Ultimately, we are interested in the welfare of people and we argued in the previous chapter that perhaps the best macroeconomic indicator of welfare is total output. To study total output, we need a measure of it. Total output in the U.S., and in other countries also, is measured by the gross domestic product, or GDP for short. In this chapter we discuss the meaning, measurement, and uses of the gross domestic product.

The Meaning of GDP

GDP is the total dollar value of final goods and services produced by an economy over some given period of time. Now let us look at each part of this definition in some detail.

There are many different types of goods produced in an economy. These range from blue jeans to EKG machines. Converting goods to their dollar values provides a common denominator. We can't add blue jeans and EKG machines directly, but we can add the dollar value of blue jeans sold with the dollar value of EKG machines sold.

In the above definition final means final user. For example, when a household buys grapes it is the final user of the grapes. However, when Welches buys grapes these grapes are an intermediate product in the production of grape juice. The final user of the grapes that Welches buys will be the consumer of the grape juice. So, the value of grape sales to Welches is not counted in GDP, but grape juice sales are.

GDP is an income concept or a flow variable. A flow variable is a variable that requires a time unit to be informative. To see the importance of a time unit, suppose someone told you that her income was $1000. Is this a high income or a low income? It depends. It depends on how long it takes to earn the $1000. If this is $1000 per hour, then this is a high income indeed (so
long as you can get work). If it is $1000 per year, this is a very low income. A flow variable may be contrasted with a stock variable. A stock variable is defined for a point in time. For example, if you ask a friend how much money she had and she says $20, you have an answer to your question. No time unit is required, $20 cash in your friend's pocket has meaning at a point in time. For GDP to be informative, it must have a time unit and so it is a flow variable. A GDP of $600 billion means one thing if it is per month, and another thing if it is annual. If it is monthly, then the economy is about the size of the U.S. If it is annual, it is an economy roughly the size of Italy.

An economy can be interpreted in one of two ways. On the one hand, we may define an economy's total output as the total dollar value of goods and services produced within a nation's geographic borders. Here physical borders define the economy. In this case, the output produced by a Mexican or Canadian citizen working in the U.S. would be counted as part of U.S. total output. On the other hand, we may think of an economy as made up of all the citizens of a nation and include the output of those citizens in their nation's total output; whether or not the production actually takes place inside the borders of the country. In this case, the output from a U.S. professor on leave at a German university would be counted as part of U.S. total output. Similarly, the production of the Mexican or Canadian would be included in their country's total output, even though they were working in the U.S.

Two definitions of an economy naturally leads to two definitions of total output. GDP defines an economy by the geographic borders of a nation. A second measure of total output, called gross national product or GNP, defines an economy as the citizens of a nation. Prior to December of 1991, GNP was the "official" measure in the U.S., but most other countries used GDP. Since then we have conformed and it has become standard in the U.S. to discuss total output in terms of GDP. Fortunately, the choice between focusing on GDP or GNP is not crucial. In most countries the two are numerically very close and they move together.

Finally, it's important to see that the definition requires that the good or services be produced in the current period. So, for example, if I sell you my 1985 Ford for $1200, the value of this sale should not be included in this year's GDP since the production of the Ford occurred earlier. This sort of transaction is just a transfer of one existing asset, the car, for another existing asset, the money. It does not represent the value of new production.
Measuring GDP

a. the output approach

A straightforward way to calculate GDP is to total up the dollar value of final goods and services produced over some period. Calculating GDP in this manner is called the output approach. It is often useful, both for accounting purposes and the development of our theory later, to break up the goods and services into different categories. The breakdown is usually into consumption, investment, government spending, and the difference between exports and imports. In symbols, this is written as

\[ GDP = C^n + I^n + G^n + X^n - IM^n. \]

In this equation, \( C^n \) stands for consumption, \( I^n \) stands for investment, \( G^n \) stands for government spending on goods and services, \( X^n \) is exports, and \( IM^n \) is imports. The difference between our exports and our imports, \( X^n - IM^n \), is called net exports. The superscript \( n \) indicates that the variables are expressed in terms of dollars. In 1995 GDP in the U.S. was about $7 trillion.\(^6\)

