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**Measurement of GDP by final expenditure approach: an
introduction**

Vu Quang Viet

Background paper

**Chapter 4 of GDP by production approach: A general introduction with emphasis on an
integrated economic data collection framework**

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Chapter 4. Measurement of final expenditures

4.1 This chapter will discuss the measurement of various components of final expenditures which include final consumption expenditure, exports and imports and finally gross capital formation. It also touches on the issue of how to capitalize an expenditure.

A. Final consumption expenditure

4.2 Final consumption includes goods and services, which are used by households or the community to satisfy their individual wants and social needs. Thus final consumption is broken down into:

- a) Final consumption expenditure of households;
- b) Final consumption expenditure of general government;
- c) Final consumption expenditure of non-profit institutions serving households.

4.3 For households, all consumed goods - durable such as cars, refrigerators, air-conditioners, etc. and non-durable such as food, clothes - are part of final consumption, with the exception of purchases, own-construction or improvements of residential housing, which is treated as part of gross capital formation.

4.4 Included in final consumption expenditure of households are:

- a) All goods and services bought for final consumption by households;
- b) All goods produced for own final consumption by households, including those goods and services produced by household enterprises and retained for final consumption;
- c) Domestic services produced for own final consumption by employing paid staff such as servants, cooks, gardeners, chauffeurs;
- d) Services of owner-occupied dwellings (whose imputed values are equivalent market rentals);
- e) All goods and services acquired by households in barter transactions for final consumption;
- f) All goods and services received by households as payment in kind from producers;
- g) Expenditures incurred in “do-it-yourself” decoration, maintenance and routine repairs of own dwellings and personal goods;
- h) Payment to government units to obtain various kinds of licenses, permits, certificates, passports, etc.;

- i) Explicit and imputed service charges on household uses of financial intermediation services provided by banks, insurance companies, pension funds, etc.

Table 4.1. Allocation of government expenditure to government final consumption expenditure

Expenditures on current goods and services	⇒	Government final expenditure
1. As non-market output of government less sales (see also table 3.6)		
Expenditures to produce non-market individual goods and services less sales for delivery free of charge or at insignificant prices to households such as education, health services, sports and recreation, culture, provision of housing services, collection of household refuse, operation of public transport, etc.	⇒	Government individual final consumption expenditure
Expenditure to produce non-market collective goods and services for general administration, national defense, security and other common benefits to the community as a whole.	⇒	Government collective final consumption expenditure
2. As social benefit in kind		
Reimbursements from government's social security funds to households on specified goods and services bought by households on the market; Other social security benefits in kind except reimbursements: This includes goods and services which are <i>not produced</i> by the government sector but bought and distributed free or almost free to households under the social security funds (any payment by household must be deducted); Social assistance benefits in kind: This includes goods and services similar to <i>other social security benefits</i> but not under social security schemes.	⇒	Part of government final consumption expenditure
3. Expenditures on of capital goods	⇒	Government capital formation
4. Other expenditures		Uses in income and capital accounts
<ul style="list-style-type: none"> • Payment for social security, foreign assistance for current expenditures, etc. • Interest payments on debts • Re-payment of principle on debts 		<ul style="list-style-type: none"> • Current transfers • Property income • Financial transactions

4.5 Included in the final consumption expenditure of general government and non-profit institutions serving households are:

- a) Non-market output other than own-account capital formation, which is measured by production costs less incidental sales of government output (own-account capital formation is treated as government output and consumed as capital formation);
- b) Expenditure on market goods and services that are supplied without transformation and free of charge to households (called by the SNA as social transfers in kind).

4.6 Practically, the compilation of government final consumption expenditure is based on the classification of data from actual consolidated annual budgets of all levels of the government (i.e. central, state and local governments) to appropriate national accounts concepts. Data on actual government expenditures are however not normally available at the end of the year, thus government expenditures must be estimated on the basis of budgeted expenditures using some relationships (simple ratios for example) between actual and budgeted expenditures in the past. Estimates of government output and final consumption expenditure will have to be revised when actual data is available.

B. Exports and imports of goods and services

Definition

4.7 Exports and imports between the domestic economy and the rest of the world are transactions between residents and non-residents of an economic territory (see figure 2.4).

