The Wealth of Nations: Defining and Measuring Macroeconomic Aggregates

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Introduction

- We focus on the **economy as a whole**.
- Economists refer to the **total activity** in an economy as **aggregate economic activity**.
- **Macroeconomics is the study of aggregate economic activity**.

Introduction

- The field of macroeconomics has been completely **transformed** in the past century. **Before World War I, no country even had a system for measuring aggregate economic activity**. Back then, economists had to **guess** what was happening by looking at small pieces of the bigger picture.
    - They studied things like the tonnage of steel that was manufactured or the volume of freight that was transported on rail lines. These indicators were used to make educated guesses about aggregate economic activity. If freight shipments were booming, it probably meant that the aggregate economy was booming too, but nobody could be certain.
- Today, we no longer have to guess what is happening in the economy. **Modern economies have a sophisticated system that measures the level of aggregate activity**. Careful measurement has made it possible to study the aggregate economy and to design policies that improve its performance.

Outline

1. Macroeconomic Questions
2. National Income Accounts: Production = Expenditure = Income
3. What isn't Measured by GDP?
4. Real versus Nominal

Key ideas

- **Macroeconomics is the study of aggregate economic activity**.
- National income accounting is a framework for calculating gross domestic product (GDP), which is a measure of aggregate economic output.
- GDP can be measured in three different ways, and these three methods all yield the same measure of aggregate economic output:

$$\text{Production} = \text{Expenditure} = \text{Income}$$

- **GDP has limitations as a measure of economic activity and as a measure of economic well-being**.
- Economists use price indexes to measure the rate of inflation and to distinguish nominal GDP (which lets prices vary) from real GDP (which holds prices fixed).

1. Macroeconomic Questions

- Recall that **macroeconomics is the study of economic aggregates and economy-wide phenomena**, like the annual growth rate of a country's total economic output, or the annual percentage increase in the overall cost of living.
- Macroeconomic analysis **explains past patterns** in aggregate economic activity and **tries to predict future changes**.
- For example, macroeconomists are interested in the enormous differences in income across countries and the adoption of policies that would enable countries to sustainably increase their level of economic output

1. Macroeconomic Questions

- **Income per capita**: Is income per person. It is calculated by dividing a nation's aggregate income by the number of people in the country.
    - Income per capita in the United States is more than twice the level in Portugal, four times the level in China, and almost 100 times the level in Zimbabwe. The comparisons are adjusted for the cost of living in these different countries. **How do we measure these cross-country differences? What causes them? How long will they persist?**
    - China has been catching up to the United States very quickly. China's economy has been growing four times as quickly as the U.S. economy for almost 40 years. **Will China eventually match the level of U.S. income per capita? Will China surpass the United States? Or will something else happen?**
- To understand how to achieve long-run economic prosperity, we need to understand **how different government policies augment or undermine economic growth**.
- Corruption and confusion can lead policymakers down the wrong path. **Which policies reduce long-run growth, and how can we avoid them in the future?**

1. Macroeconomic Questions

- To answer these important questions, we need some special tools and new models. The first thing that we must do is **measure** what we are studying: a country's aggregate economy. This is a seemingly impossible task. **How can we measure the total activity of millions of economic agents?**

- A hundred years ago, nobody knew how to do this. Fortunately, economic science has progressed. Today, we have a framework called the **national income accounts**, which we use to measure the entire economy.

- In the United States, the formal name for this system of national accounts is the **national income and product accounts**. Once we understand how these accounts work, we will be ready to start answering the interesting and important questions posed above

2. National Income Accounts: Production = Expenditure = Income

To measure aggregate economic activity, we will need to take both quantities and prices into account. Let's start by considering the hypothetical nation of Fordica. Fordica is a small country with only one employer, the Ford Motor Company (hereafter, "Ford"), which produces 5 million cars each year. We assume that Fordica has $200,000$ citizens who are the workers in Ford's factories.

We'll look at three different ways of thinking about Fordica's economy production approach, an **expenditure approach, and an income approach**.