Consumption can be further broken down into the consumption of services, non-durable goods, and durable goods. Services include electricity, medical services, concert performances and baseball games. Food and clothing make up about 70% of non-durable consumption. Non-durables also include gasoline, fuel oil, and magazines. A durable good has a useful lifetime that generally exceeds three years. Automobiles, refrigerators, and VCRs are examples of durable goods. The distinction between durable and non-durable goods is sometimes important. For example, savings is defined as income that is not consumed. Many economists think that a significant portion of expenditures on durable goods should be included in savings. After all, if you receive a windfall today, one option is to save the windfall, and consume slowly over time by drawing down your savings account. But you can also buy a new TV, and consume the entertainment services from the tube over time. In both cases you smooth the consumption of your one-time increase in income. However, in the first case your traditional savings balance

\(^6\) Seven trillion is a very large number. For example, light travels at the speed of 186,000 miles per second. It figures that it goes a long way in a year. A light year is just a bit under 5.9 trillion miles.
increases, while in the second case your stock of durable goods increases. In short, you can think of buying durable goods as a form of savings.

A capital good is often defined as a produced means of production and investment is just newly produced capital. Examples of capital include plants, equipment, inventories, and also residential structures, such as houses, apartment buildings and so forth. Capital includes residential structures because these structures provide or produce flows of "shelter services" over long periods of time. The names of different categories of capital have changed over time. Plants are now called non-residential structures; and not only include factories, but also office buildings and malls. Equipment is now producer durables, and includes laser beams as well as drill presses. The sum of non-residential structures and producer durables is called fixed business capital, and new capital of this type is fixed business investment.

At any given time, some goods are in the process of production and some are sitting on shelves. These goods are stocks of inventories. Changes in a nation's stock of inventories are included in investment and called inventory investment. Inventory investment is positive when firms are building their inventories and negative when firms are depleting their stocks.

It is important to note that purchases or sales of stocks and bonds, or any other financial asset, are not investment in the above sense. Neither is the purchase of existing plants or equipment. For example, when there is a takeover of one firm by another, no investment takes place. Instead, the ownership of an existing asset changes hands. It is just like the sale of the Ford mentioned earlier. There is not a new plant built, or new equipment put into place. Stocks, bonds, or other assets are forms in which households may hold their wealth. Buying these assets constitutes savings for an individual household and might in some circumstances be called financial investment, however we reserve the word investment for newly produced capital.

Government spending refers to spending on goods and services, and it includes spending at the federal, state, and local levels. At the federal level the largest component of spending is military spending and the majority of this spending is on the wages and salaries we pay to the armed forces. Also included at the federal level is spending on airports, highways, the space program, and the federal courts and prisons. State and local governments spend their revenue on a variety of goods and services. Among these are spending on roads, hospitals, police and fire protection, and education.
Governments also transfer income from one party to another. Food stamps, Social Security checks, Aid for Dependent Children, and Supplemental Security Income for the handicapped are examples of these transfer payments. This spending does not represent spending on new production and is not included in GDP. It only transfers resources from one household to another.

The U.S. exports a wide variety of goods and services. Our leading export category is machinery and transport equipment. We also export large amounts of food and chemicals. Even intermediate goods and services count in GDP if they are sold abroad. This is because their value does not appear in any other domestic output and so we take the foreign buyer as the final user.

What about the goods we import? Some of the food included in consumption is coffee grown in Brazil and consumer durables includes spending on Sony TVs. Some investment goods, such as computers with memory chips from Japan, contain foreign parts and even our exports may contain imported components. Since these goods, or a part of them, are not produced in the U.S., they should not be included in U.S. GDP. To avoid counting the value of goods produced abroad as our own, the value of imports is subtracted from the sum of consumption, investment, government spending, and exports.

b. the income approach

Every transaction has two sides. When you buy a $40 textbook, it is the purchase of a consumption good. But where does that $40 go? Some of it is used to pay the salaries of the bookstore employees, and the store's electric bill. Part of it is the profit of the publisher, and a small part goes to the author. In short, the $40 payment for the book shows up as income somewhere else.