4.8 A transaction of goods and services (sales, barter, gifts) from residents to non-residents is an export and from non-residents to residents is an import. From this definition, purchases of goods and services by non-resident tourists in the country are treated as exports and purchases of goods and services by resident tourists outside of the country are treated as imports.

4.9 Exports and imports exclude all transactions in land, buildings and non-movable non-produced assets, and in financial assets (stocks, bonds, money, monetary gold, etc.) The SNA takes an exception rule on land, buildings and non-movable non-produced assets since they are still used for production purposes in the domestic economy. Financial assets are neither goods nor services.

4.10 Exports and imports occur when there are changes of ownership between residents and non-residents regardless of whether there are corresponding physical movements of goods across borders). However there are three exceptions that require imputation of changes of ownership: (i) financial leasing; (2) deliveries between affiliated enterprises; and (iii) goods sent for significant

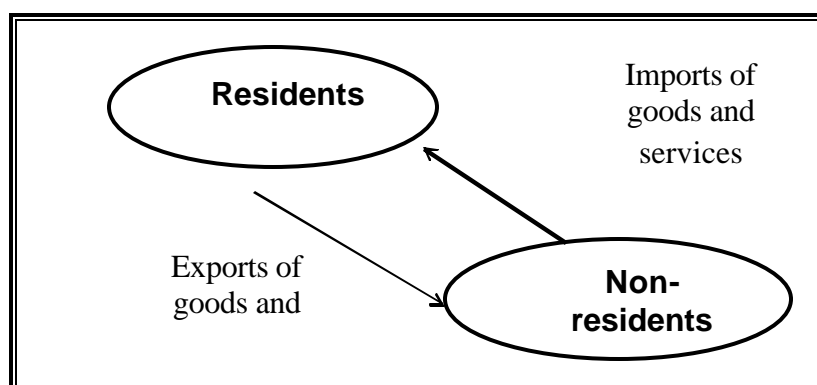
processing to order or repairs. Goods bought from non-residents and sold to non-residents by commodity dealers within the same accounting period are not recorded as exports or imports.

Residents and non-residents

4.11 Exports and imports between the domestic economy and the rest of the world are transactions between residents and non-residents of an economic territory (see figure 4.1).

4.12 An institutional unit, for example a household, an enterprise, a non-profit unit, etc. is a resident unit when it has a center of economic interest in the economic territory in question. Center of economic interest is understood as ownership of land, ownership of structures or engaging in production in the territory for a long period of time (at least a year).

Figure 4.1. Exports and imports as transactions between residents and non-residents



4.13 Military personnel, civil servants including diplomats employed abroad by an economic territory are residents of the territory that employs them.

4.14 Students are residents of their country of origin however long they study abroad.

4.15 International organizations are not considered residents of any national economy, but their workers are residents of the economy in which they are expected to have their abode for at least a year.

4.16 Owners of buildings and non-produced assets like land, subsoil assets, legal constructs like leases, etc. even though are not residents; they are treated as residents of the economy since these assets remain in the economy and serve the production activities of the economy. Transactions of them are not part of exports and imports.

Valuation of exports and imports

4.17 Exports are valued f.o.b. (free on board), i.e. at the prices at the domestic customs frontier before being shipped out. They should be, by definition, equivalent to purchasers' prices since they include domestic transport, and trade costs to bring the good to the ports, and also include taxes less subsidies on products paid by the purchasers or received by the producers.

4.18 Imports must also be valued f.o.b. (free on board), but in this case they are valued at the prices at the foreign custom frontier.

4.19 Imports are normally valued c.i.f. (i.e. including insurance and freight costs) at the domestic custom frontier by customs. To derive imports f.o.b., cost of freight and insurance services between the two borders must be estimated and deducted from imports c.i.f. Freight and insurance services on imports may be provided by either residents or non-residents. Those provided by non-residents are imports but those provided by residents are domestic output. Imports f.o.b. avoid counting domestic output as imports and avoid double counting imported freight and insurance services, as they are already included in data on imports of services.

