods and
services
consumed

(B)

Value of products

Input (2):
Labour

Input (3):
Capital and entrepreneurship

(C)

Return to labour:
"Compensation of
employees"

(D)

Return to capital and entrepreneurship:
"Gross operating surplus"

(1)+(2)+(3)=(4);   **(B)=(A)+(C)+(D)**

Value added = (B) − (A) [**production approach**]

= (C) + (D) [**income approach**]

Physical flow

Value flow (i.e. money or
equivalent)

Value added of an industry = Sum of value added of all producing units in the industry

GDP = Sum of value added of all industries

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Special notes regarding the calculation of "Gross Output"

1. Gross output (vs Sales)

In practice, Value of sales of products produced may not be the same as the value of "Gross output". Sales may be smaller than production, and there is increase in stocks ("inventories"). Or, sales may be bigger, and there is decrease in stocks (i.e. "the stocks have been drawn down").

[[Note : a similar situation with intermediate consumption vs purchases. Stocks of raw materials and supplies may be accumulated or drawn down]]

2. Retailers:

- The service is counted on the basis of the "distributive service" rendered. And it is valued as the "Gross Trade Margin"

  Note : "trade margin" is different from "mark- up", as there is wastage (especially the easily perishable goods) in the process of buying and subsequent selling

Special notes regarding the calculation of "Gross Output"
3. Real estate development companies

Gross Output is calculated on the basis
"Real Estate Developer's Margin (REDM)".

>Professional Services, Construction Services (etc.) are all separately calculated under the respective sectors. They are _not_ taken as "Intermediate Consumption" in the production and sales of the flats

>REDM is thus calculated from the value of the sale of the flats LESS the cost of construction works of the flats and the cost of the land.

A VERY IMPORTANT POINT- the selling price of the flats may include the element of "land appreciation", which has to be removed through some means; otherwise, it would get counted in the "value-added", which should NOT be the case.

"Intermediate consumption" of a real estate development company includes offices expenses, advertising, services of sales agents,..

- In the Production Account,

    for an individual Producing Unit :

  Gross output = intermediate consumption

    plus compensation of employee

    plus gross operating surplus

Interest payment is NOT included in "intermediate consumption".
  (Note – HOWEVER, "interest payment" is normally counted as
  expenses in **commercial accounting**)

It is considered as **secondary distribution of income** (the
  entrepreneur *SHARES* the profit of the company with the lender,
  in the form of paying the interest which is *due* to the latter).

    See also POINT 5 BELOW

>> (a) They earn service charges for the services rendered
(e.g. commissions, service charges for money transfers.)
However, banks' main activity is "borrowing and lending".
As mentioned in [4] above: at the individual
"Producing Unit " level, "interest payment" is **not**
counted as payment for "intermediate consumption.

(b) At the "macro-" level, *Banking service (for deposits and
loans, etc.) is **"imputed"** – in the form of "interest earned less
interest paid".* Then, such services(in total) produced by the
institutions mentioned above are to be **distributed among**
various sectors using the services **with some special methods.**

Special notes regarding the calculation of "Gross Output"- - 6. Ownership of premises (OOP)

Different treatments for different situations:

1. Owner is a company (the business of which is property leasing) and it rents out the property --   the rental service forms the gross output of the "real estate" sector

2. Owner is a company the business of which is not property leasing:

   If it rents the property out, it produces a rental service and this service is part of the gross output of the sector which the company belongs

   If it uses the property for its own business, it does not pay rent. The position of the property is similar to the machinery and equipment it uses.

3. Owner is an individual person/household:

a.   A property is rented out – the rental service is the gross output of the OOP sector

b.   The individual/household resides in the property : rental service is rendered to itself— **"imputed" rental service** is to be included in the OOP Sector. (the basis of imputation is "making reference to similar premises rented out in the market")

GDP by economic sector

Note: "at currrent prices" is to be contrasted with "at constant prices" (or " at chained prices") [see relevant slides below]