To show the consequences of this fact, consider a simple example. A farmer produces 8000 ears of corn and sells her yield to a grocer for $.25 per ear. The farmer receives $2000. In producing the corn the farmer hired some workers and out of the $2000 pays them $1100 in employee compensation, which not only includes wages and salaries, but also the value of any benefits that the farmer provides, such as health and life insurance. Last year our farmer borrowed money to buy a new tractor and she uses part of the $2000 to pay $250 in interest on her loan. Rent on the plow ran $150. She also used $300 to keep her other equipment up to par.
since it was worn down during the planting season. This last expenditure measures depreciation or capital consumption. The $200 that is left over goes to our farmer in the form of proprietor's income.

<table>
<thead>
<tr>
<th>seller</th>
<th>value of sales</th>
<th>uses of funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>farmer</td>
<td>$2,000</td>
<td>proprietor's income: $200</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rent: $150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>interest: $250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>employee comp.: $1,100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>capital consumption: $300</td>
</tr>
<tr>
<td>grocer</td>
<td>$2,400</td>
<td>farmer: $2,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rent: $50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>employee comp.: $200</td>
</tr>
<tr>
<td></td>
<td></td>
<td>indirect bus. taxes: $50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>corporate profits: $100</td>
</tr>
</tbody>
</table>

The grocer sells each ear of corn for $.30 and receives $2400. Of this $2400, $2000 goes to the farmer, $50 goes for the rental of the grocer's building, $200 is paid to the employees of the grocery store, and $50 goes to the state for sales tax. The sales tax is an example of an indirect business tax. Other examples include the excise tax on cigarettes, alcohol, and gasoline. To include all possible categories of income, we assume that the grocery store is a corporation so that the remaining $100 goes for corporate profits. Table 2.1 records these transactions.

The contribution to GDP from this process is easy to calculate from the output approach. It is just the $2400 that the grocer's customers pay for the corn. But, because there are two sides to each transaction, we can also find the contribution to GDP by totaling up the uses of funds or "incomes" generated by this process.\(^7\) There are seven uses of funds and they sum to GDP.\(^8\)

---

\(^7\) Since we have GDP in mind, employee compensation would include payments to foreigners working in the U.S. and would exclude payments to U.S. citizens working abroad.

\(^8\) Only net interest is included in GDP. Net interest is the excess of U.S. business system interest payments over its interest receipts plus excess of interest from abroad over interest paid to foreigners. It
discussion can be summarized by

\[
\text{GDP} = \text{employee compensation} + \text{proprietors' income} + \text{rents} + \text{net interest} + \\
\text{corporate profits} + \text{indirect business taxes} + \text{capital consumption}.
\]

In our example these numbers are

\[
$2400 = $1300 + $200 + $200 + $250 + $100 + $50 + $300.
\]

Calculating GDP by adding up all of the uses of funds is called the income approach. By definition, GDP calculated from the income approach equals GDP calculated from the output approach. This will be very important to remember later on. Sometimes it's easier to write or talk in terms of income and sometimes it's easier to use the word output. For example, if a person's income goes up, she might increase her consumption. On the other hand, if the technology to produce goods improves, then output will increase. Although it would not be wrong to interchange the words income and output in these two sentences, it would surely be awkward.

In practice, there are reporting errors and omissions, so GDP found by the income approach doesn't exactly equal GDP found by the output approach. The difference between the two is called statistical discrepancies. The two approaches act as checks on each other and this is useful since GDP is a complex and important calculation.

c. the value added approach

In the above example why didn't we just add the farmer's $2000 to the grocer's $2400 to get a contribution to GDP of $4400? The answer is pretty clear. If you did this, you would be adding the farmer's contribution twice. You would add it once directly in the $2000, and again indirectly in the $2400 since $2000 of this amount reflects payment to the farmer. If you were to total up GDP in this way, you would have committed the error of double counting.

\(\text{is a measure of an implicit rental payment to capital. The interest in the example would be counted as net interest.}\)
The value added approach safeguards against double counting and provides a third way to calculate GDP. In our example the farmer starts with nothing and produces something worth $2000. Her value added is $2000. The grocer starts with something worth $2000, and produces something worth $2400. The grocer’s value added is $400 (what did the grocer do to add this value?). The sum of the value addeds, $2000 + $400, equals the contribution to GDP of this process. The sum of the value addeds by all the producers in the economy equals GDP.

Many countries use a so-called value added tax, or VAT, to raise revenue. The VAT acts much like a sales tax except the tax is collected at each stage of production instead of being collected at the retail sale. In the above example, the farmer would have been taxed on $2,000 of value added and the grocer would have had to pay a tax on $400 of value added. We do not yet have a VAT in the U.S., but it is often discussed when the topic of tax reform comes around.

