International Macroeconomics: Lecture Notes

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Preface

These lecture notes are for a very short course—roughly twelve 75-minute lectures—on international macroeconomics that I have taught to junior and senior undergraduates. Although no prior knowledge of economics is assumed, students typically come to the course after completing courses on introductory microeconomics and macroeconomics.

This course is the second half of a one-semester course on international economics, with the first half on international trade. The course's textbook is *International Economics: Theory and Policy*, Twelfth Edition, by Paul R. Krugman, Maurice Obstfeld, and Marc J. Melitz, Pearson, 2022, ISBN 9780135766859. My goal here is simply to present a concise version of chapters 13 through 18 of that book.

I had to grapple with some tough trade-offs because of the severe time constraint. The core of the course is the theoretical framework originally proposed by Robert A. Mundell and J. Marcus Fleming. I assume perfect capital mobility throughout and, thereby, avoid all discussion of wealth effects and portfolio theory.[1] I also assume a "small" country and, thereby, avoid the complex interactions of two-country models. The perfect capital mobility and small country assumptions keep this course very similar to the undergraduate macroeconomics course that most of my students would have also taken. This simplicity, I think, allows students to focus on the special aspects of *international* macroeconomics without having to learn a new kind of macroeconomics.

However, the discussion of expectations here may surprise even students who have taken intermediate macroeconomics courses. I have broken up the discussion of short-run analysis into separate chapters on permanent and temporary changes in exogenous variables. Expectations are assumed to be anchored to the long-run equilibrium outcome. This assumption is at the root of the need to distinguish between temporary and permanent changes in, say, fiscal policy. A

[1] On these issues, see *Open Economy Macroeconomics* by Asbj{ø}rn R{ø}dseth, Cambridge University Press, Cambridge, UK, 2000, ISBN 0-521-78304-6 (hardback) and 0-521-78874-9 (paperback). By perfect capital mobility I mean a world in which (a) people who buy assets care only about the expected returns of those assets, and (b) they all have the same expectations about future changes in exchange rates. See section XXX.

temporary change affects neither the long-run equilibrium outcome nor people's expectations, which are, after all, assumed to be tied to the long-run equilibrium outcome. On the other hand, a permanent change in, say, government spending affects the long-run equilibrium level of the future value of the exchange rate and, consequently, people's expectations about the future value of the exchange rate. This change in expectations has short-run ramifications that are absent in the analysis of temporary changes in government spending.

These notions are present in the book by Krugman, Obstfeld, and Melitz, but are not developed in a way that is clear enough and leisurely enough for most students to grasp.[2] Other international macroeconomics textbooks are no better in this respect, and usually a lot worse.[3]

The role of the long-run outcome in anchoring expectations is also my reason to discuss the long run before the short run. It would be essentially impossible to do short-run analysis without some notion of how expectations are formed, and the formation of expectations would be impossible to explain without a discussion of long-run equilibrium.

These lecture notes are a work in progress. Readers are encouraged to suggest improvements or at the very least send in some angry comments. My mailing address is Udayan Roy, College of Management, Long Island University, Brookville, NY 11548, USA. My email address is udayan.roy@liu.edu.

[2] On page 442 of their book, Krugman, Obstfeld, and Melitz address the issue as follows: "A permanent policy shift affects not only the current value of the government's policy instrument (the money supply, government spending, or taxes) but also the *long-run* exchange rate. This in turn affects expectations about future exchange rates. Because these changes in expectations have a major influence on the exchange rate prevailing in the short run, the effects of permanent policy shifts differ from those of temporary shifts."

[3] Consider *International Economics*, by Robert C. Feenstra and Alan M. Taylor, Worth Publishers, New York, NY, 2008, ISBN 0-7167-9283-4. On page 551 of their excellent textbook, the authors write, "[W]e can form expectations of the future exchange rate using the long-run monetary approach …" This easy-to-miss mention of the idea that expectations are based on the long-run equilibrium outcome is not adequately developed, as far as I am concerned. And the consequent need to distinguish between temporary and permanent policy changes is not as clearly developed as I would like.

Chapter 1

Preliminaries

1.1 Economics

Economics is the study of how we—as individuals and as societies—deal with the inescapable reality that "we can't always get what we want". This fact of life, which economists call *scarcity*, makes it important for us to know how the many economic variables that are important to us—such as the gross domestic product, the unemployment rate, the consumer price index, etc.—can be made to increase or decrease as needed. For example, scarcity makes it important to understand whether our gross domestic product would increase or decrease if we imposed tariffs on imported goods.

Economics consists of:

- **theories**, which are explanations—not necessarily proven—for the observed up and down movements of the economic variables that matter to us, and of
- **statistical studies** that seek to test the reliability of economic theories.

1.2 Macroeconomics

Macroeconomics is the part of economics that deals with economic variables that describe a country. When describing the economy of the United States, an economist will probably mention the gross domestic product, the unemployment rate, the inflation rate, the trade deficit, etc., of the United States. These variables that describe an entire country are at the heart of macroeconomics. Macroeconomics consists of (a) theories that derive predictions about the likely changes in such economic variables and (b) statistical studies that scour history to check the predictive accuracy of the theories.

1.3 International Macroeconomics

The macroeconomic behavior of a country that is economically isolated from other countries—a **closed economy**, in the jargon of economics—will not necessarily be the same as the macroeconomic behavior of a highly globalized country—an **open economy**. International macroeconomics is the part of macroeconomics that deals with countries for which international economic links are important. Such links may include international trade in goods and services, cross-border migration of people, and cross-border borrowing and lending.

1.4 Why Study International Macroeconomics?

The point of studying international macroeconomics is to be able to *evaluate alternative macroeconomic policies* and choose the one that's best. If we have a reliable theory that explains the reasons why a certain variable goes up or down, we might be able to figure out policies that will move that variable in the desired direction. For example, if we can figure out the reasons for the up and down movements of a nation's trade deficit, we might be able to design economic policies that drive the trade deficit in the desired direction, be it up or down.

In discussing macroeconomic policy I will focus on **fiscal policy** and **monetary policy**.

1.4.1 What Is Fiscal Policy?

Fiscal policy consists of all the methods of controlling an economy by making changes to the government's budget. A government's **budget** is a description of its spending and revenue-raising plans. So, for my purposes, fiscal policy essentially consists of changes in total **government spending**, G, and **total tax revenue**, T.[1]

Second, to be more precise, T represents total *net* tax revenue, which equals the tax revenues of the government less **transfer payments** made by the government. Transfer payments are gifts, such as cash grants to the poor.

Third, G represents government *purchases* rather than government spending. The latter includes the former plus transfer payments, which, as I said in the previous paragraph, are gifts, not payments made for purchases. G represents only what the government spends for its purchases of goods and services.

