Economics Collection
Philip J. Romero and Jeffrey A. Edwards, *Editors*

Macroeconomics

Integrating Theory, Policy, and Practice for a New Era

David G. Tuerck

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First published in 2015 by
Business Expert Press, LLC
222 East 46th Street, New York, NY 10017
www.businessexpertpress.com

ISBN-13: 978-1-60649-676-3 (paperback)
ISBN-13: 978-1-60649-677-0 (e-book)

Business Expert Press Economics Collection

Collection ISSN: 2163-761X (print)
Collection ISSN: 2163-7628 (electronic)

Cover and interior design by Exeter Premedia Services Private Ltd., Chennai, India

First edition: 2015

10 9 8 7 6 5 4 3 2 1

Printed in the United States of America.

To the memory of my parents,
George and Bertha Tuerck

Abstract

Macroeconomics is the study of the economy as a whole and of work and saving choices of individual economic agents from which macroeconomic activity emerges. This book takes an integrative approach to that topic, showing how short-run and long-run forces operate simultaneously to determine the behavior of key economic indicators such as employment and real, inflation-adjusted GDP. The first goal of macroeconomic policy is to bring real GDP into line with the maximum attainable potential real GDP—the level of real GDP at which there are enough jobs to provide employment for every person who wants to work and at which government has done all it can to eliminate disincentives for workers to seek jobs and for employers to offer them. The second goal is to promote economic growth, which means encouraging innovation and a business climate conducive to innovation. The book corrects a popular view that a protracted economic downturn is necessarily characterized by an excess supply of labor and goods and a need for expansive monetary and fiscal policies. In fact, and as was shown some 40 years ago, the problem could just as well be characterized by an excess demand for labor and goods and a need for contractive monetary and fiscal policy. The macroeconomic challenge consists largely of determining just which of these conditions applies and which policy line is called for. The book examines the policies adopted, first, by the United States and, second, by an additional 20 countries, for their comparative effectiveness in bringing about recovery from the recent Great Contraction. The overall conclusion is that the recovery was stronger in countries that adopted an expansive fiscal policy but held the line on minimum wage increases and safety-net benefits. This reinforces the theory that government policies that create disincentives for firms to hire workers or for workers to take jobs worsen the problem of bringing about economic recovery. As for the Great Contraction, it appears that the downturn was caused by a lack of aggregate demand. At the same time, a plausible argument can be made, for the United States in particular, that the cause was a sharp decline in labor supply. The problem of identifying the cause of economic contraction is, and will remain, a judgment call.

Keywords

aggregate demand, aggregate supply, baseline scenario, chain-weight method, classical tradition, Cobb-Douglas production function, compensated supply curve, consumption tax, contractive monetary and fiscal policy, cost of capital, demand multiplier, depreciation rate, diminishing marginal rate of substitution, excess demand, excess supply, expansive monetary and fiscal policy, flat tax, frictional unemployment, full employment, golden rule of economic growth, Great Contraction, gross national product, income effect, individual equilibrium, interest parity condition, intertemporal elasticity of substitution, INUS, Keynesian scenario, labor force participation rate, labor income, Laffer curve, leisure, long-run aggregate supply, macro foundations, marginal effective tax rate, marginal product, marginal propensity to consume, marginal propensity to produce, marginal rate of substitution, marginal utility, micro foundations, money, natural unemployment rate, net foreign investment, new classical economics, nominal rate of return, non-accelerating inflation rate of unemployment, non-accelerating inflation rate of labor-force participation, output supply multiplier, Phillips curve, potential GDP, present value, purchasing power parity, rate of time preference, real rate of return, replacement rate, repressed inflation, repressed wages, saving rate, self-reliance rate, short-run aggregate supply, stabilization policies, steady state of economic growth, structural unemployment, substitution effect, supply side economics, uncompensated supply curve, unemployment rate

Contents

Acknowledgments

I would like to express my appreciation to a few of the many people to whom I am indebted for help in writing this book and getting it into print. First and foremost, I want to thank my wife Prema Popat, who spent many hours on short notice reading and critiquing the book in its entirety and—to my great benefit—sparing no criticism where it was needed. Next, my thanks go to Theodore Webb III, who helped me by researching the literature, working up spread sheets, and preparing the graphs and who caught many of my mistakes, typographical and otherwise. My colleague, Frank Conte, graduate assistant, Jonis Shehu, and intern, Matthew Dougherty provided valuable assistance in making final edits. Scott Isenberg, Executive Editor at Business Expert Press offered both patience and encouragement as I labored through the manuscript. Philip Romero and Jeffrey Edwards, Economics Co-Editors, provided many helpful suggestions, along with their patience and encouragement. Finally, my thanks to colleague Alison Kelly, whose prodding got me to refocus on this project after many years of hesitation and neglect. The legions of students whose questions and comments helped me organize my thinking are among the people too numerous to be mentioned by name. My thanks go to them, as well.

CHAPTER 1
Introduction

Macroeconomics is the study of the economy as a whole—as distinguished from microeconomics, which is the study of individual consumers, firms, industries, and markets. Microeconomics focuses on the individual economic decision maker (or *agent*) without attempting to take into account the full range of interactions that take place between one decision maker and another. Thus, for example, a study of the excise tax on cigarettes would consider the effect of that tax on the demand for cigarettes, but would not attempt to account for the effects of that tax on the demand for watermelon and the feedback effects on the demand for cigarettes.

When we do macroeconomics, we don't focus on cigarettes or watermelon. But we do focus on the interactions between large aggregates such as gross domestic product (GDP) and the markets for labor and capital. Indeed, we cannot do macroeconomics unless we break the economy into certain, broad constituent sectors and then study how they interact. At the heart of the question of how these sectors interact are the conditions that must prevail so that self-interested decisions of the individual economic agents who interact across these sectors will operate to their mutual advantage.

An economic system is one in which buyers and sellers coordinate their activities through a combination of market and government institutions. For the most part, and throughout the developed world, it is the market on which these individuals mainly rely for the coordination of their activities. There is, to be sure, a great deal of direction that comes from the government. Every country has a government that engages in its own transactions, and in some countries with mostly free economies these transactions account for a large fraction of economic activity. But the vast majority of transactions that take place around the world come about as a result of voluntary exchanges between buyers and sellers. The macroeconomic question is what policies are needed to make this system work effectively and what policies are called for when the system breaks down—as it surely can and will from time to time.

The possibility of system breakdown gives a second meaning to macroeconomics. Indeed, the field came into being from a book called *The General Theory of Employment, Interest, and Money,* published by John Maynard Keynes in 1936, which was all about how the economic system in place at the time broke down and deteriorated into a worldwide depression (Keynes 1936). Keynes did not use the word macroeconomics—that came later.[1] But he did set the stage for a formal theory of the economy in which wage and price adjustments that normally keep the economy at *full employment* (a term on which we elaborate below) fail and leave the economy in a state that calls for government intervention in the form of expansive monetary and fiscal policy. Government policies aimed at correcting the failure of an economic system to achieve full employment are frequently referred to as *stabilization policies*, connoting the idea that it is the job of the government to stabilize the economy at a level that brings about full employment.

From this Keynesian perspective, the distinction is between conditions that require no intervention by the government for the economy to function well (given that there will always be government interventions such as taxes and welfare benefits that affect the performance of the economy) and conditions that call for government deficits or an expansive monetary policy, that is, stabilization policies. A substantial part of this book is aimed at showing that a badly performing economy might just as well call for government surpluses or a contractive monetary policy.

There are therefore two ways of looking at the study of macroeconomics: (1) as a study of broadly defined economic sectors and how they interact, and (2) as a study of the breakdown in the process by which these sectors interact. Both approaches characterize the study of macroeconomics, and both will apply here. We are interested in the interactions between component parts of the economy under what we will call

[1] According to macroeconomist Kevin Hoover, the first person to use the term was the Norwegian economist (and future Nobel laureate) Ragnar Frisch in a lecture given in 1931 (Hoover 2008, 332).

long-run or classical conditions *and* also in identifying the appropriate policy response when the decentralized price system breaks down and the economy falls into a period of subpar performance, that is, a recession or depression. In practice, such periods are referred to as the *short run*, even if they can last for many years, and call for a particular set of remedies that have to do with manipulating aggregate demand and supply. This is in contrast to the *long run*, when the (mostly) unregulated price system performs normally and the emphasis is on aggregate supply.

One respect in which this book differs from others has to do with the contention here that policy makers have to determine not only when the price system has broken down and thus when there is a case for the application of government stabilization measures, but also just *how* that system broke down and just what kind of intervention—expansive or contractive—is called for. Oddly for the many volumes of thought that the Keynesian revolution (and it was a revolution) produced, the debate since Keynes wrote the *General Theory* has been mostly over the simple question whether Keynes was right in his diagnosis of system failure and, if he was right, whether his offered remedies would work or not.

There wasn't a lot of debate over either question well into the 1960s. Most economists believed that Keynes was right on both counts. As Keynes saw it, his job was to debunk a *classical* tradition according to which observed deviations of economic activity from some normal state are self-correcting. The idea that a depressed economy would automatically right itself—insofar as anyone actually believed that at the time—had been rendered indefensible by the prolonged and severe economic downturn that began in 1929 and was at its height when Keynes published his book.

Beginning in the late 1960s, however, a counterrevolution was launched that challenged Keynes's ideas. This counterrevolution spawned a *new classical* economics, which argued that Keynes's remedies for a failing economy were likely to be ineffectual and unnecessary. This school of thought succeeded in stripping Keynes of much of his intellectual authority, at least until the recession that began in December 2007 and whose effects still linger today. It is safe to say that, until the downturn, the exponents of the new classical economics and their allies from various sub branches of this line of thinking carried the day.

I will state upfront that I subscribe to this new classical school, insofar as I think that it has much to say about improving both short-run and long-run economic performance, especially through tax and welfare reform. Thus, the first eight chapters of this book are focused on explicating a *classical* world, in which the economy is performing normally (which is to say, it hasn't broken down owing to imbalances between aggregate supply and demand) and will respond positively to incentive-producing tax changes. The remaining chapters consider policies that are appropriate for correcting protracted periods of low employment.

I do not believe that protracted periods of low employment are a thing of the past (especially in the light of recent economic events) or that Keynes's prescriptions for righting a slumping economy are always wrong. What I do believe is that, while Keynes's prescriptions are sometimes right, they can also be just the opposite of what is called for.

A line of theorizing that emerged in the 1970s provides the basis for this assertion (Barro and Grossman 1976). The conclusion to which that line of theorizing leads is that the remedy for a sustained downturn might be government intervention through *contractive* monetary and fiscal policy. The intellectual foundations for this possibility have been in place for decades although much ignored.

Keynes's core idea was that a sudden, unanticipated fall in the demand for goods could create a state of affairs in which the economy would sink into a long-lasting slump. This fall in demand could come from various sources. (The fact that the U.S. money supply shrank by about a third during the Great Depression certainly suggests that a fall in aggregate demand was a principal cause of that downturn.) If a downturn occurs because of a fall in aggregate demand that came about because of monetary contraction, falling exports, a housing crisis, a related financial crisis, or any other such cause or combination of causes, then the obvious remedy is for the government to increase demand through expansive monetary and fiscal policy.

While there are differing views on how an unwanted decrease in demand could lead to economic collapse, the view adopted here is that it would happen because of a failure of wages and prices to adjust downward as needed to restore the demand for goods and labor. Unless prices and wages fall in tandem, firms cannot find enough buyers to buy their goods and workers cannot find enough employers to use their services. Failing a downward, parallel adjustment in prices and wages, there would emerge an excess supply of both goods and labor and a necessity for the government to restore aggregate demand through the adoption of expansive monetary and fiscal policies. Keynes saw this as the cure for the downturn in the midst of which he wrote his book.

The new classical response has been to argue that expansive monetary and fiscal policies will fail in their purpose once they are known, since individual economic agents will adjust their behavior in such a way as to defeat the purpose for which the policies are implemented. (Chapters 9 and 10 explore this possibility.) A collateral proposition is that the government should focus its attention not on the demand side but on the supply side of the economy, where it can improve the performance of the economy by reducing distortions in economic activity, particularly in the form of taxes.

The ordinary way of putting the distinction between Keynesian and new classical thinking is to recognize two states in which the economy can exist. One state—the classical state—represents the long run in which markets clear through appropriate price and wage adjustments and in which improvements in tax policy and other policies can yield benefits in the form of certain efficiency gains. (In fact, I give a lot of attention to this state.) The other state—the Keynesian state—represents the short run, when price and wage rigidities prevent markets from clearing and give rise to a fall in the demand for goods and labor. The trick is to recognize which state the economy is in and to apply the appropriate remedies.

In an article entitled "The Economy Needs More Spending Now," economist Alan S. Blinder offers exactly this characterization of the long-run and short-run distinction (Blinder 2013). "Poor economic policy," he argues, stems, among other things, from "the failure to distinguish between the short-run and the long-run effects of particular policies."

In the short run, Blinder says, "deficit reduction slows growth by cutting the economy's total spending." This is to be contrasted with the long run, during which deficits can lead to higher interest rates and reduced investment. "Long-run growth," Blinder writes, "is supply-determined. It depends on an economy's ability to produce more goods and services from one year to the next." The long run is all about utilizing "inputs more efficiently" to get the greatest attainable output.

> In the short-run, however, output is demand determined. The big question is how much of the country's productive capacity is used. And that depends on the strength of demand—the willingness of businesses, consumers, foreign customers and governments to buy what American businesses are able to produce. (Blinder 2013)

Two Views of the Short Run

By the above argument, the short-run problem arises when the supply of goods and labor exceeds demand: The quantity of labor services demanded by firms is less than the quantity workers want to provide, and the quantity of goods demanded by consumers is less than the quantity firms want to provide.

What Blinder ignores, however, is an equally plausible short-run problem that arises when demand exceeds supply. The economy can suffer a downturn in production and employment because workers offer fewer labor services than firms want to hire and because firms offer fewer goods than consumers want to buy. Chapter 9 will show how both scenarios—generalized excess supply and generalized excess demand—are consistent with short-run economic decline.

Keynesians emphasize the scenario in which supply exceeds demand and in which prices and wages fail to adjust downward. That is why Blinder characterizes short-run unemployment as a demand-side problem: If the economy is suffering a protracted bout of low employment and production, it must be because aggregate demand is too low relative to aggregate supply, requiring a cure in the form of government policies, for example, deficits that will boost aggregate demand.

This, however, ignores the possibility that short-run low employment can present its own supply-side problem. This would occur because prices and wages failed to adjust *upwards*, as they should in response to an increase in aggregate demand, in order to bring aggregate supply into line with aggregate demand. This is often referred to as a case of *repressed inflation*, a name that it gets from wartime experiences with price controls.

As we go forward, we will see that the same phenomenon can result not only from price controls, but also from a failure of the economy to generate wage and price increases that are needed to keep aggregate supply in line with aggregate demand.

I believe that this scenario can be better described as *repressed wages* than as repressed inflation. A repressed wages scenario could develop either because of failure on the part of employers to raise wages in line with rising prices or due to other factors that prevent wages from rising in tandem with prices as aggregate demand rises.

Once we admit the possibility of repressed wages, we have to consider the fact that a protracted downturn could be the result of too much, rather than too little, aggregate demand. There can be subnormal production and employment if either aggregate supply exceeds aggregate demand or aggregate demand exceeds aggregate supply. In any economic downturn, there are clues as to which it might be—excess supply or excess demand—but often there will also be evidence that supports either interpretation.

A Revised View of the Long Run

This book focuses on macroeconomic policy and therefore gives attention both to policies that are effective in the long-run normal times and to policies that are needed in the short-run abnormal times. From the foregoing discussion, it is clear that in order to conduct this inquiry, it will be necessary to clean up some terminological confusion. First, it turns out that what we have come to call the *supply-side* approach to macroeconomic policy is mislabeled. That's because there exists the possibility of a supply-side problem that has nothing to do with using inputs more efficiently, but rather stems from a supply shortfall brought about by the maladjustment of prices and wages.