Estimation

4.20 Instructions on preparing balance of payments published by the IMF provide details on methods to prepare exports and imports.¹ Foreign trade statistics that reflects official merchandise trade across borders recorded by customs is the main source of data for exports and imports. However, in general, it does not cover:

- a) Imports and exports through smuggling particularly for countries with land borders with other countries;
- b) Exports of fish and purchases of oil on the high seas;
- c) Imports and exports of military goods by government that are often not recorded;
- d) Imports and exports of services paid through the banking system, from postal, telephone, electricity, transport, hotels, consultancy services, electronic trade in services, financial and insurance services, etc.

4.21 Items (a) to (b) may be based on certain benchmark studies and in the absence of any additional information may be assumed to change over time in the same way exports and imports of merchandise change for years between benchmark years.

4.22 Items (c) may be obtainable only from government, even though some time they may be obtained from trade statistics of the country trade counterpart. Items in (d) can be obtainable from the Central Bank which collects data from banks under its supervision, from postal, telephone, electric, airlines, transport and shipping, insurance and financial companies that do business across borders.

C. Gross capital formation

¹ IMF, Balance of Payments Manual. Free electronic document:
<http://www.imf.org/external/pubs/ft/bopman/bopman.pdf>

4.23 Gross capital formation in the SNA is the same as the concept of *investment in capital goods* used by economists. It includes only produced capital goods (machinery, buildings, roads, artistic originals, etc.) and improvements to non-produced assets. Gross capital formation measures the additions to the capital stock of buildings, equipment and inventories, i.e. the additions to the capacity to produce more goods and income in the future.

4.24 Non-produced assets such as land, natural resources, patented entities may also be used as capital in an establishment or enterprise or the whole economy but they are not part of the gross capital formation in the SNA.

4.25 In business accounting, investment in capital goods may include acquisitions less disposals of non-produced assets (such as land, mineral resources, etc.). At the national level, the inclusion or exclusion of non-produced assets would not affect the value of investment in capital goods, as the sale of a non-produced asset by one economic entity will be offset by a purchase of the same asset by another economic entity.

Common usage of the term "investment"

4.26 In common usage (business and households) the concept of investment is very broad. It includes:

- a) Investment in produced and non-produced assets (i.e. patents, goodwill, natural resources);
- b) Investment in financial assets.

4.27 Gross capital formation which is a major factor in changing the values of non-financial assets in the economy includes (see table 2.3 for the classification of assets and the effects of gross capital formation on assets):

- a) Gross fixed capital formation;
- b) Changes in inventories;
- c) Acquisition less disposals of valuables (like jewellery and works of art).

Gross fixed capital formation

4.28 Practically for the compilation of gross fixed capital formation, the worksheet that includes assets by types should be used (see table 4.2). This will be discussed later. Conceptually, gross fixed capital formation includes all goods and related services that can be used repeatedly for more than one year to produce other goods and services. It reflects the following types of transactions:

- a) Acquisitions less disposals of new or existing produced assets such as dwellings, other building structures, machinery and equipment, cultivated assets (e.g. trees and livestock), mineral exploration, computer software, entertainment, literary or

- artistic originals and other intangible fixed assets, capitalized research and development;
- b) Costs of ownership transfers on non-produced, non-financial assets like land and patented assets;
 - c) Major improvements to produced and non-produced, non-financial assets that extend the lives of assets (e.g. reclamation of land from sea, clearance of forests, rock, etc., draining of marches or irrigation of forests, and prevention of flooding or erosion);
 - d) Acquisitions can be in terms of purchase, own-account production, barter, capital transfer in kind, financial leasing, natural growth of cultivated assets and major repairs of produced assets;
 - e) Disposals can be in terms of sale, barter, capital transfer in kind, financial lease. Exceptional losses, such as those due to natural disasters (fire, drought, etc.) are not recorded as disposal.

4.29 It is important to realize that assets in business accounting are measured at book values and are adjusted for depreciation, therefore the difference between the values of assets of the two periods would not provide the value of gross fixed capital formation (see table 4.3 for the factors that change values of assets during an accounting period). These factors include acquisitions less disposals of assets and inventories (adding to the value of assets as gross capital formation), consumption of fixed capital (reducing the value of assets) and other changes in assets that may be volume changes and/or price changes). Thus, to get a proper value of gross fixed capital formation, assets must be revalued. However, it is much better to ask for information on new investment in fixed capital directly from businesses.