GDP by economic activity at current prices	2014	2017	2018[@]
Percentage contribution of economic activities to GDP at basic prices			
Agriculture, fishing, mining and quarrying	0.1	0.1	0.1
Manufacturing	1.3	1.1	1.0
Electricity, gas and water supply, and waste management	1.6	1.4	1.3
Construction	4.4	5.1	4.5
Services	92.7	92.4	93.1
Import/export, wholesale and retail trades	24.1	21.5	21.4
Accommodation[1] and food services	3.6	3.3	3.4
Transportation, storage, postal and courier services	6.2	6.0	5.9
Information and communications	3.5	3.4	3.4
Financing and insurance	16.7	18.8	19.7
Real estate, professional and business services	10.9	10.8	10.4
Public administration, social and personal services	17.2	18.2	18.4
Ownership of premises	10.5	10.4	10.5
Total	**100.0**	**100.0**	**100.0**
GDP at basic prices (HK$ billion)	**2,206.0**	**2,551.1**	**2,698.8**

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Shares of
Compensation of Employees and
Gross Operating Surplus in GDP
(at basic prices "is different from "at market prices" -
- the difference being "indirect" taxes)

	2001	2010	2018
GDP (at Basic Prices) (HKD Billion)	1269	1737	2698
Compensation of Employee (as % of GDP)	52.7%	50.5%	51.0%
Gross Operating Surplus (as % of GDP)	47.3%	49.5%	49.0%

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GDP by Expenditure Approach

Consider the Gross Output produced by producers : -

- Some are exported

- Some are consumed by households   (e.g. food;
              a computer purchased by a household)

- Some are put in place as capital goods (e.g. a machine; a computer bought by a firm)

- Some are purchased by other producers as
 "raw materials, supplies…" *(intermediate consumption*)

GDP by Expenditure Approach

- Under **this** approach, we work *backwards*
  from the **use** of the goods (and services) produced
  to arrive at the GDP.

- We add up the values of
  all the final goods and services USED
  and then remove the **imported contents**.

- We do the REMOVAL of IMPORTED CONTENTS *at one go* at the end,
  in fact, *we are ONLY able to do so.*
  (We are unable to remove the imported contents of individual items of goods and services)

In the Expenditure GDP: We *only* look at the products and services for *final use*;
(*otherwise) there will be a lot of double counting*

- From cotton to yarn ; and yarn to cloth; and cloth to shirt ----

- the yarn, if used by the cloth factory, is "intermediate goods"; and the cloth, if used by a local shirt factory, is "intermediate goods" too. In NOT counting the intermediate goods, we will not incur double counting

- **If** the sales of spinning factory, weaving factory and garment factory **were** added together, the value of cotton *would have been counted several times.*

GDP by Expenditure Approach
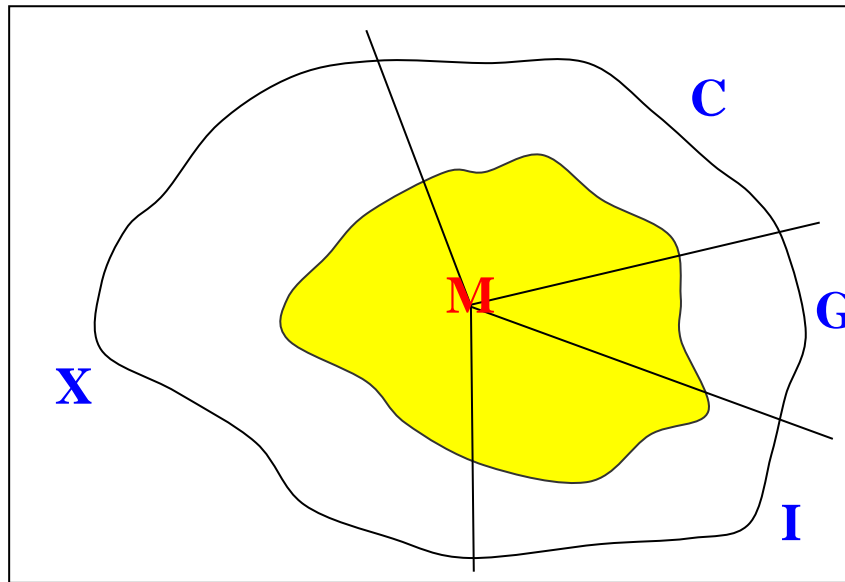
C = Private consumption expenditure