Henceforth, we will simply refer to solutions aimed at increasing economic efficiency as classical solutions, since the classical model assumes away the possibility of sustained excess supply or excess demand. We will give a great deal of attention to how the government can expand the economy by employing classical solutions, particularly solutions of the kind that consist of reducing distortions in the price system brought about by taxes.

However, when there is a failure of prices and wages to adjust and therefore a protracted downturn in the economy, there is a case for non-classical solutions in the form of expansive or contractive monetary and fiscal policy, whichever may be called for. Then the need will be for a correct diagnosis of the problem (too little demand or too little supply) and the application of the appropriate remedies.

By looking at the problem in this manner, we undertake a radical departure from conventional books on macroeconomics. Authors traditionally take the approach taken by Blinder in his *Wall Street Journal* article. In this traditional approach, there is only one diagnosis to perform, which is to answer the question whether the moment is right for a *demand-side* or for misnamed *supply-side* remedies.

This book approaches the problem differently. Having renamed as the classical approach what Blinder and many others call the supply-side approach, we first examine the economy under classical assumptions and consider the policies that are available to improve economic efficiency and through which to increase what we will call *long-run aggregate supply*. We next consider whether non-classical remedies—expansive or contractive monetary and fiscal policy—are called for.

In order to avoid terminological confusion, the book will recognize a distinction between two kinds of economic subperformance: (1) short-run (though, possibly protracted) subperformance brought about by imbalances between *aggregate* supply and demand and (2) long-run subperformance brought about by imbalances between *individual* supply and demand in the markets for labor and capital. In discussing the first kind of subperformance, we will distinguish between imbalances attributable to excess aggregate supply (the Keynesian scenario) and imbalances attributable to excess aggregate demand (the repressed wages scenario). In discussing the second kind of subperformance, we will characterize the problem as one that stems from government-imposed distortions in the price system.

The Great Contraction of 2007–2009 appears to have resulted from a Keynesian-type reduction in aggregate demand. In Chapter 12, we see evidence that the weakness of the ensuing recovery was attributable to a failure on the part of the government to adopt a sufficiently expansive policy response. Yet the evidence is not unambiguous. Given the distortions in the price system created by safety-net measures that took place concurrently with the downturn, it is possible that a contractive policy was called for. These competing explanations exemplify the difficulty policy makers encounter in their efforts to hit upon the correct response to an economic downturn.

Organization of the Book

First, a word of warning. This book is not going to be useful if the reader is unwilling to wade through some math and graphics. It is intended to be accessible to anyone who can remember his high school algebra. Such calculus as there is appears in an appendix and in footnotes. Yet the book is not for light reading during train or air travel. Better to enjoy the movie than to tackle this project. I hope, of course, that many readers will not be deterred and will wade through to the end.

Why all the math? The reason is that, without the math, the reader, to be blunt, will continue to be vulnerable to the great amount of folklore that continues to misinform just about everyone's understanding of the topic—and this, I am sorry to say, includes some distinguished macroeconomists. The math notwithstanding, the book should serve as a principal or supplementary text for Intermediate and Master's level courses in macroeconomics.

The book can be divided into six principal topics: (i) macro preliminaries (Chapters 1 and 2), (ii) micro foundations (Chapters 3 and 4), (iii) supply and demand for labor and capital (Chapters 5 and 6), (iv) fiscal and tax policy (Chapters 7 and 8), (v) competing theories of persistent unemployment (Chapters 9 and 10), and (iv) recent evidence and conclusions (Chapters 11 to 13).

Chapter 2 identifies the key economic indicators by which we measure the performance of the macroeconomy—notably real GDP and employment. Chapter 3 gets into the weeds of the classical model. Taking a micro foundations approach it takes up a two-period model in which the individual must solve two problems: how to divide current time between leisure and work and how to divide current income between consumption and saving. Chapter 4 elaborates on the second problem by generalizing the individual's choice calculus to incorporate a planning horizon of any length, which means that it takes the individual saver from a two-period to an *n*-period model. Chapter 5 extends the analysis of Chapter 4 to incorporate the firm's investment calculus. There we work out the conditions under which the choices of the supplier of capital (the saver) are coordinated with the decisions of the user of capital (the firm) to bring about an equilibrium capital stock.

Chapter 6 returns to the work and leisure calculus and shows how the supplier of labor (the worker) coordinates his decisions with the user of labor (the firm). In that chapter, we generalize the analysis to incorporate economic growth and work out the conditions that must apply for economic growth to take place.

Chapter 7 brings the government into the picture by considering how government deficits (and, by implication, surpluses) affect economic activity. There we continue in the classical tradition by arguing that government deficits ordinarily have little effect, positive or negative, on economic activity, provided that the government is perceived as a credit-worthy borrower.

Chapter 8 considers another important aspect of government policy, which is to say, tax policy. In that chapter, we consider how taxes on labor and capital income create a *wedge* between the before- and after-tax return to work and saving and, in the process, shrink the amount of labor and capital supplied and used in production. The chapter concludes with a consideration of how proposals to *untax* net investment would expand the supply of capital and therefore economic activity.

Chapters 9 and 10 take a *macro foundations* approach by considering the question of how the failure of wages and prices to adjust to changing economic conditions can lead to a protracted spell of low employment. Chapter 9 examines the conditions under which the classical assumptions of the preceding chapters apply, which is to say, conditions necessary for equality between aggregate supply and demand. It then examines the conditions under which either aggregate supply exceeds aggregate demand (the *Keynesian scenario*) or aggregate demand exceeds aggregate supply (the *repressed wages scenario*) and considers the policy responses appropriate to both. Chapter 10 extends the analysis to consider the problem the government faces in diagnosing the root cause for an observed fall in economic growth. Failure to diagnose the problem correctly can lead to a misapplication of the policy options available to the government.

Chapter 11 considers the Great Contraction of 2007–2009 as an example of exactly such a misapplication. The recovery from that recession continues to be exceptionally weak. Drawing on the work of economist Casey Mulligan, Chapter 11 pulls together evidence showing the Great Contraction to have been aggravated by the expansion of the government safety net and by a tepid response in the form of expansive fiscal policy. Chapter 12 examines the experience of 21 countries in reacting to the Great Contraction. There it is observed that countries with the best economic records implemented expansive macroeconomic stabilization measures while avoiding politically popular increases in safety-net benefits and the minimum wage. Chapter 13 sums up the preceding chapters.

It is hoped that the reader of this book will come away from it with a solid understanding of the micro foundations of macroeconomic analysis and, from that understanding, acquire a more sophisticated appreciation of the role of tax and fiscal policy in macroeconomic policy analysis. It is also hoped that he or she will come away from it with an understanding of how economic systems can slump into a protracted downturn and how, in forging the appropriate policy response to that downturn, it is important to diagnose correctly the cause of the downturn.

The book offers, as the title suggests, an integrative approach to its subject. Ever since Keynes's work, there has been tension between Keynesian and classical elements of macroeconomic theory. The goal here is to integrate these elements into a more internally consistent approach to the subject matter. More generally, the goal is to integrate the short-run and the long-run elements of macroeconomic activity and policy so as to avoid the approach common to other books, which is to take the reader through a series of alternative, disjointed models that leave the reader puzzled about which model works best.

This is not at all to say that I have been able to create a window to the world through which all macroeconomic reality can be seen clearly. On the contrary, I close with the warning that the evidence may point to many, equally plausible explanations of economic activity and as many plausible government policy options.

Indeed, I foresee a new era macroeconomic policy and practice—one in which policy makers will have to make, at best, informed conjectures about how best to deal with periods of protracted low employment. Contrary to conventional wisdom on this matter, there will be the difficult problem of choosing between expansive or contractive monetary and fiscal policy.

As the reader will see, however, the book does not take some relativistic approach, according to which one policy is as good as another. A view much emphasized in the concluding chapters is that the government's capacity to alleviate short-run problems is enhanced by its willingness to reduce distortions in the price system that worsen economic conditions both in the long run and the short run. Keynes is often quoted as saying that "in the long run we are all dead." True as that is, during the short run, when we are still alive, there is much about the long run that matters for how well we live—and how good we are at making macroeconomic policy.

CHAPTER 2

Macro Measurements

There are numerous ways to assess the performance of the macroeconomy. Toward the beginning of every month, the U.S. Bureau of Labor Statistics provides estimates of what might be the most commonly cited measures of macroeconomic performance—the number of jobs created or lost and the unemployment rate of the preceding month. The attention given to these numbers reflects the Keynesian-inspired preoccupation with jobs or, more precisely, with the failure of the private sector to *create* enough jobs to eliminate the excess supply of labor brought about by a lack of aggregate demand.[1]

As fascinated as politicians and the public might be with the jobs numbers, there is a more comprehensive measure issued every calendar quarter, and that is the growth of real, inflation-adjusted gross domestic product (GDP) during the preceding quarter. Economists refer to this indicator to assess macroeconomic performance.

GDP is the market value of final goods and services produced within a country over a year's time. Although it is the most commonly used measure of macroeconomic performance across the globe, GDP has come in for criticism in recent years as a macroeconomic indicator.

In his book, *Gross National Happiness*, Arthur C. Brooks claims that it is happiness that matters and that happiness has little to do with GDP but depends more on the nation's commitment to spiritual and family values.

> The astronomical rises in American GDP reflect the fact that, as a nation, we are creating huge amounts of value—we are the most

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[1] It's a characteristic of this preoccupation to ignore the possibility that there are fewer jobs than we might wish because there are too few workers who want to work. We will comment at length about this possibility in future chapters.

> successful nation on earth. Yet … happiness *doesn't* follow GDP growth over time. In the United States, our gross national happiness has remained essentially static for the past three decades. (Brooks 2008, 124–25; emphasis original)

In 2008, President Nicholas Sarkozy of France commissioned a group of scholars to produce a report in which they would identify "the limits of GDP as an indicator of economic performance and social progress" (Stiglitz, Sen and Fitoussi 2010, 2). A key finding was "that the time is ripe for our measurement system to *shift emphasis from measuring economic production to measuring people's well-being*" (Stiglitz, Sen and Fitoussi 2010, 10; emphasis original). Alternative measures of well-being include consumption and household income, household wealth, the distribution of income and wealth, and nonmarket services that households provide for themselves (Stiglitz, Sen, and Fitoussi 2010, 1, 10–14). The shift from the production of goods to the production of services and the growing importance of services provided by the government make it imperative to reexamine what amounts to an increasingly antiquated method of measuring macroeconomic performance, or so the authors claim.

Crocodiles and GDP

A few years ago, I spent a week in Ghana, where I witnessed poverty of the kind that would jar any American. One day, I was eating lunch at a restaurant that my travel companion and I chose because it was built over a pond infested with crocodiles. (You don't get that eating at McDonald's in the United States.) As I ate, I happened to see two boys go down to that pond to fetch water, possibly for their mother's laundry. As I watched, I prayed that the crocodiles were too busy eating morsels tossed to them from the restaurant customers to attack the boys. And I thought of my own grandsons whose mother wouldn't let her children near the shallow end of the baby pool without all kinds of floating gear attached.

I relate this story to point out that it means something to say that the GDP per capita of the United States is about 32 times the GDP per capita of Ghana. We need comparisons like that because anecdotes about crocodiles are not enough to make economic policies. We need some way to track the difference it makes for individual living standards for government to implement policies that are intended to increase what we call *real* GDP (discussed in the next section). The question is not whether a single number will do but just what number best represents what it is that we are trying to measure. GDP is still that number.

This book, therefore, focuses on GDP and does so unashamedly. Yes, it is easy to cite examples of how GDP provides a misleading measure of economic performance and indeed, happiness. The destruction of the World Trade Center added billions of dollars to GDP in the form of construction costs for the new tower. Automobile accidents increase GDP by requiring the services of ambulances, doctors, car repair shops, and lawyers. Hard as it is to believe, the royalties paid to rap performers add to GDP. Drug deals that take place in the underground economy go uncounted. But these anomalies do not undermine the importance of measuring economic activity that does take place and, as puzzling as it often seems, in response to consumer demand. There is no conflict between the broad policy of increasing real GDP growth and the importance of discouraging terrorist attacks, traffic accidents, and loud, unpleasant noise masqueraded as music.

The problem with critiques such as those offered by Brooks and by the Sarkozy commission is that they make perfect sense without providing a useful alternative to GDP as a measure of economic performance. “Well-being is multidimensional,” say the authors of the Sarkozy report (Stiglitz, Sen, and Fitoussi 2010, 15). Well, yes, but that’s just the problem. Once we expand the measurement of economic performance to encompass indicators such as “political voice and governance” and “social connections and relationships,” any hope of identifying policy changes that rather clearly improve or worsen macroeconomic performance is lost. To muse about social connections is to drift off into speculations about matters best left to social psychologists.

Nominal versus Real GDP

Let’s consider a country that has two goods, A and B, which are produced over a span of two years. Table 2.1 provides data on the quantity of each good produced and the price at which it is sold each year. We see

Table 2.1 Prices and quantities, years 1 and 2

	Year 1	Year 2
Price ($) of good		
A	$1.00	$2.50
B	$2.00	$2.75
Quantity of good		
A	60	65
B	70	90

that $60.00 (= $1.00 × 60) worth of good A was produced in year 1 and $162.50 in year 2. Thus, in *nominal* dollars, production increased by 171 percent. But not all of this increase was *real*. The number of units produced rose by only 8.3 percent (from 60 to 65). The rest of the increase in nominal output was inflation—the rise in price from $1.00 to $2.50. Similarly, the production of good B, in nominal dollars, rose from $140.00 to $247.50. Part of this was real—the rise in output from 70 to 90 units—and part inflation—the rise in price from $2.00 to $2.75.

The first row in Table 2.2 provides calculations of nominal GDP [symbolized by the Greek letter Ψ (psi, pronounced as "sigh")] for each of the two years. Nominal GDP equals the market price of each good multiplied by the quantity produced and summed over all goods.

Nominal GDP numbers are useful, but only insofar as we can divide them into their real and inflation components. The problem for the economists at the Bureau of Economic Analysis (BEA) is how to do this, given that both the prices and the mix of goods making up GDP change from year to year.

The BEA used to calculate real GDP by picking a base year and then using the prices in that year to weigh quantities produced for subsequent years. This is called the fixed-weight (FW) method, as illustrated in row 2 of Table 2.2, where we provide calculations of real GDP, using year 1 as the base year. What this means is that we calculate real GDP for both years using current year quantities but year 1 prices. Because year 1 is chosen as the base year, nominal and real GDP for year 1 are the same. But real GDP differs from nominal GDP for year 2, insofar as we use year 1 prices to calculate the former and year 2 prices to calculate the latter.

Table 2.2 Calculating real GDP

1	2	3	4
	Year 1	**Year 2**	Y_2/Y_1
1. Nominal GDP (Ψ)	$P_{A1} \times Q_{A1} + P_{B1} \times Q_{B1}$ $\$1 \times 60 + \$2 \times 70 = \$200$	$P_{A2} \times Q_{A2} + P_{B2} \times Q_{B2}$ $\$2.50 \times 60 + \$2.75 \times 90 = \$410$	$\frac{\$245}{\$200} = 1.2250$
2. Real GDP (Y), FW(1)	$P_{A1} \times Q_{A1} + P_{B1} \times Q_{B1}$ $\$1 \times 60 + \$2 \times 70 = \$200$	$P_{A1} \times Q_{A2} + P_{B1} \times Q_{B2}$ $\$1 \times 65 + \$2 \times 90 = \$245$	
3. Real GDP (Y), FW(2)	$P_{A2} \times Q_{A1} + P_{B2} \times Q_{B1}$ $\$2.50 \times 60 + \$2.75 \times 70 = \$342.50$	$P_{A2} \times Q_{A2} + P_{B2} \times Q_{B2}$ $\$2.50 \times 65 + \$2.75 \times 90 = \$410$	$\frac{\$410.00}{\$342.50} = 1.1971$
4. $\hat{Y}$, CW			$\sqrt{(1.2250 \times 1.1971)} = 1.209$
5. Real GDP (Y), CW Base year is year 1	$P_{A1} \times Q_{A1} + P_{B1} \times Q_{B1}$ $\$1 \times 60 + \$2 \times 70 = \$200.00$	Y in base year $\times (1 + \hat{Y})$ $\$200 \times (1 + 0.209) = \$241.80$	

In the parlance of national income and product accounting, we use year 1 prices as weights in calculating real GDP.