Changes in inventories

4.30 Inventories include:

- a) Materials and supplies;
- b) Work-in-progress (growing crops, maturing trees and livestock, uncompleted structures, uncompleted other fixed assets, partially completed film productions and software);
- c) Finished goods;
- d) Goods for resale.

Table 4.3. Classification and formation of non-financial assets

Types of non-financial assets	Opening balance sheet	Changes in the balance sheet			Closing balance sheet
		Gross capital formation	Consumption of fixed capital	Other changes in balance sheet	
	(1)	(2)	(3)	(4)	(5) = (1)+(2)-(3)+(4)

Produced assets					
Produced fixed assets					
Dwellings					
Other buildings and structures					
Non-residential buildings					
Other structures					
Land improvements					
Machinery and equipment					
Transport equipment					
ICT equipment					
Other machinery and equipment					
Weapons systems					
Cultivated assets					
Livestock for breeding, dairy, etc.					
Vineyards, orchards and other plantations					
Intellectual property products					
Research and development					
Mineral exploration and evaluation					
Computer software and databases					
Entertainment, literary or artistic originals					
Other intellectual property products					
Inventories					
Materials and supplies					
Work in progress					
Finished goods					
Military goods					
Goods for resale					
Acquisitions less disposals of valuables					
Acquisitions less disposal sof non-produced assets					
Natural resources					
Land					
Subsoil assets					
Mineral and energy reserves					
Non-cultivated biological resources					
Water resources					
Other natural resources					
Acquisitions less disposals of contracts, leases and licenses					
Contracts, leases and licenses					
Purchase, sale of goodwill and marketing assets					

Not applicable

D. Capitalization of own-account capital formation: an example

4.31 Many activities from own-account construction of dwellings, own-account research and development and software development are capitalized by the SNA. This means they are used as fixed assets over a time period longer a year to produce other goods and services. Without being capitalized, the goods and services used to produce them are treated as intermediate consumption and the wages and salaries paid as well as consumption of fixed capital in producing them make up gross value added. The example below will be used to show the necessary imputations in the accounts.

Table 4.1. Account without imputation of own-account capital goods: an example

Output at basic prices		120
Goods and services used in production		40
Gross value added at basic prices		80
Other taxes on production		0
Compensation of employees (COE)		60
Consumption of fixed capital (CFC)		10
Net operating surplus		10

Cost of own-account R&D: 11

- Goods and services: 2
- COE: 8
- CFC: 1

Table 4.2. Account with imputation of own-account capital goods: an example

	Original output before capitalization	Output after capitalization	
		Primary output	Secondary output
Output at basic prices	120	120	11
Goods and services used in production	40	38	2
Gross value added at basic prices	80	82	9
Other taxes on production	0	0	0
Compensation of employees (COE)	60	52	8
Consumption of fixed capital (CFC)	10	9	1
Net operating surplus	10	21	0

4.32 After enumerating the costs incurred in generating research and development (R&D), which is shown in the red box within table 4.1, the output of R&D is imputed as the sum of costs (which is 11 in the example). Thus now the company produces two products: (1) its own principal product which is still valued at 120 (calculated on the basis of sales), and (2) its secondary product which is value at cost at 11. Thus when own-account production is capitalized instead of being treated as merely current cost of production, the output and value added generated by the company and thus the whole economy increase by the same amount of output capitalized, which is 11 in the example (see table 4.2). Essentially, this means that the imputed income retained by the company (or saving in the national accounts concepts) is utilized to purchase its own output as gross capital formation. So in terms of balancing supply and uses of goods and services in the economy, out of the output of 131, sales to others is 120 and 11 is sales to itself as gross capital formation.

4.33 **The consequence of imputed capitalization is higher gross value added and thus higher GDP by the same imputed amount.** With this imputation, it is expected by economists specializing in productivity analysis and the 2008 SNA that the imputed intellectual property assets can explain productivity effect on economic growth. Other economists are still uneasy of imputations that go beyond actual transactions, particularly in case of research and development where they may not yield any concrete results. In addition the depreciation of these assets can only be based on some convention.