2. National Income Accounts: Production = Expenditure = Income

PRODUCTION

- **Gross domestic product (GDP)**: is the market value of the final goods and services produced in a country during a given period of time.

- To keep things simple, to determine the market value of production in Fordica, we multiply the quantity of cars produced by the market price of each car. For example, if the market price of a Ford is $30,000$, then Fordica has total annual production of:

$$(5 \ million \ cars) \times (\$30,000/car) = \$150 \ billion$$

- By multiplying production quantities (during a particular year) and corresponding market prices, we have a measure that reflects the market value of the goods produced in the economy during that year. So the economy of Fordica produces goods with a market value of $150 billion per year.

2. National Income Accounts: Production = Expenditure = Income

EXPENDITURE

- Households and firms, some of whom reside in Fordica and some of whom reside in foreign countries, are going to buy all of the cars produced in this economy. If we add up all these car purchases, we will find that the total expenditure on Fordica's output is exactly $150 billion (again).

- Expenditure is the market value of all expenditures on final goods and services produced by factors of production inside the borders of the country.

2. National Income Accounts: Production = Expenditure = Income

INCOME

- We've already calculated that Ford generates $150 billion of revenue. Assume that it pays $X to its workers, and it therefore gives the rest of its revenue ($150 billion - $X) to the people who own the company. So the income that is paid to the workers in Fordica and the income that is paid to the owners of Fordica sums up to

$$\$X + (\$150 \ billion - \$X) = \$150 \ billion$$

2. National Income Accounts: Production = Expenditure = Income

- The fact that we keep coming up with the amount $150 billion is not a coincidence. Because of the way we've set up the system of national income accounts, **every dollar of revenue must either go to a worker or an owner**. So the **total value of revenue must equal the total value of income received by workers and owners**.
- This necessary equivalence is referred to as an **identity**. *Two variables are related by an identity when the two variables are defined in a way that makes them mathematically identical*.
- The equivalence of the value of production, the value of expenditure, and the value of income may not be apparent at first glance, but the three concepts have been defined so that they are necessarily identical.
- You can now understand the following aggregate accounting identity:

$$Production = Expenditure = Income$$

2. National Income Accounts: Production = Expenditure = Income

CIRCULAR FLOW
To understand how the three parts of the national income accounts - production, expenditure, and income - relate to one another, we need to think about the connections between households and firms.
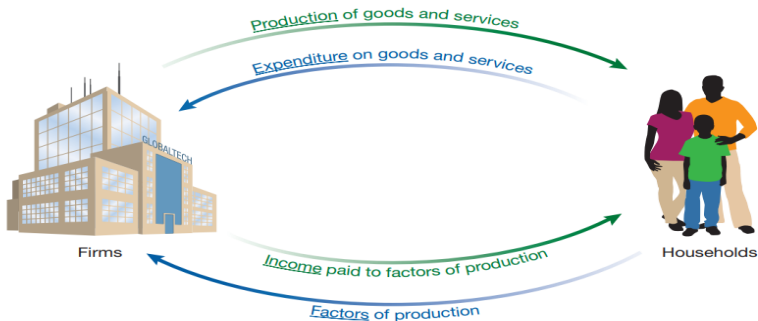
- Firms, like the aircraft manufacturer Boeing, demand physical capital and labor.
- Firms supply goods and services, like airplanes.
- Households demand goods and services, like air travel.
- Households supply physical capital and labor.

2. National Income Accounts: Production = Expenditure = Income

Figure: Circular Flow Diagram

Exhibit 5.1 Circular Flow Diagram

Economists have designed national income accounts that measure GDP in four equivalent ways: production, expenditure, income, and factors of production. The circular flow diagram provides a visual way of remembering the relationships among these four equivalent systems. Firms on the left produce goods and services (production), which households on the right purchase (expenditure). Firms pay households for physical capital and labor (income), which firms use as factors of production (factors). The national income accounting system is set up so that all four sets of flows are equal in market value.