At this point, it is useful to mention that, in calculating real GDP, size matters only insofar as we need it to determine the growth of real GDP from one year to the next. Thus, using the FW(1) method, which uses year 1 prices as weights, we find that real GDP grew by 22.5 percent $\left(= \frac{\$245}{\$200} - 1\right)$ from year 1 to year 2 (see Table 2.2 row 2, column 4).

The problem with this approach, quite obviously, is that it puts too much emphasis on year 1 prices. The consequence is an exaggeration of the measured growth in real GDP. (Consider what it would mean to use five-year old prices in measuring the contribution to current GDP of smartphone services, whose price, thanks to Wal-Mart and other vendors, has gone down in recent years as the number of services used has dramatically risen.)

We could approach this problem by using year 2 prices instead of year 1 prices as weights. Now under the FW(2) method, nominal and real GDP are the same for year 2, whereas year 1 real GDP differs from year 1 nominal GDP. Using this method, the growth of real GDP is measured as 19.71 percent $\left(= \frac{\$410.00}{\$342.50} - 1\right)$, as shown in row 3, column 4 of Table 2.2.

The current approach combines FW(1) and FW(2) methods to create the *chain-weight* (CW) method in which the BEA annually updates both prices and quantities. This is the geometric mean of the growth of FW(1) GDP and FW(2) GDP, which is calculated as shown in row 4, column 4 of Table 2.2. This method shows that real GDP grew by 20.9 percent $\left(= \sqrt{(1.2250 \times 1.1971) - 1}\right)$ from year 1 to year 2.

With year 1 as the base year, we see that real GDP in year 2 is now calculated as year 1 real GDP times one plus the CW growth rate of real output.

$$Y = \$200 \times 1.209 = \$241.80. \qquad (1)$$

In the National Income and Product Accounts (NIPA), the current base year is 2009. Thus, in Table 2.3, nominal GDP, Ψ, and real GDP,

Table 2.3 U.S. GDP data ($ billions)

Year	Ψ	$\hat{\Psi}$	Y	$\hat{Y}$	P	$\hat{P}$
1999	$9,666	NA	$12,071	NA	0.80	NA
2000	$10,290	6.46%	$12,565	4.09%	0.82	2.50%
2001	$10,625	3.26%	$12,684	0.95%	0.84	2.44%
2002	$10,980	3.34%	$12,910	1.78%	0.85	1.19%
2003	$11,512	4.85%	$13,270	2.79%	0.87	2.35%
2004	$12,277	6.65%	$13,774	3.80%	0.89	2.30%
2005	$13,095	6.66%	$14,236	3.35%	0.92	3.37%
2006	$13,858	5.83%	$14,615	2.66%	0.95	3.26%
2007	$14,480	4.49%	$14,877	1.79%	0.97	2.11%
2008	$14,720	1.66%	$14,834	–0.29%	0.99	2.06%
2009	$14,418	–2.05%	$14,418	–2.80%	1.00	1.01%
2010	$14,958	3.75%	$14,779	2.50%	1.01	1.00%
2011	$15,534	3.85%	$15,052	1.85%	1.03	1.98%
2012	$16,245	4.58%	$15,471	2.78%	1.05	1.94%
2013	$16,803	3.43%	$15,767	1.91%	1.06	0.95%

Source: U.S. Bureau of Economic Analysis (www.bea.gov)

Y, are shown as the same in 2009. Using the formula provided above, the CW growth of real GDP, $\hat{Y}$, from 2009 to 2010, was 2.5 percent, so that the real GDP of 2010 was $14,779 (= $14,418 × 1.025).

We can now use this method to divide nominal GDP growth into real GDP growth and inflation. We begin with the formula

$$\Psi = PY, \tag{2}$$

which means that the nominal GDP equals the price level times real GDP. Applying this formula to 2010, we get

$$\Psi = 1.01 \times \$14{,}779 = \$14{,}958 \text{ (before rounding)}. \tag{3}$$

We can think of real output, Y, as nominal output, Ψ, divided by the price level, P.[2] Also the growth (percentage change) of nominal output, $\widehat{\Psi}$, is the sum of the growth of P and of the growth of Y:

$$\hat{\Psi} = \hat{P}\hat{Y}. \quad (4)$$

Thus, in 2010,

$$\widehat{\Psi} = 1.01\% + 2.50\% \approx 3.75\%.^{3} \quad (5)$$

These formulas become important in subsequent chapters, where we discuss the sources of real GDP growth and inflation.

Expenditure Approach to GDP

In a simplified model of the world, GDP can be thought of as either of the two sides of an accounting statement. On one side, we add up all the production that takes place as a result of domestic and foreign expenditures on goods produced in the home country. On the other side, we add up all the income that is generated as a result of these expenditures. Let's start with the expenditure side of this statement. Table 2.4 breaks down GDP into its principal expenditure components. Personal consumption expenditures (C) are purchases of goods and services by persons. Gross private domestic investment (I) equals net private domestic investment plus the consumption of private fixed capital or depreciation (D):

$$I = \text{Net } I + D = \$\ 527 \text{ billion} + \$2{,}121 \text{ billion} = \$2{,}648 \text{ billion}. \quad (6)$$

If Net I is the change in the capital stock, then

$$I = \Delta K + D. \quad (7)$$

Private fixed investment consists of private purchases of residential and nonresidential structures and of capital equipment and computer software. Private and government purchases of capital goods are

[2] P is called the *implicit price deflator* in the NIPA.

[3] In fact, this adds up to 3.51 percent, not 3.75 percent. The discrepancy results in part from rounding errors and in part because of the way we compute percentage changes. The discrepancy would be smaller if we did not use rounded numbers and if we computed the percentage change using logarithms.

Table 2.4 Expenditure components of U.S. GDP 2013*

Component	$ billions	As a % of GDP
Gross domestic product (GDP)	16,768	100
Personal consumption expenditures (C)	11,484	68
+ Gross private domestic investment (*I*)	2,648	16
Net domestic investment (Net *I*)	527	3
+ Consumption of private fixed capital (*D*)	2,121	13
+ Government purchases (G)	3,144	19
Government consumption expenditures (GC)	2,548	15
+ Gross government investment (GG*I*)	596	4
+ Net exports (*NX*)	–508	–3
Exports (*X*)	2,262	14
– Imports (M)	–2,770	–17

Source: U.S. Bureau of Economic Analysis (www.bea.gov).

*All data are in nominal dollars. Some numbers in this and subsequent tables may not add up due to rounding.

called capital spending. We have to include depreciation when calculating capital spending since a portion of that spending goes to replace depreciated capital. Only the remaining portion can be counted as net investment.

Net exports (NX) are exports minus imports, where exports (X) are goods and services bought by foreign residents from home country residents, and imports (M) are goods and services bought by home country residents from foreign country residents:

$$NX = X - M = \$2{,}262 \text{ billion} - \$2{,}770 \text{ billion} = \${-508} \text{ billion}. \quad (8)$$

As the reader can see, personal consumption expenditures (C) is by far the largest component of GDP. Government consumption expenditures, which represent about the same share of GDP as gross private domestic investment, consist of compensation paid to government employees and purchases of intermediate goods and services. Government gross investment (GGI) is government spending on structures and equipment. We designate the sum of government purchases as G:

Table 2.5 The government sector 2013 ($ billions)

Net government saving (*NGS*)	–874
Total government income (*GINC*)	4,789
Taxes (*TAXES*)	3,284
+ Contributions for social insurance (*SS*)	1,110
+ Other government income (*OTHER INC*)	395
Total government current expenditures (*GEXP*)	5,663
Government consumption expenditures (GC)	2,548
+ Transfer payments (*TR*)	2,437
+ Interest payments (*INT*)	618
+ Subsidies (*SUB*)	60

Source: U.S. Bureau of Economic Analysis (www.bea.gov)

$$G = GGI + GC = \$596 \text{ billion} + \$2{,}548 \text{ billion} = \$3{,}144 \text{ billion}. \quad (9)$$

This part of government spending is not to be confused with government expenditures that consist of funds that the government simply takes from taxpayers and provides to recipients, without any provision of goods and services in exchange. These funds are identified in Table 2.5 as transfer payments (*TR*), which are mainly social benefits distributed to U.S. residents, interest payments on government debt (*INT*), and government subsidies (*SUB*). It is notable that only about half of current government spending goes for purchases of goods and services, while the rest goes for social benefits, interest on the debt, and various subsidies.

We can measure GDP in terms of its expenditure components. Using Ψ, again, as nominal GDP we get

$$\Psi = C + I + G + NX = \$11{,}484 \text{ billion} + \$2{,}648 \text{ billion} + \$3{,}144 \text{ billion} - \$508 \text{ billion} = \$16{,}768 \text{ billion}. \quad (10)$$

Income Approach to GDP

Now let's approach the calculation of GDP, which we continue to designate as Ψ, from the income, as opposed to the expenditure, side of the ledger (see Table 2.6).

Table 2.6 GNP and income 2013 ($ billions)

Gross national product (GNP)	16,992
Gross domestic product (GDP)	16,768
+Net receipts of factor income from the rest of the world (*NRFI*)	224
Net national product (NNP)	14,365
Gross national product (GNP)	16,992
−Consumption of fixed capital (*CFC*)	2,627
National income (*NIN*)	14,577
Net national product (*NNP*)	14,365
−Statistical discrepancy (*STAT*)	–212
Personal income (*PIN*)	14,167
Disposable personal income (*DIN*)	12,505
Personal income (*PIN*)	14,167
−Personal tax and nontax payments (*PT*)	1,662

Source: U.S. Bureau of Economic Analysis (www.bea.gov)

GDP measures production that takes place within the home country. Gross national product (GNP) measures production by home country residents. The difference is the net receipts of factor income from the rest of the world (*NRFI*).

$$\text{GNP} = \text{GDP} + NRFI = \$16{,}768 \text{ billion} + \$224 \text{ billion} = \$16{,}992 \text{ billion.} \tag{11}$$

GNP and GDP differ insofar as some home country production provides income to foreigners and some foreign production provides income to Americans. Thus, income earned by Germans from Volkswagens produced in the United States is part of U.S. GDP but not U.S. GNP. Incomes earned by Americans on Apple products produced in China are part of U.S. GNP but not U.S. GDP.

Net national product (NNP) is GNP minus depreciation (consumption) of private and government fixed capital. National income equals the sum of all incomes—wages, interest, profits, and rents—and equals NNP except for a statistical discrepancy between the measured value of total production and the measured value of total income generated by production.

Personal income is income received by persons, as opposed to corporations. The BEA calculates personal income as compensation paid to employees plus profits, rent, asset income, and transfer payments received by persons minus contributions for governmental social insurance (principally Social Security and Medicare taxes). See Table 2.7. Disposable personal income—which is a key variable in the Keynesian model—equals personal income minus personal taxes and certain nontax payments and is disposed of in the form of consumption, personal saving, interest payments, and personal transfer payments (see Table 2.8).

In the Keynesian model, there is an important issue concerning the disposition of disposable personal income between consumption and personal saving. This is because, in that model, saving is considered a *leakage* from the economy. Table 2.8 breaks down disposable personal income in terms of its disposition between consumption, saving, and other items.

Table 2.7 Sources of personal income 2013 ($ billions)

Personal income (*PIN*)	14,167
Compensation of employees (*WAGES*)	8,845
+Proprietors' income (*PROFITS*)	1,337
+Rental income of persons (*RENT*)	596
+Personal income receipts on assets (*ASSET INC*)	2,080
+Personal current transfer receipts (*TR*)	2,415
−Contributions for government social insurance (*SS*)	1,105

Source: U.S. Bureau of Economic Analysis (www.bea.gov)

Table 2.8 Disposition of disposable personal income 2013 ($ billions)

Disposable personal income (*DIN*)	12,505
Personal consumption expenditures (C)	11,484
+ Personal saving (*PS*)	608
+Interest paid by persons (*CINT*)	247
+ Personal transfer payments (*PTP*)	166

Source: U.S. Bureau of Economic Analysis (www.bea.gov)

Just as we obtained GDP previously by adding up its expenditure components, we can also obtain GDP by adding up the various ways the incomes are generated in producing goods and services. As Table 2.6 shows, the NIPA arrives at national income by adjusting GDP for *NRFI* and depreciation (consumption) of fixed capital.

Finally, we can break down GDP according to how it is disposed of. Broadly, GDP is disposed of for the purpose of personal consumption expenditures, private saving, and taxes minus transfer payments, interest on the debt and subsidies (see Table 2.9).

People use most of their income for personal consumption expenditures (C), first seen in equation (10), as part of GDP. The next largest allocation goes to gross private saving (S). Gross private saving is the sum of personal saving, business saving, and depreciation of private fixed capital. Because depreciation is a part of gross investment, it must be included under gross saving. Gross private saving is a component of gross saving, which equals combined private and government saving.

Gross private domestic investment and *GGI* measure capital spending by private investors and government, respectively, and therefore include spending to replace depreciated capital. Depreciation of private capital is included under S but depreciation of government capital (DG) is not. It therefore gets a separate entry in Table 2.9.

A large portion of income goes to paying taxes. In Table 2.9, T equals all government income, which mostly consists of tax revenues, minus

Table 2.9 Disposition of GDP 2013 ($ billions)

Gross domestic product (GDP)	**16,768**
Personal consumption expenditures (C)	11,484
+Gross private saving (S)	3,402
+Depreciation of government fixed capital (DG)	506
+Government receipts less transfers (T)	1,674
+Taxes and transfer payments to foreigners (TPF)	138
−Net receipts of factor income from the rest of the world ($NRFI$)	224
+Statistical discrepancy ($STAT$)	−212

Source: U.S. Bureau of Economic Analysis (www.bea.gov) transfer payments and other payments similar to transfer payments. Specifically, we use Table 2.5 to calculate T as:

$$\begin{aligned} T &= GINC - TR - INT - SUB \\ &= \$4{,}789 \text{ billion} - \$2{,}437 \text{ billion} - \$618 \text{ billion} - \$60 \text{ billion} \\ &= \$1{,}674 \text{ billion.} \end{aligned} \quad (12)$$

By T we therefore mean, taxes plus some other forms of government income minus all payments made by the government that provide for the transfer of tax dollars to persons without the provision of any service by the recipient in return.

Another, much smaller, part of GDP is disposed of by paying taxes and making transfer payments to the rest of the world. NFRI must be subtracted because they are part of GNP but not GDP. Finally, it is necessary to adjust for the discrepancy between the BEA's calculation of GDP as expenditures and its calculation of GDP as income.

Gross saving can be divided between net private saving, consumption of private and government capital and net government saving (Table 2.10). A final, important item is gross investment (GI), which equals gross saving (see Table 2.11).