[1] First, note that I have begun to introduce symbols to denote economic variables. As you will see, the good part of the use of symbols is that it speeds up the discussion considerably. The bad part is that you will need to remember which symbol denotes which variable.

1.4.2 What Is Monetary Policy?

Monetary policy consists of all the methods of controlling an economy by making changes to the economic variables that are directly controlled by the country's monetary authorities, such as the Federal Reserve in the United States. For my purposes, monetary policy consists of changes in a country's **money supply**, M. A central bank may print money and lend it to financial institutions such as banks. If and when these financial institutions in turn lend the money to people or to businesses, the newly printed money begins to affect actual economic activity. This, of course, is why the central bank printed the money in the first place.

1.4.3 Monetary Unions

In the case of the 24 European countries that all use the same currency, the euro, there is no monetary policy at all to conduct![2] These countries have willingly given up their individual currencies and formed a **monetary union**. The monetary policy of the entire eurozone is determined by the European Central Bank in Frankfurt.[3]

It is important to understand the pros and cons of the formation of a monetary union so that countries considering joining a monetary union may make smart choices.

Just as multiple countries may choose to use a common currency, they may also choose to adopt a common fiscal policy whereby a central budget sets expenditure and revenue-raising rules for all members of the club. For example, the USA may be thought of as a union of fifty states with a common currency and a unified fiscal policy decided in Washington, D.C. In fact, we will see that it may be difficult for a group of countries to share a common currency and retain independent national fiscal policies. During the economic crises that cascaded through several eurozone countries—such as Ireland, Greece, and Spain—during 2009–2012, some commentators argued that the eurozone countries needed to unify their budgets—and become something like a United States of Europe—if they were to have a stable monetary union.

In any case, countries considering a monetary and/or fiscal union need to be able to make their choices with their eyes wide open. It is, therefore, necessary for international economics to have something useful to say on the issue.

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[2] As of October 2023, the eurozone consists of 20 members who are European Union (EU) members and use the euro. They are Austria, Belgium, Croatia, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia and Spain. The non-EU countries that use the euro are Andorra, Vatican City, and Monaco and San Marino.

[3] This lack of the ability to use monetary policy is also true of a handful of countries that have "dollarized". These are countries that have decided to use another country's currency as their own currency. For example, East Timor, Ecuador, El Salvador, and Panama use the U.S. dollar as their currency.

Chapter 2

National Income Accounts, Prices, and Inflation

Recall from sections Section **??** – Section **??** that international macroeconomics consists of explanations for the observed up-and-down movements of important macroeconomic variables in a globalized (or, open) economy. This chapter begins the task of defining some of those important macroeconomic variables. This chapter also discusses certain accounting rules that describe how certain important macroeconomic variables are related to each other, simply by virtue of the way they are defined.

2.1 National Income Accounts

The national income accounts of a country consist of data on variables that tell us about the country's total production of goods and services, and what those goods and services are being used for. An important measure of the total production of goods and services is the gross domestic product (GDP). If you look up a country's GDP data in a book or on the Internet, you'll see that GDP data comes in two flavors, nominal and real. Nominal GDP is discussed in the next section, and real GDP is discussed in the section after that.

2.2 Nominal Gross Domestic Product {#sec-nGDP}

There are three equivalent ways of understanding nominal gross domestic product: the value-added approach, the income approach, and the expenditure approach.

2.2.1 GDP: The Value-Added Approach

The **value added** by a firm is the monetary market value of the goods and services produced by the firm *minus* the monetary market value of the goods and services that the firm purchases from other firms (for use in its own production, obviously). A country's gross domestic product is then the total value added—during a specified time period, such as a year—by all producers of for-sale goods located within the country.

Consider a university. Let's say that the market value of the educational services provided by this university was \$20 m during 2008, as measured by the tuition paid by its students. It would be incorrect, however, to say that the market value of the work done in the university was \$20 m. The university used a lot of electricity that was produced by some other firm. The university bought massive amounts of paper, computer printer cartridges, and other stationery from other firms. The university's capital equipment (which includes its buildings, its computers, its fleet of cars and trucks, etc.) needed costly replacements that had to be bought from other firms. Suppose the monetary market value of these and all other goods and services that were purchased from other firms and used by the university's employees during 2008 was \$16 m. Then the value added by the university was only \$20 m – \$16 m = \$4 m.

And, as we saw two paragraphs back, *the total value added by all producers of for-sale goods and services located within a country's borders is that country's gross domestic product.*

2.2.2 GDP: The Income Approach

Now, returning to our hypothetical university, a question arises: What happens to the \$4 m that the university has left of its \$20 m tuition revenues after paying \$16 m to other firms for its various purchases? Where will this \$4 m go?

A big chunk will go to pay **wages** to the university's employees. The university will have to pay **rent** on some property that it had leased from others. It will have to pay **interest** to its banks for the loans it had taken. It will have to pay what are called **indirect business taxes** to the government. And whatever remains will be the university's **profits**, which belong to the university's owners or shareholders. In other words, the university's value added ends up as the income of the owners of the resources employed by the university.

What's true for this university is true for all firms in the country. Therefore, as a country's gross domestic product is its total value added, one can say that *a country's gross domestic product is the total income earned by the owners of all the resources employed by producers located within the country's borders.*

2.2.3 GDP: The Expenditure Approach

Let us consider our hypothetical university one more time. The education it provides its students is an example of a **final good**.[1] A good is called a final good when it is sold to its final user; a final user is someone who will not use the purchased good to produce something else for sale.

The electricity, paper, other stationery, etc., that the university buys for the purpose of producing educational services are called **intermediate goods**. When goods are bought by businesses from other businesses, used as inputs in the production of other for-sale goods, and, in the process, end up disappearing completely inside those other goods, they are called intermediate goods. (Think of all the milk produced by U.S. dairy farmers that disappear into the ice cream made by U.S. firms such as Ben & Jerry's.)

In my example, students paid $20 m for education, the final good produced by the university. As we saw in section Section **??** above, this money ends up as the incomes of all the resources—employed by the university and by the firms from which the university bought electricity, paper, and all sorts of other intermediate goods—that were used to produce the final good, education.

Extrapolating from this example, we can say that the total expenditure on all final goods produced domestically and sold to domestic final users—let's call these goods category a goods—is equal to the income earned by all resources employed in the production of these final goods and the intermediate goods used in the production of these final goods.

Moreover, what's true for education must also be true for the domestic production of all exported goods—let's call these category b goods. The total expenditure on these goods must end up as the total income of all resources used to make these goods and the intermediate goods bought by the producers of these goods.

