Chapter 17

Measuring Economic Activity: GDP

支出與國內產出之衡量

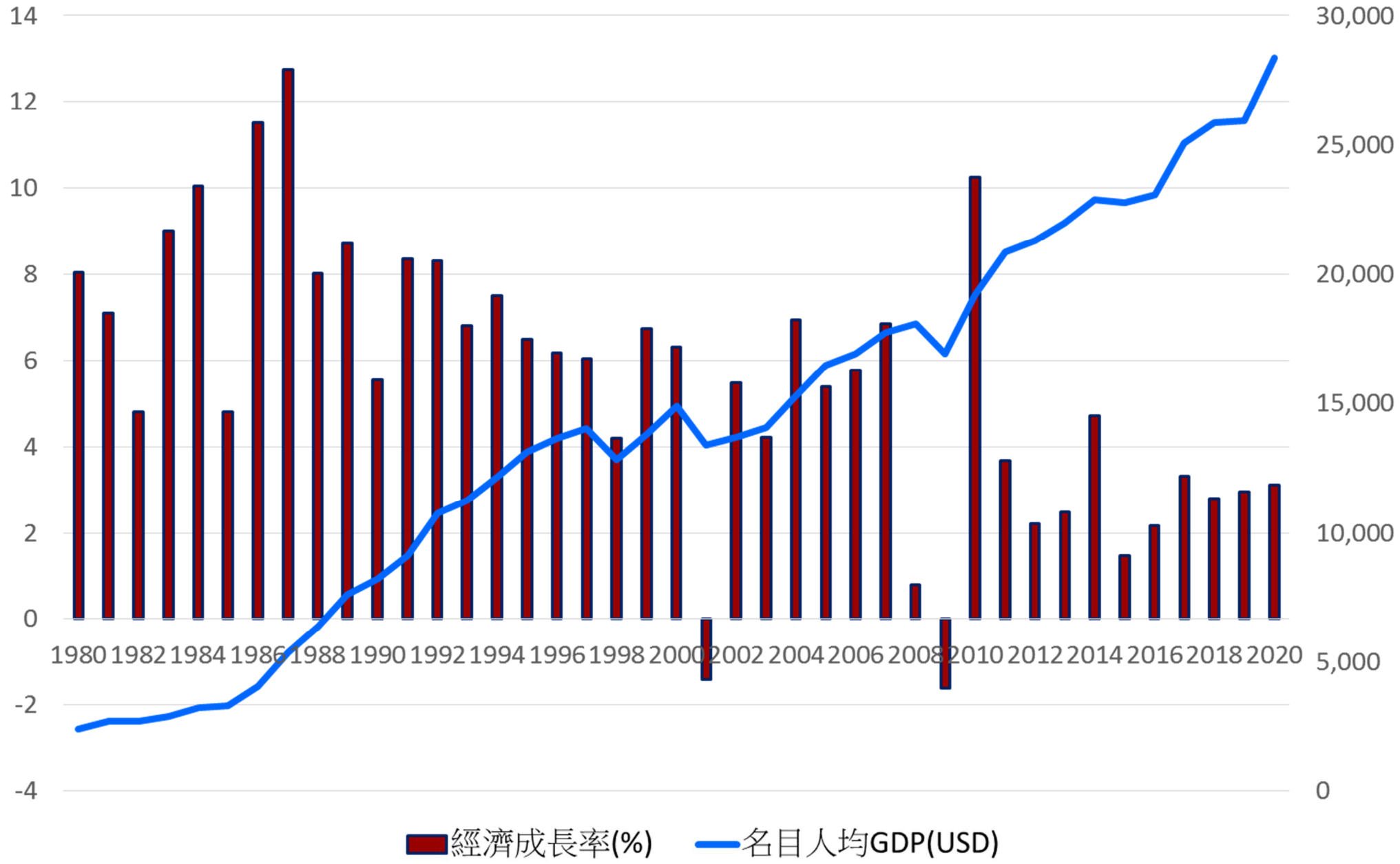
Principle of Economics • 林佑龍
National Chi Nan University
2022/02/22

Outline

1. Computing GDP.
   - Explain how economist define and measure an economy's output.
2. Nominal GDP v.s. real GDP.
3. GDP and economic well-being (國內產出和經濟福利的關係).
   - Income distribution.

- Recall: The core of macroeconomics is income.
- Questions:
  - How to measure the economic performance?
  - Why does the economic fluctuate?
    Why business cycle exists?
  - Why the labor income in country A is higher than country B?
  - What are the relationships between GDP and economic well-being?
- The key index is: Gross domestic product, GDP.

台灣歷年經濟成長率 (1980-2020)

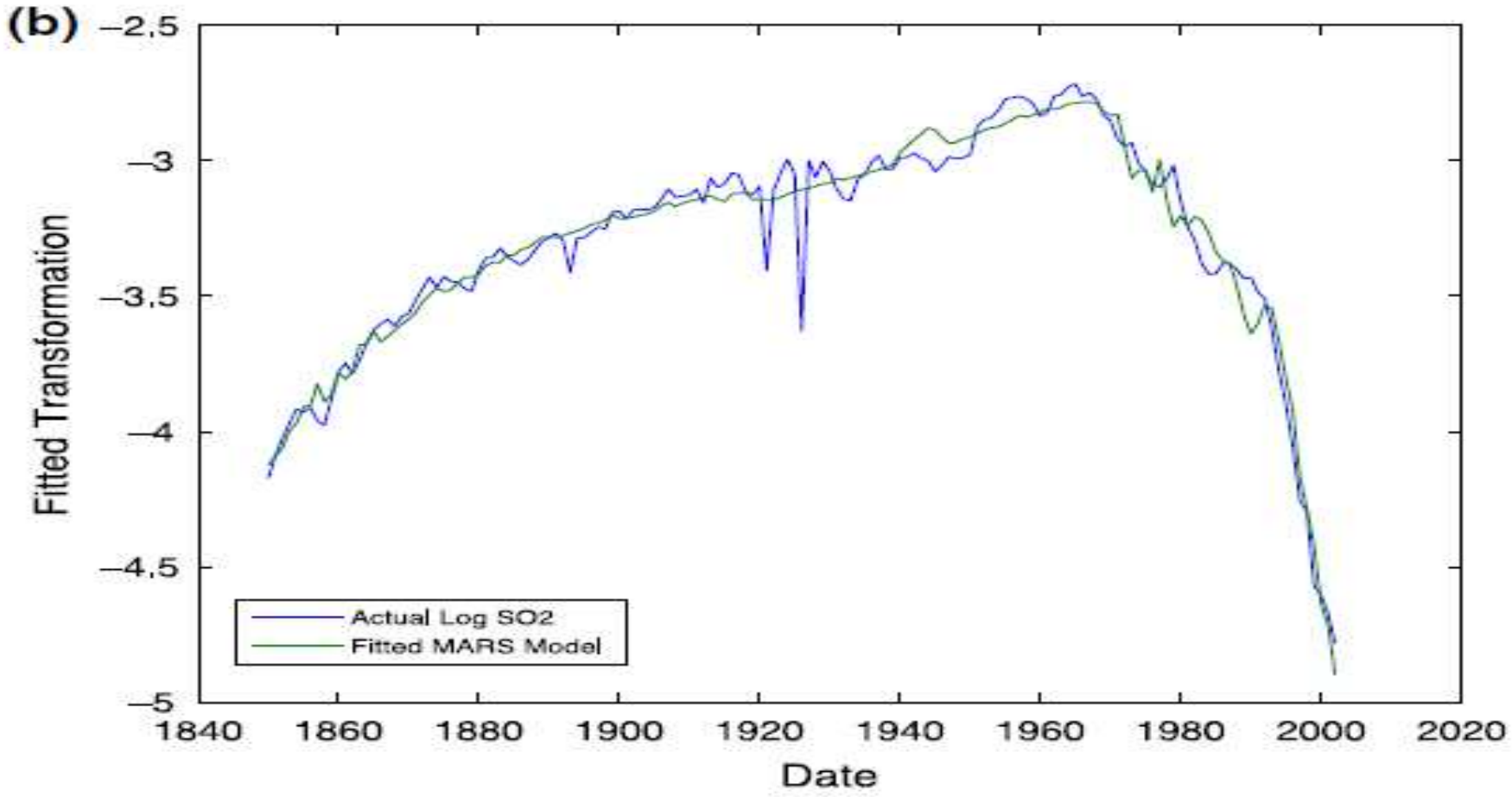


1. Gross domestic product, GDP

- GDP is the way that economists measure economic activities.
- Who develops the comprehensive system to measure a nation's output of goods and services?
  - 1937 US Department of Commerce.
  - Simon Kuznets (顧志耐) in the US.
    - 1971 Nobel Prize.
  - Richard Stone in the UK.
    - 1984 Nobel Prize.
  - Nowadays: United Nations 2008 SNA (System of National Accounts).

- Kuznets curve (KC)

- Environmental Kuznets curve (EKC)



Sephton and Mann (2016), p309.

Definition of GDP

- The market value of the final goods and services produced in a country during a given period. (一個國家在特定期間內，所創造的最終產品和勞務的市場價值總和。)
  - 亦即: 一個國家在特定期間內，所創造的附加價值之總和。

- Produced within a given country' borders.
  - Territorialism.
  - Nationality of owners or company is not relevant.

- 比較:
  - 台灣: 個人綜合所得稅採屬地主義
    - 非中華民國境內居住之個人，而有中華民國來源所得者，其應納稅額，分別就源扣繳。
  - 台灣: 贈與稅採屬人和屬地主義
    - 居住者贈與財產，不論是贈與國內財產或國外財產，都要報繳贈與稅。
    - 贈與稅是對贈與人課徵，只要贈與人是中華民國居住者，就符合課稅要件。

- For a given period:
  - Annual
  - Quarterly

    Ex: Sell a 20-year old house for $20,000,000, and pay $12,000 commission.
    - Value added is $12,000.
    - House was not produced in the period of time studied.

- Final goods or services
  - To avoid double counted.
  - Goods or services consumed by the ultimate user.
    - They must be the end products of the production process.
- Intermediate goods or services
  - Goods or services used up in the production of final goods and services.
    - They are not counted as part of GDP.

- Ex: A country consists of a farmer, a flour factory, and a bakery.
  - The farmer produces $16 wheat and sells it to the flour factory.
    The wheat is used to make $24 flour by the flour factory and the flour factory sells it to the bakery.
    The bakery makes $38 bread by using the flour and sells them to the consumers.
  - Intermediate goods: wheat, flour.
  - Final goods: bread.
  - Values of output: $38.

- Goods sometimes can be final and intermediate. Ex: Milk can be sold as a final product or used as an intermediate good.
  - Gallons of milk in the grocery store.
  - Gallons of milk sold to restaurants or bakery.
  - Count only the final goods.
- Ex: A barber's assistant earns $2 per haircut for providing services such as shampooing/ sweeping up.
  - Barber charges $10 per haircut.
  - Haircut's contribution to GDP is $12? or $10? or $8? ➔ 助手的工作屬中間財貨，不是最終財貨。

- Not only goods but service:
  - Business service
  - Transportation service
  - Financial service
  - Police
  - Medicare
  - Education service
  - Entertainment service
  - Cleaning service
  - … …

- Using market values of different goods and services (以市場價格來計算).
  - 項目太多，需同時有一個共同標準以加總。
    ➔ 貨幣價格。
  - 透過市場買賣(交易)才能知其確實價格(price)。故家庭內之生產不計入GDP。
  - Allows economists to aggregate the quantities of many different goods and services (可以在不同的物品間加總).