In the NIPA, gross investment is the sum of gross private domestic investment (GGI) and net foreign investment (NFI) plus an adjustment

Table 2.10 Gross saving and its components 2013 ($ billions)

Gross saving (GS)	3,034
Net private saving (*NPS*)	1,281
Business saving (*BS*)	673
+Personal saving (*PS*)	608
+Consumption of private fixed capital (*D*)	2,121
+Net government saving (*NGS*)	–874
+Consumption of government fixed capital (*GD*)	506
Addendum	
Gross saving (GS)	3,034
Gross private saving (*S*)	3,402
+ Gross government saving (GGS)	–368

Source: U.S. Bureau of Economic Analysis (www.bea.gov)

Table 2.11 Gross investment and its components 2013 ($ billions)

Gross investment (*GI*)	3,034
Gross private domestic investment (*I*)	2,648
Private fixed investment (*FI*)	2,574
Change in inventories (Δ*INV*)	74
+Gross government investment (*GGI*)	596
+Net foreign investment (*NFI*)	–422
Net exports (*NX*)	–508
+Net receipts of factor income from the rest of the world (*NRFI*)	224
−Taxes and transfer payments to foreigners (*TPF*)	138
+Statistical discrepancy between GS and GI (*STAT*)	212

Source: U.S. Bureau of Economic Analysis (www.bea.gov)

for a statistical discrepancy between the expenditure and income sides of the account:

$$GI = I + GGI + NFI + STAT = \$2{,}648 \text{ billion} + \$596 \text{ billion} - \$422 \text{ billion} + \$212 \text{ billion} = \$3{,}034 \text{ billion}. \quad (13)$$

Gross private domestic investment, *I*, can also be expressed as the sum of private fixed private investment (*FI*) and changes in inventories, which we label Δ*INV*, so that

$$I = FI + \Delta INV = \$2{,}574 \text{ billion} + \$74 \text{ billion} = \$2{,}648 \text{ billion}. \quad (14)$$

Let's substitute equations (8) and (14) in equation (10). Then

$$\Psi = C + FI + \Delta INV + G + X - M. \quad (15)$$

This equation reminds us that Ψ measures production, whereas *C*, *FI*, and *G* measure expenditures. If expenditures result in the sales of goods out of existing inventories, Δ*INV* is negative, which means that inventories fall by the amount sold out of inventories. This amount must be subtracted from expenditures in order not to overstate Ψ. Similarly, insofar as residents spend money on imports, then imports must also be subtracted.

Net Foreign Investment

NFI equals the "the net acquisition of foreign assets by U.S. residents less the net acquisition of U.S. assets by foreign residents."[4] When Americans acquire foreign assets, they acquire claims on foreigners. When foreigners acquire American assets, they acquire claims on Americans. Americans acquire claims on foreigners by selling goods and services to foreigners. Foreigners acquire claims on Americans by selling goods and services to Americans.

If we add net exports to NFRI and subtract taxes and transfers payments to foreigners we get the balance on current account, which is just equal to NFI. If Americans are spending more on imports and other items than foreigners are spending on Americans, then the current account must be in deficit and foreign claims on Americans must be rising faster than American claims on foreigners. Then also *NFI* must be negative.

We calculate *NFI* as

$$NFI = NX + NRFI - TPF = -\$508 \text{ billion} + \$224 \text{ billion} - \$138 \text{ billion} = -\$422 \text{ billion}. \quad (16)$$

As we go forward, we will ignore *NRFI* and *TPF*. Thus we will define NFI in terms of net exports:

$$NFI = NX. \quad (17)$$

Here are a few examples of how net exports translate into NFI:

Example 1

- French wine sellers have a bank account of \$2,000 in Kansas on January 1, 2014.
- In 2014, Kansans import \$1,000 worth of wine from France and export \$500 worth soybeans.

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[4] The BEA no longer uses the term *net foreign investment* but instead, refers to "net lending or net borrowing," which it identifies "as an indirect measure of the net acquisition of foreign assets by U.S. residents less the net acquisition of U.S. assets by foreign residents."

- At end of 2014, the French wine sellers have $2,500 in their account (because they added $1,000 by selling wine and subtracted $500 by buying soybeans).
- The change in U.S. claims on foreigners is zero and the change in foreign claims on the United States is $500.
- *NFI* = $0 – $500 = –$500 and *NX* = $500 – $1,000 = –$500.

Example 2

- French wine sellers have a bank account of $2,000 in Kansas on January 1, 2014, and Kansas soybean sellers have a bank account in Paris of $2,000 worth of euros.
- In 2014, Kansans import $1,000 worth of wine from France and export $500 worth soybeans.
- At end of 2014, the French wine sellers have $3,000 in their bank account in Kansas (because they sold $1,000 worth of wine) and Kansans have $2,500 worth of euros in their bank account in Paris (because they sold $500 worth of soybeans).
- The change in U.S. claims on foreigners is $500 and the change in foreign claims on the United States is $1,000.
- *NFI* = $500 – $1,000 = –$500 and *NX* = $500 – $1,000 = –$500.

Example 3

- French wine sellers have a bank account of $2,000 in Kansas on January 1, 2014, and Kansas soybean sellers have a bank account in Paris of $2,000 worth of euros.
- In 2014, Kansans import $1,000 worth of wine from France and export $500 worth soybeans.
- The French also spend $1,000,000 opening up a vineyard in Kansas. The American manager of the vineyard imports $1,000,000 worth of equipment from France. So now U.S. exports = $500 and imports = $1,001,000.
- Just as in Example 2, the French wine sellers have $3,000 in their bank account in Kansas at the end of 2014 (because they sold $1,000 worth of wine) and Kansans have $2,500 worth

of euros in their bank account in Paris (because they sold \$500 worth of soybeans). The French also own a U.S. facility, which is worth \$1,000,000.

- The change in U.S. claims on foreigners is \$500 and the change in foreign claims on the United States is \$1,001,000.
- $NFI = \$500 - \$1{,}001{,}000 = -\$1{,}000{,}500$ and $NX = \$500 - \$1{,}001{,}000 = -\$1{,}000{,}500$.

The link between NFI and net exports is important for understanding the recurrent deficits in the U.S. current account.

Now some further simplifications are in order. We will therefore assume that the income side of GDP has just three components, *WAGES*, *NW* and *D*, where

$$NW = PROFITS + RENT + ASSET\ INC. \tag{18}$$

This permits us to write

$$\Psi = WAGES + NW + D = C + I + G + NX, \tag{19}$$

Going forward, we will also simplify the accounting by assuming that NRFI is zero, so that GDP equals GNP. We will likewise assume that *DG*, *TPF* and *STAT* are zero. This leaves us with the following identity:

$$\Psi = C + I + G + NX = C + S + T. \tag{20}$$

From that identity we can write

$$I + NX = S + (T - G). \tag{21}$$

Substituting equation (17) in equation (21),

$$I + NFI = S + (T - G). \tag{22}$$

The left-hand side is now gross investment and the right-hand side is gross saving. $T - G$ can be thought of as gross government saving.

Now consider this identity:

$$NFI = S + (T - G) - I. \tag{23}$$

We saw that the United States ran a foreign trade deficit (excess of imports over exports) of $508 billion in 2013. (*NFI* was 86 billion dollars less, but we ignore that distinction here.) The question is whether this trade deficit reflects a distortion in trade or a willingness on the part of foreigners to buy U.S. assets.

Observe that according to Table 2.5, net government saving was –$874 billion in 2013. That's government dissaving—a deficit—of $874 billion. That number provides a measure of the amount of borrowing that combined federal, state, and local government had to do in 2013.[5] Government financed a portion of that deficit by selling bonds to foreigners. The sales of U.S. bonds to foreigners are counted as increases in foreign claims on the United States. Thus, insofar as government runs a deficit financed by foreigners, *NFI* is negative and imports exceed exports. Indeed, we can think of government deficits as having the effect of permitting Americans to enjoy more imports now, with the consequence of having to pay more taxes later so that foreigners can buy U.S. goods.

If this is a problem, the solution must be found on the right-hand side of equation (23). Some combination of three things must happen in order to *improve* the deficit in the balance of trade: Private saving must rise, government saving must rise (which is to say government deficits must fall), and/or private investment must fall.

Another interpretation is that there is no problem at all. Suppose that foreigners just like to buy U.S. assets, and think that U.S. bonds, as well as U.S. factories and hotels are a good place to put their money. Then U.S. trade account deficits are just a reflection of this taste for U.S. assets.

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[5] It's a crude measure in part because it does not account for government investment expenditures. In thinking about the U.S. government deficit, it is more useful to focus on the numbers provided by the U.S. Office of Management and Budget. This agency reported a U.S. government deficit of $680 billion in 2013

We will delve into the importance of government deficits and what motivates foreigners to buy U.S. assets in the chapters that follow.

This chapter provides a snapshot of the macroeconomy and its component parts. Next we take up the task of showing how those parts interact as individual decision-makers (economic agents) go about the business of deciding how much to work and how much to consume.

CHAPTER 3

Individual Equilibrium

The chapter title might seem puzzling to the reader. In Chapter 1, we distinguished macroeconomics from microeconomics by defining the former as applying to aggregate economic activity and the latter to individual economic activity.

Yet macroeconomic activity boils down to making decisions to supply labor and financial capital (which is what people provide when they save) to firms that use their labor and financial capital to produce the goods that workers buy. It means that we have to go through some microeconomics before aggregating the choices made at the microlevel to the entire economy.

So let's start with some fundamentals: (1) Firms produce things because people demand them; (2) firms *can* produce things that people demand because individuals are willing to supply them with labor and financial capital. People supply labor because the reward for doing so, as measured by their after-tax earnings, exceeds the reward for not doing so, as measured by the pleasures of leisure and as affected by the numerous incentives the government offers to people on the condition that they not work (along with the numerous government-created disincentives to work, such as taxes on labor income).

People provide financial capital because the after-tax return that they receive for putting their cash into financial instruments like bank CDs and corporate stocks, which are forms of saving, exceeds the pleasures of using that cash for current consumption. Their incentives to save are, as we shall see, diminished by taxes on capital income.

This chapter and the next will work through the details of what determines people's willingness to work and save. Once we have the groundwork in place for determining how people choose to work and save, we will go on to consider how firms take their work and saving and convert it into production.

Why Am I Writing This Book?

At any moment, I have a choice between working and not working. For example, at this moment I am writing the book in front of you. In the parlance of economics, I am sacrificing leisure and in the process, supplying labor services in exchange for what I hope to be the income (and satisfaction) that I will enjoy several months from this moment when the book is published. Maybe I will apply the future income I get from writing the book toward the purchase of a car. Or maybe I will use it to acquire financial assets that I will need to fund my eventual retirement. In the first instance, on the basis of narrow pecuniary considerations, I would use the income to finance future consumption; in the second, again in the parlance of economics, I would use it to finance future leisure.

Suppose that instead of writing this book, I were engaged in a consulting project for which I was paid as I worked. The consulting assignment would pay a fixed, agreed-upon amount immediately, not a royalty contingent on book sales. So which would have been the better choice? The book or the consulting project?

The fact that you are holding this book in your hands (or reading it off your computer) makes it obvious which choice I made. By this point in my life, I have accumulated enough in liquid assets that I could cover current expenses out of those assets in anticipation of future royalties that I would use, in effect, to repay myself for my investment. Then there is the fact that either pursuit—the book or the consulting project—would have required the sacrifice of current leisure. So, I might as well choose the project (the book) from which I would get more personal satisfaction, no matter what pecuniary reward I might get. Thus, the choice of the book-writing project became the superior one in my personal calculus.

The cost-benefit test that led to this outcome was a matter of making choices at the margin: The sacrifice of some certainty and immediate rewards in exchange for personal satisfaction and the hope that the future rewards from the book will exceed the rewards from the other use of my time.

I make these reflections, not because I think that they will fascinate the reader, but because of how obvious they must seem, once revealed. Each person makes choices like this every day of his or her life. Shall I double down at the office and work all the harder in hopes of a promotion, or shall I take the time to polish my resume and start looking for something better? Shall I take a part-time job, now that the kids are in high school and make the needed investment in new clothes and maybe a new car, or shall I go back to school or just stay at home until they are in college?

The government presents us with other, less-appealing choices. Shall I take another job and boost my income or just let well enough alone and avoid disqualifying my family from healthcare subsidies or unemployment insurance? Shall I take the higher paying job on the other coast or avoid uprooting my family and pushing us into a higher tax bracket? Shall I save more now or believe the government's promises about future Social Security benefits? How about that stock tip from my broker? Shall I buy the stock or not, considering that the tax on dividends and capital gains has just gone up, or just put the money in a low-paying CD?

Such choices, as they are made every day by every participant in the economic system, are what give rise to the activity we study under the heading of macroeconomics. Yes, when we assess or predict the performance of the macroeconomy, we look at broad indexes of how individual choices combine to produce overall economic activity, but behind those indexes are minute choices of the kind just described in which people make trade-offs between the different uses of their time and money.

Macroeconomists, as noted in the Introduction, are economists who look at big trade-offs, not small ones. They look at the total number of hours available to the civilian noninstitutional age-eligible population and think about how that population divides those hours between work and leisure. They look at national income and think about how the country divides what's left of that income after taxes between consumption and saving. They think big.

But they also think small. That's because, as noted above, all the big choices are the result of the small choices made by individuals about how to divide their time between work and leisure and how to divide their after-tax income between consumption and saving. Thus, they have to drill down to the choice calculus of the individual who must decide how to spend each day as it looms ahead of him at 5:00 a.m. (I'm an early riser) and how to use each paycheck as it appears (minus the part that goes to the government) each month in his bank statement.

That is the way macroeconomists of the new classical persuasion (among whom I count myself) approach their subject, and that is the way we approach macroeconomics in this chapter.

One more thing. This chapter and the next embrace what macroeconomists call a *micro-foundations* approach: Working up to the big from the small. A characteristic of this approach is that it makes use of a hypothetical individual called the *representative agent*. In this book, I have two representative agents—Adam and Eve. I rely on Biblical authority to start with Adam, but after he has been expelled from Eden and faces the necessity of making worldly trade-offs.

So let's begin with the problem faced by Adam when it comes to supplying labor services. There are 24 hours in a day, 168 hours in a week and 8,760 hours in a year. Adam, whom we assume to be at least 16 and not in the military or in prison, must spend every one of those hours either working for money or not working for money. Economists, as previously stated, characterize this as a choice between work and leisure even if time counted as leisure includes going to college, cutting the lawn, or any other activity, however pleasurable or onerous, that is not directed at making money. (We ignore barter as it offers the option of gains from trade without the need for money.)

The reader may think it strange to imagine a worker carefully deciding every day or week or year how much time to allocate between work and leisure. Should Adam work eight hours today? Or six? Or sixteen? Twelve months this year or only three? In fact, there are many occupations that provide flexibility in choosing working hours. And there are workers with eight-hour-a-day jobs who choose to work part time at other jobs. And many workers move in and out of eight-hour-a-day and permanent jobs over the course of their lifetimes.

In deciding how to divide his time between work and leisure, Adam has to take into account how his current choices will affect his future ones. If he makes $100 by working an hour today, he could spend the entire amount today or use the $100 to buy some income-earning asset and then use the cash value of that asset to engage in consumption or to enjoy leisure at a later time.

The Labor and Leisure Choice

Let's suppose that Adam has just two periods to live, period 1 and period 2. Period 1 starts on a given day at midnight and period 2 the next day at midnight. The period 1 wage rate is w_1 and the period 2 wage rate is w_2. In period 1, Adam has h hours available to divide between leisure and labor. (Because we usually think in terms of the labor-leisure choice over a single day, h is equal to 24.) Let's abbreviate period 1 labor income as lay_1. (This follows the convention of using the letter y to designate income and lower-case letters to represent individual rather than societal choices.) Then

$$lay_1 = w_1 (h - le_1), \tag{1}$$

where le_1 is the amount of time Adam allocates to leisure in period 1. So, if $le_1 = 16$, he works eight hours that day. There are no taxes to worry about just yet. We will postpone that worry to later chapters.

We can write a similar equation for lay_2, his period 2 labor income:

$$lay_2 = w_2 (h - le_2). \tag{2}$$

Adam can receive income in the form of wages (sometimes called *earned income*) or in the form of income on some asset that he owns, such as a bank CD (*unearned income* or asset income). For now let's assume that Adam's total period 1 income y_1 is labor income, so that

$$y_1 = lay_1, \tag{3}$$

But then he can receive asset income as well as labor income in period 2. If Adam receives a one-day return of r on an asset that he purchased out of his saving s_1 in period 1, then he divides his period 1 income between consumption c_1 and saving sav_1, so that

$$sav_1 = lay_1 - c_1. \tag{4}$$

Now we can write an equation for his period 2 total income as

$$y_2 = lay_2 + sav_1 (1 + r). \tag{5}$$

So far, as labor income depends on the division of time between labor and leisure, Adam has three variables, le_1, le_2, and s_1, to solve in order to determine his total income in period 1 and period 2.