4.34 **The treatment of military weapons systems as gross fixed capital formation** is in fact not an imputation since they have useful lives of more than one year and can be used repeatedly. It is doubtful that the increase in the accumulation of these assets explains economic growth. This is the reason that for analysis of economic growth only non-military assets should be used.

E. Estimation of gross capital formation

4.35 A worksheet shown in table 4.4 will help facilitate the compilation of gross fixed capital formation (GCF) and inventories by kind of assets, which must be in purchasers' prices. The main focus is on obtaining data for columns (1), (2) and (3). GCF for each kind of asset is derived from domestic production, imports which are then reduced by exports. In addition to utilizing these sources to estimate investment in fixed assets, surveys on investment of enterprises would provide the total value of investment to be used as total controls. Surveys are normally designed to find indicators that allow for the extrapolation of benchmark data on fixed assets.

4.36 Construction statistics provide a major source of information to construct gross capital formation in dwellings, other buildings and structures. From construction statistics, only activities that result in fixed assets or that prolong the assets' life will be counted as assets (i.e. major repairs).

Table 4.4. Worksheet for compiling gross fixed capital formation

Types of non-financial assets	Domestic production	Imports	Exports	Gross capital formation
	(1)	(2)	(3)	(4) = (1) + (2) - (3)
Produced assets				
Produced fixed assets				
Dwellings				
Other buildings and structures				
Non-residential buildings				
Other structures				
Land improvements				
Machinery and equipment				
Transport equipment				
ICT equipment				
Other machinery and equipment				
Weapons systems				
Cultivated assets				
Livestock for breeding, dairy, etc.				
Vineyards, orchards and other plantations				
Intellectual property products				
Research and development				
Mineral exploration and evaluation				
Computer software and databases				
Entertainment, literary or artistic originals				
Other intellectual property products				
Inventories				
Materials and supplies				
Work in progress				
Finished goods				
Military goods				
Goods for resale				
Acquisitions less disposal of valuables				
Acquisitions less disposal of non-produced assets				
Natural resources				
Land				
Subsoil assets				
Mineral and energy reserves				
Non-cultivated biological resources				
Water resources				
Other natural resources				
Acquisitions less disposals of contracts, leases and licenses				
Contracts, leases and licenses				
Purchase, sale of goodwill and marketing assets				

Not applicable

4.37 Machinery and equipment are obtained from domestic production, which after deducting exports is an important source of data on GCF. Merchandise imports of machinery and equipment would normally identify another important source of supply.

4.38 Weapons system must be based on government sources.

4.39 Cultivated assets are derived from agricultural statistics and the work of national accountants on agriculture.

4.40 Intellectual property relies on industrial surveys and imputation of data by national accountants particularly with data on employment to be used for estimation or extrapolation.

4.41 Data on inventories must rely on industrial and distributive trade surveys. Most countries focus mainly on inventories kept by major industrial producers and enterprises involved in distributive trade, and national strategic inventories of important commodities such as petroleum, rice, and wheat that are kept by government.

F. Estimation of consumption of fixed capital

4.42 Special characteristics of consumption of fixed capital include:

- a) Consumption of fixed capital is a cost of production. It measures the decline in the current values of the stock of fixed assets owned and used by producers as a result of physical deterioration, normal obsolescence and normal accidental damages during the accounting period;
- b) Thus, consumption of fixed capital can be measured directly or indirectly. The direct method is through surveys of produced fixed assets at market at two consecutive periods and then calculating the decline in the market values of the stock of fixed assets. The indirect method recommended by the SNA is the perpetual inventory method, which is an approximation of market valuation and less costly to implement. Depreciation in business accounting is not acceptable in national accounting since it is based on historical book values;
- c) The example below shows the difference between depreciation used in business accounting and consumption of fixed capital, which is the economic concept adopted by the SNA.