G = Government consumption expenditure

I = Investment (Gross domestic fixed capital formation *plus* Changes in inventories)

X = Exports of goods and services

M = Imports of goods and services

GDP	=	C	+	G	+	I	+	X	−	M
2845	=	*1945*	+	*281*	+	*617*	+	*5350*	−	*5348*

>> For C, G, I, X : only FINAL goods and services" are counted

>> The above are 2018 figures in HK$ billion.
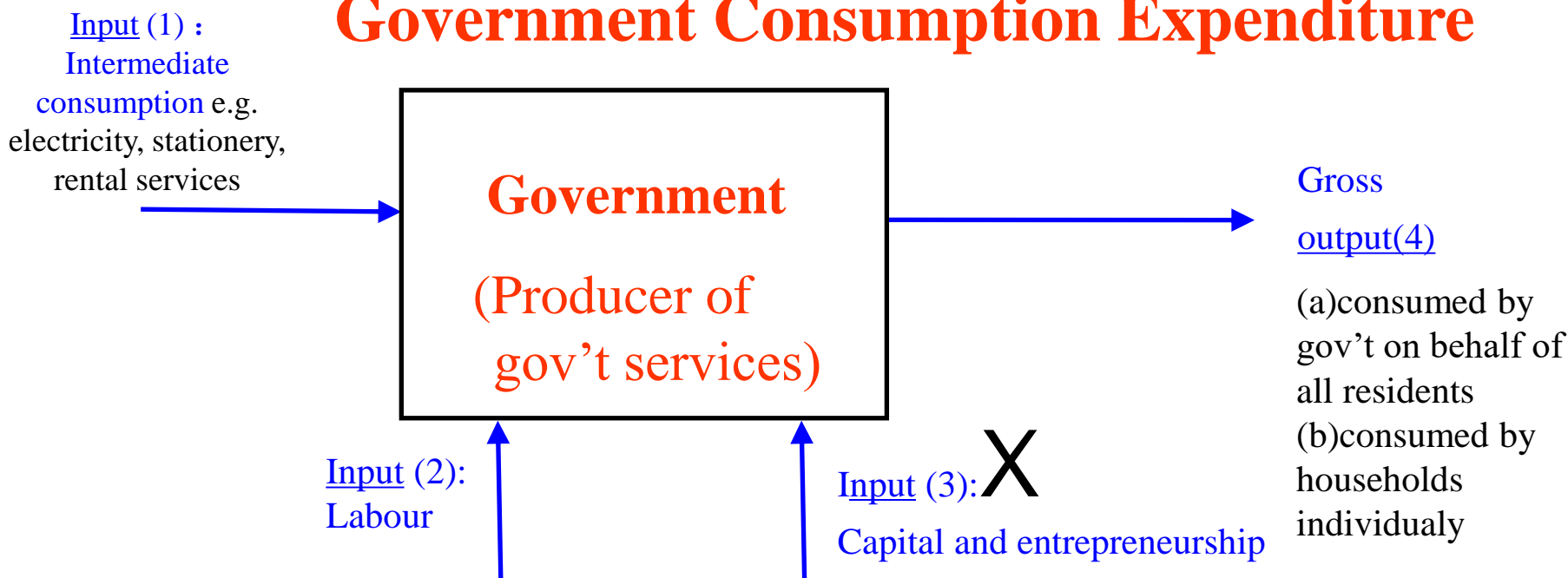
   (Figures may not add up due to rounding)

>>For C and G, see further explanation later.

>> The per capita GDP of HK was $380 thousand in 2018

   (GDP divided by population)