Substituting equation (4) in equation (5), we get:

$$y_2 = lay_2 + (lay_1 - c_1)(1 + r). \tag{6}$$

Because the individual lives for only two periods, he will not save in period 2. Thus, his period 2 consumption will be equal to his period 2 income, earned and unearned:

$$c_2 = lay_2 + (lay_1 - c_1)(1 + r). \tag{7}$$

Rearranging,

$$c_1 + \frac{c_2}{1 + r} = lay_1 + \frac{lay_2}{1 + r}. \tag{8}$$

The left-hand side of this equation represents the present value of Adam's current and future consumption and the right-hand side the present value of his current and future labor income. The equation illustrates mathematically the principle that at every moment in our lives we are making a choice between current and future consumption based on our expectations about current and future income. To understand this, let's get a firm idea of what is meant by *present value*.

Suppose that r = 10 percent, lay_1 = \$500, and lay_2 =\$550. Then the present value of Adam's income is \$1,000. The present value of lay_1 is \$500 because that is the money he will receive during the current year. The present value of the \$550 to be received a year from now is, at 10 percent interest, worth only \$500.

To understand this, let's suppose that Adam wants to spend \$1,000 in period 1. He has only \$500 as income that period so in order to spend

\$1,000 he must borrow against his period 2 labor income. Because the interest rate is 10 percent, he would have to borrow \$500 now and pay back principal and interest of \$550 out of his period 2 income. If he takes this route, he is left with no money to apply to consumption in period 2, but the choice is up to him. Or Adam could, at the other extreme, consume nothing in period 1, put his period 1 income in the bank, so that with interest he would have \$550 to apply for his period 2 consumption, permitting him to set his period 2 consumption at \$1,100.

Now let's rewrite equation (8) as follows:

$$lay_1 = c_1 + \frac{c_2 - lay_2}{1+r}. \qquad (9)$$

This tells us that labor income in period 1 can be used to finance period 1 or period 2 consumption, or to reduce period 2 labor income and thus period 2 work time. Conversely, period 2 labor income can be used to finance period 1 or period 2 consumption, or to reduce period 1 labor income and thus period 1 work time. Everything depends on everything else.

But how does Adam make these trade-offs? Let's approach this question by assuming for now that in choosing lay_1, Adam takes lay_2 as fixed and that in choosing lay_2 he takes lay_1 as fixed. (We will relax that assumption later on.)

We also need some assumptions about how Adam chooses between labor income and leisure. Fundamentally, we assume that Adam wants to maximize utility. In Chapter 4, we will discuss the idea of maximizing the present value of a *utility function* that is defined over consumption that takes place in an entire lifetime. Here we keep things simple by sticking with the two-period example.

Let's, first of all, think of our decision-maker Adam as having to choose either more or less leisure now. Suppose Adam has been dividing his day between 10 hours of work and 14 hours of leisure and that he has been making \$500 per day as income. Now he considers expanding his leisure by one hour. The question is how much income, at most, would he be willing to sacrifice for that additional hour of leisure?

In considering a problem like this, we can imagine that Adam carries a computer around in his head that assigns units of utility—*utiles*—to different quantities of things. This brain-computer assigns a certain number of utiles to Adam's leisure time and a certain number to his income. For now, however, we don't have to care about Adam's *total utility* from leisure and income. All we have to care about is his *marginal utility* from the given changes in leisure and labor income. The marginal utility of leisure is the change in utility that Adam experiences per unit change in leisure, written $\frac{\Delta U}{\Delta le}$. Suppose that an additional hour of leisure would increase Adam's utility by 400 utiles; then we would write:

$$\frac{\Delta U}{\Delta le} = \frac{400}{1} = 400, \qquad (10)$$

which is to say that the change in Adam's utility per unit change in leisure is 400. We see Adam as choosing leisure time in terms of hours. So one more hour of leisure adds 400 utiles to Adam's total utility.

Now let's calculate the marginal utility of his labor income. Let's suppose that the following equation applies:

$$\frac{\Delta U}{\Delta lay} = \frac{4}{1} = 4, \qquad (11)$$

which is to say that the change in his utility per unit change in labor income is 4. One more dollar of labor income adds 4 units to utility. Labor income adds to utility because it makes it possible to consume more, now or later.

Proceeding with this example, the question is how much income, at most, would Adam be willing to give up for an additional hour of leisure? The answer is \$100. Why? To show why (if it isn't already obvious) we introduce another concept, which we will call the *marginal rate of substitution of leisure for labor income* or the MRS_{LeLay}. We can define the MRS_{LeLay} as

$$MRS_{LeLay} = \frac{\Delta U / \Delta le}{\Delta U / \Delta lay} = -\frac{\Delta lay}{\Delta le}, \qquad (12)$$

which indicates the amount of labor income the individual is willing to give up for another unit of leisure or, equivalently, the amount of labor

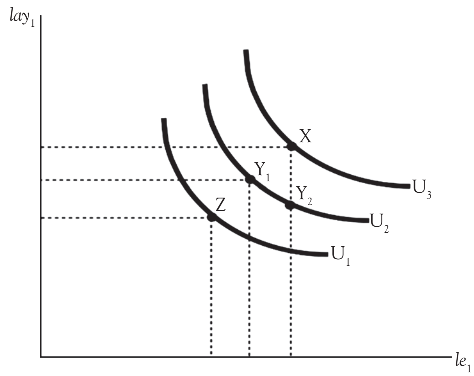

Figure 3.1 Individual indifference curves for leisure and labor income

income with which the individual must be compensated to be willing to give up another unit of leisure. In this example, the MRS_{LeLay} is \$100 $\left(= \frac{\$400}{4}\right)$.[1]

We assume that utility increases with a rise in both leisure and income, so that the individual always prefers more leisure to less leisure and more income to less income. Thus, in Figure 3.1, where we measure Adam's leisure along the horizontal axis and his labor income along the vertical axis, he prefers the combination of leisure and labor income indicated by point X to that indicated by points Y_1 and the combination indicated by point Y_1 to that indicated by point Z.

Just as Adam always prefers more to less, he can be indifferent between combinations like Y_1 and Y_2, where one combination has more income than the other, but less leisure, or more leisure but less income. A curve that traces out these combinations is called an *indifference curve*, and it indicates different combinations of leisure and labor income that register a fixed amount of utility in Adam's brain-computer.

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[1] A clarification about signs: In calculating the $\frac{\Delta lay}{\Delta le}$, we assume that either labor income rises as leisure falls or labor income falls as leisure rises. Thus, $\frac{\Delta lay}{\Delta le}$ must be negative. Because we want to think of MRS_{LeLay} as a positive number, we place a minus sign in front of $\frac{\Delta lay}{\Delta le}$. We follow this convention throughout the book.

Figure 3.1 contains three such indifference curves, all of which have some properties in common: (1) they are negatively sloped to reflect the idea that to remain at the same level of utility, the individual has to give up some leisure as income expands, (2) they do not intersect (which is necessary for his choices to be consistent), and (3) they are bulged downward, that is, convex from below. Adam's total utility rises as he moves from indifference curve U_1 to indifference curve U_2 and to indifference curve U_3, but it is constant as he moves along any of these curves.

Now our job is to lay out a process by which Adam makes his leisure and work choices in period 1. We begin by assuming that work becomes more onerous, and leisure more desirable, as more and more time is allocated to work. A person who is working 14 hours a day, and has only 10 hours for sleep and other leisure activities, would be willing to give up quite a bit of labor income for another hour of leisure. Whereas, a person who is working 4 hours a day, and already has 20 hours of leisure, would be willing to give up only a little labor income for an extra hour of leisure. Hence, the downward bulge in the indifference curves. Let's illustrate further with the same example.

See Figure 3.2. If Adam is at point X_1 on one of his indifference curves, he is consuming 10 hours of leisure and getting \$700 per day as income. Now he considers expanding his leisure from 10 to 11 hours, so that he would move from point X_1 to point X_2. We see that he can sacrifice as

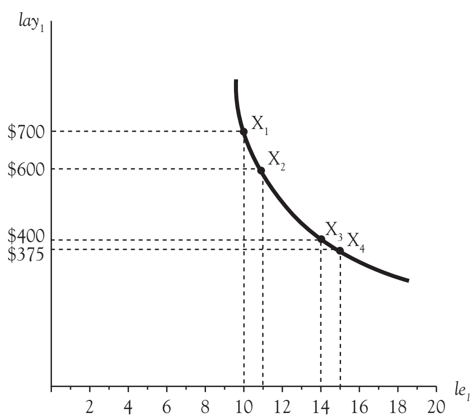

Figure 3.2 Declining MRS $_{LeLay}$

much as $100 of income in making this move without moving to a lower level of utility. Now compare a possible move from X_3 to X_4. Once Adam has expanded his leisure time to 14 hours per day, he will be willing to give up only as much as $25 in labor income for another hour of leisure.

Adam's MRS_{LeLay} is $100 when he has 10 hours a day as leisure and $25 when he has 14 hours a day as leisure. His choices are governed by the law of *diminishing marginal rate of substitution of leisure for consumption*, whereby the amount of labor income he is willing to give up for an hour of leisure falls as leisure increases. Equivalently, the amount of labor income with which he must be compensated in order to give up an hour of leisure decreases as his leisure expands.

Figure 3.3 shows how Adam picks the combination of consumption and leisure that maximizes his utility, that is, makes him best-off. Here we assume that he gets a wage of $50 per hour, as measured by the slope of the line CD, and that he has to decide how to allocate his time each day between consumption and leisure. If he wanted to, he could (technically at least) have either $1,200 as labor income and no leisure or no labor income and 24 hours of leisure, or any linear combination in between.

In this example, Adam picks point X_2 where he makes $500 as wages, allocating 10 hours of his day to work and 14 to leisure. Why select this point? The answer is that choosing any other point would leave him worse off.

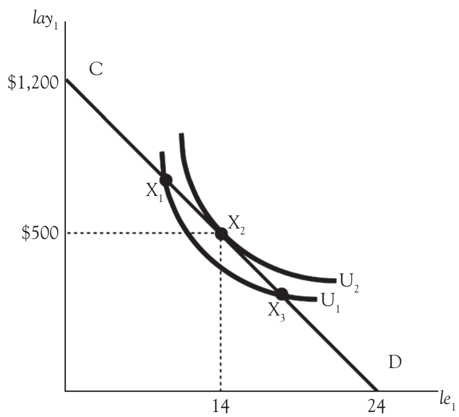

Figure 3.3 Individual equilibrium in the leisure and income choice calculus

First, Adam will not pick points X_1 or X_3 because they lie on an indifference curve U_1 that lies below the indifference curve U_2 on which X_2 is located. We can also see this if we measure the marginal rate of substitution as the absolute value of the slope of the indifference curve, wherever we find ourselves along that curve on line CD.[2] We would expect indifference curves to be steep for combinations of leisure and labor income that contain a small amount of leisure and large amount of labor income and to be flat for combinations that contain a large amount of leisure and a small amount of labor income. Thus, the indifference curve for U_1 is steeper at point X_1 on CD than it is at X_3.

At point X_1, Adam is willing to give up more than $50 of labor income for another unit of leisure, as measured by the slope of indifference curve U_1 at that point. Because it costs only $50 in forgone wages and consumption for an additional unit of leisure, he will increase utility by moving CD toward point X_2.

At points to the right of X_2, Adam is willing to give up less than $50 in labor income for an additional hour of leisure. At point X_3, for example, the last hour of leisure enjoyed was worth less than $50, as evidenced by the flatness of the curve, and Adam will want to move up the line CD to point X_2. Thus, the optimal choice of consumption and leisure is represented by point X_2. It is at this point that the slope of his highest attainable indifference curve U_2 is just equal to the slope of line CD, which equals $50. Because, at this point,

$$MRS_{LeLay} = w = \$50, \tag{13}$$

Adam cannot increase his utility by either reducing or increasing the amount of leisure he enjoys.

Now let's examine Adam's period 2 calculus and in combination with his period 1 calculus just described. We represent this in Figure 3.4,

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[2] Absolute value means numerical value. The slope of a downward sloping line is negative, but it is more convenient to speak in terms of the numerical value (say, 50) of the slope, rather than the actual value of the slope (say, −50). To make the language less cumbersome, we will often refer to the slope of an indifference curve even though we really mean the absolute or numerical value of the slope.

which is comprised of Figures 3.4a, 3.4b, and 3.4c. Figure 3.4c presents the same information as Figure 3.3, except that the vertical axis is now the leisure axis and the horizontal axis the labor income axis. By flipping the axes in this figure, we can observe the combined results of his period 1 and period 2 choices. Figure 3.4b illustrates Adam's period 2 choices, with the horizontal axis serving as the leisure axis and the vertical axis as the labor income axis, as before. We assume that he expects his period 2 wage rate to be \$55 per hour. Adam (coincidentally) chooses to allocate 10 hours to work and 14 hours to leisure in both period 1 and period 2. His period 2 labor income is \$550. In equilibrium,

$$MRS_{LeLay} = w = \$55 \tag{14}$$

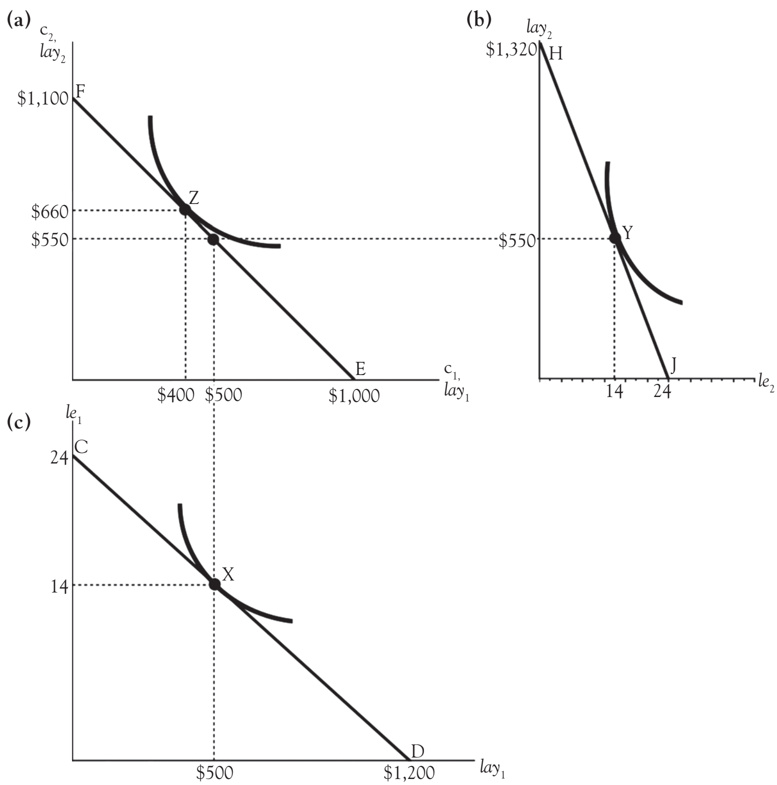

Figure 3.4 The two-period choice calculus

Figure 3.4a identifies the choice faced by Adam in choosing between period 1 and period 2 consumption. Assume that there is an interest rate of 10 percent, which Adam receives on the money he saves and which he pays on the money he borrows. He can then have as much as $1,000 in period 1 consumption and $0 in period 2 consumption, if he wishes, or $0 in period 1 consumption and $1,100 in period 2 consumption or any linear combination of these choices.

The Consumption and Saving Choice

Let's see how these choices present themselves. We have already seen how he could end up with $1,000 in period 1 consumption and $0 in period 2 consumption. In this event, he simply consumes all of his period 1 income, which comes to $500. Then he borrows $500 from the bank (or maybe his trusting brother-in-law), promising to pay $500 plus interest of $50 when the loan comes due. That will leave him with $1,000 to consume in period 1 but nothing to consume in period 2. We can think of this as a process in which Adam sells an IOU to a lender and then pays off the IOU a year later.