Production of goods and services

Expenditure on goods and services

Income paid to factors of production

Factors of production

Firms

Households

Figure: Macroeconomics (Acemoglu, Laibson, List 2022), Page 123

2. National Income Accounts: Production = Expenditure = Income

- **Production** represents the goods and services that are produced by firms. These goods and services are ultimately sold to households.

- **Expenditure** represents the payments for goods and services. These payments are made by households to firms. Note that production and expenditure both involve goods and services, so these two flows are grouped together. They jointly represent the market for goods and services.

- **Income** represents the payments that are made from firms to households to compensate the households for the use of their physical capital and labor (in other words, the use of the households' factors of production). These payments include things like wages, salaries, interest, and dividends.

- **Factors of production** represent the productive resources that are owned by households and used by firms in the production process. Because factors of production - both labor and physical capital - are directly or indirectly owned by households, we draw an arrow from the household sector to the firm sector.

2. National Income Accounts: Production = Expenditure = Income

The remarkable thing about these four types of transactions or "flows" is that, in the framework we are using, **they must all be exactly the same in market value**. That's where the system of national income accounts comes in.

If we do the accounting correctly, the market value of expenditure must equal the market value of production. Likewise, the market value of expenditure must equal the market value of income of the households in the economy. Finally, the market value of income must equal the market value of the factors of production—labor and physical capital—that are receiving those income payments. These relationships are just mathematical consequences of the ways we define the system of national income accounts.

3. What isn't Measured by GDP?

Physical Capital Depreciation

- We start by noting that GDP omits physical capital depreciation, which is the reduction of the value of physical capital due to obsolescence or wear and tear.

- Most productive processes cause physical capital to lose some value over time. Driving a tractor-trailer wears down the brakes and the tires. Pumping oil from the ground depletes remaining petroleum reserves.

- Most governments do try to measure depreciation in their national accounts, though they do not subtract depreciation when calculating GDP. Depreciation analyses tend to find that depreciation is equal to about 10–20 percent of GDP. For example, the U.S. national accounts estimate that depreciation is large enough so that if it were subtracted, it would offset about 16 percent of GDP.

3. What isn't Measured by GDP?

Home Production

- GDP also stumbles when it comes to what economists call *home production*, which is just our name for unpaid work that (typically) takes place at home. Unpaid work is not included anywhere in the national income accounts.

- If you grow your own flowers (without buying seeds or shovels from a plant store), the bouquet you create is home production and is not measured in GDP. However, if you buy domestically grown flowers from the local florist, every dollar is included in GDP.

- Many people without formal jobs are engaged in a considerable amount of home production, including food preparation, household maintenance, and childcare.

3. What isn't Measured by GDP?

The Underground Economy

- The *underground economy* - transactions that are intentionally hidden from government statisticians - represents another hole in the GDP accounts. This includes the plumber who asks to be paid in cash and the taxicab driver who negotiates a lower rate if you would just agree to let them turn off the meter (and pay in cash). Plumbing and cab driving are perfectly legal, but some workers hide income to avoid paying taxes. In the United States, this sort of tax avoidance amounts to $500 billion per year.
- Earnings from legal professions may also be hidden for other reasons. For instance, if a citizen of a foreign country is working as a nanny in the United States but doesn't have a work visa, they may prefer to be paid in a way that enables them to stay off the radar screen of the U.S. government.
- The underground economy also includes markets in illegal professions. Illegal drug sales alone are estimated to be equal in magnitude to almost 1 percent of GDP. For the U.S. economy, that is equivalent to the value of all agricultural production.

3. What isn't Measured by GDP?

Externalities

- Negative externalities occur when an economic activity has a spillover cost that does not affect those directly engaged in the activity.
- Positive externalities occur when an economic activity has a spillover benefit that does not affect those directly engaged in the activity.
- Externalities - both negative and positive - are usually omitted from the GDP calculations.
- Consider a coal-powered electrical plant generating power for thousands of homes and simultaneously belching out a continuous stream of toxic airborne pollutants. GDP counts the electricity produced but fails to subtract the social cost of the pollution.
- Sometimes negative externalities even get counted as positive contributors to economic output. For example, property crimes, like theft, lead people to purchase locks and other security devices. In some cases, property owners hire guards to safeguard their possessions. All such preventive activity counts as positive contributions to GDP.