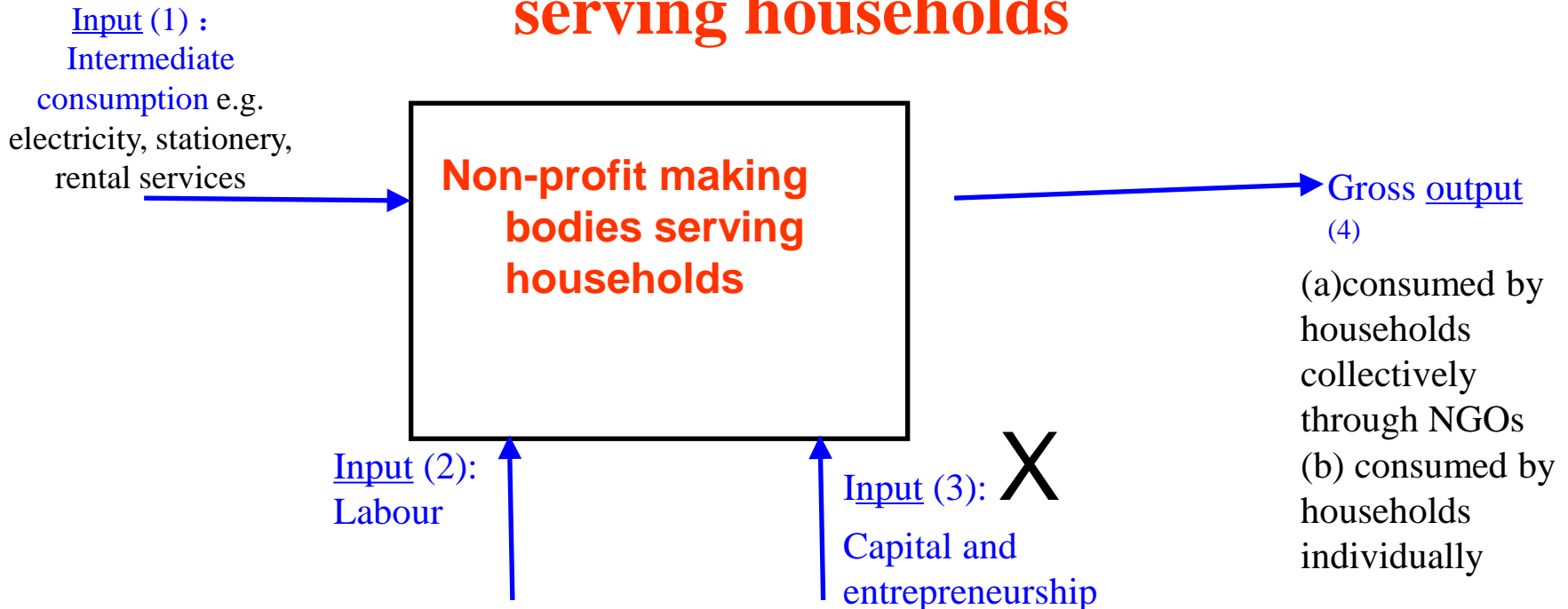# Value added of Government ; Government Consumption Expenditure

Input (1) : Intermediate consumption e.g. electricity, stationery, rental services

Government

(Producer of gov't services)

Input (2): Labour

Input (3): X
Capital and entrepreneurship

Gross output(4)

(a)consumed by gov't on behalf of all residents
(b)consumed by households individualy

→ Physical flow

Value added = (4) - (1)

= (2) +(3) =(2) + 0 = (2) [[Gross Operating Surplus is taken as zero]]

A method of " Valuation of 'Output' by 'Sum of Inputs' is used, since the output is not a marketable commodity   { (4) = (1)+(2)+(3) }

Note– 4(b) is usually rather small.

Non-profit making bodies serving households

Input (1) :
Intermediate consumption e.g. electricity, stationery, rental services

Non-profit making bodies serving households

Gross output
(4)

(a) consumed by households collectively through NGOs
(b) consumed by households individually

Input (2): Labour

Input (3): X
Capital and entrepreneurship

→ Physical flow

Value added = (4) - (1)

= (2) +(3) =(2) + 0 = (2) [[Gross Operating Surplus is taken as zero]]

A method of " Valuation of 'Output' by 'Sum of Inputs' "is used, since the output is not a marketable commodity { (4) = (1)+(2)+(3) }

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Gross Domestic Fixed Capital Formation

- Gross value of expenditure on building and construction, machinery, equipment and computer software

- [[Expenditure on acquisition of existing fixed assets is not included – this represents just transfer from one owner to another.]]

- But the cost of transfer (commission for the broker, say) is included. This represents the brokers' services.

Gross Domestic Fixed Capital Formation

- Note --Real Estate Developer's Margin [REDM] is included—it represents the RED's contribution in terms of organizing the activity, bearing the investment risk etc….