Table 4.4. Depreciation and consumption of fixed capital

1. Depreciation in business accounting at book value (straight line over 4 years)								
		Calculating method	T ₋₄	T ₋₃	T ₋₂	T ₋₁	T	T ₊₁
1	Gross capital formation at book value (GCF)			800				
2	Depreciation at book value (D)	D= Line (1)/4		200	200	200	200	0
3	Net capital stock at book value, end of period*	NCS=NCS+GCF-D	0	600	400	200	0	0

2. Consumption of fixed capital in national accounting by the perpetual inventory method								
		Calculating method	T ₋₄	T ₋₃	T ₋₂	T ₋₁	T	T ₊₁
4	Price index of fixed asset			100	105	106	115	
	At base year price of T₋₂							
5	Gross capital formation (GCF)			840				
6	Consumption of fixed capital (CFC)	= Line (5)/4		210	210	210	210	0
7	Net capital stock, end of period	=NCS+ GCF-CFC	0	630	420	210	0	0
	At current market price							
8	Consumption of fixed capital at current market prices	=Line (6) price-adjusted by line (4)		200	210	212	230	0
9	Net capital stock at current market prices, end of period*	= Line (7) price-adjusted by line (4)		600	420	212	0	0

*By convention, depreciation and CFC start in the year in which GCF takes place.

Notes to table 4.4:

- The very simple example below shows how depreciation in business accounts and consumption of fixed capital is calculated. It is assumed that the fixed asset was bought at time T-3 for 800 and entered in the business account at this price (e.g. book value, or historical value), has a lifetime of 4 years and will be scrapped after that. The value of the fixed asset is assumed to decline proportionally over 4 years (straight line depreciation).
- Table 4.4.(1) shows the calculation of depreciation in business or government accounting. Gross capital formation is recorded at book value. As the asset survives 4 years, depreciation is simply calculated by dividing the book value by 4.
- Table 4.4.(2) shows the calculation of consumption of fixed capital by using the perpetual inventory method. The method requires first the calculation of gross capital stock and consumption of fixed capital at the base year price and then the inflating of these values into current prices by using price indices. Thus the following steps are required:
 - The gross capital stock at book value is converted to the price of a base year. In this example, the base year is set at T-2.
 - The consumption of fixed capital at the base year price is calculated by using the same straight -line depreciation assumption. Net capital stock at the base year price is the difference between gross capital stock and consumption of fixed capital.

- The next step is to derive consumption of fixed capital and net capital stock at current market values by using the price indices.
- As can be seen in table 4.4.(2), the calculation of the consumption of fixed capital of one fixed asset with a 4-year lifetime at time T requires data on gross capital formation of that kind of asset from year T-3 on. The consumption of fixed capital of buildings with 30-year lifetime at the present time will require data on annual gross capital formation of buildings of the same kind for 30 years before that. Thus, the calculation of consumption of fixed capital requires long time-series of data on gross capital formation, their average service life and their probability of retirement. In practice, the compilation of net capital stock and the calculation of consumption of fixed capital require a combination of obtaining an initial benchmark estimate of capital stock (by survey) and series of gross capital formation statistics.
- The simple method shown in table 4.4 omits the effects of asset mortality, i.e. how assets are retired around the average service life especially when there is more than one fixed asset of the same kind. The assumption of a straight-line depreciation may need to be replaced by a more realistic assumption that is appropriate for each kind of assets as some depreciate quickly at the beginning and slowly at the end of its service life, while the opposite is true for others.
- For more detailed information on the perpetual inventory method, readers are advised to read chapter 8 of the handbook, *Links Between National Accounting and Business Accounting* (United Nations, ST/ESA/STAT/SER.F/F76) or *Measuring of Capital: A Manual on the Measurement of Capital Stocks, Consumption of Fixed Capital and Capital Services* (OECD).

G. Relationship between consumption of fixed capital, net capital formation, net saving and net value added

4.43. Gross capital formation is the actual investment expense to increase stocks of non-financial assets. However, part of it is to replace the fixed assets that are used up in production. The using up of fixed assets is reflected in physical deterioration, normal obsolescence or normal accidental damages. Thus the economic increase in fixed assets is net capital formation, which equals gross capital formation less consumption of fixed capital. Correspondingly, net value added and net saving are calculated by subtracting consumption of fixed capital from gross value added and gross saving.

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