- True or false? 中央山脈發現金礦1000公噸，且市面上之黃金市值每公噸二萬元(新台幣)，故GDP增加二仟萬元(新台幣)。

Computing market value

- Aggregate measure of quantities produced.

Arkadia	Apples	Bananas	Shoes
Price	$0.25	$0.50	$20.00
Quantity	4	6	3
GDP contribution	$1.00	$3.00	$60.00

  - Arkadia's GDP is $64.

Some tricks for GDP measurement

- Nonproductive market activities (非生產性的市場活動):
  - Market (value)? Yes.
  - Production? No.
- Productive nonmarket activities (非市場性的生產活動):
  - Market (value)? No.
  - Production? Yes.

Nonproductive market activities

- Transfer payments (移轉性支付)
  - Social insurance payment, social welfare payment (社會安全給付、社會福利與救助等)
    - 若是金錢之移轉(現金津貼)，如醫療保險給付、失業救濟金等，對生產活動並無貢獻。
    - 若是實物給付，則計入政府消費。
- Securities transactions (證券交易)
  - 資產所有權之移轉對生產活動並無貢獻。
  - New stocks should be counted.
  - Commission should be counted.
- Second hand (二手貨買賣)

Productive nonmarket activities

- These goods have value, but prices cannot be established (不經過價格機制而產出).
- Self-tilling farmers' food consumption (自耕農之自家食物消費)
  - 農家種植稻穀等初級商品供自家食用者。
  - Imputation: 依據市場交易價格估算其生產價值。
- Rental for owner-occupied residence
  - Imputation: 自己住自己住宅時，租金需計入GDP。
  - 自己不住可租別人，是為其機會成本。

- Government goods and services are not sold in the market (各
  - 國防、消防、警政、社會工作、一般政務等.
  - Government production is valued at cost. (無市場交易、故以投入之總成本來衡量)
  - Overstates GDP if there is waste and inefficiency.

- Self-lawn care, self-home repair, self-car repair, volunteer services, … (自行修繕房屋、自行修理汽車、志工服務、農村農忙時之互助行為等)
  - Not counted into GDP.

- Household tasks
  - Not counted into GDP.
  - 國民所得統計之「家事服務」，僅指受僱於家庭，從事提供對該家庭服務之工作者其服務之價值，即受僱人員(如園丁、個人司機、保姆等)之報酬。
  - Ex: If the househusband/housewife works outside the home and find a housekeeper to do the housework and pay.
    How about the GDP variation?

[新聞]: 當老媽子 18年勞務值6千多萬

(2010.06.20. 中國時報/潘勛)

為人子女者對母親付出的心血，真應心存感激，絕不能等閒視之。

據最新研究指出，媽媽為子女做飯、打掃、洗衣、當顧問，林林總總各項付出，一直到孩子十八歲，所做的工作，若以時薪計算，價值約一四二萬四千五百零四英鎊(約台幣六七九〇萬元)。

這18年間，媽媽花了8萬8000小時照顧小孩，「工資」超過2800萬台幣。打掃整理家裡，花1600小時，「薪酬」超過65萬台幣。烹飪花364個小時，值得給約530萬台幣。開車接送小孩，以一般計程車資計算，合台幣近210萬元。

這項研究係由《Tesco》雜誌進行。

- Underground economy
  - is all unreported transactions, legal and illegal.
  - 蓄意逃漏稅或物物交換。
  - Drug dealers, bookies, fences, prostitution
  - Casual labor is often paid in cash.
  - Not counted into GDP.

- Midterm 2014:

下列項目是否包含在當年GDP內? 請分別說明理由。

(a)購賣二手積架跑車。

(b)購買台中市土地。

(c)果農消費自己種的水果。

(d)到老人院做公益服務。

(e)立法委員之薪水。

(f)購買華碩公司股票。

(g)媽媽照顧嬰兒。

(h)今年生產但未售出之存貨。

(i)監獄內交易違禁品。

(j)政府發放救濟金賑助災民。

Measuring GDP

- Methods of computing GDP:

  ① Expenditure approach ➔ Demand side.

  ② Value added approach ➔ Production side.

  ③ Factor income approach ➔ Income side.
  (要素成本法)

Value added approach

- Value added: Values between production and intermediate input costs. (廠商的生產額與中間投入的差額稱為附加價值)。
  - is the value that the firm creates.
  - Ex: IPhone firm and monitor firm
    - The monitor firm bought a special material $1000 abroad as an intermediate input, then the IPhone firm bought $3500 monitor as an intermediate input.

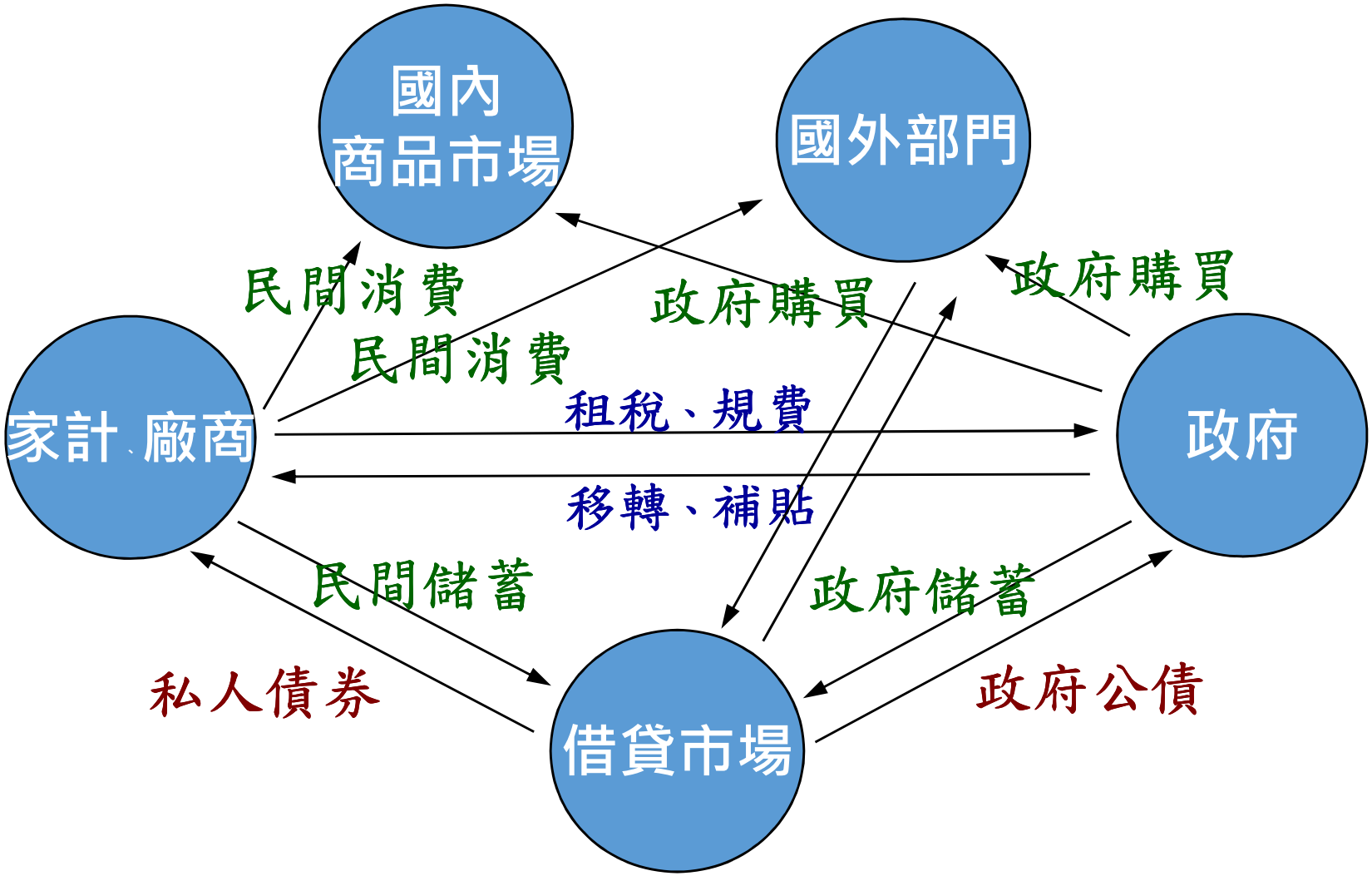
Firm	Revenues	Intermediate goods	Depreciation
IPhone	$3500	$1000	$150
Monitor	$6000	$3500	$200

- GDP of the economy: $5000
- Net domestic product:
  NDP = GDP – depreciation = $4650

Expenditure approach

- From the view of purchase
  - Four buyers of final goods and services
    - Households
    - Firms
    - Governments
    - Foreign sector
- Final product / final use
  - Consumption (private and government sectors)
  - Fixed capital formation (private and government sectors)
  - Net export