[[[Note: Carefully contrast between **REDM** and
Cost of building and construction.

>> The Developer acquires land at a certain cost, organizes the production of the flats and sells them,

>> The money he gets (REDM) is calculated as the revenue received **less** the cost of the land, professional fees, the cost of construction works etc.).

But the amount has further to be adjusted (usually deduction) **for the appreciation in land price** **during the period** that the Developer has held the land.

Stocks and shares

- The stocks and shares relate to ownership and their transfer between two parties do not represent production.

- But, cost of transfer represents the **services** rendered by brokers and the Stock Exchange. Some of the services are used by households (in managing their savings and wealth)

Gross Domestic Capital Formation (GDCF)
(denoted as "I" in the formula : with the notion of INVESTMENT)

Sum of : -

Gross Domestic *Fixed* Capital Formation
(GDFCF) –
Machinery and equipment, plants, buildings, infrastructures…

And

Change in inventories (magnitude is usually much much smaller than GDFCF)

Exports and Imports : (Goods and services)

- Goods : domestic exports and re-exports

- Services: transportation, insurance, professional services; services related to travel ; medical services; advertising services; educational services, cultural services and entertainment

Another way of looking at GDP (Expenditure Approach)

Total Supply (8193)	=	Total Demand (8193)
GDP + M	=	C + G + I + X
2845 + 5348 (4712[g]+636[s])	=	1945 + 281 + 617 + 5350 (4458[g]+892[s])

g=goods; s= services

The above are 2018 figures of GDP at Current Market Prices in HK$ billion

(Note- "Total Demand " - - also known as "Total Final Demand".

"Total Domestic Demand" (C+ G + I) - - also known as "Total Domestic Final Demand"

....

Ratio to GDP
- An indication of the relative economic significance

  Ratio of X to GDP is **188%**
- X has both **domestic contents** and **imported contents**. It is *not exactly* a "component" of GDP (although sometimes it is called this way).
  Hence it is totally possible for the ratio to be bigger than 100%. *And hence,*
  we should *not* say ….. "the *share* of exports in GDP is xx %"
  we should *instead* say "the *ratio* of exports to GDP is xx %")

-- Similarly, with C (or G), we should say "the *ratio* of C (or G) to GDP is zz %")

How to obtain GDP at <u>constant</u> prices (of a selected base year) from GDP at <u>current</u> prices

GDP at constant prices (of 2010)
   = GDP, with all current price value figures
          RE-VALUED at the prices of the base year
  = Sum of detailed components of GDP at constant prices

•••••••••••••••••••••••••••••••••••

The methods of RE-VALUATION :

- 1. Multiply quantity data with base year price data (if this can be done)
  (e.g. rice, gasolene..)

- 2. "Deflate" current value with an appropriate price index
  e.g. current value = $100000. Price index = 115
  the deflated value is $100000 / 1.15

Examples of Price Indices Used in Compiling Constant Price GDP

- Consumer Price index (various sub-indices for different items of consumer goods and services are relevant for use in deflating the current price values of various sub-items in "Private Consumption Expenditure)

- Producer Price Index

- Unit Value Index based on external merchandise trade statistics

- Salary Rate Index of Government employees

GDP Deflator

- Having got the GDP at constant prices,
  we do the division

  We do the division :
   GDP (current prices)/GDP(constant prices)

   and get the "GDP deflator" —

  It is **conceptually** "the price index of the GDP".

"GDP deflator" is a measure of overall inflation in the economy (more strictly, changes in the price of the domestic contents of the "final goods and services")

- Changes :   2018 over 2017   (2015/14)   (2011/10)   (2009/08)   (2003/02)
  GDP deflator   +3.7 %   (+3.6 %)   (+3.9%)   (-0.4%)   (-6.0%)
  CPI   +2.6 %   (+3.0 %)   (+5.3%)   (+0.5%)   (-2.6%)

>>>

- "Constant price" estimates for GDP *from the production approach* can also be done (with more complicated methods). That for income approach is seldom done.

