



Course: Economics I (macroeconomics)

Study text

2nd Chapter

Macroeconomic Measurement

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2 Macroeconomic measurement

In this chapter we will analyze the issue of measuring the performance of the economy as a whole, which is one of the basic prerequisites enabling the description and analysis of the economy at the macroeconomic level. There will be included the military spending (defense spending) in the framework of the national accounts. The basic methods used for calculation of macroeconomic output will be characterized during the lecture and the complexity of the product measurement will be taken into account. In the end, the basic macroeconomic identities will be presented and items that are not included in the calculation of the gross domestic product (GDP) will be introduced.

2.1 The need for and the issue of measuring economic performance

During the historical development of national economies it has shown that it is necessary to know the exact information about the health of the national economy. The Great Depression of the early 30s of the 20th century was the evidence to have to measure economic performance. During that time factories were closed, farmers went bankrupt and millions of people lost their jobs. Experience has shown efforts to create a certain macroeconomic accounting, denouncing about how much output is produced, for what it is used, how much income it generates, what happens to wages and prices etc. If we measure the performance of the economy, that gives us a useful insight into the way, how the economy works.

Now let us look at the history of laying the foundation for national accounting. The first signs date back to the 17th century. First was Sir William Petty (1620 - 1687), who used statistics to monitor the development of the UK economy at war with Holland, and he particularly famous for his detailed research of population and incomes in Ireland in the 17th century. Simon Kuznets (1901 - 1985) also dealt with measuring the performance of the economy and he was first who introduced the quantity of GDP in the United States Congress in 1937, as a response to the need for quantifying the performance of the output of the economy after the Great Depression of the early 30s in 20th century. Fragmented data on industrial production and sale of automobiles were replaced with aggregates of economic performance. As co-authors of modern techniques for measuring the economy is regarded British scientist Nicholas Stone (1901 - 1991), author of the theory of “double entry” that says that every expenditure of some economic operator is someone’s else revenue. Moreover, N. Stone was asked by the UK government on costings for a possible entry into the war of World War II.

Let us move now to the present. The range of goods and services that developed market economies now produce is huge. All sorts of goods and services, that we can buy, can be part of the total economic output. The first problem we encounter is to find a summary indicator of economy’s performance (output). It is not possible to make a sum of all products because they are inconsistent and are measured in

different units - in kilograms, liters, meters or in number of items. Therefore, there is used a mechanism through which we can sum units. This mechanism is the **pricing mechanism**. Each product available at the market has a certain price, and it serves as an indicator of value for the total output.

Another essential step is to define **the time period** for measuring the output. If we want to compare the macroeconomic outputs, we have to measure them over the same period. Using a pricing mechanism for figuring the market output allows us to summarize the output of the economy. The outputs (e.g. annual) can be compared in years. First, we focus on the final output that goes to the end user.

The product is the total market value of final products produced in a particular economy over a given period of time.

The basic variables used to measure the performance of the economy are *the gross national product* and *gross domestic product*.

Gross national product (GNP) is a variable measuring the performance of production factors according to their nationality. So for example output of some Czech company that has a branch in Poland is included in GNP of the Czech Republic, but output of a German company that has a branch in the Czech Republic is not included in GNP of the Czech Republic. In an environment of increasing interdependence of economies, where the factors of production and property very easily cross the borders countries, GNP is increasingly complex issue and is rated as less reliable indicator of the economic prosperity of the country.

Gross domestic product (GDP) is geographically focused. It includes all outputs produced within the borders of a country, regardless of who owns the factors of production used to produce the output. So the output of the German company that has a branch in the Czech Republic is included in GDP of the Czech Republic. This variable is associated with employment in the territory of the state (a German company employs the Czech people). Geographical focus of the GDP allows us to compare economic activity on an international scale, but even more the variable GDP per capita is used for international comparison of the total output of various countries, and that is, the total volume of GDP divided by the number of population of the country.

If we subtract GDP from GNP, we will get the variable net income from assets abroad, or **NPI - Net Property Income**. It's the difference between the flow of income from national inputs used abroad and foreign income flow of inputs used in the domestic economy. NPI value may has negative or positive sign. GNP can also be calculated as the sum of GDP and NPI.

$$GNP - GDP = NPI$$

$$GNP = GDP + NPI$$

Product includes only goods and services in the form of finished products. If counted each market activity, the output would be counted several times and would overstate his. The problem is that the production of goods and services typically comprises several different stages. In the manufacture of pretzels, as can be seen in Table 2.1, one must first grow wheat, other bodies must grind, then the baker bake fresh pretzels and at the last step there is the owner of a store that sells these pretzels to consumers. This leads to 4 phases and 4 separate transactions (farmer sells wheat to miller, miller sells the flour to baker, baker sells pretzels to a store owner and the store owner sells pretzels to consumers).