Four buyers of final goods and services



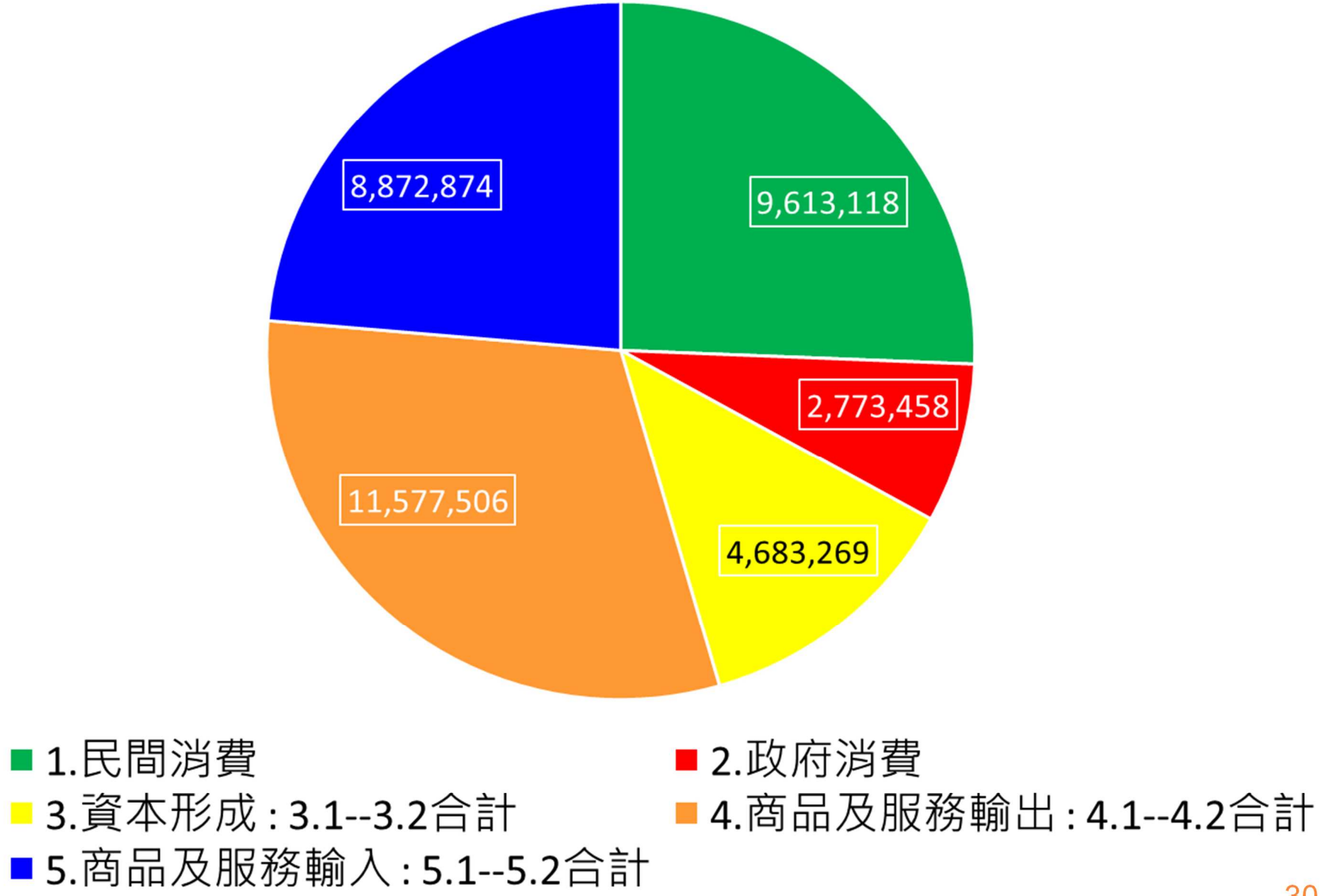
GDP expenditures equation

- Terminology

Y	Gross Domestic Product or output
C	Consumption Expenditure
I	Investment
G	Government Purchases
NX	Net Exports

- GDP expenditures equation: $Y = C + I + G + NX$
  - Example. in p.25: GDP = \$6000 – import
    = \$6000 – \$1000 = \$5000

台灣 GDP之組成 (2020,百萬$NTD)



依購買者分類

C : consumption (民間消費支出)

- 房子之外，家庭的其他支出都列為 C

I : capital formation (資本形成)

- 電腦軟體與研發支出屬之。
- 二手機器設備或二手房子買賣不計入。

G : government consumption (政府消費支出)

X : export (出口)

- 有一部分用於購買進口品M，須扣除

- 只要生產出來，不論是消費掉、出口或變成存貨，都計入當年度GDP。

Consumption expenditure

- Spending by households for goods and services
  - Except for buying a house
  - Durable goods, non-durable goods, services
    - Consumer durables are long-lived consumer goods
      - Cars
      - Furniture
      - Appliances
    - Consumer non-durable goods are shorter-lived goods
      - Clothing
      - Food
      - Bedding
    - Services are the largest component of consumer spending
      - Education
      - Taxi rides
      - Haircuts

Investment (投資; 資本形成)

- Investment = fixed capital formation (固定資本形成) + inventory investment (存貨增加).
- Fixed capital formation (gross fixed investment; 固定資本形成毛額)
  - Is Not used to intermediate consumption,
  - Continue producing:
    - Business fixed investment is purchases of new capital goods.
    - Residential investment is construction of new homes and apartment buildings. (新建住宅)
    - Ex: Software, mining, …

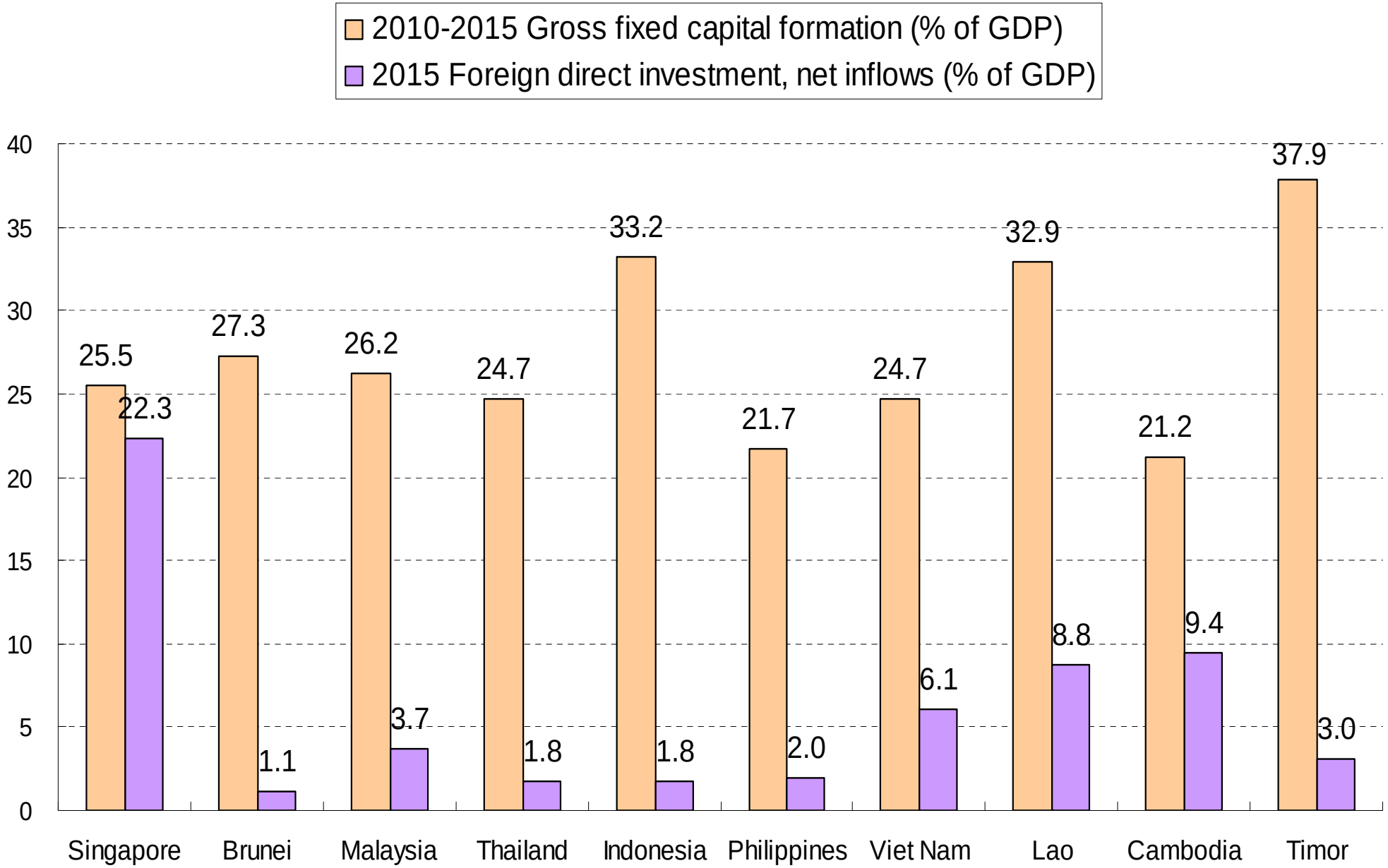
- 固定資本形成即購買資本財之支出。資本財為可重複且持續使用與生產達一年以上，且具未來利益的生產財。實務上以新產出的資本財計入GDP。

- 存貨係生產者購入擬用於生產但非資本財之物品，或生產後未能於當年銷售出去的商品。
  - 包含: 原料、半成品、未銷售商品等。

- 固定資本形成及存貨變動，依購買主體，分為: 民營企業、政府、公營事業三類。

- 資本財依型態，可分為8類:
  - ① 住宅房屋
  - ② 非住宅房屋 (如廠房、校舍)
  - ③ 其他營建工程 (如道路、機場)；
  - ④ 運輸工具；
  - ⑤ 機器設備；
  - ⑥ 土地改良、耕地及果園之開發；
  - ⑦ 種畜、役畜及乳牛；
  - ⑧ 智慧財產 (無形固定資產)
    - 研發支出、電腦軟體屬之。
- Money is not a capital good.

Capital formation (Source: United Nations)



Government purchases (政府購買)

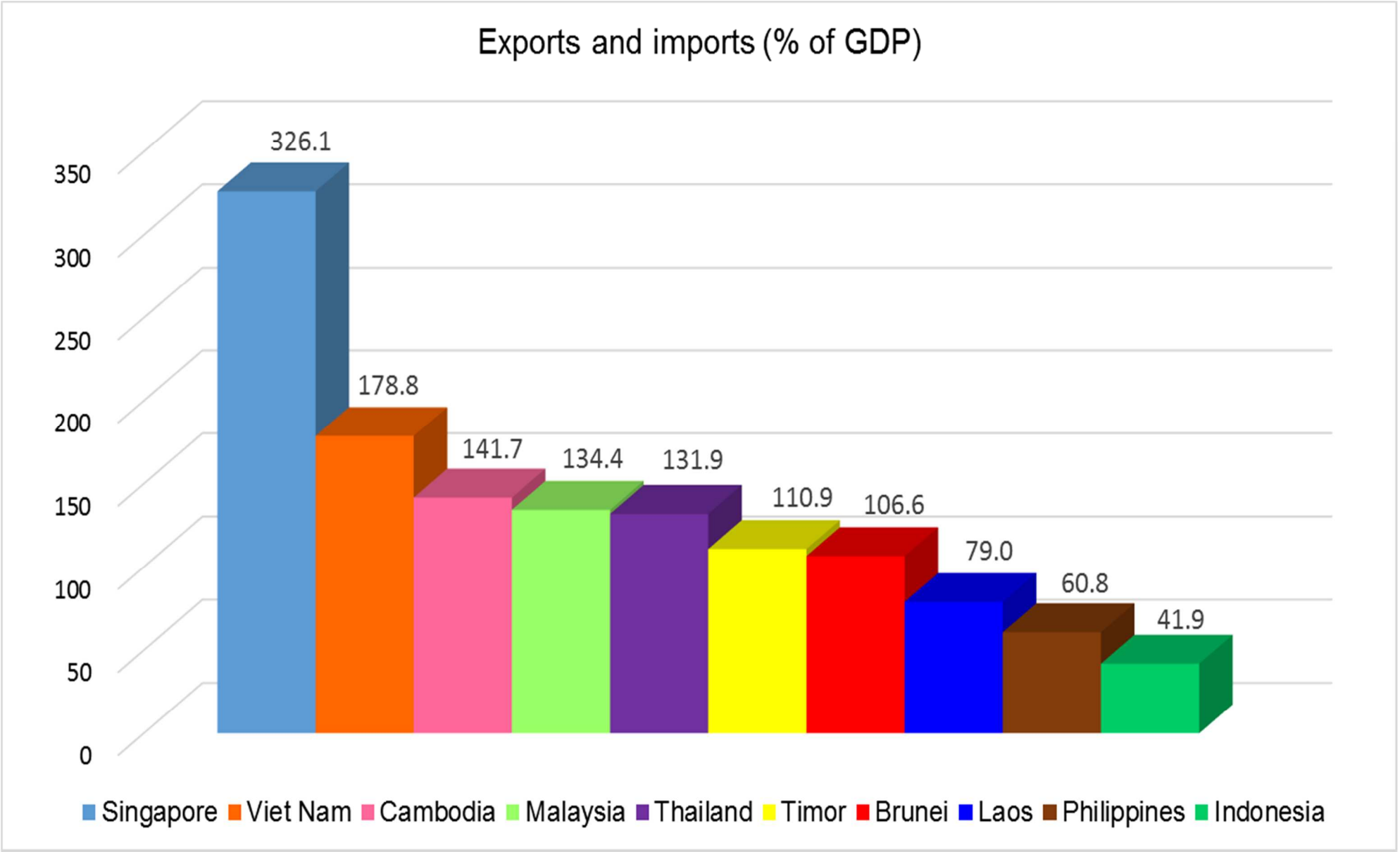
- 政府提供之服務包括: 國防、公共安全、經濟發展、環境保護、外交、教育、社會安全等等。
- 政府購買 (政府消費支出) 包括經常購買支出、軍公教人員薪資、政府固定資本消耗、間接稅淨額、對中央銀行服務之購買等等。
  - 經常購買支出係指使用期限在一年以下的消費財，含國產品與進口品。
    - 軍事支出屬之。
  - 對中央銀行服務之購買係支付央行代理國庫業務的成本。