Therefore, the total expenditure on the goods in categories a and b *minus* the value of the intermediate goods imported by the producers of category a and b goods is the total income of all resources that were used to make category a and b goods and the *domestically produced* intermediate goods bought by their producers.

But this income must be the total income of all resources employed in domestic production. After all, any domestic producer would have to produce either final goods sold to domestic buyers (category a), or exported goods (category b), or the domestically produced intermediate goods bought by category a and b producers.

Therefore, going by the definition of GDP in Section **??**, the total expenditure on category a and b goods *minus* imports of intermediate goods equals gross domestic product.

[1] When I say "good", I mean "good or service".

In publications of government statistics, the total expenditure by households residing within a country is called **personal consumption expenditure** or, simply, consumption. The total spending on final goods by domestic businesses is called **gross private domestic investment** or, simply, investment. Total spending by domestic government entities is called **government expenditure**. Therefore, total expenditure on *all* final goods by domestic residents is consumption + investment + government spending. Consequently, total expenditure on final goods produced domestically and sold to domestic residents—category a—is consumption + investment + government spending − imports of final goods. Therefore, the total expenditure on goods in categories a and b equals consumption + investment + government spending + exports − imports of final goods. Therefore, recalling the last sentence of the previous paragraph, gross domestic product equals consumption + investment + government spending + exports − imports of final goods − imports of intermediate goods. Consequently, we get:

$$\text{GDP} = \text{consumption} + \text{investment} + \text{government spending} + \text{exports} - \text{imports}. \tag{2.1}$$

This is easily the most important equation in this book. It is called the **national income identity** and will be central to our discussion right up to the very end of this book.

Note that it is not terribly meaningful to distinguish between exports of final goods and exports of intermediate goods. And the same can be said about imports too. Nevertheless, if we simplify a bit and assume that all exports and imports are of final goods, Equation **??** can be interpreted as follows: a country's gross domestic product is the market value of all final goods and services produced within the country in a given period of time (usually a year). This is a very popular definition that you will see in many textbooks. I will use this definition in this book too, as a convenient shorthand.

2.2.4 GDP: Overview

According to the Bureau of Economic Analysis of the U.S. Department of Commerce, the nominal GDP of the United States for 2008 was $14,441.4 billion.[2] This means that spending by US residents on final goods and services that were "Made in USA" in 2008, plus net exports of "Made in USA" goods and services were together equal to a grand total of $14,441.4 billion. This number is also the total value added by all producers located in the USA. And—perhaps most meaningfully—this number is the total income earned by all productive resources employed by producers located in the USA.

[2]See http://www.bea.gov. The second column of the table in Figure **??**} shows America's nominal GDP during the decade 1999–2008.

Year	Nominal GDP, billions of current dollars	Real GDP, billions of chained 2005 dollars	Implicit Price Deflator for GDP
2002	10642.3	11543.1	92.196
2003	11142.2	11836.4	94.135
2004	11853.3	12246.9	96.786
2005	12623	12623	100
2006	13377.2	12958.5	103.231
2007	14028.7	13206.4	106.227
2008	14291.5	13161.9	108.582
2009	13939	12703.1	109.729
2010	14526.5	13088	110.992
2011	15094	13315.1	113.361

Figure 2.1: Nominal GDP, Real GDP, and Implicit Price Deflator for GDP, U.S.A., 2002–2011

2.3 Real Gross Domestic Product {#sec-rGDP}

Looking at the second column of the table in Figure **??**, we see that the nominal gross domestic product of the United States was $11,867.8 billion in 2004, $12,638.4 billion in 2005, $13,398.9 billion in 2006, $14,077.6 billion in 2007, and, as was mentioned earlier, $14,441.4 billion in 2008. If one assumes that our quality of life depends crucially on the goods and services we produce, these ever increasing dollar figures seem like good news.

But are they?

As nominal gross domestic product is the monetary market value of all final goods produced, it could increase from one year to the next either as a result of:

- increases in the production of various goods, or
- increases in the market prices of those goods, or
- increases in both production and prices.

Consequently, increases in nominal gross domestic product do not necessarily imply increases in production. Mere inflation could make the numbers go up and up.

Now if, by sheer luck, all prices remained unchanged during 2004–7, then, yes, the increases in nominal GDP during that period would indeed strongly indicate rising overall levels of production.[3]

[3]Even in this case, production might rise for some goods and fall for others. But it is

Of course, in real life, prices do not stay unchanged year after year. But even if prices moved around a lot during 2004–7, we could still ask a hypothetical question: What would nominal GDP have been during 2004–7 if prices had remained unchanged at 2004 levels? This is not an unanswerable question. We know the 2004 prices of all final goods, and we know the quantities produced, of all final goods, during the years 2004, 2005, 2006, 2007, and 2008. (Otherwise, we would not have been able to calculate the nominal GDP figures in Figure **??**.) Therefore, we can easily calculate what America's nominal GDP would have been in those years, had the prices of 2004 prevailed in all years.

Indeed, data on this hypothetical measure—formally called **real gross domestic product** or **constant-prices gross domestic product** or **inflation-adjusted gross domestic product**—is available for virtually every country in the world. The third column of the table in Figure **??** shows America's real gross domestic product, calculated on the assumption that the prices of the year 2005 prevailed in all years, for the decade 1999–2008.[4]

As you can see, not only did America's nominal GDP increase throughout 1999–2008, so did *real* GDP. This is clear evidence of actual increases in production. To repeat, the dollar figures in the third column of the table in Figure **??** were all calculated on the hypothetical assumption that 2005's prices prevailed in every year. As the same prices were used for every year's real GDP calculations, the increases in real GDP strongly indicate overall increases in production.

The year whose prices are being assumed hypothetically to prevail in all years—the year 2005 in this case—is called the **base year**. There is nothing sacrosanct about the year 2005—any other year could have served just as well. As long as every year's GDP is calculated using the same set of prices, we will get a measure of GDP that is not affected by fluctuations in the overall level of prices.

In the rest of this book, all references to gross domestic product are references to *real* gross domestic product. Also, I will use the symbol Y to denote real gross domestic product.

2.3.1 Notation: Growth Rates

Consider a variable x. I will denote its *current value* as simply x and its *past value* as x_{-1}. Then, the *growth rate* of x, which I will denote x_g, can be defined as follows:

$$x_g \equiv \frac{x - x_{-1}}{x_{-1}}. \tag{2.2}$$

Here, $x - x_{-1}$ represents the increase in the value of x. Therefore, $(x - x_{-1})/x_{-1}$ is the proportionate increase in the value of x or, simply, the growth rate of x.

straightforward to show that if nominal GDP rises and prices stay unchanged, a country would be able to buy increasing amounts of *every* good through international trade.