Tab. 2.1 Value added at each stage of production

Stages of production	Value of the transaction	Value added	Value of the intermediate goods
1st The farmer grows and sells wheat	0.30 CZK	0.30 CZK	-
2nd The miller grinds the wheat and sells flour	0.65 CZK	0.35 CZK	0.30 CZK
3rd Baker bakes and sells pretzels to a store owner	1.30 CZK	0.65 CZK	0.65 CZK
4st The store owner sells pretzels to consumers	2.00 CZK	0.70 CZK	1.30 CZK
Total	4.25 CZK	2.00 CZK	-

Adding the value of individual transactions, we get a much higher number than the value - the price of one pretzel (compare values in Table. 2.1 in the “transaction value” CZK 2.00 and CZK 4.25).

To get the correct data about GDP, we have to distinguish between **intermediates** and **final products**. Intermediates are products purchased as input to the next stages of production. The final products are the products produced at the end of the production chain for use by consumers or other market participants, while they are the end users of goods and services. The value of the final production can be calculated in two ways, as shown in Table 1.2. We add up the value of market transactions that relate to the stage no. 4 - the sale of finished products. This calculation excludes any outputs produced in the manufacturing stages 1-3, which would still not appear in the fourth stage output.

The second way how to calculate GDP is by adding up only value added at each stage of production. The value added at each stage of production is a real contribution to total output. Added value is equal to the market value of the product

minus the cost of intermediates. If we count only the value added at each stage of production, we avoid duplicate calculation. That means intermediates will not be included in calculating – manufacturers buy them from other manufacturers and then they are used as inputs for the production. Notice in the table, the market price (the value of the transaction in the fourth stage of production, i.e. CZK 2.00 corresponds to the sum of value added at each stage of production, see column “added value”).

Pricing mechanism, as we discovered, is suitable for measuring the market value of goods and services, but **prices can distort the view of the real output of the economy**. Increase in GDP (at market prices) may or may not be the result of increased amount of goods and services. The economy can produce the same amount of production, and yet its GDP may be higher. Then it will be due to the fact that the prices of final production. To distinguish increase in the final production and the growth in prices, it is necessary to distinguish between the real and nominal product.

Nominal GDP is the value of final output produced for the period, measured in the prices of this period - that is, at current prices.

Real GDP represents the value of final output produced for the period, adjusted for price changes. When calculating real GDP we use constant prices of the base period. The distinguishing between nominal and real GDP is important in the economy if there is a change in the price level.

Real GDP can be calculated as the ratio between nominal GDP in year t and the price index (P).

$$\text{Real GDP in year } t = \frac{\text{nominal GDP in year } t}{\text{price index (P)}}$$

The price index (P) expresses how average prices have changed since the base period to the year t .

The monetary value of output is usually growing faster than the quantity of output, reflecting steady growth in the price level - or inflation (increase in the average level of prices of goods and services).

Changes in real GDP in years demonstrate how the output has changed (has increased or decreased), respectively its quantity - denoted by Q, or Y.

Recall also that the production possibilities of the economy determine how much output the economy can produce. Production possibilities are given by quantity of production factors, their quality and level of technology. If some of the factors of production are used (used up) to produce output, future production possibilities of the economy will be reduced. The economy will not be able to produce enough output, until it replaces consumed factors of production. In the manufacturing process buildings and production facilities (capital) are normally depreciated. The value of

capital consumed in the production of goods and services is usually called amortization (synonyms are used as terms of capital depreciation, depreciation or capital consumption). In essence, it is the amount of capital that is depreciated when applied in a given year, or have become obsolete due to the development of technology.

If we subtract the value of depreciated capital from GDP, we obtain the quantity **NDP - net domestic product**, or if we subtract the value of depreciation of capital from GNP, we obtain **NNP - net national product**. Net domestic (national) product is the part of the output, we can consume without reduced the supply of capital, and the production possibilities in the next year. Distinguishing between gross and net product is reflected in the distinction between gross and net investment.