- 不計入政府消費支出者:
  - Excludes transfer payments (移轉性支付): Transfer payments are made by government but the government receives no current goods or services (養老年金、失業保險給付、救濟金等，凡為金錢給付者，不牽涉購買或生產).
  - Excludes interest paid on government debt (公債利息不計).
  - 政府銷售予家庭者 (如公立學校之學雜費收入)，須扣除。
    - 為家庭的最終消費。

Net exports (淨出口)

- Net exports equals exports minus imports (出口減進口).
- Exports (出口)
  - Domestically produced final goods and services that are sold abroad
- Imports (進口)
  - Purchases by domestic buyers of goods and services the were produced abroad

Trade in GDP (2015)



(Data source: United Nations)

40

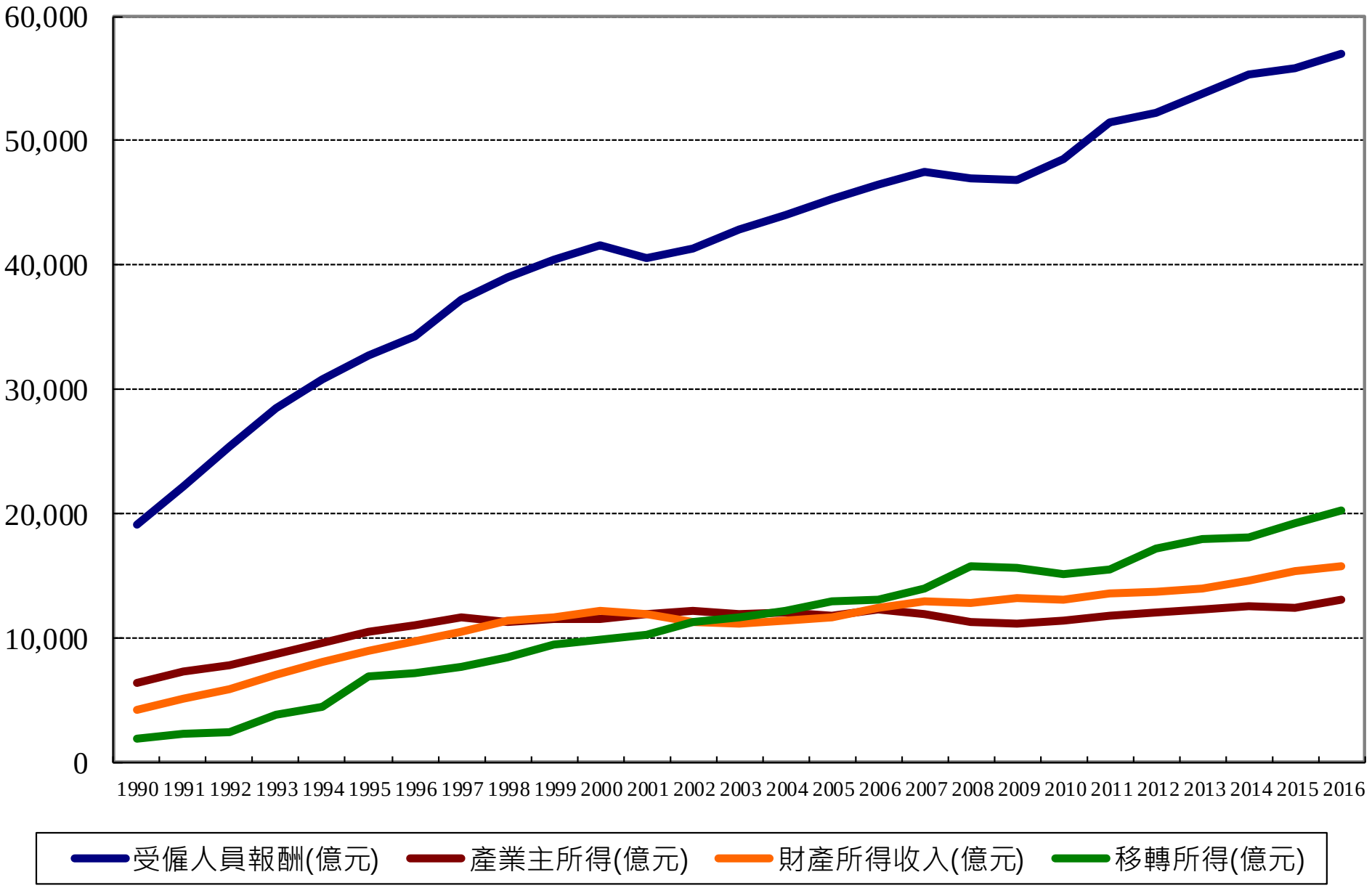
Factor income approach

- Factors: Labor and capital
- Total income = labor income + capital income
  - Labor income is comprised of:
    - Wages, salaries
    - Incomes of self-employed (自營作業者所得)
- Capital income is from
  - Payments to owners of physical capital (實質資本: factories, machines, office buildings)
    - Profits of business owners
    - Rent paid to land owners or buildings
    - Interest received by bondholders
  - Intangible capital (非實質資本)
    - Copyrights, patents, royalties

所得的種類

- 薪資所得 (受僱人員報酬、工資)
  - 本業薪資與兼業薪資、年終獎金、工作獎金、考績獎金、不休假獎金、福利金(加班值班費、教育補助費、伙食費、差旅費、水電補助)、雇主代付之公勞健保費或工會費、撫卹金、遣散費、婚喪生產補助費等
- 產業主所得
  - 自主營業收入、自力耕作、漁、牧、林、礦之所得等
- 福利性所得
  - 敬老福利生活津貼、低收入戶生活補助、國保老年基本保證年金、老農年金、彩券中獎獎金、急難救助、災害殘障生活補助、公勞農漁軍健保保險受益、競技競賽獎金、獎學金、就業保險給付、救濟金等
- 資本利得
  - 財產交易所得、利息所得、租賃所得、公司股東所分配的股利、專利權、智慧財產權等

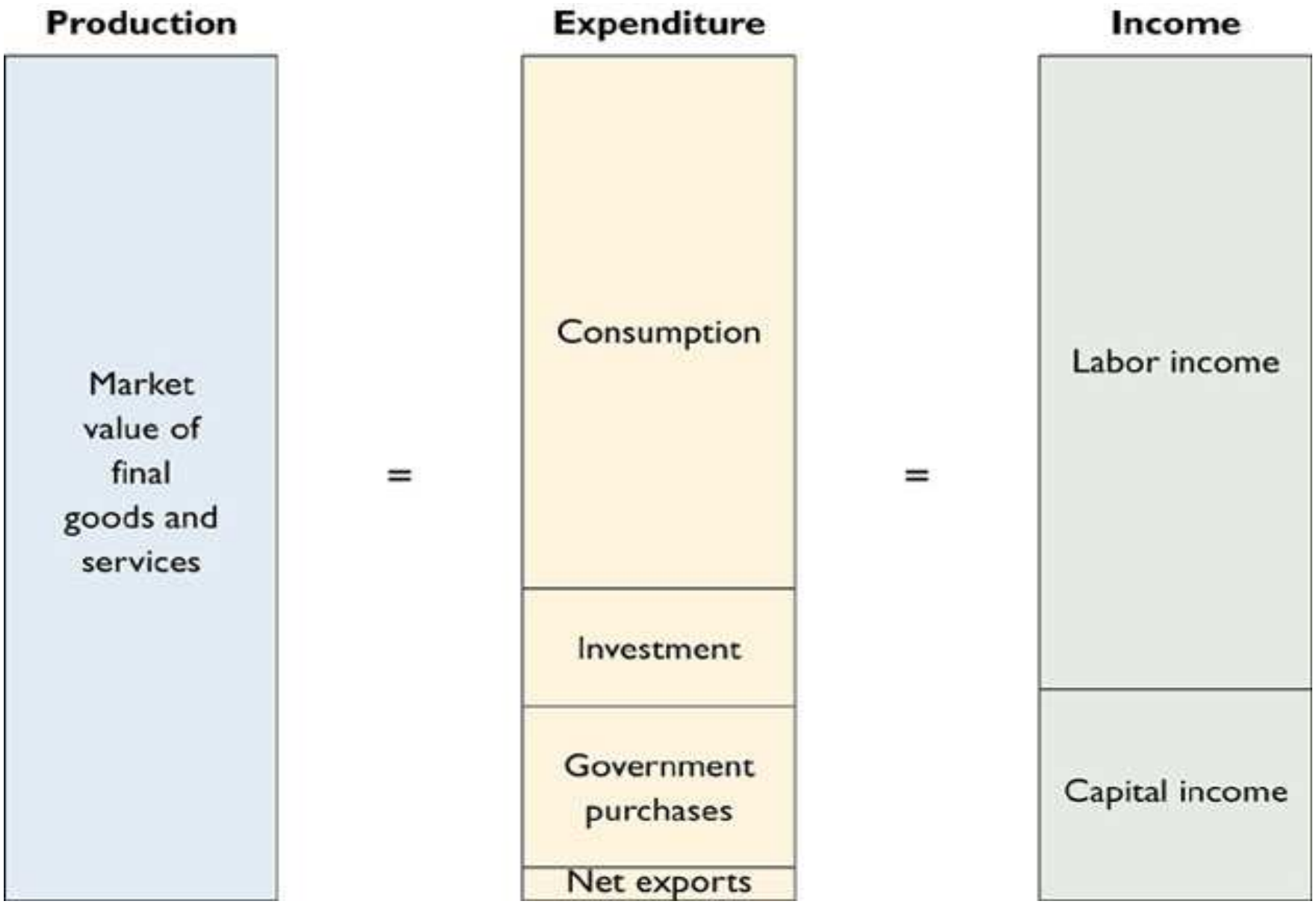
台灣家庭所得來源結構 (1990-2016)