**Uses and limitations of GDP**

GDP is a measure of the output, the amount of "things" or "stuff," an economy produces and it is an indicator of the material well-being of the people in the country. The more stuff the country produces, the more stuff the average household in that country enjoys. Interest in GDP across time and across countries arises from the concern over the material well being of people, or, to put it another way, a concern for social welfare. Unfortunately, GDP is not a perfect indicator of social welfare. Some of the problems with GDP are fairly straightforward to fix, but others are not.

a.  *per capita GDP*

One important adjustment that is made when comparing GDP in different countries or during different time periods is for population changes. GDP in one country may be smaller than in another country, but if the first country has a very small population, then its average citizen may be better off. To adjust for population differences, GDP is divided by the population. GDP adjusted in this way is called per capita GDP, which in symbols is

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9 Of course, if something is not perfect, it doesn't mean that it is useless. If it did, we would all be in trouble.
Per Capita GDP = GDP/population.

This is an important adjustment when comparing output in different countries, or output in one country over a long period of time. However, over relatively short periods of time, say the 5-year span of the typical business cycle, the distinction between per capita GDP and GDP is less important since population growth does not change abruptly over such short periods. So, we often ignore this distinction when we study the business cycle.

Per capita GDP is also easier to comprehend. U.S. GDP in 1995 was just over $7 trillion. This is clearly a large number, but what does it mean in terms of how people live? In 1995, the U.S. population was about 260 million and per capita GDP in the U.S. was

Per Capita U.S. GDP 1995 = $7 trillion/260 million

= $26,923 per person

If income were equally distributed, a family of four would earn a little of $100,000 per year. This number if meaningful. It means that this family could live very comfortably indeed.

b. changes in prices

Another important adjustment is made for changes in the average level of prices. Suppose that all of the prices in an economy double. Furthermore, suppose this includes all the wages and bank deposits so that they double also. This doubling of prices would also double GDP (check this out in the earlier numerical example). But would the people in this economy be twice as well off? Of course not. They have the same skills that they had before, the same machines, refrigerators, and the same everything else. The only things that have changed are the numbers on price tags, paychecks, and bank statements. To adjust for changes in prices, we need
a measure or an index of the average level of prices, but, since developing such a measure is somewhat involved, we will postpone our discussion of this adjustment until the next chapter. For now just note that GDP can be adjusted to take into account changes in the average level of prices.

c. omitted items

Some problems with GDP do not have convenient solutions. GDP omits some goods and services that ideally would be included. The value of housework, do-it-yourself projects, gardens, and so forth is not counted in GDP. Volunteer work is also omitted. This is not because these activities have no value. On the contrary, some are among society's most valued. Instead, they are omitted because they are not traded in a market where prices and quantities could be established and recorded. We therefore do not have satisfactory data to include the value of these activities in GDP.

Similarly, so-called productive crimes—crime where a good or service is produced—such as prostitution, gambling, and illegal drugs are omitted, even though these goods and services are bought and sold in markets. Again, the lack of data explains their omission. The value of these transactions is not publicly recorded for obvious reasons. Other transactions are not recorded to evade taxes. An accountant might do a doctor's taxes in return for normal check-ups, and neither would "charge" the other on the books. This reduces the reported incomes of both parties and lowers their tax liabilities. A merchant may hire temporary or occasional labor and pay them cash without recording them on the payroll. Both parties again evade taxes and other employment costs such as contributions to unemployment insurance, workmen's compensation and mandated fringe benefits. In each case, goods and services are produced, but their value is not recorded, at least not publicly recorded. These sorts of transactions and activities that seek to hide from the law are often referred to as the underground economy.

d. classification problems

The treatment of some business expenses poses conceptual problems. Suppose you take a client to a fine restaurant for a "business" lunch. The lunch bill will be treated as an expenditure
on an intermediate product. The meal is an "input" in whatever business is accomplished during lunch. On the other hand, the spending of the people on vacation sitting next to you, eating the same food and paying the same bill, will be treated as consumption. The question is: for the business people how much of the lunch was really business and how much was really consumption? Many have argued that at least some of the business lunch should be counted as consumption, but no consensus on how much has been reached.