[4]Formally, these numbers are in "chained 2005 dollars". The subtleties of this particular method of adjusting nominal values for inflation will not concern us here.

If $x_{-1} = 50$ and $x = 60$, the increase is $x - x_{-1} = 60 - 50 = 10$. But the rate of growth is $x_g \equiv (x - x_{-1})/x_{-1} = (60 - 50)/50 = 0.20$.

If you want the growth rate *as a percentage*, simply multiply x_g by 100 to get $0.20 \times 100 = 20$ percent.

To take a more concrete example, consider real gross domestic product (Y) and its growth rate (Y_g). Figure **??** tells us that real GDP of the U.S. (in billions of chained 2005 dollars), was $13,254.1 in 2007 and $13,312.2 in 2008. Therefore, the growth rate of America's real GDP in 2008 was

$$Y_g = \frac{Y_{2008} - Y_{2007}}{Y_{2007}} = \frac{13,312.2 - 13,254.1}{13,254.1} = 0.004,$$

or $0.004 \times 100 = 0.4$ percent. The real GDP growth rates for the years 1999–2008 are given in Figure **??**. (Can you use the data in the second and third columns of that table to figure out the real GDP for 1998?)

Year	Real GDP, billions of chained 2005 dollars	Real GDP Growth %	Implicit Price Deflator for GDP	Inflation %
2002	11543.1	1.81	92.196	1.62
2003	11836.4	2.54	94.135	2.10
2004	12246.9	3.47	96.786	2.82
2005	12623	3.07	100	3.32
2006	12958.5	2.66	103.231	3.23
2007	13206.4	1.91	106.227	2.90
2008	13161.9	-0.34	108.582	2.22
2009	12703.1	-3.49	109.729	1.06
2010	13088	3.03	110.992	1.15
2011	13315.1	1.74	113.361	2.13

Figure 2.2: Real GDP, GDP Growth, Implicit Price Deflator for GDP, and Inflation, U.S.A., 2002–2011. Source: Bureau of Economic Analysis, U.S. Department of Commerce, National Income and Product Accounts, Tables 1.1.1, 1.1.6, and 1.1.9. Real GDP is discussed in **?@sec-rGDP**, the growth rate of real GDP in Section **??**, the implicit price deflator in Section **??**, and inflation in Section **??**.

	2008	2009	2010	2011
Gross domestic product	13161.9	12703.1	13088	13315.1
Personal consumption expenditures	9211.7	9037.5	9220.9	9421.3
Gross private domestic investment	1939.8	1454.2	1714.9	1797.3
Fixed investment	1978.6	1606.3	1648.4	1761
Change in private inventories	-36.3	-144.9	58.8	34.6
Net exports of goods and services	-494.8	-358.8	-421.8	-413.6
Exports	1649.3	1494	1663.2	1774.2
Imports	2144	1852.8	2085	2187.7
Government consumption expenditures and gross investment	2497.4	2539.6	2556.8	2502.7

Figure 2.3: Real GDP and its Components, U.S.A., 2008–2011, in billions of chained 2005 dollars. Source: Bureau of Economic Analysis, U.S. Department of Commerce, National Income and Product Accounts, Table 1.1.6.

	2008	2009	2010	2011
Gross domestic product	100	100	100	100
Personal consumption expenditures	69.99	71.14	70.45	70.76
Gross private domestic investment	14.74	11.45	13.10	13.50
Fixed investment	15.03	12.64	12.59	13.23
Change in private inventories	-0.28	-1.14	0.45	0.26
Net exports of goods and services	-3.76	-2.82	-3.22	-3.11
Exports	12.53	11.76	12.71	13.32
Imports	16.29	14.59	15.93	16.43
Government consumption expenditures and gross investment	18.97	19.99	19.54	18.80

Figure 2.4: Real GDP and its Components, U.S.A., 2008–2011, as percent of Real GDP. Source: Bureau of Economic Analysis, U.S. Department of Commerce, National Income and Product Accounts, Table 1.1.6.

For my discussion of the theory of international macroeconomics, I will also use a *forward-looking* definition of the growth rate of a variable. Specifically, the **forward-looking growth rate** of x is defined as follows:

$$x_g \equiv \frac{x_f - x}{x}. \tag{2.3}$$

Here, x_f represents the value of x in the future. Therefore, $x_f - x$ represents the increase in the value of x. Therefore, $(x_f - x)/x$ is the proportionate increase in the value of x or, simply, the growth rate of x.

2.4 The Components of GDP

Now that we have discussed the measurement of a country's total production, let us look at what happens to it. Government statisticians typically publish data not only on a country's output of final goods and services (that is, its GDP) but also on who bought those final goods and services. As in Figure **??**, national income data usually breaks down the big GDP number into four smaller numbers that represent the final-goods purchases made by four major categories of buyers:

- personal consumption expenditures (C),
- gross private domestic investment (I),
- government purchases (G), and
- net exports of goods and services (NX).

In other words, Equation **??**, which is called the national income identity and breaks down *nominal* gross domestic product into its components, is equally true for *real* gross domestic product:

$$Y = C + I + G + NX. \tag{2.4}$$

{#eq-nii}

2.4.1 Consumption

The real (i.e., inflation-adjusted) **personal consumption expenditures** of the residents of a country in a given year is denoted by the symbol C. In U.S. data, C consists of *spending by households* on all final goods except newly built homes. As you can see from the U.S. data in Figure **??**, C is a very large part—more than two-thirds—of GDP.

2.4.2 Investment

The real **gross private domestic investment** (or, simply, investment) of a country is denoted by the symbol I. In U.S. data, I consists of:

- the purchases of fixed assets (equipment, software, and buildings) by businesses for use in production,
- the purchases of new homes by households,[5] and
- increases in inventories of unsold goods held by businesses.

Note that the inclusion of these three categories of final goods under investment is not random. There is an underlying theme here: machines, new buildings, stocks of as-yet-unsold goods, etc., all contribute to our *future* welfare.[6] The money we spend on pizzas and backrubs, by contrast, are all about the here and now and are included under consumption, C.

As you can see from the U.S. data in Figure **??**, I, at less than 15% of GDP, is a lot less important than C. And yet, because of its tendency to fluctuate wildly, investment spending is an important cause of the ups and downs of the overall economy.

2.4.2.1 Inventories

The inclusion of increases in businesses' stocks of unsold goods in I needs some justification. What's the point of including this in I?