Factor income approach

- GDP = wage (w) + rent (r) + interest payment (i) + profit (π) + depreciation + net indirect taxation
  - Net indirect taxation = the indirect tax that levied from firms – subsidies that firms receive from the government.
  - 折舊與間接稅淨額為最終產品價值內、要素報酬以外之成本，故須加上。

The three faces of GDP



Using GDP for comparison

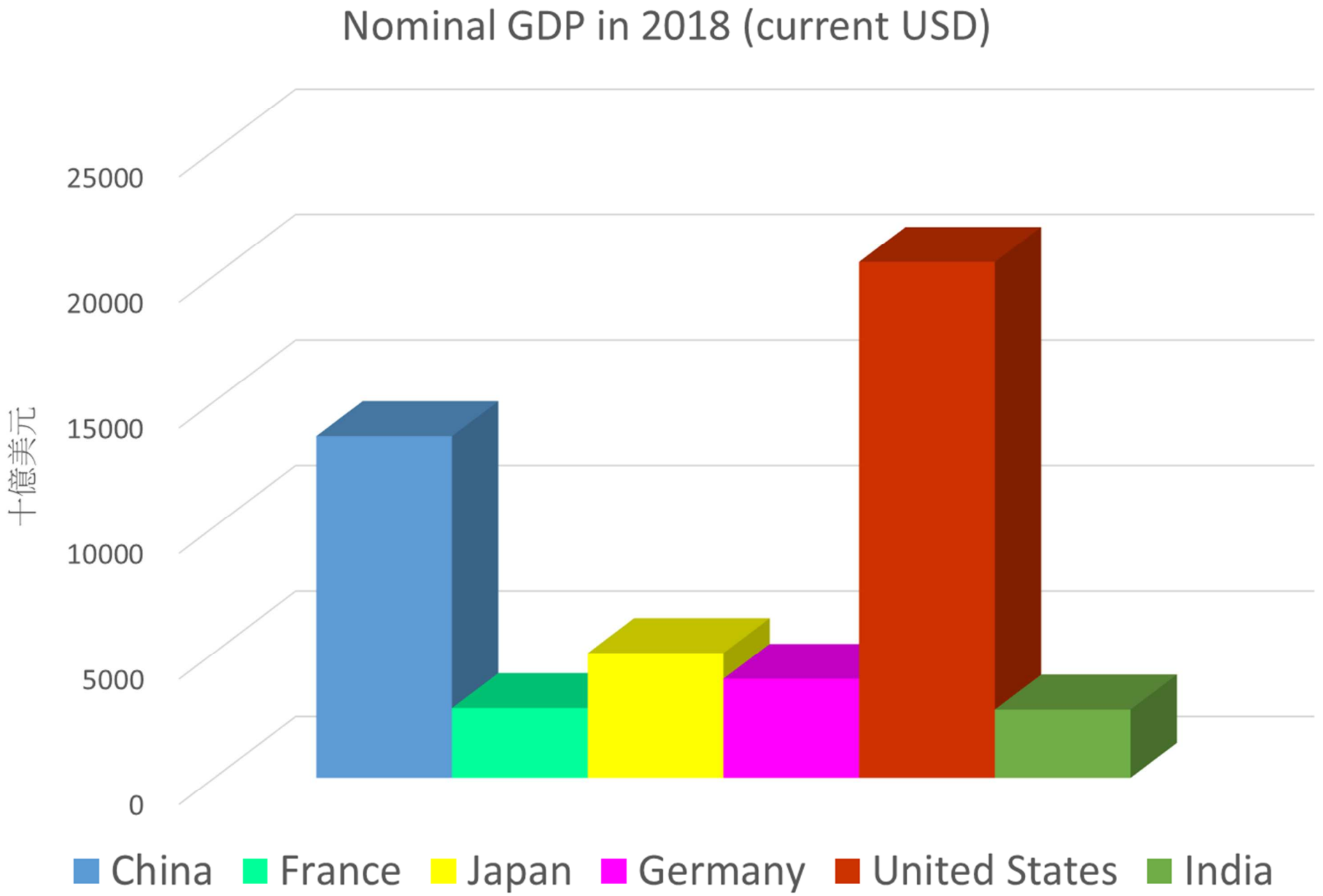
- We can compare GDP across
  - Different locations
    - State-by-state GDP
  - Different times → price level, inflation
    - 1996 GDP to 2000 GDP
  - Across countries → exchange rate fluctuations
    - US v.s. Japan ; China v.s. UK

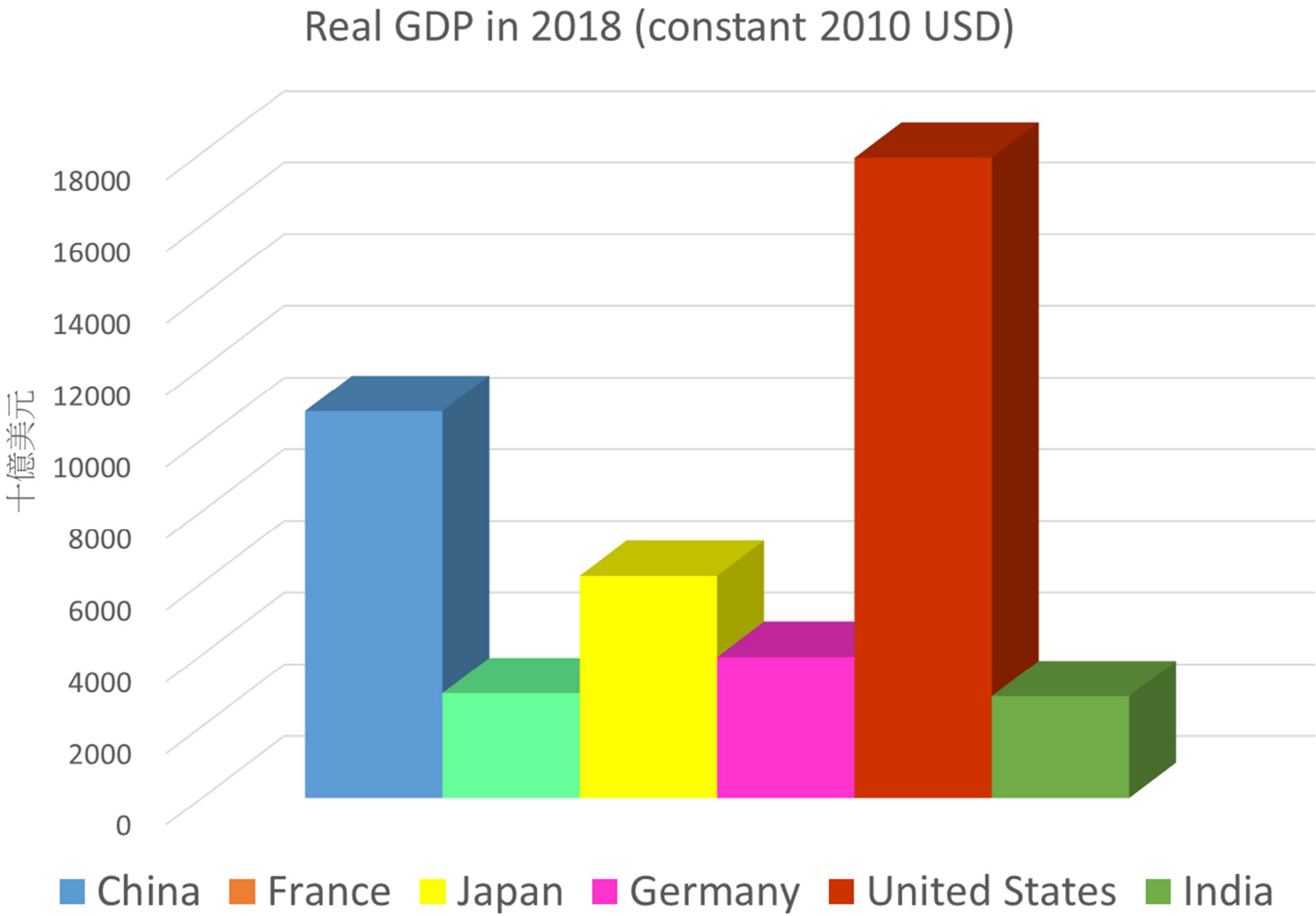
2. Comparing GDP over Time

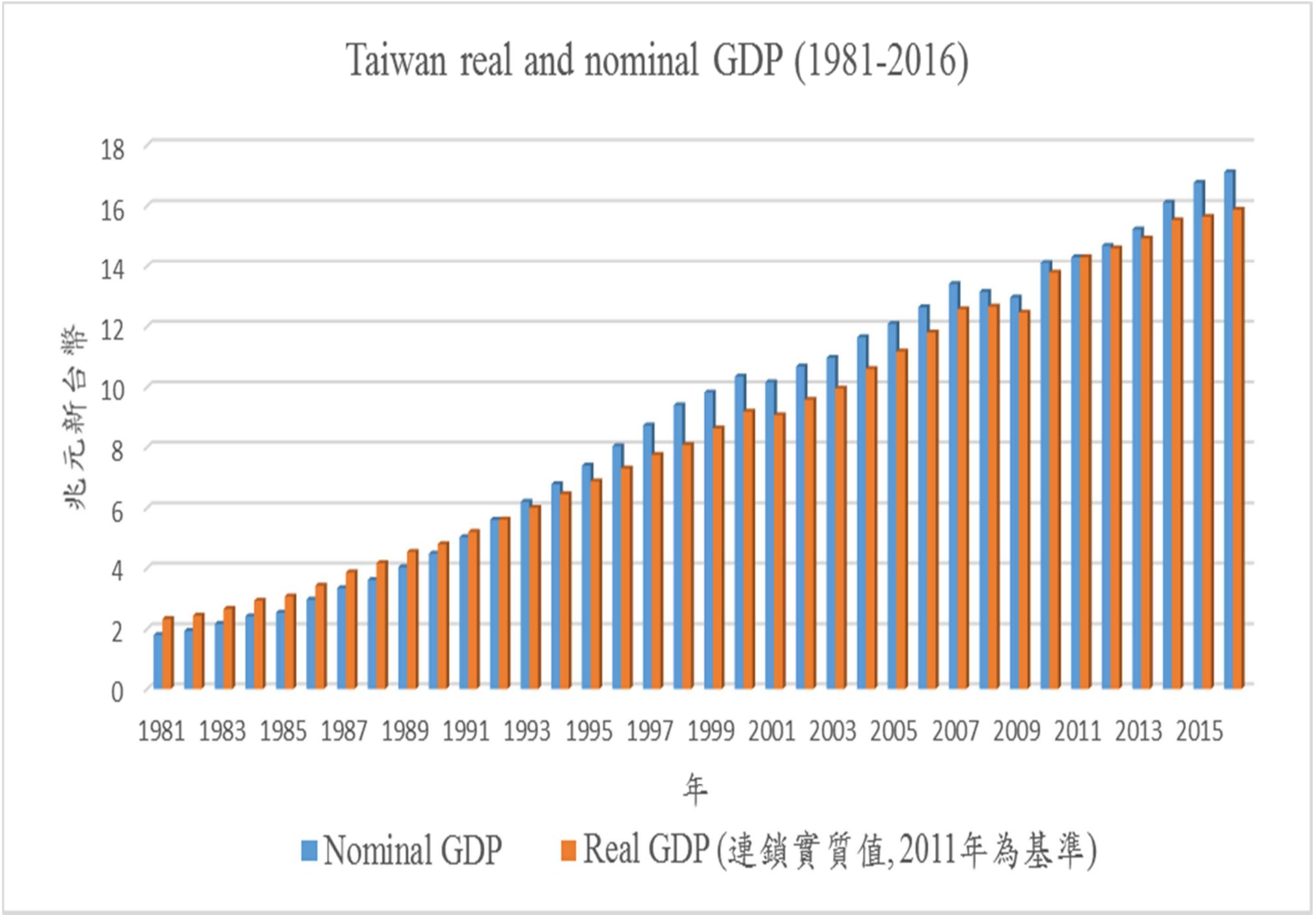
- Comparing GDP across time may be misleading
  - Because of inflation

- Economists use a base year (基期)
  - A particular year

- Real GDP v.s. Nominal GDP


Nominal GDP in 2018 (current USD)
十億美元
25000
20000
15000
10000
5000
0
China
France
Japan
Germany
United States
India


Real GDP in 2018 (constant 2010 USD)
十億美元
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
China
France
Japan
Germany
United States
India



Source: 行政院主計總處.