Alternatively, Adam could use all of the $500 of current income to buy an IOU and then when the IOU comes due in a year he could supplement his period 2 labor income with the $550 principal and interest from the IOU to finance $1,100 for consumption. Line FE in Figure 3.4a illustrates these and all the intermediate possibilities. As in our earlier example, the present value of Adam's period 1 and period 2 labor income is $1,000:

$$PV = lay_1^* + \frac{lay_2^*}{1+r} = \$500 + \frac{\$550}{1+0.1} = \$1,000, \qquad (15)$$

where lay_1^* indicates the equilibrium choice of labor income in period 1, and lay_2^* indicates the equilibrium choice of labor income in period 2.

The future worth of Adam's period 1 and period 2 labor income is $1,100:

$$FW = lay_1^*(1+r) + lay_2^* = \$500(1+0.1) + \$550 = \$1,100. \qquad (16)$$

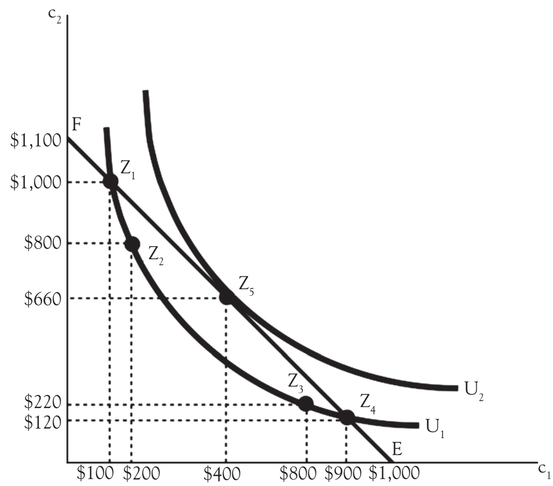

Figure 3.5 Individual equilibrium in the two-period consumption model

The slope of FE equals 1.1, reflecting the fact that Adam forgoes \$1.10 [= \$1(1 + 0.1)] in consumption next period for each \$1 he puts into consumption this period. We say that the opportunity cost of \$1 in consumption this period is \$1.10 in consumption next period.

Before proceeding further with this example, consider Figure 3.5, which adds detail to Figure 3.4a. Adam has a utility-maximization problem in regard to choosing between current and future consumption. A dollar allocated to current consumption is a dollar not saved and a dollar not saved is a dollar plus earnings that are unavailable for future consumption. So the question is how the utility gained by adding a dollar to current consumption compares to the utility forgone by virtue of the resulting loss of future consumption. Let's write the marginal utility of period 1 and period 2 consumption as follows:

$$MU_{c_1} = \frac{\Delta U_1}{\Delta c_1} \qquad \text{and} \tag{17}$$

$$MU_{c_2} = \frac{\Delta U_2}{\Delta c_2}, \tag{18}$$

where $\frac{\Delta U_1}{\Delta c_1}$ is the change in period 1 utility per dollar change in period 1 consumption, and $\frac{\Delta U_2}{\Delta c_2}$ is the change in period 2 utility per dollar change in period 2 consumption.

Part of the answer to the question just posed lies in the in the size of these variables: Insofar as the marginal utility of period 2 consumption exceeds the marginal utility of period 1 consumption, the individual is advised to shift consumption from period 1 to period 2.

Another consideration has to do with how Adam weighs period 2 utility against period 1 utility. We assume that he always puts the higher weight on current, or period 1, utility, than on future, or period 2, utility. We use the Greek letter rho, written as ρ, to indicate the amount of period 2 utility with which Adam must be compensated in order to willingly give up a unit of period 1 utility. We call ρ his rate of time preference. Thus, the present value of period 1 plus period 2 utility is

$$PVU = U_1(c_1) + \frac{U_2(c_2)}{1+\rho}, \tag{19}$$

which, in plain English, means that the present value of Adam's current utility combined with his future utility is his current utility plus his future utility discounted by his rate of time preference. Then his marginal rate of substitution of current for future consumption is

$$MRS_{C_1C_2} = \frac{MU_{c_1}}{MU_{c_2}}(1+\rho). \tag{20}$$

Suppose that Adam's period 1 utility rises by 200 utiles if he gets another dollar of period 1 consumption so that

$$MU_{c_1} = 200, \tag{21}$$

and suppose that his period 2 utility rises by 105 utiles if he gets another dollar of period 2 consumption, so that

$$MU_{c_2} = 105. \tag{22}$$

Finally suppose that his rate of time preference is five percent, meaning that, for Adam, a utile now is worth five percent more than a utile later. This permits us to think about how the present value of Adam's utility changes with his period 1 and period 2 consumption. The change in the present value of his utility per unit change in period −1 consumption is:

$$\Delta PVU/\Delta c_1 = MUc_1 = 200, \tag{23}$$

and the change in the present value of his utility per unit change in period 2 consumption is:

$$\Delta PVU/\Delta c_2 = MUc_2/(1+\rho) = 100, \text{ so that} \tag{24}$$

$$MRS_{c_1c_2} = \frac{\Delta PVU/\Delta c_1}{\Delta PVU/\Delta c_2} = \frac{200}{100} = 2. \tag{25}$$

Thus, the *marginal rate of substitution of period 1 consumption for period 2 consumption* is 2, that is, Adam is willing to give up \$2 dollars of period 2 consumption for another dollar of period 1 consumption.

In Figure 3.5, we represent Adam's preferences with indifference curves that have the same properties as the indifference curves presented in Figures 3.1 and 3.2. Each indifference curve reflects a higher level of utility than the indifference curve below it. Each has the similar downward slope and convex shape. And each has a property similar to the indifference curves just considered in examining the choice between leisure and labor income. This property is the *diminishing marginal rate of substitution of period 1 consumption for period 2 consumption.*

Ignore line FE for now and compare points Z_1 and Z_2 in Figure 3.5. If Adam chooses point Z_1, he consumes \$100 in period 1 and \$1,000 in period 2. Now let's suppose he considers adjusting to point Z_2, where he consumes \$200 in period 1 and \$800 in period 2. We can simplify the calculation of his marginal rate of substitution of period 1 for period 2 consumption as

$$MRS_{c_1c_2} = -\frac{\Delta c_2}{\Delta c_1} = -\frac{\$800 - \$1,000}{\$200 - \$100} = 2. \tag{26}$$

As Adam expands period 1 consumption he is willing to give up less and less period 2 consumption for another dollar of period 1 consumption. To see this, consider points Z_3 and Z_4, which lie on the same indifference curve. At Z_3, he consumes $800 in period 1 and $220 in period 2. At Z_4, he consumes $900 in period 1 and $120 in period 2. The $MRS_{c_1c_2}$ is 1. As period 1 consumption expands, Adam's $MRS_{c_1c_2}$ decreases.

Now consider the budget line FE, which we import into Figure 3.5 from Figure 3.4a. Points Z_1, Z_2, Z_3, Z_4, and Z_5 are all attainable, but the only points that Adam will consider are points Z_1, Z_4, and Z_5, since the other two points do not take advantage of all of the labor income available to him.

Adam can adjust to any point he wishes along the line FE but chooses the point that permits him to attain the highest indifference curve. As before, we can measure the $MRS_{c_1c_2}$ for small changes anywhere along an indifference curve in this space by finding the slope of the indifference curve at that point.

Suppose that Adam chooses point Z_1. Because the slope of U_1 at Z_1 is greater than the slope of FE, we know that the amount of period-2 consumption he is willing to forgo for another dollar of period 1 consumption at that point is greater than the amount he would have to forgo and that he should therefore expand period 1 consumption. If he chooses point Z_4, we know that the amount of period 2 consumption that he was willing to forgo for his last dollar of period 1 consumption was less than what he had to forgo and that he should therefore contract period 1 consumption. Only at point Z_5, where he consumes $400 in period 1 and $660 in period 2 does he maximize utility.

Putting the Choices Together

Now return to Figure 3.4. As mentioned earlier, Adam's period 1 wage rate is $50 and his period 2 wage rate is $55. The decision to have 14 hours of daily leisure in both period 1 and period 2 translates into $500 in period 1 labor income and $550 in period 2 labor income. The decision to have $400 in period 1 consumption then translates into a decision to have $660 in period 2 consumption: Our decision-maker, Adam, consumes $400 of his $500 in period 1 labor income, saving $100. He then

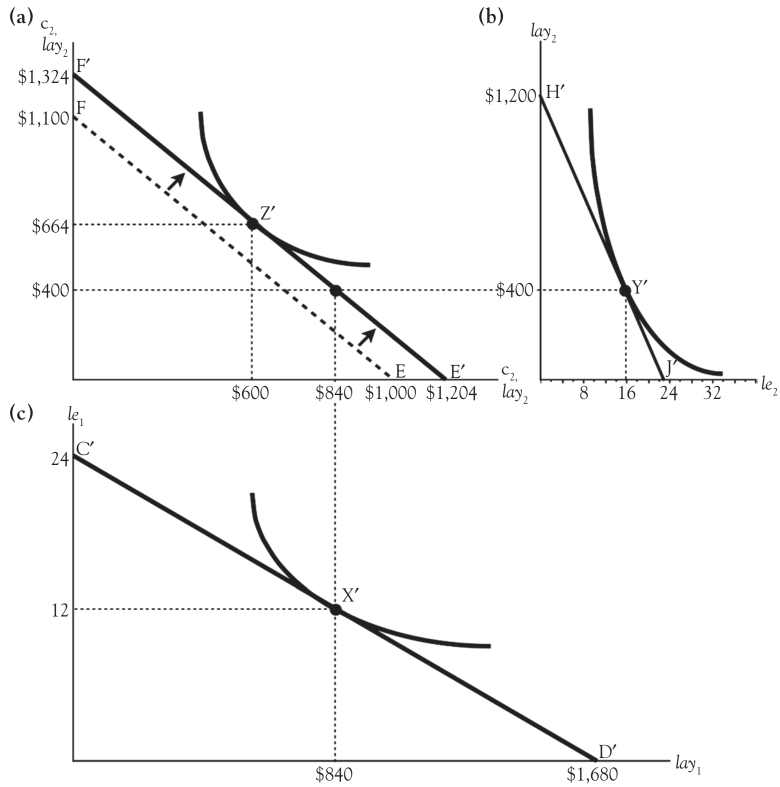

Figure 3.6 The two-period model with a change in the wage rate

augments his period 2 consumption by $110, as he cashes in the asset that he bought for $100 in period 1, which is now, at 10 percent interest, worth $110. In this way, he sets his period 2 consumption at $660.

Figure 3.6 illustrates how a change in the period 1 and period 2 wage rates can affect these choices. In Figure 3.6a, Adam's wage rate rises from $50 (as assumed in Figure 3.4c) to $70 in period 1, so that he is now on the new budget line C′D′ in Figure 3.6c and falls from $55 (as assumed in Figure 3.4b) to $50 in period 2, so that he is now on line H′J′. Period 1 leisure falls from 14 to 12 hours and thus work expands from 10 to 12 hours Conversely, the fall in his period 2 wage rate causes him to expand leisure from 14 to 16 hours and to contract work from 10 to 8 hours. The budget line FE, imported from Figure 3.4, correspondingly shifts outward in a manner parallel to itself so that it now becomes line

F′E′, intersecting the horizontal axis at \$1,204 and the vertical axis at \$1,324. These amounts are calculated as follows:

$$PV = lay_1^{*\prime} + \frac{lay_2^{*\prime}}{1+r} = \$840 + \frac{\$400}{1+0.1} = \$1,204 \text{ and} \tag{27}$$

$$FW = lay_1^{*\prime}(1+r) + lay_2^{*\prime} = \$840(1+0.1) + \$400 = \$1,324. \tag{28}$$

Adam decides to set his period 1 consumption at \$600, saving \$240. This permits him to set his period 2 consumption at \$664 (= \$400 + \$240 × 1.1).

We can take a few policy lessons away from this demonstration. The Keynesian view is that current consumption depends on current labor income. The foregoing demonstration, however, shows that current consumption depends as much on expected future income as on current income, a matter into which we will delve more deeply in the next chapter. If economic agents expect future income to fall, they will reduce current as well as future consumption. And they may reduce current consumption even if current income is rising.

Another possibility is that r would change, while (let's assume) the wage rate remains constant. See Figure 3.7. There we replicate Figure 3.4, except that the interest rate rises to 15 percent. There we can see that period 1 consumption falls from \$400 to \$300 and that period 2 consumption rises from \$660 to \$780, as Adam adjusts from line FE to line F″E″ in Figure 3.7a.

The Work-now and Work-later Choice

Next consider how Adam's work-leisure calculus would take into account, not just the wage rate he gets now but also the return to his saving and the wage rate he might get in the future. It is intuitively clear that a high return to current saving will induce people to work more now. If Adam believes that the stock market will head straight up for the next few years but may not thereafter, he would have reason to work hard now so that he can save now and enjoy the fruits of his labor later when the market goes down. Likewise, if Adam realizes that he is in his prime earning years, he

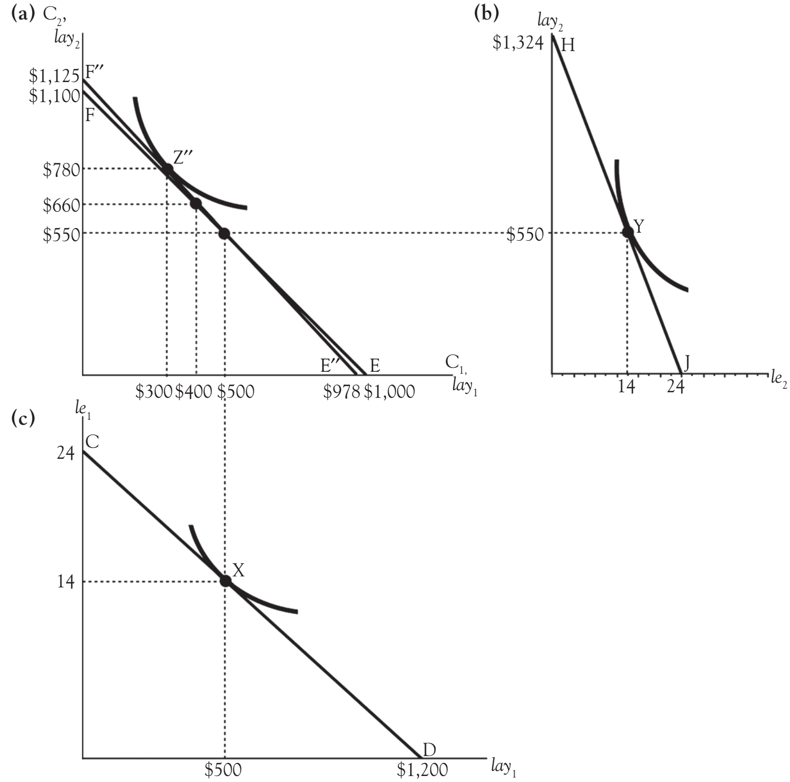

Figure 3.7 A rise in the interest rate in the two-period model

will want to work hard now in order to save up for the years to come when his earning power will be diminished. Think about athletes who figure that they have until age 35 to make big money and scientific geniuses who are convinced that they must make their score even before they turn 30, after which their mental capacities will never again be so keen. This is as opposed to piano soloists and some college professors who keep going until they drop.

To simplify the problem, let's suppose Adam figures that he will make $50 an hour today but $25 an hour a year from now. Put differently, the cost of leisure for him now is twice what it will be in a year. Adam has an incentive to work especially long hours now, given that the reward for work will fall by 50 percent next year.

Suppose further that Adam can get 10 percent interest on a CD that will mature in one year. If he puts the $50 he makes by working an additional hour into the purchase of that CD, he will have $55 to spend next year. Now fast forward to next year, when he collects that $55 on the matured CD. With that much money, he can "buy" himself 2.2 (= $55/$25) hours of leisure: He does this by using the CD to replace the income he would lose by reducing his work time by 2.2 hours.