Keep in mind that to get an accurate picture of the health of an economy in a given year we need to count the market value of all goods and services produced during the year, whether or not they are sold by December 31st of that year. Those unsold goods would not be counted in C, I, G, and NX, if these four variables included only the actual *purchases* of final goods by households, businesses, the government, and foreign buyers. To make sure that all goods produced in 2008 get counted in that year's GDP—even if they are not sold in 2008—statisticians include the additions of unsold goods to businesses' inventories (or, warehouse stocks) in I.

Note that I did not say that additions to businesses' inventories of unsold *final* goods are included in I; even the intermediate goods that were produced in 2008 but not sold by the end of that year need to be counted in that year's GDP.

Sure, as the ice cream made by Ben & Jerry's is counted in GDP, one should not separately count the milk that went into it because the monetary market value of the ice cream already includes the monetary market value of the milk. But let's complicate the story a little. Suppose Ben & Jerry's buys $10 million of freshly produced milk some time in 2008, but does not turn it into ice cream by December 31, 2008. Instead, the milk is sitting in their freezer on that last day of 2008, waiting to be turned into Cherry Garcia some time in 2009. This $10 million worth of milk was produced in 2008 and, therefore, should be included in 2008's GDP. To ensure this, the rules of GDP accounting require that any

[5] As we saw in the previous paragraph, this is the only category of household spending that is *not* included in C.

[6] The first two categories—fixed assets and new homes—are combined into the *fixed investment* category in Figure **??**.

goods that have been added to the inventories (or, warehouse stocks of goods) of private businesses during 2008 are *final* goods and their value must be counted in the GDP for 2008.

2.4.3 Government Spending

Real **government expenditures** (G) is pretty much what it sounds like; it is the inflation-adjusted monetary value of all final goods and services bought by government entities.

Typically, governments also spend huge amounts of money on **transfer payments** or, loosely speaking, gifts (usually to needy people). But G includes only the money spent on the purchase of final goods and does not include transfer payments.

2.4.4 Net Exports

Real **exports of goods and services** (EX) is the inflation-adjusted value of all domestically produced goods that are bought by foreigners.

Real **imports of goods and services** (IM) is the inflation-adjusted value of all foreign-made goods that are bought by domestic residents.

Real **net exports** (NX) is then defined as $NX \equiv EX - IM$. This also goes by other names, such as **trade surplus**, **balance on goods and services**, and, somewhat loosely, **balance on the current account**—see Equation **??**. Note, therefore, that NX could be positive, zero or negative. When NX is positive/zero/negative, the country is said to have a **Trade Surplus/Balanced Trade/a Trade Deficit**.

2.4.4.1 All exports and imports are final!

There's one more loose end in my definition of GDP that I need to tie up. Note that in Section **??** above I defined exports as "all domestically produced goods that are bought by foreigners", not all domestically produced *final* goods". Similarly, note that I defined imports as "all foreign-made goods that are bought by domestic residents", not all foreign-made *final* goods". Why am I including exports and imports of intermediate goods? Suppose that American dairy farmers produce $10 million of milk in 2008 and sell it to a Canadian ice cream company that turns the milk into ice cream in its plant in Vancouver, also in 2008. The monetary value of the ice cream would not be counted in America's GDP because the ice cream was made in Canada. So, if the $10 million of milk is regarded as an intermediate good, it would not be counted at all in America's GDP. When the milk is turned into ice cream by Ben & Jerry's, the ice cream is counted in America's GDP and, therefore, so is the milk, although indirectly. But as for the milk that is sold to a Canadian ice cream company, the only way to have it counted in America's GDP is to require that *anything* sold to foreign-

ers is counted in EX. Similarly, it is straightforward to show that imports of intermediate goods should be counted in the importing country's IM.

So, here's the final corrected version—fingers crossed!—of the definition of gross domestic product: *GDP is the monetary market value of all final goods and services produced within a country in a given year plus the increase in its inventories of intermediate goods plus its net exports of intermediate goods.*

2.5 The National Income Identity

To recap, we have so far defined real gross domestic product (Y), real personal consumption expenditure (C), real gross private domestic investment (I), real government spending (G), and real exports (EX). It is tempting to argue that Y must be equal to $C+I+G+EX$. After all, Y represents all final goods that are "Made in USA" and any such good would have to be bought either by American households (C), or by American businesses (I), or by America's government (G), or by foreigners (EX). Therefore, Y should be equal to $C+I+G+EX$, right?

Well, not exactly. Although $C+I+G$, which incidentally is referred to as **gross domestic purchases**, does represent the total purchases by domestic households, businesses, and government entities, it includes purchases of imported goods as well as domestically produced goods. Therefore, only if we subtract the inflation-adjusted monetary value of all imported goods (denoted by the symbol IM) from $C+I+G+EX$ would we get Y. That is, $Y = C+I+G+EX-IM$.

As we saw in Section **??**, the terms **net exports**, **trade surplus**, and **balance on goods and services** all refer to $NX \equiv EX - IM$, the excess of exports over imports. Therefore, we get the **national income identity**:

$$Y = C + I + G + NX. \tag{2.5}$$

This is a reappearance of Equation **??** and **?@eq-nii**.

Figure **??** shows data on real gross domestic product and its components for the United States for the years 2005–8. You can check that $C+I+G+NX$ is indeed equal to real GDP.

A theoretically equivalent measure is **gross domestic income**. When government statisticians measure the total value added by domestic producers, they measure the gross domestic product (GDP). When they measure the total income of all resources employed by domestic producers, they measure gross domestic income (GDI). As we have seen above, if measured with perfect accuracy, these two magnitudes should be the same, as they are theoretically equivalent. In practice, however, errors do creep in, and the GDP and GDI numbers tend to differ. This difference is called the **statistical discrepancy**: $GDP = GDI +$ statistical discrepancy.

2.5.1 Beyond GDP: Other Measures of Total Production

Gross domestic product is not the only measure of a country's total production, there are others.

2.5.1.1 Gross National Product

Recall that a country's gross domestic product is not only the total value added by all producers located within the country, it is also equal to gross domestic income, which is the total income earned by the factors of production (or, in plain language, resources) employed by all producers located within the country.[7]

Some of the resources employed by producers located within the country may be owned by foreign residents, and the income paid to these resources goes, necessarily, to their foreign owners. Conversely, some residents of the domestic country may earn income for work done for producers located in foreign countries. A country's **net factor income earned from foreign residents** (NIF) *equals* total income earned by domestic residents from foreign residents *minus* total income paid by domestic residents to foreign residents.

As, in some cases, it is important to know the total income earned by the factors of production owned by a country's residents, we often pay attention to a country's gross national product (GNP):

$$\text{GNP} = \text{GDP} + \text{NIF}. \tag{2.6}$$

A theoretically equivalent measure is gross national income: $GNI = GDI + NIF$. Recall from Section **??** that although GDP and GDI are theoretically the same, and would be equal if accurately measure, in practice the measured magnitudes differ slightly: $GDP = GDI +$ statistical discrepancy. The same distinction needs to be made between GNP and GNI as well; they'd be equal if measured accurately, but in practice $GNP = GNI +$ statistical discrepancy.