Gross (gross) investment is total capital expenditure for the period. It consists of net investment and restitution investment.

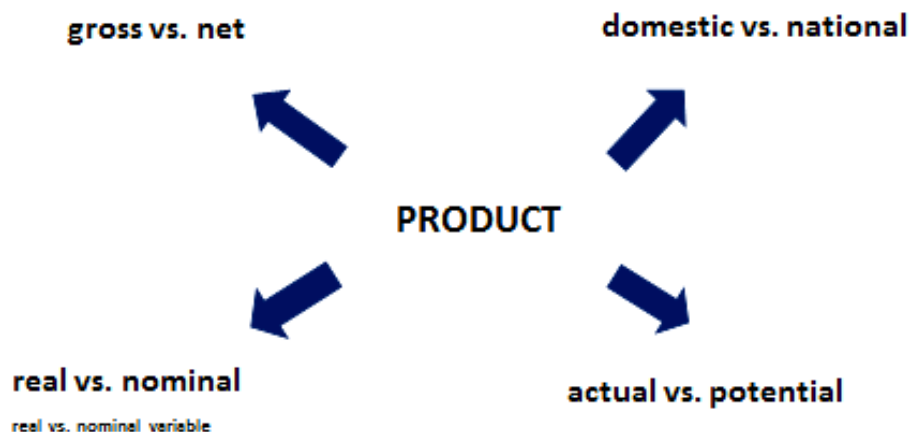
Gross investment = net investment + restitution investment

$$I_B = I_N + I_R$$

To maintain the production possibilities of the economy, it must at least replace depreciated capital. This replacement is referred to herein as **restitution - replacement investment**. Net investments are newly produced capital goods, meaning the creation of additional capital goods and a prerequisite for increasing production. The capital reserve is not growing, if not exceed the gross investment amortization – i.e., the net investment must has a positive sign. If the economy consumes capital goods faster than they would have been replaced, net investment would be negative and capital stock would recede. This would have reduced the ability of the economy to produce goods and services.

Fig. 2.1 shows possible breakdown of the product. We usually use real and nominal product to capture price changes in the product. Potential product is defined as a product, when all production resources are used in the economy and we can compare it with an actual product (which the economy actually achieves in a given time), further distinguishes are between domestic and national product, and in the previous paragraph, we examined the definition of the net and gross product.

Fig. 2.1 Possible breakdown of the product



2.2 Methods of measuring GDP

There are three basic methods for the measurement of economic output, which is dedicated to closer scrutiny in the following text. All three methods are being used in the national accounting system to quantify the GDP of the economy.

1st Measuring GDP by expenditures

Using this method we find application output. Thus counted GDP provides information on the composition of output or response of the fundamental economic question: what to produce? If a product is defined as the market value of the final output achieved for a given period of its implementation on the market attaches to the expenditure of those who buy this product. The main uses of the total output correspond to the four basic groups of market participants; they are households, firms, state and foreign entities. If we measure GDP using the expenditure of economic entities, is expressible sum of the following items:

C = household consumption expenditures,

I_B = gross private domestic investment,

G = government purchases of goods and services (government spending)

NX = net exports (difference between exports and imports).

Gross domestic product expressed expenditure method it is possible to write:

$$GDP = C + I_B + G + NX$$

Let us examine more closely the following items.

I. Household consumption expenditures

Household consumption expenditures represent goods and services directed to the use of the households, usually called consumer goods. They can be divided into three main groups:

- spending on household durables (e.g. furnishings, cars, garden furniture),
- expenditure on short-term household consumption (e.g. purchases of food, clothing, gasoline, etc.),
- services expenditure paid by households (eg. payment of rent, water, gas, electricity and health care fees, payments, lawyers etc.).

Household consumption expenditure in the Czech Republic are around 50 % of GDP and constitutes the most significant component of total expenditure and aggregate demand (total planned expenditure). Changes in consumers' decisions about the size of expenditure is reflected in the change of the size of aggregate demand (AD) and then in a change in gross domestic product.

II. Private gross domestic investment

Already we have outlined that private gross domestic investment (I_B) forms both investment costs associated with the restoration of capital goods and also net investment, meaning expansion or creation of additional equity capital goods.

Private gross domestic investment purchases are made by investment companies (e.g. the purchase of raw materials, machinery, and construction of manufacturing buildings). Among capital expenditures are counted in the statistics and expenses associated with the construction of houses. These are the expenses associated with the purchase of the final production (investment in this sense it is not such as buying stocks and bonds).