This tells us that the sacrifice entailed by taking another hour of leisure now can be seen in either of two ways: First, as we have already seen, it entails the sacrifice of current income and therefore current and future consumption. Second, and alternatively, it entails the sacrifice of future leisure. The cost to Adam of another hour of leisure now is 2.2 hours of leisure that he would have to sacrifice next year because of the labor and asset income that he sacrifices by taking that hour of leisure now. We can also say that if he gives up an hour of leisure now, he could reward himself with 2.2 more hours next year. Would it be in Adam's interest to give up that hour of leisure now? As usual, we need to do some math to tackle this issue.

Let the *marginal rate of substitution of current for future leisure*, $MRS_{Le_1 Le_2}$, be the amount of leisure Adam would give up in period 2 for another hour in period 1. Let's return to the practice of referring to current leisure as period 1 leisure and future leisure as period 2 leisure. In this example, he has to give up 2.2 hours of period 2 leisure for another hour of period 1 leisure. Suppose that the $MRS_{Le_1 Le_2} = 2.5$, meaning that he would be willing to give up 2.5 hours of leisure in period 2 for another hour of leisure in period 1. Because it costs only 2.2 hours of leisure in period 2 to give up an hour of leisure in period 1, he will want to expand leisure in period 1. Now suppose that the $MRS_{Le_1 Le_2}$ is 1.5, so that he is willing to give up only 1.5 hours of period 2 leisure for another hour of period 1 leisure, whereas it cost him 2.2 hours of period 2 leisure for that last hour of period 1 leisure. In that instance, he would have expanded his period 1 leisure too far and would want to contract his period 1 leisure and expand his period 2 leisure.

Only when the amount of period 2 leisure that Adam is willing to sacrifice for another hour of period 1 leisure just equals the amount of period 2 leisure that he must sacrifice for that additional hour of period 1 leisure has he adjusted his work-leisure choices for both periods optimally. Formally, we write that Adam should adjust those choices so that

$$MRS_{Le_1Le_2} = \frac{w_1(1+r)}{w_2}. \tag{29}$$

The cost of another hour of period 1 leisure is $\frac{w_1(1+r)}{w_2}$, which is to say, the amount of period 2 leisure Adam must sacrifice in order to have that additional hour of period 1 leisure. Adam will want to adjust his choices of leisure in both periods so as to bring the value he places on period 1 leisure, as measured by the value of $MRS_{Le_1Le_2}$, into line with this cost.

Let's think about what this means to the macroeconomy. Suppose, in the forgoing example, that Adam has adjusted his allocation of leisure time between the two periods in such a way that he has satisfied equation (29). Thus, for the moment,

$$MRS_{Le_1Le_2} = \frac{\$50(1+0.1)}{\$25} = 2.2. \tag{30}$$

Now suddenly Adam's period 1 wage rate rises from \$50 to \$90.91 while his period 2 wage rate and his $MRS_{Le_1Le_2}$ remain unchanged. Temporarily,

$$MRS_{Le_1Le_2} = 2.2 < \frac{\$90.91(1+0.1)}{\$25} = 4.0. \tag{31}$$

The price of period 1 leisure has risen from 2.2 to 4.0 hours of period 2 leisure. Adam has an incentive to contract period 1 leisure and expand period 2 leisure. That is to say, he would want to expand period 1 work and contract period 2 work.

Alternatively, suppose that r rose from 10 to 15 percent, while the wage rate and his $MRS_{Le_1Le_2}$ remained unchanged. Here again the cost of current leisure would rise. Now he would face the following situation:

$$MRS_{Le_1Le_2} = 2.2 < \frac{\$50(1+0.15)}{\$25} = 2.3. \tag{32}$$

Here again, there is an incentive to contract period 1 leisure and expand period 1 work, inasmuch as the cost of an hour of period 1 leisure has risen from 2.2 to 2.3 hours of future leisure.

In this process, we encounter another version of the familiar idea of diminishing marginal rate of substitution. That is to say, Adam's marginal rate of substitution of current for future leisure will fall as his period 1 leisure expands. If Adam is in equilibrium to begin with and $\frac{w_1(1+r)}{w_2}$ falls, he will want to bring his $MRS_{Le_1Le_2}$ back into line with $\frac{w_1(1+r)}{w_2}$ by expanding period 1 leisure and contracting period 2 leisure, through which process his $MRS_{Le_1Le_2}$ will fall until it equals $\frac{w_1(1+r)}{w_2}$.

On the other hand, if, as in the foregoing examples, he is in equilibrium to begin with and $\frac{w_1(1+r)}{w_2}$ rises, he will want to substitute period 2 leisure for period 1 leisure until his $MRS_{Le_1Le_2}$ rises to equal $\frac{w_1(1+r)}{w_2}$.

The analysis so far provides some hints about the effects of government policy changes on individual behavior. We have seen that, acting rationally, people have an incentive to spread the effects of changes in current income over their present and future consumption. We will see that this is important in thinking through such matters as the burden of government debt on future generations and the effects of government policy changes on asset income and current consumption.

Also, insofar as the government can influence the wage that a person earns, policies that have the effect of increasing take-home pay (as opposed to wages, which include income and payroll taxes as well as take-home pay) can induce people to work more, just as policies that reduce take-home pay can induce them to work less. Our examples in Figure 3.6 intimated as much, anyway. Finally, policies that cause a rise in the returns of financial assets can induce people to work more and to save more.

It turns out, however, that things are not so simple. To see why, we have to recognize the distinction between substitution and income effects.

Substitution versus Income Effects

Let's consider the scenario illustrated by Figure 3.8. Adam is initially at point *X* on line AB, where he receives a wage of $50 per hour and chooses

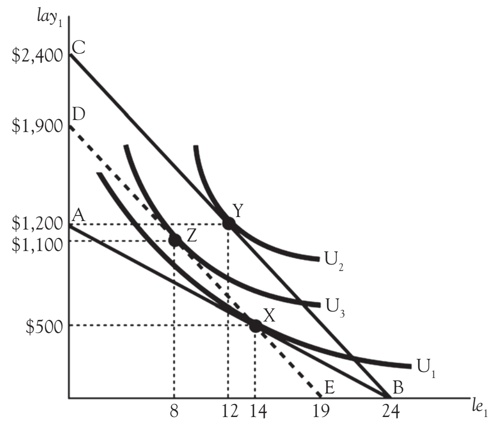

Figure 3.8 Separating substitution and income effects

14 hours of leisure (hence, 10 hours of work) and $500 in labor income. Then his boss raises his wage from $50 to $100 per hour, putting Adam on line BC, where he chooses to work 12 hours and earn $1,200.

We need to see how this rise in the wage rate exerts a *substitution effect* and an *income effect* on Adam's leisure-income choice. Before the wage rate rose, the *opportunity cost* to Adam of each additional hour of leisure was $50. Because the cost has now risen, Adam will have an incentive to substitute income (and therefore consumption) for leisure. The substitution effect occurs as a result of this change in the opportunity cost of leisure. The individual will always expand consumption at the expense of leisure when his wage rate rises, apart from the fact that the higher wage rate also makes him richer. But because it does make him richer, it also exerts an income effect that works in just the opposite way of the substitution effect.

In Figure 3.8, we see how it is possible to separate these two effects. Recall that Adam, hard worker that he is, decided to increase his work day from 10 to 12 hours, that is, to reduce his leisure from 14 to 12 hours when his wage rose from $50 to $100 per hour. This takes him from point *X* to point *Y*. Now an economist comes along and suggests an experiment to Adam's boss. According to the experiment, his boss tells Adam that the higher wage is still available but only if Adam agrees to contribute $500 a day to the boss's favorite charity. This puts Adam on line DE. Now Adam finds that if he were to return to Point *X* and continue working the same 10 hours that he did before his wage was increased, his take-home pay would be only as high as it was before, which is to say, $500. By working 10 hours, he would earn $1,000 but by being forced to give away $500 of that amount, he would be back to bringing home only $500.

However, Adam will not return to point *X*. Because the opportunity cost of leisure has risen and because he is now $500 poorer than he would otherwise have been. He would shift to some point on DE such as Z, where he would work something more than 12 hours a day. He may decide to work 16 hours a day (reducing his leisure to eight hours a day) and make $1,600 before having to pay the $500 to the charity, leaving him with $1,100 in take-home pay.

Eventually, in this scenario, the experiment ends. Adam's boss says that Adam no longer has to give up $500 of his earnings and Adam is allowed to return to Point Y, where he lives happily ever after. The purpose of this experiment was to isolate the substitution effect from the income effect of the wage change. The substitution effect was the adjustment from X to Z and the income effect the adjustment from Z to Y. Stripped of the income effect, Adam expands his work by six hours. With the income effect, he expands it by only two hours. The reason why the income effect causes him to reallocate two of those hours back to leisure is that leisure is desirable and becomes more affordable at a higher wage.

This demonstration reminds us that as wage rates rise, we should expect the quality of life to rise, not just because it increases people's spending power but also because it permits them to allocate more time to leisure. Even if the individual ends up working more, as here, he has the option of working less while maintaining his standard of living.

Let's see how a rise in the wage rate affects the supply of labor. Figure 3.9 traces the effects of the preceding experiment on Adam's supply of labor. When the wage rate is $50, Adam is at point A and supplies 10 units of a labor. When the wage rate rises to $100, he increases his supply of labor to 12 (point B) or 16 (point C) units depending on whether the income effect is present or not. Figure 3.9 shows that there are two labor supply curves along which Adam could adjust, one that includes the income effect (l^S) and one that includes only the substitution effect ($l^{S\prime}$).

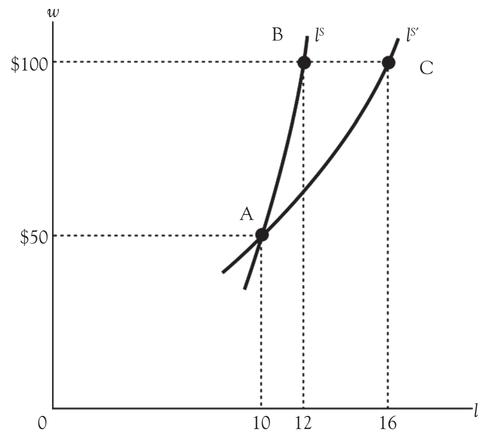

Figure 3.9 Compensated and uncompensated labor supply curves

The alert reader will see that, if the income effect were large enough, Adam could actually reduce the quantity of labor he offers to his employer when his wage goes up. Yes, the substitution effect would induce him to provide more labor, but if the income effect is large enough it might overwhelm the substitution effect and he might, in the end, supply less labor.

This possibility comes up in discussions about tax policy. We will delve more deeply into tax policy in a later chapter, but we can see the outline of the problem now. Supply-side economists argue that if the government taxes labor income at a lower rate, people will work more because their after-tax wage will rise and when they work more, the economy will expand as more labor enters production. But what if the income effect dominates and people respond to the increase in their take-home pay by working less rather than more?

One answer is that it shouldn't matter how they respond. A rise in take-home pay is welfare-enhancing whether the person whose pay rises enjoys benefits in the form of increased pay or increased leisure. Much of human progress is measured by the opportunities for leisure and the reduced onerousness of work that has come with technical progress and capital accumulation.

Income effects are also present when there is a rise in the return to saving (*r* in our examples). We go into this matter in greater depth in the next chapter. But for now, look again at Figure 3.7, where we let an increase in r bring about a rise in saving. That same increase in r could, however, have also led to a decrease in saving as Adam took advantage of the higher r to increase current consumption. (Stay tuned. As promised, we look at this possibility much more closely in the next chapter.)

Policy Implications

While some might see these distinctions as nuances, they in fact have great importance in forging macroeconomic policy. Suppose we take it as a given that a principal goal of macroeconomic policy is to increase work and saving (even though leisure and consumption are good things, too). This goal derives its appeal from the fact that production is good and that it occurs because of the application of labor to capital inputs. In order to get more production, some combination of the following must occur:

1. People must save more and investors must apply the increased saving to capital formation;
2. Workers must supply more labor and employers must apply the labor supplied to their capital; and
3. Technology must advance.

These conditions are timeless and applicable everywhere for increased production. This chapter dealt with items 1 and 2. Insofar as people want to save more as the return to saving rises and insofar as workers want to work more as wage rates rise *and* insofar as the government can affect these variables, we see an opportunity for the government to expand output.

This chapter was about the individual choices that drive the decision to supply labor and to save. For all the minutiae through which we had to wade, we covered only half the story on the matter of saving and work. The other half of the story concerns what must be true so that investors will want to apply saving to capital formation and so that employers will want to hire the labor supplied to them.

So what have we learned so far? Actually, two important things. First, increases in wage rates will increase the amount of labor people will want to supply, provided any income effect exerted along the way is less than the substitution effect. Second, increases in the return to saving increase saving, again, provided that any income effect is less than the substitution effect. Thus if the goal is to increase the supply of labor and to increase saving *and* if conditions are suitable, then the government should adopt policies that cancel out the income effect. We will consider just what sorts of policies might do that in a later chapter.

Also important in later chapters is the question of how workers respond to changes in what we can call the *net real wage rate*. This is the inflation-adjusted wage that the worker receives after accounting for any reduction in his inflation-adjusted real gross wage that results from his incurring an additional tax liability or from his sacrificing a government benefit by earning another dollar of labor income.

Suppose that Adam's boss pays him a gross wage of $50 for an hour's work. (We will ignore how inflation affects Adam's real wage for the purpose of this example.) Suppose further that either Adam has to pay 25 percent of his wage in income tax or he has to forgo 25 percent of his wage under a means-tested welfare program from which he receives benefits. In either event, his net wage is $37.50 (= 0.75 × $50). It is to changes in this net wage that Adam will respond in adjusting his work and leisure calculus.

An important question for purposes of considering the efficiency (or classical) effects of policy changes is how workers respond to changes in their net wage. The more they respond, the greater the amount of labor that will be supplied to producers for any increase in the net wage brought about by changes in tax rates or benefit formulas.

One measure of this responsiveness is the Frisch elasticity of labor supply. As described by economist Casey Mulligan, whose work we will examine closely in Chapter 11, the Frisch elasticity:

> measures how people adjust their work behavior in response to a one-time, temporary change in after-tax compensation (whereas the substitution elasticity measures how people adjust their work behavior in response to a permanent change in after-tax compensation). The Frisch elasticity equals the sum of the substitution elasticity and a measure of people's willingness to trade off work and consumption over time.

Mulligan considers Frisch elasticities between 0.4 and 1.1 in his work (Mulligan 2012, 108).

The authors of another study report that the Congressional Budget Office uses "a Frisch elasticity that ranges from 0.27 to 0.53, with a central estimate of 0.40." (Reichling and Whalen 2012, 3).

We will see how the Frisch elasticity has particular relevance to the stimulus measures adopted by Congress in order to aid in the recovery of the U.S. economy from the recession of 2007 to 2009. The greater the elasticity, the greater the adjustment by the individual to changes in his wage rate. Policies that reduce the after-tax wage rate have a greater, negative effect on work the greater the Frisch elasticity.

This chapter used a two-period model to introduce the reader to the fundamentals of the work and leisure, saving and consumption choice calculus. Next we expand the analysis to an n-period model in which the person adjusts current consumption and saving to earnings expectations and consumption plans over his entire lifetime (and beyond).

CHAPTER 4

Saving

In Chapter 3, we saw that the return to saving *r* enters into the decision whether to consume or save. There we alluded to the fact that the effect on saving of a rise in the return to saving depends on the relative strength of the substitution and income effects at work.

The substitution effect results from the fact that, with a higher *r*, the individual finds that each dollar added to saving brings a higher return in the form of increased future consumption than it did before. If *r* rises from five percent to six percent, the individual gets $1.06 to apply to next year's consumption for every dollar saved, rather than $1.05. This operates to increase saving.