2.5.1.2 Gross National Disposable Income

The residents of a country may send gifts to—and receive gifts from—the residents of other countries. A country's **net unilateral transfers of income from foreign residents** (NUT) is defined as gifts received *minus* gifts given. Gross national disposable income (GNDI) is then defined as

$$\text{GNDI} = \text{GNI} + \text{NUT}. \tag{2.7}$$

Recall that gross domestic product is denoted by the symbol Y. In practice, the statistical discrepancy between GDP and GDI (or between GNP and GNI) is small. Moreover, net factor income earned from foreign residents (NIF) and net unilateral transfers of income from foreign residents (NUT) tend to be small too.

[7] In other words, if measured accurately, GDP = GDI.

As a result, the differences between GDP, GDI, GNP, GNI, and GNDI are, for most practical purposes, small enough to be ignored. Consequently, to keep the discussion simple, I will use the symbol Y to refer to *all* these different ways of measuring a country's total value added, total income, and total expenditure.

2.5.1.3 National Income Identity, Revisited

Recall from Equation **??** that

$$Y = C + I + G + NX.$$

Therefore,

$$Y + \text{NIF} + \text{NUT} = C + I + G + NX + \text{NIF} + \text{NUT}.$$

It is clear from equations Equation **??** and Equation **??**, the last equation can be re-written as

$$\text{GNDI} = C + I + G + (NX + \text{NIF} + \text{NUT}).$$

As we will see in the next chapter's discussion of balance of payments accounting, the expression within parentheses in the last equation is called the **balance on the current account** or, simply the current account (CA). The equation above then yields a slightly updated version of the national income identity:

$$\text{GNDI} = C + I + G + CA. \tag{2.8}$$

The reader should be warned, however, that I will use the terms net exports (NX) and current account balance ($CA = NX + NIF + NUT$) interchangeably throughout this book, because—as was pointed out a short while back in Section **??**—both NIF and NUT tend to be small in magnitude.

2.6 Prices and Inflation

Inflation is a topic of major concern in economics as well as in our daily lives. Therefore, it is important to understand what causes it and how it can be controlled. But before we can get to that, we need to discuss how inflation is measured.

The measurement of inflation can be quite tricky. While the prices of some goods may rise from one year to the next, the prices of other goods may fall. In such cases, one needs to come up with *one* number that summarizes the *overall* change in prices.

2.6.1 The Implicit Price Deflator for GDP

Suppose you recently spent a day in Boston followed by a day in San Antonio. You ate the same meals in both cities, bought the same newspaper, rented the same type of car, and stayed in identical hotels. Nevertheless, you ended up spending 10% more in Boston. Why? You did not buy more stuff in Boston; in fact, you bought exactly the same things in both cities. Therefore, the only explanation is that prices were higher overall in Boston. Some things may be cheaper in Boston and some other things may be cheaper in San Antonio. But it is reasonable to conclude—from your own limited experience in the two cities—that the overall level of prices was 10% higher in Boston relative to San Antonio.

Now consider another hypothetical example. Suppose you spent both October 1, 2005 and October 1, 2006 in Boston and during both visits you bought the exact same things, used the same transportation, and stayed in identical hotel rooms. And yet, you ended up spending 4% more in 2006 than in 2005. Using the same logic as in the last paragraph, we can conclude that although individual items' prices may have changed at different rates, the overall level of prices in Boston rose 4% in 2006 relative to 2005.

In fact, you don't even have to visit Boston on two different dates. After your October 1, 2006 visit, you could dig up data on the prices that you would have paid if you had visited Boston a year earlier and bought the same goods and services that you bought during your October 1, 2006 visit, and you would have again reached the conclusion that the overall level of prices rose 4% in Boston in 2006. And that, by and large, is what government statisticians do to measure the rates of change of the overall level of prices in the US and other countries.

One way to measure the overall level of prices is to compare the nominal GDP and the real GDP for a particular year. We see in Figure **??**} that in 1999 America's nominal GDP was $9,353.5 billion and America's real GDP, with base year 2005, was $10,779.8 billion. Stated differently, in 1999 America's nominal GDP was 86.8% of America's real GDP:

$$\begin{aligned} \frac{\text{Nominal GDP in 1999}}{\text{Real GDP in 1999 with base year 2005}} \times 100 &= \frac{9,353.5}{10,779.8} \times 100 \\ &= 86.8. \end{aligned}$$

So, at 1999 prices, the dollar value of all final goods produced in the U.S. in 1999 was $9,353.5 billion, whereas, at 2005 prices, the dollar value of the exact same goods was $10,779.8 billion.

Now, how could one dollar value of the final goods made in 1999 be different from the other dollar value of the exact same goods? As the quantities used in the nominal GDP calculation are the same as the quantities used in the real GDP calculation, these two dollar values must be different because they use different *prices*.

More precisely, the only possible reason why America's nominal GDP in 1999 is 86.8% of America's real GDP in 1999 must be that the prices that prevailed

in 1999, which are the ones that were used in the calculation of nominal GDP, were, in an overall sense, 86.8% as high as the prices that had prevailed in 2005, which are the ones that were used in the calculation of real GDP.

It would be incorrect to conclude that *all* final goods were 86.8% as pricey in 1999 as in 2005. For apples, the 1999 price may have been 80% of the 2005 price. For haircuts, the 1999 price may have been 130% of the 2005 price. For gas at the pump, the 1999 price may have been 99% of the 2005 price. But it is reasonable to say that in an overall sense the 1999 prices were 86.8% as high as the 2005 prices because the final goods that were produced in America in 1999 were only 86.8% as valuable at 1999 prices than at 2005 prices.

Thus, by comparing the nominal and real GDP values for a particular year we are able to measure how that year's prices as a whole measure up relative to the base year's prices. Formally, the

$$\text{Implicit Price Deflator for GDP in year } n \text{ with base year } m = \frac{\text{Nominal GDP in year } n}{\text{Real GDP in year } n \text{ with base year } m} \times \tag{2.9}$$

shows what the overall level of final goods' prices in year n was as a percentage of the base year's overall price level. More compactly,

$$\text{Implicit Price Deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} \times 100. \tag{2.10}$$

The fourth column in Figure **??**} shows America's implicit price deflator for GDP (IPDGDP) for the 1999–2008 decade. Specifically, it shows that the overall level of prices in 1999 was 86.8% of the overall level of prices in 2005. Similarly, the overall level of prices in 2005 was 100% of the overall level of prices in 2005—what a shocker!—and the overall price level in 2007 was 106.2% of the overall level of prices in 2005.[8]

In the remainder of these lectures, I will represent the overall price level for a particular year not by the implicit price deflator for GDP but by a very slightly different version of it:

$$\begin{aligned} P &= \frac{\text{Implicit Price Deflator for GDP}}{100} \\ &= \frac{\text{Nominal GDP}}{\text{Real GDP}} \times \frac{100}{100} \\ &= \frac{\text{Nominal GDP}}{Y}. \end{aligned} \tag{2.11}$$

{#eq-P} Note that **?@eq-P** comes from equation Equation **??**.