In the Czech Republic this component is about 30 % of GDP.

III. State purchases of goods and services

This component includes state expenditure on the purchase of the final production (marking G). It does not count the current transfer payments (e.g. social benefits, pensions). These funds will turn in consumer spending to households.

This group total spending in the economy include **defense spending** (military spending). The expression level of defense spending in addition to the absolute amount (in the currency) used therefore their percentage of GDP variable. Performance of the economy and defense spending together most closely related.

In the Czech Republic state expenditures for the purchase of goods and services reach around 20 % of GDP.

IV. Net export

The fourth component of the total expenditure in the economy consists of net exports. It is a variable that is collected, if we subtract the value of imports (imports) from exports (exports). It is the difference between spending foreign economic entities for goods and services produced within the national territory, and spending by domestic businesses spent on the purchase of goods and services produced abroad.

$$NX = X - M$$

NX stands for net exports, X export and import M.

The net exports can be positive or negative. For variable net exports (NX) we also uses the term of trade balance. Even though we know export forms a relatively high percentage of GDP in the Czech Republic, we must not forget that in GDP counts export minus import, which can be, for example, only 1 % of GDP.

We note the percentages of individual components of GDP. Percentages of consumption expenditure, investment expenditure for the purchase of goods and services, and net exports should, for the period, calculated at the same price, equal to 100 %.

2. Measuring the GDP by incomes

The income approach means that we measure the performance of the economy through household income that households receive as payment for services of production factors in their possession. If we add up all these incomes that belong to households, we obtain a **national income**. Owners of the factors of production belong to the following scheme:

- earnings before taxes (gross wages) for a factor of production work,
- annuities, pensions landowners
- corporate profits before tax (gross profit)
- net interest (the difference between the interest that households receive, and the interest they pay)
- incomes for self-employed workers.

The sum of its income obtained national income, but will not reach the level of national product (GDP using the expenditure approach). This is mainly due to the amortization of capital and indirect taxes. The national income does not include amortization (depreciation) of capital, is contained only in the prices of goods and services.

Furthermore, we still had to subtract from national income production subsidies, if provided state enterprises to recoup their losses. Also taken into account the fact that

some of the income in the local economy include foreigners and their incomes spread abroad. On the other hand, citizens own domestic economic factors of production abroad and pensions for their use flow into the domestic economy. Roughly we can write:

National product = national income + capital depreciation + indirect taxes on goods and services – subsidies + net property income from abroad.

Next, we introduce variable **personal income** (PI - Personal Income), this variable takes into account the following factors:

- the company pays tax on the profits,
- portion of corporate profits not distributed,
- there are evacuated payments to special funds - social and health insurance,
- households receive income in the form of transfer payments from the state (e.g. social benefits)
- sectors, except households, receive or pay interest.

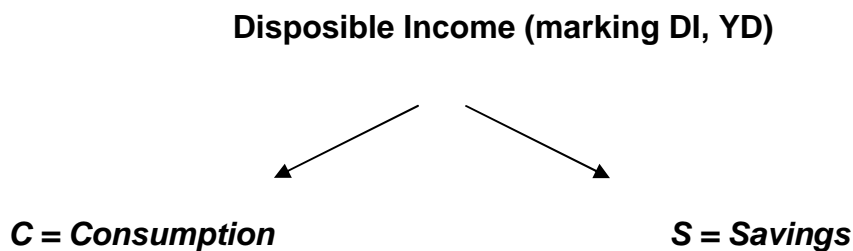
For the calculation of personal income received by households before payment of personal income taxes, we can write:

national income - corporate taxes - undistributed profits - payments into Social Security and Medicare + transfer payments + net interest income = personal income.

Because personal income subjects to taxation, will be further reduced by the personal income tax. If we subtract from the personal income personal income tax (depending on the amount of income), we obtain **disposable income** (DI = Disposable Income, marking is also possible YD):

personal income – personal income tax = disposable income.