The classification of a good as a final good or an intermediate good is also difficult for some of the services the government provides. Suppose a police department decides to enlarge its force and a security guard who worked for a local firm is hired. Moreover, suppose the community pays for the new officer by increasing taxes on the firm, but, since the community has a larger police force, the firm does not need to replace the guard. The firm's spending on intermediate goods goes down and its profits go up; remember that these are gross profits not after-tax profits. Nothing of substance has changed. The firm enjoys the same protection that it had before, only now it is provided publicly instead of privately. Nevertheless, GDP will increase because spending on police is counted as spending on a final service whereas spending on a security guard is not. Examples like this one suggest that at least some government spending, on police and fire protection for example, should not be considered spending on final goods and services. It should instead be considered spending on intermediate goods and services.

e. externalities

Other potentially important distortions to GDP arise from externalities. An externality occurs when a party not voluntarily involved in the consumption or production of a good is affected by the activity. The classic example is pollution. Consider a firm that produces a good and in the process belches out large amounts of black smoke into the air. The smoke falls on the people and homes of the nearby town. This clearly imposes a cost on these people. Their health may be impaired and their property certainly soiled. Ideally, the townspeople could charge the plant for these costs and their value would be treated as an intermediate product. However, if the townspeople cannot get payment from the firm, the higher medical bills they pay, and the
increased spending on fresh paint will be counted as consumption. Failing to account for negative externalities therefore leads to an overestimate of material well-being.

Not all externalities are negative ones. Consider, for example, a neighborhood that decorates its homes in lights and figures at Christmas time. GDP captures the value of new lights and trimmings to the households who buy them, but it misses the value to the passerby. Those who do not decorate their homes, but nevertheless enjoy seeing the lights, the reindeer, the Santas, and all, reap a benefit from the Christmas cheer that is not included in GDP. Positive externalities lead GDP to understate welfare.

\[ f. \quad \text{other dimensions of welfare} \]

We should also mention that there are many dimensions of welfare other than the per capita amount of goods and services produced in an economy. For example, the distribution of income is important. To see why, consider two countries. In country 1 there are 100 people and GDP is 1,000,000 units. Each individual shares equally and has an income of 10,000 units. In the second economy GDP is 2,000,000 units and there are also 100 people. But in country 2 there is one rich household that has an income of 1,999,900 units, while the remaining 99 households split the other 100 units. Per capita GDP is higher in country 2, but would you choose to be born in country 1 or in country 2? Country 2 would be great if you're born into the rich household, but the odds of this are small. In country 1 you will not be fabulously wealthy, but you are sure to miss the abject poverty suffered by the vast majority in country 2. To avoid the likely outcome of poverty many would prefer being born in country 1, even though it has a smaller per capita GDP.

GDP also misses the importance of leisure. Suppose a working parent toils at a job that demands 60 hours of work a week. Weekends are hardly ever free and the job requires a lot of travel. The work rewards the parent with $90,000 a year. However, the parent tires of the pace and realizes that the children will soon be grown and gone. To slow down, and enjoy other aspects of life, the parent quits her job and takes one that requires 40 hours at the workplace, and little travel. Unfortunately, it pays only $40,000 a year. GDP records a decline in total output of $50,000 a year, but are we correct in saying that welfare has declined? Clearly we are not. The parent must consider herself better off or she wouldn't have made the switch in the first place.
The problem with the GDP accounts here is that they don't value leisure, and in this case the parent attached a high value to a job with fewer demands on her hours.

**Effect of Measurement Errors**

The long list of problems with GDP as a welfare measure suggests that at best we should take it as an approximation, and you may think we should throw it out all together. We do not throw it out, even with its flaws, because it is better than the alternative, which is no measure at all. One strategy is to fix the problems. We can try to guess at the value of home production, volunteer work, leisure, and so on, and add those in. Then guess at the value of the negative externalities, the intermediate goods counted as final goods, and so on, and subtract those out. Some economists have made these calculations. William Nordhaus and James Tobin estimate a measure of economic welfare, or MEW. However, this measure hasn't obtained the "official" status accorded to GDP, probably because of the difficulty in obtaining consensus on how the guesses and approximations should be made.