[8] If you saw Figure **??**, but without any information about 2005 being the base year in the heading of the third column, would you still be able to figure out that 2005 is the base year?

In other words, while real GDP is represented by the symbol Y, the overall level of prices is denoted by the symbol P, and nominal GDP is given by

$$\text{Nominal GDP} = P \times Y. \tag{2.12}$$

2.6.2 The Consumer Price Index

The implicit price deflator for GDP is not the only one-number representation of the overall level of the prices of the innumerable goods that are bought and sold in a modern economy. Indeed, it may not even be the most popular method: a frequently cited alternative measure of the overall level of prices is the **consumer price index**.

Whereas the implicit price deflator for GDP is (100 times) the value of the current year's output of final goods at the current year's prices divided by the value of the same set of goods at the base year's prices, the consumer price index is (100 times) the value of *a fixed bundle of goods that represents the purchases of a* typical consumer* at the current year's prices divided by the value of that same bundle of goods at the base year's prices.

Although **?@eq-P** sees the overall price level, P, as the implicit deflator for GDP divided by 100, you may, if you wish, think of P as the consumer price index divided by 100. In practical terms, these two measures of the overall price level tend to move in sync most of the time.[9]

2.6.3 Inflation

Finally, how do we measure inflation? Inflation is defined simply as the growth rate of the overall level of prices, where the term 'growth rate' is as it is defined in Section **??**. I will denote inflation by the symbol π, which is the lower-case Greek letter 'pi'. Denoting the past value of the overall price level by the symbol P_{-1}, we can use equation Equation **??** to express inflation as follows:

$$\pi \equiv \frac{P - P_{-1}}{P_{-1}} \equiv \frac{P}{P_{-1}} - 1. \tag{2.13}$$

The increase in the overall price level is $P - P_{-1}$. But the proportionate increase in P is $(P - P_{-1})/P_{-1}$. And to express inflation as a *percentage*, one has to multiply π by 100.

[9] However, an increase in the price of M16 rifles, which are usually bought by a country's armed forces but not by its typical consumer—not yet anyway!—would raise the value of the GDP deflator but not the CPI.

For example, the annual inflation rate for, say, 2004 is

$$\begin{aligned}
&\text{Inflation during 2004} \\
&= \frac{P_{2004} - P_{2003}}{P_{2003}} \times 100 && (2.14) \\
&= \frac{\text{IPDGDP}_{2004} - \text{IPDGDP}_{2003}}{\text{IPDGDP}_{2003}} \times 100 && (2.15) \\
&= \frac{96.77 - 94.1}{94.1} \times 100 \\
&= 2.8 \text{ percent.}
\end{aligned}$$

{#eq-inflation2004}

America's annual inflation rates, as defined above, are shown in Figure **??** for 1999–2008. Although these inflation numbers are calculated based on the implicit price deflator for GDP as the price level, one could also think of inflation as the annual percentage increase in the consumer price index, which has been discussed above in Section **??**. In practical terms, this does not make much difference to inflation data, especially over longer periods, as you can see in Figure **??**. Over short periods of time, however, inflation measures based on the consumer price index are more volatile, as can be seen in Figure **??**}.

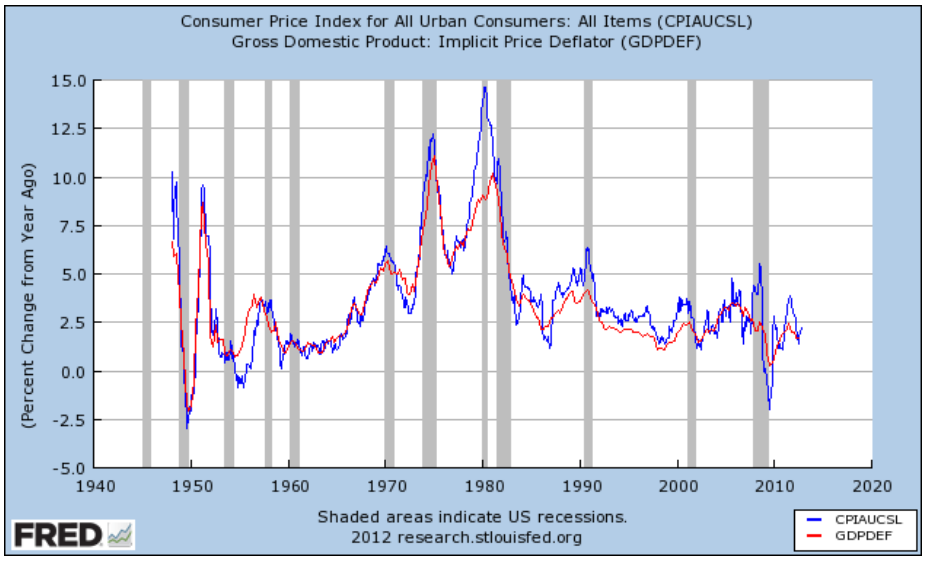

Figure 2.5: Inflation: Two Measures The red graph represents US inflation measured by the year-on-year percentage change in the implicit price deflator for GDP. The blue graph uses the consumer price index (for all urban consumers) instead. Source: Data on the implicit price deflator for GDP was downloaded from http://research.stlouisfed.org/fred2/series/GDPDEF and data on the consumer price index was downloaded from http://research.stlouisfed.org/fred2/series/CPIAUCSL, both on November 25, 2012.