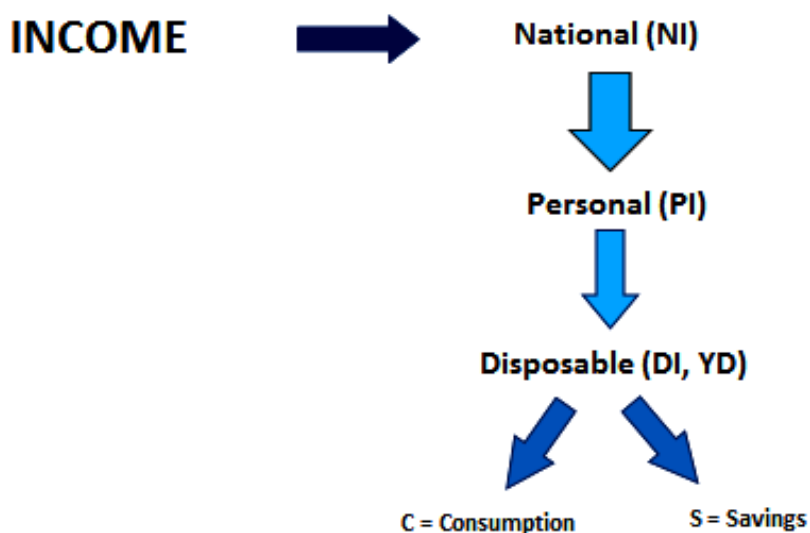
Once households get disposable income, they can buy it for goods and services. If you spend any disposable income for purchasing goods and services ($YD = C$), their savings are equal to zero ($S = 0$). Savings means disposable income that is not spent on consumption. If disposable income is higher than the level of consumption, savings form. Otherwise households dissolve savings. The following is a diagram of the distribution of disposable income on consumption and savings.



The annual flow of income forms part of a continuous process. Households spend most of their disposable income on consumption. These expenditures in the next round are added to GDP, thereby helping to maintain the flow of income in motion.

The following is a diagram that helps to understand the distinction of national, personal and disposable income. Individual values are equally important for economists and are obtained by adding, respectively, by subtracting the items.

Fig. 2.2 Possible breakdown of income



3rd Measuring the GDP by value added

Using this method, we determine the output of the economy as the sum of gross value added, which were created in the period in various sectors of the national economy. To approach the value of the national product, the sum of gross value added should be added the indirect taxes (net of tax on goods and services).

Table 2.2 compares all three methods of measuring economic output (GDP at market prices).

Tab. 2.2 Representation of different methods for measuring the performance of the economy

Expenditure method	Income method	Production method
C	wages, profits, rents, net interest, incomes for self-employed	the sum of the values added (value added basic sectors: primary, secondary, tertiary)
I _B	+ capital amortization	
G	+ indirect taxes + net property income from abroad	
NX	- subsidies	+ net taxes imposed on goods and services
GDP in market prices		

2.3 Shortcomings of GDP

Gross domestic product itself does not reflect all the facts and mainly negative phenomena in the economy. GDP does not capture all use of production factors, which the company has, does not reflect environmental damage as a byproduct of manufacturing activities. Following the definition of items that are not in the GDP of the economy included:

- **non-market goods.** Understand those goods and services that produce household and household creation, for example, cooking, cleaning, washing, ironing, DIY or work in the garden;
- **quality of goods and services.** The GDP figure as we see the quality of production, e.g. in rising prices may not be included higher production quality and it may happen that the price development has also been moving in the opposite direction than the quality of production;
- **the value of leisure time.** The actual GDP does not reflect the fact that the economies there are changes in working hours. There are differences in working hours between countries, which can cause distortions in international comparisons;
- **pollution.** In economic theory, the damage to the environment known as a negative externality. They are a major problem and should be deducted from GDP. Or so thinks economists who have respect for the environment;

- **population health.** A healthy lifestyle positively affects the quality of people's lives and is a positive externality for the whole economy is affected by labor productivity and consequently economic performance. To produce products and services that contribute to the health of the population in some economies, the state provides subsidies;
- **underground (gray and black) economy.** This is a sector whose performance does not pass the official market. The underground economy includes tax fraud or moonlighting, although these are legitimate activities, but illegally conducted. Into the black economy include illegal activities such as drug trafficking, prostitution, human trafficking, arms. Estimates of the sector varies across countries, the share of the underground economy can achieve eg. 20% of the GDP of the country.

If we tried to take into account these items, you get variable net economic welfare (NEW - Net Economic Welfare). This is a much larger quantity with better explanatory power than the gross domestic product (GDP).

In life, we can meet even the phrase "national wealth." National wealth includes a general indication of material goods owned by a specific time period given nation.

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