3. What isn't Measured by GDP?

The Increase in Income Inequality

- One of the biggest problems with GDP and GDP per capita is the lack of detailed information about how economic output is divided up among individual households. For example, the United States and Norway have very similar levels of per capita GDP. However, the United States has more income inequality.

- For instance, consider the economic fortunes of households who earn enough income to be in the top 1 percent of earners in each country. In the United States, the top 1 percent of U.S. households earn 18.6 percent of the nation's income, while the remaining 99 percent earn 81.4 percent of national income. In contrast, in Norway the top 1 percent of households earn 8.4 percent of total Norwegian income, leaving 91.6 percent of national income to the remaining 99 percent of the population.

- These differences in inequality imply that the richest 1 percent of U.S. households are richer than richest 1 percent of Norwegian households and the "bottom" 99 percent of U.S. households are not as well off as the bottom 99 percent of Norwegian households. These differences exist even though the two countries have very similar levels of GDP per capita.

3. What isn't Measured by GDP?

Leisure

- The GDP accounts give an economy no credit for producing leisure. However, most people would agree that leisure is a key ingredient in human well-being.
- For example, in time-use surveys, people report that they are happiest when they are socializing.
- Likewise, people report that they are the least happy when they are at work or commuting to and from work. When you think about GDP comparisons across countries, you need to remember that different countries are working at different levels of intensity.
- GDP tells us how many material goods are being produced by an economy, but it does not tell us whether all of those material achievements are being used to optimize human happiness

3. What isn't Measured by GDP?

Does GDP Buy Happiness?

- Despite the omission of leisure, GDP per capita is often used as a summary measure of the well-being of a society. We would like to know whether GDP per capita is actually a good predictor of human happiness.
- When survey researchers ask about happiness in millions of interviews around the world, some remarkable patterns appear in the data. GDP per capita turns out to be a strong predictor of life satisfaction.

3. What isn't Measured by GDP?
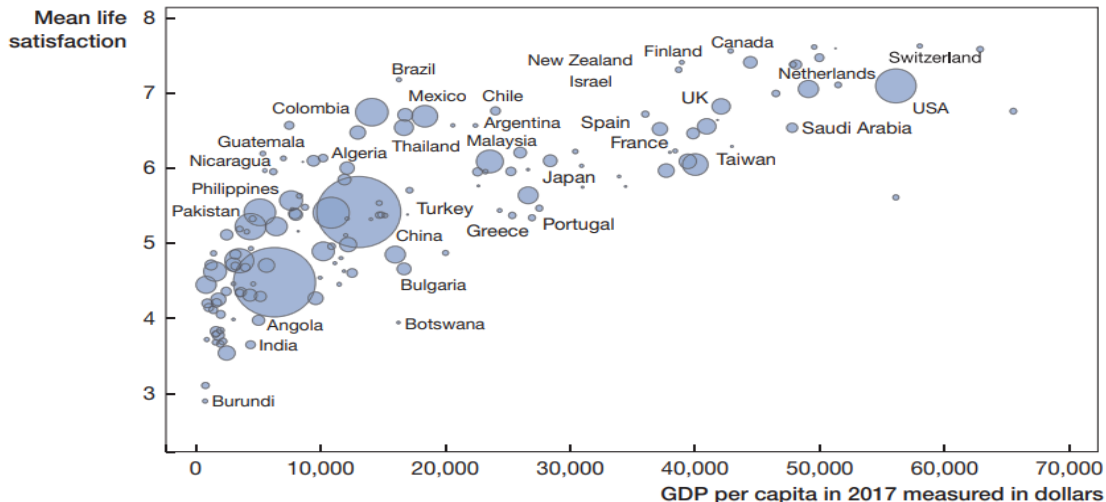
Figure: GDP per Capita and Life Satisfaction

Figure: Macroeconomics (Acemoglu, Laibson, List 2022), Page 136

3. What isn't Measured by GDP?

Does GDP Buy Happiness?