Ex: Calculating real GDP for 2020

- Nominal GDP
  - Nominal GDP for 2010 is $175 = 10x10 + 15x5
  - Nominal GDP for 2020 is $420 = 20x12 + 30x6
- Calculate real GDP using current year quantities and base year prices (實質GDP = 當期產出 x 基期價格)
  - Using 2010 as the base year, real GDP in 2020 is

    (20 pizzas) x ($10) + (30 calzones) x ($5) = $350
    - 可以排除價格變動的影響。

	Number of Pizzas	Price of Pizza	Number of Calzones	Price of Calzones
2010	10	$10	15	$5
2020	20	$12	30	$6

Observations on real and nominal GDP

- When the nominal GDP goes up and real GDP goes down.
  - Prices increase faster than output
  - 1990-1992 US economy did show this pattern
- When the real GDP rises and nominal GDP falls.
  - Prices are falling faster than output
  - 1990s Japan.
  - but this is rare.

3. GDP and well-being

- Real GDP is a flawed measure of well-being (實質GDP並不是衡量福利水準的好指標)
  - GDP measures market value only (只計算市場交易).
    - Omits illegal transactions, volunteer work, and household production (忽略許多未經過市場的經濟活動).
      - Underground economy
  - GDP不衡量休閒
    - 休閒本身不會生產物品，但可能有助於生產效率提昇
    - 忽略休閒的價值，可能低估 GDP

- Omit intangibles people value:
  - Crime rates (犯罪率)
  - Traffic congestion
  - Sense of community (社區意識)
  - Open space
- Omit environmental quality / resource depletion (資源的消耗)
  - 環境的破壞與維護，是複雜的問題
  - 設置工廠可以增加GDP，修正工廠帶來的汙染可能再提高GDP
  - 環境被破壞，資源被消耗，無法透過GDP來顯示；因此有綠色GDP的概念

- Omit poverty and economic inequality.

- Maximizing GDP will not necessarily maximize national well-being.
  - 需要其他衡量方法輔助。

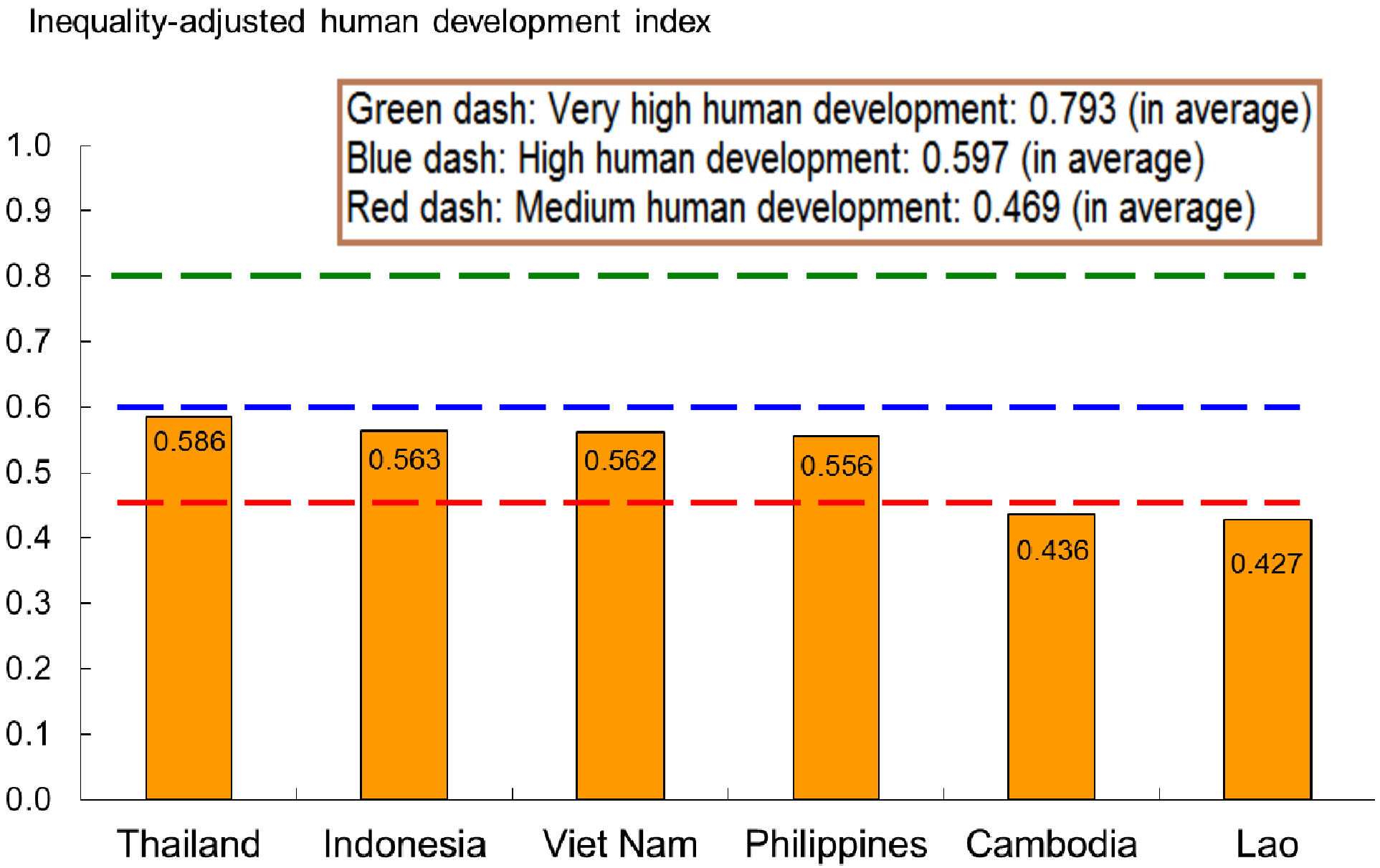
(1) Human Development Index (HDI): A composite index measuring average achievement in three basic dimensions (a long and healthy life, knowledge and a decent standard of living) of human development.

- Life expectancy at birth
- Expected years of schooling, mean years of schooling
- GNI per capita

(2) Inequality-adjusted HDI (IHDI): HDI value adjusted for inequalities.

- Life expectancy
- Years of schooling
- Income/consumption

Inequality-adjusted human development index (IHDI, 2015. Source: United Nations)

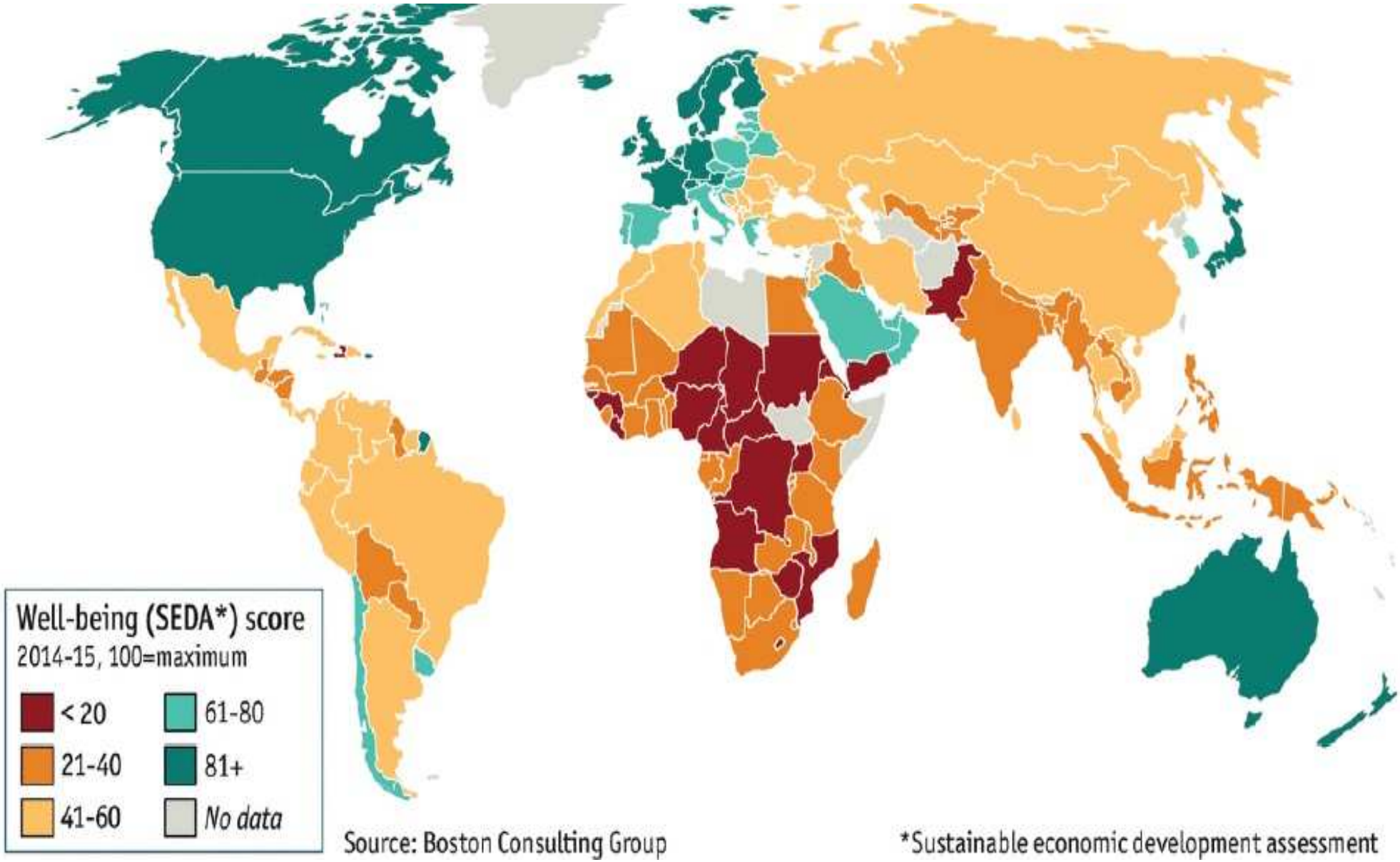


(3) Sustainable Economic Development Assessment (SEDA): developed by the Boston Consulting Group.