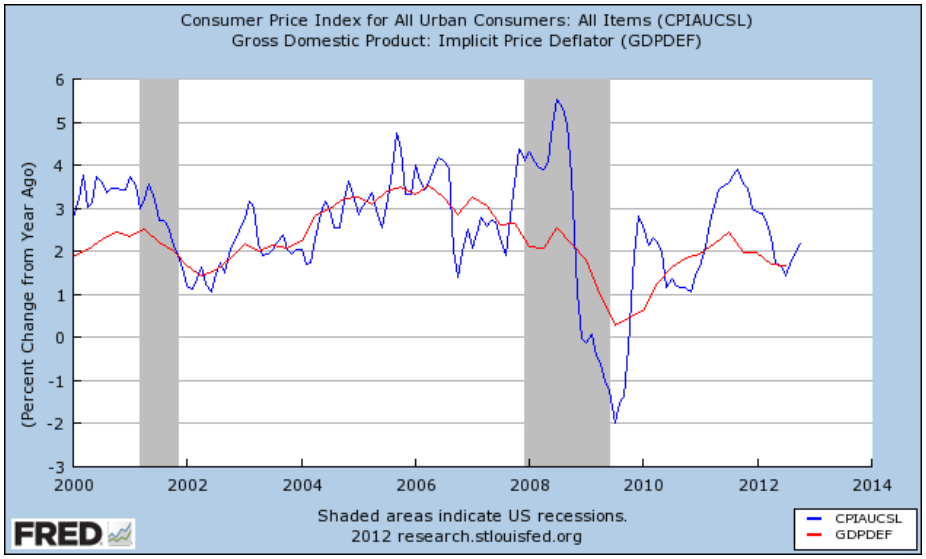

Figure 2.6: **Inflation: CPI Is More Volatile** The red graph represents US inflation measured by the year-on-year percentage change in the implicit price deflator for GDP. The blue graph uses the consumer price index (for all urban consumers) instead. This chart focuses on the 21st century and highlights the volatility of the CPI. Source: Data on the implicit price deflator for GDP was downloaded from http://research.stlouisfed.org/fred2/series/GDPDEF and data on the consumer price index was downloaded from http://research.stlouisfed.org/fred2/series/CPIAUCSL, both on November 25, 2012.

Chapter 3

Balance of Payments Accounts

A country's balance of payments account for, say, 2003 summarizes all economic transactions that took place between its residents and foreign residents during 2003.

The balance of payments accounts consist of the **current account**, the **capital account**, and the **financial account**.

3.1 The Current Account

To keep things simple, let's assume that in every transaction there is one person who hands over some goods, services or assets and another person who pays (for those goods, services or assets) with cash.[1]

Transactions in which *goods or services* are traded between *residents* of America and *residents* of other countries are summarized in America's current account.

[1]By assets I mean *non-cash* assets. It is possible that a US resident might buy some Swedish kroner, which is a cash asset, and just hang on to it. But I will keep things simple by assuming that a US resident who buys some Swedish kroner would immediately spend it on some goods, services or non-cash assets (such as stocks, bonds, the title to a house, etc.) perhaps because she has no use for Swedish kroner in the US. As a result, it makes sense to assume that when cash is offered as payment, it is to buy some non-cash asset. Moreover, although it is possible for Alan to hand over some IBM shares to Betty and get some Google shares in return, not much realism is lost by assuming that Alan gets cash for his IBM shares and then uses the cash to buy Google shares from Betty.

3.2 The Capital Account

The balance of payments accounts also includes the capital account. But I will ignore it because it usually involves small sums of money and is not important for my purposes. According to *International Economics*, 2nd edition, by James Gerber (Addison Wesley; Boston, MA; 2002; page 176), "The capital account includes transfers of specific types of capital, such as debt forgiveness, the personal assets that migrants take with them when they cross international boundaries, and the transfer of real estate and other fixed assets, such as the transfer of ownership of a military base or an embassy."

Prior to 1996 what we now call the financial account used to be called the capital account and used to include what we now call the capital account.

To repeat, I will ignore the capital account. That is, unless I make an explicit statement to the contrary, I will assume that none of the types of international transactions that are formally classified under the capital account are actually taking place.

3.3 The Financial Account

Transactions in which *assets* are traded between residents of America and residents of other countries are summarized in America's financial account.

An **asset** is pretty much anything that you can buy today (if you have some surplus cash) and sell later (if you need some extra cash). If your asset provides some service to someone while you are its owner, you can earn an *income* from your asset. For example, if an American buys a house in Germany, she would be buying an *asset*. And the rental income she earns by renting out the house is her *asset income*. If an American buys a German company's stock, she would be buying an *asset*. And the dividend income she earns (as long as she owns the stock) is her *asset income*. If an American puts money in a German bank, that bank account is an *asset* that will periodically yield interest *income*.

Interestingly, while *international asset trades are recorded in the financial account* of a nation's balance of payments, the *income earned from those assets are considered to be payments for services rendered by the assets and are, therefore, recorded in the current account*. So, an American's purchase of a house in Germany will be recorded in the financial account and any subsequent rental income from that house will be recorded in the current account.

The financial account includes the **Official Reserve Transactions Account**. Most countries have **central banks** that design and carry out their monetary policies. For example, America's central bank is the Federal Reserve (or, simply, the Fed). Central banks often buy and/or sell assets. For example, the Bank of Japan (i.e., Japan's central bank) may buy U.S. Treasury bonds. It may then sell those bonds at a later date if it needs dollars. The assets that central banks typically buy and sell are called **reserve assets**. *International trade in reserve*

assets conducted by central banks is recorded in the official reserve transactions account.

3.4 Credits, Debits, and Balances

Recall that all economic transactions that take place between a country's residents and the residents of other countries are recorded in the country's current, capital, and financial accounts. The recording of these transactions follows strict rules. This section presents a simplified look at the rules of balance of payments accounting.

3.4.1 Which Transactions Are Recorded as Credits?

Recall from Section **??** that I have assumed that in every transaction there is one person who hands over goods, services or non-cash assets (such as stocks and bonds) and another person who pays with cash or check (i.e., money; to economists, both currency and checks count as money). Any transaction resulting in a receipt of money from foreigners is entered in the balance of payments accounts as a credit and is given a positive (+) sign. In other words, any transaction in which we sell (i.e., *export*) goods, services or assets to foreigners is recorded as a *credit*.

3.4.2 Which Transactions Are Recorded as Debits?

Any transaction in which we pay money to foreigners is entered in the balance of payments accounts as a debit and is given a negative (−) sign. In other words, *imports* of goods, services and assets are recorded as *debits*.

3.5 Accounting Rules: Examples

Here are some examples that illustrate the rules of balance of payments accounting that I have discussed above:

- The sale (i.e., export) of a U.S. car to Germany is a *credit* in the U.S. *current* account.
- An American's purchase (i.e., import) of a house in Germany is a *debit* in America's *capital* account.
- The rental income earned by an American from her house in Germany is seen as the *export* of housing services from America to Germany and is, therefore, a *credit* in America's *current* account.
- When a German deposits some extra cash in his New York bank account, it is seen as the purchase by the German (and, therefore, an *export* by America) of an American asset (in this case, the increased value of the bank account) and is recorded as a *credit* in America's *financial* account.