Errors in GDP go in both directions. There are values that are omitted and should be added in, and there are values that should be subtracted out, but are not; so we cannot be sure whether measured GDP is higher or lower than the "true" value. Whatever the bias in the level of GDP, it need not affect our estimate of the rate of growth in GDP. For example, in Figure 2.1 measured GDP is below true GDP at time \( t_0 \). At time \( t_1 \) the bias in levels remains the same proportion of GDP. So, at both time \( t_0 \) and time \( t_1 \) GDP is understated, but does this affect the growth rate of GDP? The answer is no. The slopes of the two lines equal the rates of growth in true and measured GDP. Since the bias remains the same proportion, these lines are parallel and the

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growth rate of GDP is the same whether you calculate it based on measured GDP or you calculate it based on the true value.

Trouble appears even for growth rates if the bias changes over time. For example, in 1870 a large proportion of households still lived on farms. Many of these folks grew much of their own food, sewed their own clothes, made and repaired their own tools, and so on. In short, there was a good deal of home production. By 1990 a relatively small number of people lived on farms, and relatively more production took place in the market. Food was purchased from the grocer, clothes from department stores, tools from hardware stores and so on. The absence of home production in both 1870 and 1990 understates GDP, but the understatement is larger in relative terms for 1870. Figure 2.2 pictures this situation. In this case, the decline in the bias leads the measured values to overstate the rate of growth in GDP since 1870. Of course, many other things have changed since then. Infant and adolescent mortality have declined, leisure has increased, and poverty has fallen to name just a few. In light of these positive developments, we cannot say for sure that GDP growth rates over this span overstate the true rate of growth in material well-being. However, we can say that when the bias in the level of GDP changes, the growth rate calculated with measured GDP will not be the true growth rate.

In chapter 1, we showed that growth rates take the trend out of GDP and allows us to focus on the business cycle. Over the span of the business cycle, it seems reasonable to expect that measurement errors do not change by much. If this is true, then the growth rate of GDP gives us a fairly good picture of changes in welfare over the cycle.

Other Measures of Output
Our first observation here probably belongs in the previous section. GDP neglects to subtract out the value of the capital worn out in the process of producing new goods and services. Machines break and require repair. Structures weather and routine maintenance absorbs resources. Maintenance and repair represent a cost of production. The value of durables and structures worn out over the period and the cost of maintaining the rest should be subtracted from GDP. This cost is called capital consumption or depreciation. When we subtract capital consumption from GDP, we get the net domestic product, NDP. In symbols we can write

\[ \text{NDP} = \text{GDP} - \text{capital consumption} \]

Another way to look at this problem is to recognize that this year's investment goes for two purposes. On the one hand, some investment adds to the nation's stock of capital. This is called net investment. On the other hand, some investment goes to replace the capital worn out in the process of production. This last type of investment is called replacement investment. Total investment is called gross investment and we can write

\[ \text{gross investment} = \text{net investment} + \text{replacement investment} \]

GDP includes gross investment where as NDP includes only net investment. Replacement investment is the same thing as capital consumption just viewed from a different perspective and so we can rewrite net domestic product as

\[ \text{NDP} = \text{C} + \text{net investment} + \text{G} + \text{X} - \text{IM} \]

NDP equals the sum of consumption, net investment, government spending on goods and services, and net exports.

Sometimes you will see other measures of output and income reported in the press and for certain problems other measures are more appropriate. We define some of them now. National income is NDP less indirect business taxes. In symbols it is

\[ \text{national income} = \text{NDP} - \text{indirect business taxes}. \]
If you go back and review the income approach, you will see that national income can also be written down as

\[
\text{national income} = \text{employ comp} + \text{prop inc} + \text{rents} + \text{net interest} + \text{corp prof}
\]

National income is the sum of the five categories of income that we identified in our earlier example.

We may be interested in how much income households receive. This would be particularly useful if we wanted to predict household spending. All of national income does not make it to households. For example, corporations must pay taxes so some of their profit goes for this purpose. Also, corporations that have attractive opportunities to expand their business may keep some corporate profits to invest in plant and equipment. Funds used for this purpose are called retained earnings or undistributed corporate profits. The remaining profits are paid out to the shareholders in the form of dividends. In symbols, corporate profits can be written as

\[
\text{corporate profits} = \text{corporate taxes} + \text{undistributed corporate profits} + \text{dividends}.
\]

The first two items do not go to households so in our search for household or personal income we should subtract them out. Also, some of net interest goes to corporations, so we should subtract out net interest; but we should be sure to add personal interest income back in.