- Previous figure displays a positive relationship between GDP per capita and self-reports of life satisfaction in a large sample of countries.
- The countries with higher levels of GDP per capita report higher levels of life satisfaction.
- The exhibit plots GDP per capita on the x-axis and average life satisfaction on the y-axis. Life satisfaction was measured on a 10-point scale. Each circle represents a different country, and the size of the circle reflects the size of the population in that country. The large circle on the right represents the United States. The two large circles on the left are for India and China.

3. What isn't Measured by GDP?

Does GDP Buy Happiness?

- This positive correlation between GDP and life satisfaction shows up in each country as well. In other words, when economists study household level data on income and life satisfaction, we find that low-income households in a country report substantially lower life satisfaction than higher-income households in the same country

4. Real versus Nominal

- GDP is particularly useful as a tool for determining how the overall economy is growing.
- To implement this growth analysis, we would like to separate the increase in the value of GDP that is due to overall price increases (in other words, inflation) from the increase in the value of GDP that is due to increases in the quantity and quality of goods and services.

4. Real versus Nominal

- For example, suppose the country of Fordica makes ten cars in 2019 and ten identical cars in 2020. Here we make the simplifying assumption that the quality of the cars hasn't changed over time. Economists have sophisticated tools for handling improvements in quality, but we'll sidestep those issues to keep the analysis as simple as possible. Holding quality fixed, assume that the price of each car rises from $30,000 to $40,000 from 2019 to 2020. In this case, GDP in 2019 would be $(10 \; cars \times \$30,000/car) = \$300,000$ and GDP in 2020 would be $(10 \; cars \times \$40,000/car) = \$400,000$.
- At first glance, the economy has grown by 33 percent, or

$$\frac{GDP \; in \; 2020 - GDP \; in \; 2019}{GDP \; in \; 2019} = \frac{\$400,000 - \$300,000}{\$300,000} = \frac{1}{3} = 0.33 = 33\%$$

- But the actual number and quality of cars produced hasn't changed at all. It's still ten cars with unchanged quality.

4. Real versus Nominal

- Naturally, we would like to separate the growth that is due simply to price increases from the growth that is due to increases in the production of goods and services. To do this, we contrast the concepts of *nominal GDP* and *real GDP*.
- Nominal GDP is the standard GDP measurement that we've been discussing throughout this chapter. **Nominal GDP** is the total market value of production, using current prices to determine value per unit produced.
- **Real GDP** is based on the same idea as nominal GDP—summing up the market value of the quantities of final goods and services—but real GDP uses prices from a base year that may be different from the year in which the quantities were produced.

4. Real versus Nominal

- To illustrate this idea, let's take 2019 as the base year. In our example, the price of a Ford was $30,000 in 2019. Now let's assume that ten Fords were produced in 2019 and ten (identical) Fords were produced in 2020. To calculate real GDP, we use the 2019 prices to value the output in both 2019 and 2020. So real GDP was $300,000 in 2019 and was still $300,000 in 2020. Using the concept of real GDP, we see that there was no growth between 2019 and 2020. That makes sense—the number and quality of cars produced did not change.

4. Real versus Nominal

- The yellow box contains Ford's quantities and prices in years 2019 and 2020. The orange box contains Chevrolet's quantities and prices. Nominal GDP is the total value of production using prices and quantities from the same year. Real GDP in 2019 using 2019 prices is the same as nominal GDP in 2019. Real GDP in 2020 using 2019 prices is the total value of production using quantities from 2020 and prices from 2019.