SEDA looks at the performance of the following three items in each country:

- Economics: income, stability, and employment.
- Investment: health, education, and infrastructure.
- Sustainability: income inequality, civil society, government, and environment.

Sustainable economic development assessment (SEDA)



Source: Boston Consulting Group

*Sustainable economic development assessment

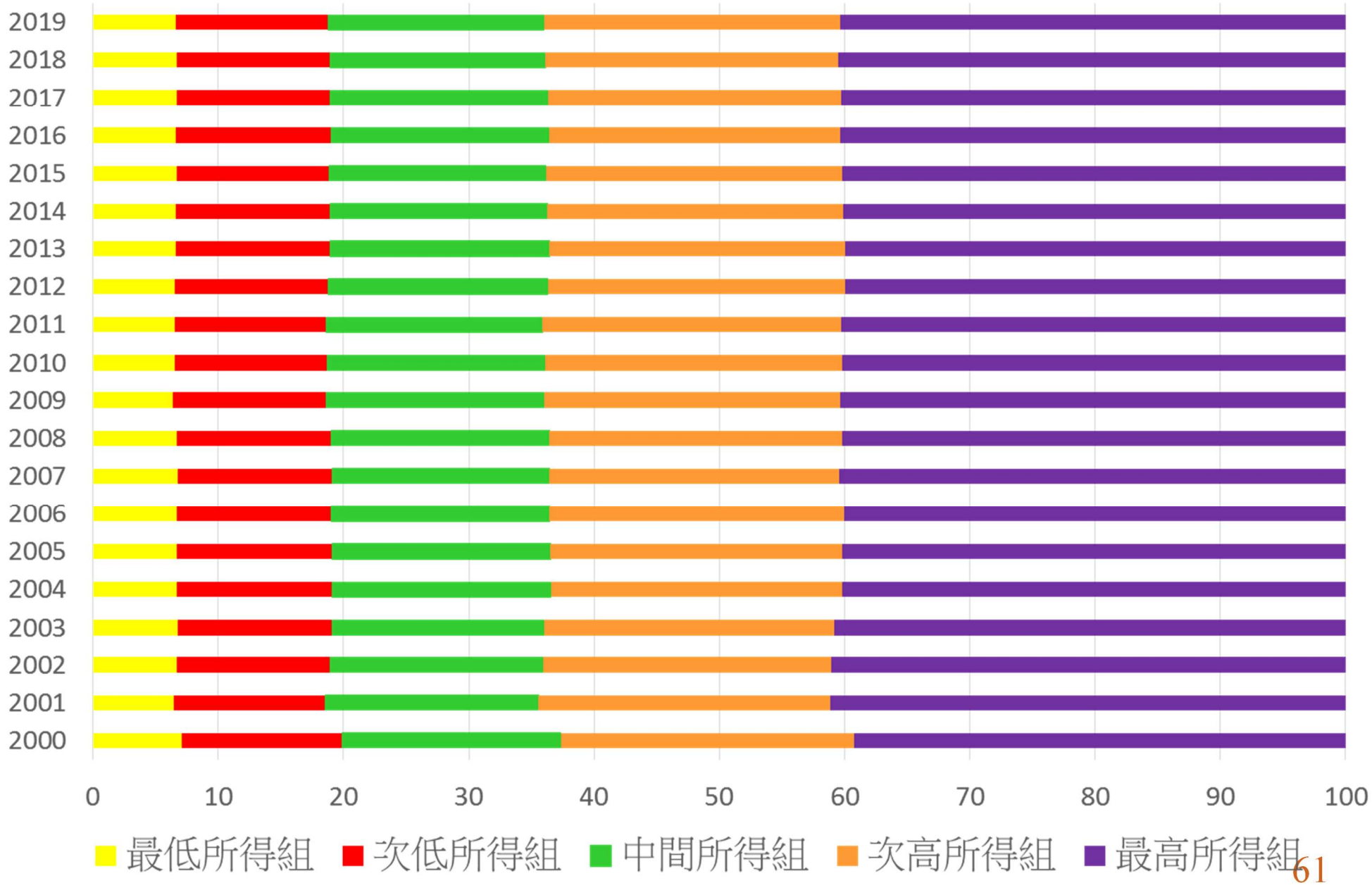
衡量所得分配的方法

① 大島指數 (Oshima index):
家庭可支配所得五等分位最高最低級距倍數

② 勞倫斯曲線 (Lorenz curve)

③ 吉尼係數 (Gini coefficient, Gini index, Gini ratio, Gini concentration coefficient)

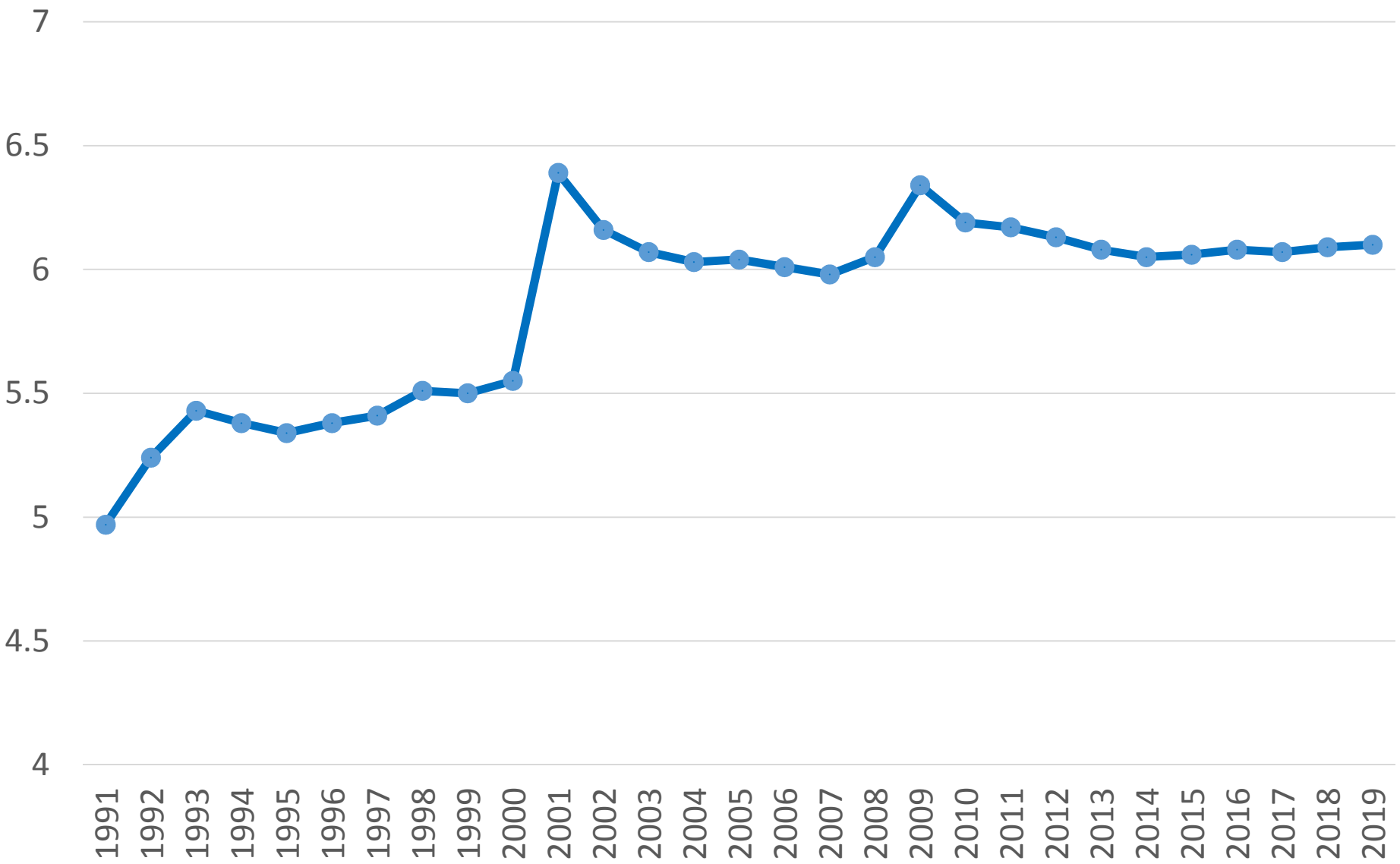
台灣戶數五等分位可支配所得分配比 (2000-2019)



大島指數

- 家庭可支配所得五等分位**最高最低級距倍數**
  - 將每戶家庭可支配所得依高低順序排列，並將全部戶數予以五等分，使每一等分戶數相等。
  - 再以第五分位組(最高所得組)之可支配所得的平均數，除以第一分位組(最低所得組)之可支配所得的平均數，所得之倍數即為貧富差距指標。
- **倍數愈大**，表示貧富差距愈大。

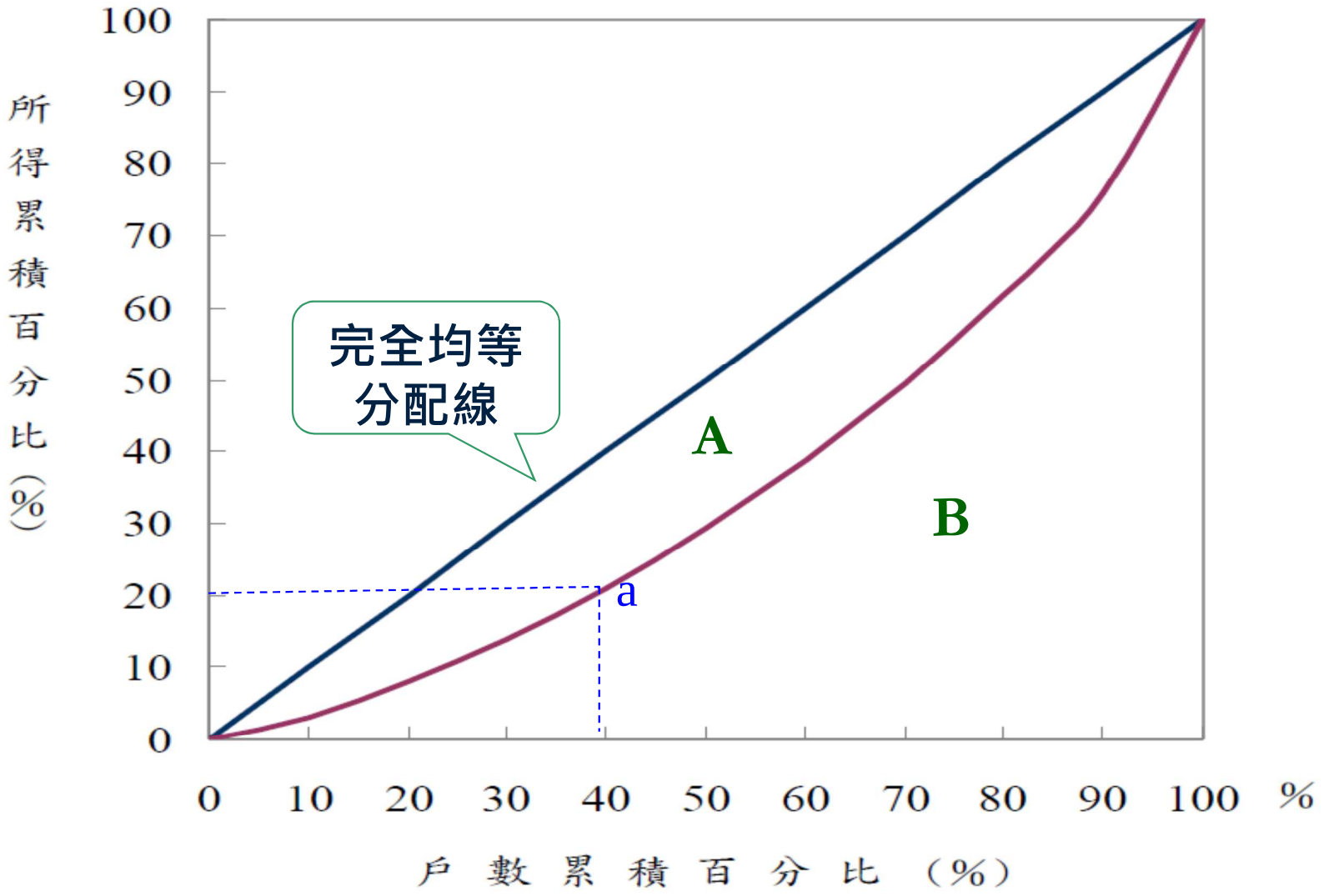
第五分位組位第一分位組之倍數 (Taiwan)