Prices of the components of GDP
(Fictitious figures for ILLUSTRATION)

$$GDP = C + G + I + X - M \quad \ldots \quad (**)$$

Re-arranging (**), we have

GDP	+	M	=	C	+	G	+	I	+	X
↓		↓		↓		↓		↓		↓
+2.9%		+ 1.6%		+ 3.8%		+ 3.3%		-4.3%		+ 2.1%

Total supply
(Price increased by 2.1% over the previous year)

Total demand
(Price increased by 2.1% over the previous year)

>>>The figures are fictitious; for illustration only

>>>   2.9%, +1.6%, etc. are price changes of year T over Year (T-1)

>>>   (C + G + I) is **Total Domestic Demand**

- **The real growth rate for year (T+1):**

  [(GDP at constant price for year (T+1)/

  GDP at constant price for year T) x 100]% -100%

  The real growth rate for Quarter q in year(T+1)

= [(GDP at constant price for qtr q in year (T+1)/

  GDP at constant price for qtr q in year T) x 100]% -100%

The concept of
"GDP in Chained (YYYY) Dollars"
[more advanced treatment of constant price GDP

A **_moving_** base year is used.

- For example, for the Year 2006, use Year 2005 as Base Year; and obtain GDP(2006) at Constant (2005) prices.

- Then, for Year 2007, Use Year 2006 as Base Year, and obtain GDP(2007) at Constant (2006) prices.   *And so on.*

- EXAMPLE: The real growth rate for 2009 (over 2006), say, will be

- {(I + r(2009 on 08)) x (1+r(2008 on 07) x(1+r(2007 on 06)] – 1}
  = R

  {the rate is usually expressed as : R x 100% }

- In Dollar terms, GDP of 2009 in Chained (2006) Dollars
         is GDP (2006) x (1+R).

GDP at chained (YYYY)dollars
(The main idea is to have a "moving" base year whereas in constant price GDP, it is a fixed base year)

Gross Domestic Product (GDP)

		2013	2017[@]	2018[@]
本地生產總值（十億港元）	**GDP** (HK$ billion)			
以當時市價計算	At current market prices	2,138.3 (+5.0)	2,662.5 (+6.9)	2,845.3 (+6.9)
以 2016 年環比物量計算	In chained (2016) dollars	2,316.7 (+3.1)	2,586.2 (+3.8)	2,664.4 (+3.0)
按人口平均計算的本地生產總值（港元）	**Per capita GDP** (HK$)			
以當時市價計算	At current market prices	297,860 (+4.5)	360,206 (+6.1)	381,870 (+6.0)
以 2016 年環比物量計算	In chained (2016) dollars	322,713 (+2.7)	349,881 (+3.1)	357,584 (+2.2)

Gross National Income(GNI)
[[formerly known as Gross National Product (GNP)]]

GNI (2987)

> **= GDP (2845)**
> **+ Primary income earned by Hong Kong residents**
> **from outside Hong Kong (1628)**
> **- Primary income earned by non-residents**
> **within Hong Kong (1486)**

Net External primary income flow = 1628 –1486 = 142

> **[["primary income" was previously called "factor income"]]**

The above are 2018 figures in *HK$ billion*.
………………………………………………………………

External primary income flow (inflows and outflows)
> — **direct investment income;**
> — **portfolio investment income;**
> — **other investment income;**
> — **income on reserve assets (Central Bank of the territory)**
> — **compensation of employees**

GDP and GNI

		2013	2017	2018
以當時市價計算	**At current market prices**			
本地生產總值	GDP	2,138.3	2,662.5	2,845.3
對外初次收入流量淨值	Net external primary income flows	40.5	115.6	141.6
對外初次收入流入	*External primary income inflow*	*1,183.6*	*1,422.7*	*1,627.7*
對外初次收入流出	*External primary income outflow*	*1,143.0*	*1,307.1*	*1,486.1*
本地居民總收入	GNI	2,178.8	2,778.1	2,986.9
		(+5.4)	(+8.8)	(+7.5)
按人口平均計算的本地生產總值（港元）	Per capita GDP (HK$)	297,860	360,206	381,870
按人口平均計算的本地居民總收入（港元）	Per capita GNI (HK$)	303,504	375,838	400,878
		(+5.0)	(+8.0)	(+6.7)

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