Year	Ford		Chevrolet		Nominal GDP	Real GDP Using 2019 Base Prices
	Quantity Produced	Price per Car	Quantity Produced	Price per Car		
2019	10	$30,000	5	$20,000	$400,000	$400,000
2020	10	$40,000	20	$25,000	$900,000	$700,000

Figure: Macroeconomics (Acemoglu, Laibson, List 2022), Page 138

4. Real versus Nominal

Calculating nominal GDP

- We simply add up the total market value of goods sold in each year, using current prices.

- In 2019, nominal GDP is

$$(10 \; Fords) \times (\$30,000 / Ford) + (5 \; Chevrolets) \times (\$20,000 / Chevrolet) = \$400,000.$$

- In 2020, nominal GDP is

$$(10 \; Fords) \times (\$40,000 / Ford) + (20 \; Chevrolets) \times (\$25,000 / Chevrolet) = \$900,000.$$

4. Real versus Nominal

Calculatin real GDP

- To calculate real GDP, we use 2019 as the base year. That means that we keep using 2019 prices in the calculation of both 2019 and 2020 real GDP. This doesn't rock the boat for 2019.

- Real GDP for 2019 is calculated with 2019 quantities and 2019 prices (exactly matching our calculation of nominal GDP in 2019):

$$(10 \: Fords) \times (\$30,000 / Ford) + (5 \: Chevrolets) \times (\$20,000 / Chevrolet) = \$400,000.$$

- The boat rocking comes when we calculate real GDP in 2020, using 2019 as the base year. Now we need to use quantities from 2020 and prices from 2019. In 2020, real GDP is:

$$(10 \: Fords) \times (\$30,000 / Ford) + (20 \: Chevrolets) \times (\$20,000 / Chevrolet) = \$700,000.$$

4. Real versus Nominal

- By holding prices constant -using prices from a single base year - we are able to make meaningful comparisons across years. Economists say that such analyses use constant dollars. In this case, the constant dollars are based on prices from 2019. To make the base year clear to their audience, economists say that the analysis uses "**constant 2019 dollars**."

- Now that you understand how to calculate real GDP, we are able to talk about the growth rate of real GDP, which is usually referred to as **real GDP growth**. For example, the formula for real GDP growth in 2020 is given by

$$(10 \, \textit{Fords}) \times (\$30,000 \, / \, \textit{Ford}) + (5 \, \textit{Chevrolets}) \times (\$20,000 \, / \, \textit{Chevrolet}) = \$400,000.$$

- The boat rocking comes when we calculate real GDP in 2020, using 2019 as the base year. Now we need to use quantities from 2020 and prices from 2019. In 2020, real GDP is:

$$\textit{Real GDP growth in } 2020 = \frac{\textit{Real GDP in } 2020 - \textit{Real GDP in } 2019}{\textit{Real GDP in } 2019}$$

4. Real versus Nominal

- By focusing on real GDP growth - which holds prices fixed across time - we compare the total value of real output in 2019 ($400,000 in our example) and the total value of real output in 2020 ($700,000 in our example).
- In this example, real GDP has grown by 75 percent:

$$\frac{\$700,000 - \$400,000}{\$400,000} = \frac{3}{4} = 0.75 = 75\%$$

- The concept of real GDP growth lets us focus on the thing that we care the most about - how much the economy is producing at different points in time - without letting price movements muddy up the comparison.

Summary

- Macroeconomics is the study of economic aggregates and the economy as a whole. An aggregate is a total. Macroeconomics studies total economic activity.

- Gross domestic product (GDP) is the market value of the final goods and services produced in a country during a particular period of time (for instance, a year). GDP is defined in three equivalent ways: Production = Expenditure = Income. The circular flow diagram explains these identities and adds a fourth identical way of measuring economic activity: factors of production.

- GDP is just a summary measure of economic activity and economic well-being. GDP leaves many details out, including depreciation, home production, the underground economy, externalities, inequality, leisure, and cross-border movements of capital and labor. Nevertheless, residents of countries with relatively high levels of GDP per capita report relatively high levels of life satisfaction.

- Economists distinguish nominal values from real values. Real GDP measures the market value of economic production holding prices fixed at those of a particular base year.