勞倫斯曲線

- 將國內所有家計單位，依所得高低，由最低到最高依序排列。再將排序後的所得等分各組，並分別計算各組戶數、所得占其總數之累積百分比。
  - 以戶數累計百分比為橫軸，所得累計百分比為縱軸，繪成圖形。
- 若全國所有家庭所得分配為完全均等時(如10%家庭擁有10%所得，80%家庭擁有80%所得)，則勞倫斯曲線為45度對角線，代表絕對平均狀態，稱為完全均等分配線。
  - 若家庭所得分配不均時，該曲線必為一條位於對角線下方的弧形曲線。
  - 下圖a點代表家計單位中所得最低40%的人口，其所得加總數占總所得的20%。

勞倫斯曲線


所得累積百分比（%）
100
90
80
70
60
50
40
30
20
10
0
完全均等
分配線
A
B
a
0
10
20
30
40
50
60
70
80
90
100
%
戶數累積百分比（%）

吉尼係數

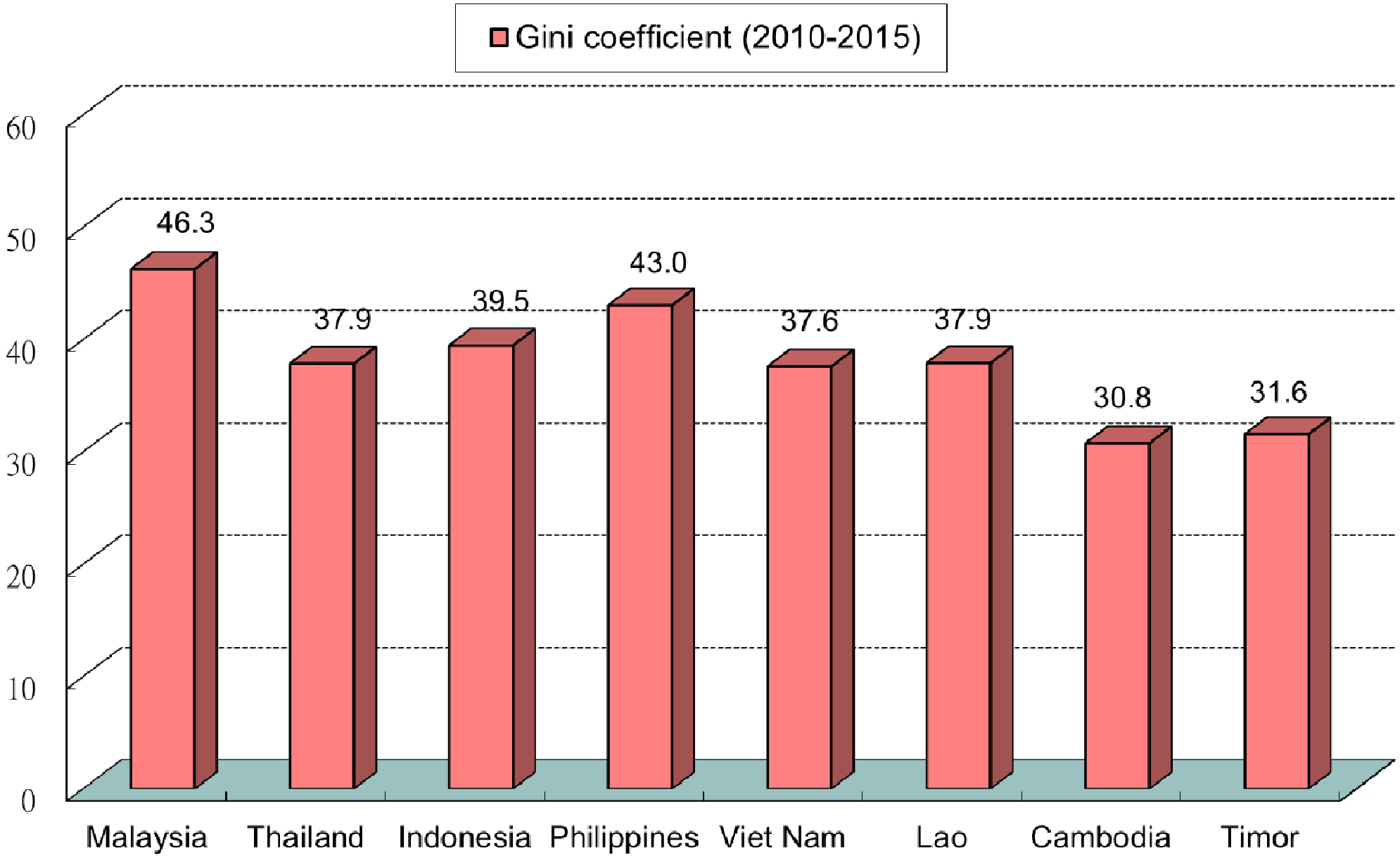
- 吉尼係數乃根據勞倫斯曲線所計算出的所得分配公平程度指標。測量勞倫斯曲線與完全均等線間包含之面積對完全均等線以下整個三角形面積之比例:

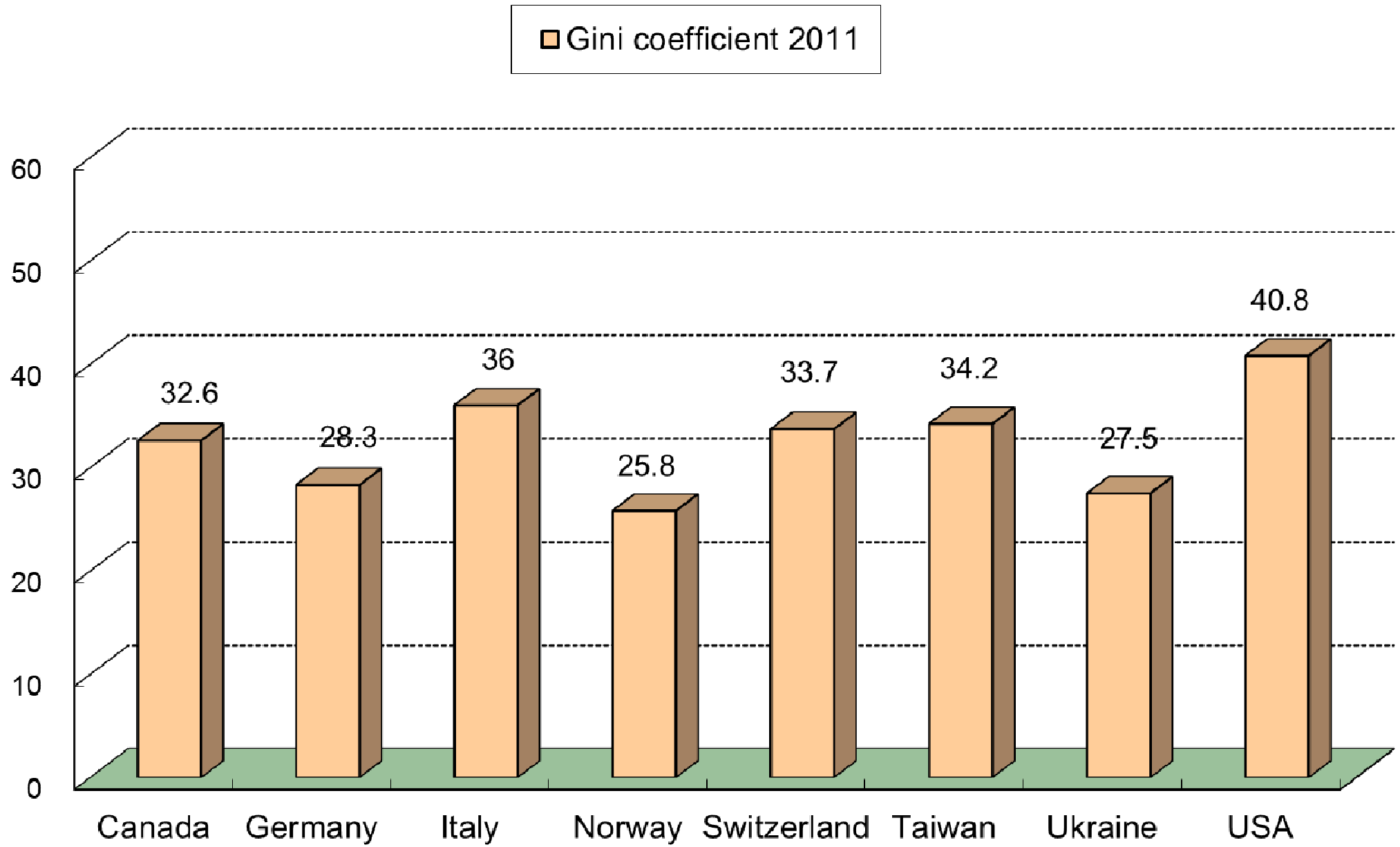
$$G = \frac{A}{A+B}, 0 \le G \le 1,$$

- 此項係數愈大，表示所得分配不均等的程度愈高。

- 在所得完全平均分配的情況下，實際的所得分配線將與對角線重合，A的面積為零，吉尼係數為零。
  - 反之，如果所得極度不平均分配，B的面積為零，吉尼係數等於一。

Gini coefficient
(2010-2015. Source: United Nations)




Gini coefficient 2011
60
50
40
30
20
10
0
32.6
28.3
36
25.8
33.7
34.2
27.5
40.8
Canada
Germany
Italy
Norway
Switzerland
Taiwan
Ukraine
USA

台灣的吉尼係數 (1991-2019)