The Social Security tax is a payroll tax, and, like indirect business taxes, it is collected by the government directly from firms. We subtract out these taxes from national income as well. Finally, we need to recognize that some households receive funds in the form of transfer payments. They can be transfers from the government in the form of food stamps, aid for dependent children, or an old age pension; or from business in the form of pension payments to former employees or severance pay to someone they had to let go. These transfers should be included if we want a measure of the funds going to households. Combining these observations, we get personal income, which is defined as

\[
\text{personal income} = \text{national income} - \text{net interest} - \text{undistributed corporate profits}
\]
- corporate taxes - Social Security taxes + personal interest income

+ transfers to persons

You can object to this measure and say that we have left out a major, legally mandated payment for households- the income tax. Your objection would be well founded and there are other personal taxes as well, such as the property tax. When we subtract these taxes from personal income, we get a measure called disposable income. In symbols

\[ \text{disposable income} = \text{personal income} - \text{personal taxes}. \]

This measure of income is useful if you are, for example, trying to forecast consumer spending patterns. It is also a necessary concept to have at hand when we study the effect of taxes later on.

**Summary**

We study economics to further the material well-being of people. We do not mean to say that material well-being is the only, or even the most important, aspect of life; but we do claim that it is an important aspect. To measure material well-being across countries and the progress of standards of living over time, we must have a measure of the total output in an economy. This measure is GDP. It is far from a perfect measure, particularly the level, but it is the measure we have.

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**REVIEW QUESTIONS**

1) The following data is for the U.S. in 1990. The figures are expressed in billions of dollars.

| employee compensation (EC) | 3,244 |
a) calculate GDP from the output side (check your answer by calculating GDP from the income side)

b) calculate corporate dividends (DIV)

c) calculate national income (NI)

d) per capita GDP

2) Calculate the percentage of GDP used for personal consumption. Let $Y^n = GDP$, which you calculated in question 1, then the percentage of GDP used for $C$ is given by:

a) \[ \frac{(C/Y) \times 100}{ } \]

b) calculate the percentage of GDP used for:

I: 

G: 

NX: 

EC: 
c) The majority of output is used for ________________

d) The majority of income is paid in the form of ________

3) There are four categories of taxes in the data. The sum of the four is total taxes. Calculate this total we call T.

a) T = _______________________

b) calculate the percentage of GDP accounted for by each of the various taxes.

CT: _______________________

IBT _______________________

PT _______________________

SST _______________________

d) calculate the average corporate tax

(CT/CP) = ____________________

4) Sometimes it is useful to have measures of the income that goes to households. A common measure of the income that goes to households is personal income (PI). To calculate personal income you need to know how much interest income households received. In 1990 this number was $142 billion. Personal income is defined by

\[
PI = NI - NETI + \text{Personal Interest} - CT - UCP - SST + TP
\]

a) Calculate PI _____________________
Personal income does not take into account that households pay taxes so that they cannot spend all of their personal income. Disposable income (DI) is defined as personal income minus personal taxes.

b) Calculate DI _________________

5) Some economists have recommended that national defense spending should not be included in GDP. Do you agree or disagree with this recommendation? Explain your reasoning. (hint: recall our discussion of the security officer)

6) In the 1870s the U.S. was primarily an agrarian economy. Food for many homes was grown or raised on their own farms, and wood was cut for fuel and clothes sewn for daily wear by their own hands. Though actual measures are hard to come by, presumably in 1990 less of total production took place at home than it did in the 1870s. How does this observation affect our comparison of GDP in 1870 with GDP in 1990? Explain.

7) Which of the following goods and services are included in GDP?
   dollar value of the sale of my old farm house
   dollar value of the new addition to my old farm house
   dollar receipts from the sale of concert tickets
   the dollar value of the time contributed by volunteers to the local hospital
   the dollar value of the sale of bonds that you inherited from your great aunt
   dollar value of the purchase of a 1993 Ford pickup
   salary of the president
   dollar value of new stock purchases

8) There are many more families with two people working than there were in the 1950s. Would this bias GDP? Would it bias growth rates?