The income effect results from the fact that an increase in *r* makes it possible to increase current consumption, and therefore reduce current saving, without reducing future consumption. Suppose that when $r = 5$ percent the individual saves $10,000. By saving $10,000 this year, he will have $10,500 more to spend next year. If *r* rises to six percent, he can *reduce* his saving to $9,906 (= $10,500/1.06) this year and still have $10,500 more to spend next year, given the rise in *r*. (For the time being, ignore the fact that this rise in *r* would reduce the present value of his income.) This creates an income effect equal to the difference between $10,000 and $9,906, that is, $94, by which he could reduce his current saving and increase his current consumption without suffering any loss in future consumption.

If, in this example, the rise in *r* induces the individual to increase current consumption and therefore decrease current saving, we say that the income effect more than offsets the substitution effect. If it induces him to decrease current consumption and therefore increase current saving, then the substitution effect more than offsets the income effect. If it induces him to keep his current consumption and saving constant, then the two effects exactly offset each other. Thus, under this last possibility and in the current example, the individual would have $10,600 to spend next year, which is about 1 percent more than was available to spend before the interest rate rose.

Alternative Views of Saving

A question of central importance to economic policy is whether a rise in the return to saving, as brought about by a reduction in the taxes on the return to saving, will cause saving to rise and by how much. The relative strength of the income and substitution effects is one factor to be considered while addressing this question.

There is another factor to be considered that has to do with how saving responds to changes in income, given that there is no change in r. The long-run, classical view is that the individual simultaneously chooses his level of work effort and saving to the end of optimizing his lifetime utility. In this view, any unexpected change in current income manifests itself in a change in the planned future consumption of the individual. If the individual sees an unexpected increase in current income, he will allocate only a small portion of that increase to current consumption, saving the remaining portion to finance future consumption.

In the short run, however, when there is low-employment equilibrium, brought about by either excess aggregate supply or excess aggregate demand, things are different. Individuals cannot optimize their consumption and saving choices because they cannot optimize their work and leisure choices. In a Keynesian slump, employers will not use all the labor services workers want to provide. In a repressed wages slump, workers will not provide all the labor services employers want to hire. In both instances, workers' current income *and* current consumption are constrained by an imbalance between aggregate supply and demand. Government policies that are effective at correcting the imbalance will manifest themselves mainly in increases in current consumption.

This presents an empirical question: Do government correctives for a perceived imbalance between aggregate supply and aggregate demand result mainly in an increase in current consumption or in current saving? If consumption, then the diagnosis and the corrective can be deemed successful. If saving, then the diagnosis was wrong and the policy wrongly applied. We consider some modern evidence bearing on this matter in Chapter 11.

Getting Back to the Classical Model

Proceeding in the spirit of the classical model, there are two central questions: (1) How do changes in the return to saving *r* affect saving? (2) How much effect do changes in current income have on current consumption (and therefore current saving)? Let's address the first question first.

In Chapter 3, we assumed that Adam was a saver. But we didn't touch upon the question whether he might be a borrower, depending on the circumstances he faces. In the interest of adding some variety to the exposition, let's switch decision makers from Adam to Eve, and let's consider the young Eve, now out of the Garden of Eden, about to set out on a career in which she expects her income to follow a predictable pattern, rising from year to year until retirement.

Eve understands that each year, her saving and borrowing decision affects her future income and therefore her future consumption. She understands that her earning power will max out only as she approaches retirement and then, as we assume here, drop to zero. But she also realizes that she has the option, when she is young, of spending either less than she earns (in which case she saves) or more than she earns (in which case she borrows). If she wants to enjoy a comfortable retirement, she can save when she is young so that she can spend more later. On the other hand, if she is in a hurry to spend when she is young, she can borrow (to a degree at least) against her future income to finance current consumption. Later we will consider the likelihood that she would want to borrow when young, save when middle aged and then dissave when old. But the general idea is that Eve is not constrained to spend only a part (or all) of her current income.

The reality, of course, is that Eve's expectations about her future income can change from moment to moment, as can the return to her saving *r*. In this chapter, we think of *r* as *the* interest rate—the rate at which Eve can alternately lend or borrow money. To simplify our understanding about Eve's thinking, we can imagine that every January 1, she reassesses her income prospects and makes a new determination of *r* for the purpose of planning her consumption and therefore her saving for the year to come, and she does this for every year going forward all the way to the end of her planning horizon.

In performing this annual recalculation, Eve recognizes *r* as serving two roles: For one thing, it measures the return to saving and likewise, the cost of borrowing. For another, it serves as the discount rate for calculating the present value of her future income. The higher the *r*, the greater the return to saving, the greater the cost of borrowing, and the lower the present value of future income. If Eve wants to use $1,000 of her income next year to buy a TV now, she can borrow $952.38 (= $1,000/1.05) now to apply for that purchase if *r* equals five percent, but only $909.09 if *r* equals 10 percent.

We accounted for this present value accounting in Chapter 3 in our discussion of Adam's choice calculus. But there we posited Adam as being a saver. A better theory would account for the possibility that he—or Eve—could switch from being a saver to a borrower or vice versa. So how will a change in *r* affect the decision to save or borrow?

The question of how changes in *r* affect Eve's lending or borrowing depends on how *r* enters into her consumption and saving decision. (Remember that lending is positive saving and borrowing is negative saving or *dissaving*.) We will shortly go into some detail figuring out how Eve would decide between consumption and saving, given whatever *r* she faces in the market for loanable funds.

Now let's turn to another question. Suppose Eve hits the lottery and brings home a check for a million dollars (we will ignore taxes and the fact that the actual immediate payoff from a lottery is always much less than the advertised payoff). Unless Eve is foolish, she will not just blow through the entire million dollars on the spot. Rather, she will spread out the benefits of her prize over her future, which will be very long if she is very young. She might even care about her future children and their future children. So the question is how much of her prize will Eve spend when she cashes the check. This goes to the question of whether a surge in current income will have much of an effect on current consumption.

Expanding the Saver's Time Horizon

To answer these questions, let's get back to work. Recall that in our two-period model, we calculate saving in period 1 as

$$sav_1 = lay_1 - c_1. \tag{1}$$

We now assume that Eve plans her consumption and saving over as long a period of time as she wishes to consider. We treat this period as beginning with year 1 and ending with year n. We allow that Eve can save or dissave (which is to say, borrow) as much as she wishes during any year $t = 1, 2, \ldots, n - 1$, given that she will consume all she can in period n. We therefore rewrite the equation for her saving as:

$$sav_t = lay_t - c_t. \tag{2}$$

Her saving rate in any year is then

$$s_t = \frac{lay_t - c_t}{lay_t}, \; t = 1, 2, \ldots, n - 1. \tag{3}$$

Now let's construct a specific *utility function*, which shows how many utiles Eve gets from consumption in any one period. A utility function that macroeconomists frequently use for this purpose is as follows:

$$u_t = \frac{c_t^{\,1-z}}{1-z}. \tag{4}$$

While this specification may look complicated, the reason that it is so popular is similar to the reason (as we shall see) that the Cobb-Douglas specification of the production function is so popular, namely, that it is easy to work with. We will shortly see why this is true. For now, the only thing that's new is the parameter z. The name of the reciprocal of z, $\frac{1}{z}$, is the *intertemporal elasticity of substitution* or IES, which measures the sensitivity of Eve's consumption (and therefore saving) decisions to the differences between the return to saving r and her rate of time preference ρ. (More on ρ, which was already considered in the previous chapter, shortly.)

We have already seen that when an individual maximizes utility, she satisfies the following equation for a two-period model in which t is period 1 and $t+1$ is period 2:

$$MRS_{c_t c_{t+1}} = (1+r), \tag{5}$$

the left-hand side of which can be expanded to read:

$$MRS_{c_t c_{t+1}} = \frac{MU_{c_t}}{MU_{c_{t+1}}}(1+\rho). \tag{6}$$

Generalizing the two-period model to n periods and substituting equation (5) in equation (6), Eve maximizes utility when

$$\frac{MU_{c_t}}{MU_{c_{t+1}}}(1+\rho) = 1+r \text{ for all } t = 1, 2, \ldots, n-1. \tag{7}$$

Now let's use an example to flesh out equation (7). Suppose that Eve's planned consumption is \$50,000 in period t and \$55,000 in period $t+1$, and let z be 0.5. A one-dollar change in her consumption in period t will cause her utility to change by

$$\begin{aligned} MU_{c_t} &= \frac{\Delta u_t}{\Delta c_t} = \frac{50{,}001^{1-0.5}}{1-0.5} - \frac{50{,}000^{1-0.5}}{1-0.5} \\ &= 447.2181 - 447.2135 = 0.0045.^{1} \end{aligned} \tag{8}$$

Correspondingly, a one-dollar change in her consumption in period $t+1$ will cause her utility to change by

$$\begin{aligned} MU_{c_{t+1}} &= \frac{\Delta u_{t+1}}{\Delta c_{t+1}} = \frac{55{,}001^{1-0.5}}{1-0.5} - \frac{55{,}000^{1-0.5}}{1-0.5} \\ &= 469.0458 - 469.0416 = 0.0043. \end{aligned} \tag{9}$$

Finally, assume that Eve's rate of time preference ρ equals 5.11 percent, so that

$$(1+\rho) = 1.0511. \tag{10}$$

Plugging the information from equations (8), (9), and (10) into the left-hand side of equation (7), we get

$$\frac{MU_{c_t}}{MU_{c_{t+1}}}(1+\rho) = 1 + \mathrm{r} = \frac{0.0045}{0.0043}(1+0.0511) = 1.10. \quad (11)$$

Also from equation (6),

$$MRS_{c_t c_{t+1}} = 1.10. \quad (12)$$

Equations (8) and (9) tell us that another dollar of period t consumption adds as much to Eve's period t utility as 1.0465 (= 0.0045/0.0043) dollars of period t + 1 consumption adds to her period t + 1 utility. If Eve gives up $1.00 of consumption in period t + 1, she loses 0.0043 utiles in period t + 1, but if she adds $1.00 dollar to her consumption in period t, she gains 0.0045 utiles in period t. So she can give up as much as 1.0465 dollars of her period t + 1 consumption while increasing her period t consumption by one dollar and at the same time keep the sum of her utility over the two periods constant. But because a period t utile is worth 5.11 percent more than a period t + 1 utile, she is willing to give up 1.10 (= 1.0465 × 1.0511) dollars of period t + 1 consumption for another dollar of period t consumption. If r equals 10 percent, she satisfies the equilibrium condition of equation (5).

Maximizing Intertemporal Utility

Now we get to find out why the specification of Eve's utility function in equation (4) is so popular. It turns out that, after a lot of mathematical calculations using equation (4) and as given in the appendix to this chapter, we can transform equation (5) into the following equation:

$$\frac{\Delta c}{c} = (r - \rho)\frac{1}{z}.^{1} \quad (13)$$

[2] This relies on a couple of mathematical tricks whereby we can approximate $\ln(1+r) - \ln(1+\rho)$ as $(r-\rho)$ and $\ln c_t - \ln c_{t-1}$ as $\frac{\Delta c}{c}$.

This tells us that when Eve is maximizing utility, the percentage change in her consumption from one period to the next equals the difference between r and ρ multiplied by $\frac{1}{z}$, which we previously identified as Eve's IES. We can simplify even more by rewriting equation (13) as:

$$\%\Delta c = (r - \rho)\text{IES}. \tag{14}$$

We can also now see exactly what IES means. IES is the number of percentage points by which desired consumption in the next period will exceed consumption in the current period for every percentage point by which r exceeds ρ. (Or, if ρ exceeds r, the number of percentage points by which desired consumption in the next period will fall below consumption in the current period for every percentage point by which ρ exceeds r).

Before thinking more about what this equation says, let's check the math. In the example just considered, Eve planned for her consumption to rise from \$50,000 to \$55,000 going from period t to period $t + 1$. Thus, her planned percentage change in consumption ($\%\Delta c$) was 10 percent (= \$5,000/\$50,000). The question is whether this planned percentage change in consumption maximized her utility. According to equation (14), it does if $(r - \rho)$IES also equals 10 percent. Well, let's check: First, $(r - \rho)$ equals 10 − 5.11 percent, that is, 4.89 percent. Next, because z equals 0.5, $\frac{1}{z}$, which is the IES for Eve, equals 2. Thus, we have 0.0489×2 or (approximately) 10 percent. Eve was in fact maximizing her utility!

The utility function specified in equation (4) thus turns out to have a convenient property, which lies in the fact that the coefficient $1/z$ measures the sensitivity of the individual's consumption plan to the difference between r and ρ, which is to say, to the difference between the return to saving and the individual's time preference.

As we know, r and ρ can change from moment to moment, but there is little sacrifice, in generality, if we continue to think of Eve as revising her plans for her economic future every January 1. The questions for this chapter are (1) what will be her year 1 consumption and saving and (2) how would a change in r or in her current and future labor income affect her year 1 consumption.

According to the usual view of Eve's saving decision, she would put aside some fraction s of her disposable income each year based on some combination of future needs (the wish to own a home, the education of her kids, her retirement, and so on). This is all right as far as it goes, but Eve understands that the money she has available to apply to her saving now will affect her consumption in every year of her life going forward (just as her income in every year of her life going forward affects her ability to consume now). So Eve needs to put together some information in order to decide how much to consume and save in every year of her life starting now and going forward. Specifically, she needs to know

1. What interest rate r to use in figuring out the return to saving and in discounting future consumption and income.
2. How much she prefers current utility over future utility, that is, what value to attach to her ρ.
3. How sensitive her future consumption will be to the difference between r and ρ, that is, what value to attach to her IES.
4. The number of years n over which she wants to plan her economic future.

Knowing this, she can figure out how much income to allocate to her current year consumption and therefore her current year saving. Once she knows that, she can apply equation (14) to figure out her second year consumption, and then again to figure out her third year consumption, and so on. [Keep in mind that her second year consumption will equal her first year consumption times $(1 + \%\Delta c)$], where $\%\Delta c$ is determined once she knows what values to assign to r, ρ, and IES.

Again, understand that economists don't require Eve to consciously make all these calculations. The computer she carries around in her brain can do all that without her explicitly thinking about it. Yet, as strange as this might seem to the non-economist, everything here is based on common sense. One way or another, Eve's consumption in 2015 will bear some relationship to her consumption in 2014. The greater the reward to saving (r), the less impatient she is for current consumption (the lower her ρ) and the more she wants to substitute future for current consumption, given the difference between r and ρ, the more she will want her next-period consumption to exceed her current-period consumption. And then also, the more she will want to save in the current period.

Suppose the computer in Eve's head has already solved equation (14) on January 1, 2014 and then, next January 1, she finds out that r has unexpectedly risen. Because this raises the return to saving, and equivalently, the cost of borrowing, Eve will want to rethink her spending plans for the year to come and for every year thereafter. Because her spending plans and her saving plans are opposite sides of the same coin, she will likewise want to rethink her saving plans.

The same will happen if her rate of time preference ρ goes down or her IES goes up. Once Eve has adjusted the left-hand side of equation (14), she will be back in utility-maximizing equilibrium. But Eve needs to figure out her year 1 consumption and saving before she can figure out how much more (or less) to spend on consumption in year 2. Equation (14) just tells us the percentage by which she will want to change her consumption going from the current period to the next. Let's identify the current period as year 1. Then Eve still needs to figure out how much to consume in year 1, after which she can plot her consumption plans all the way to retirement.

One Last Step

To figure out Eve's year 1 consumption, we need to reintroduce an assumption from Chapter 3, whereby Eve will set the present value of her current and future consumption in year 1 equal to the present value of her current and future income. Let's write that condition as

$$PV_{lay} = PV_c. \tag{15}$$

Given that assumption and equation (4), we can find a coefficient v, which when multiplied by the present value of Eve's consumption, will tell us how much she wants to consume in year 1. Generally, Eve's year 1 consumption is

$$c_1 = vPV_{lay}, \tag{16}$$

her period 1 saving is

$$sav_1 = lay_1 - vPV_{lay} \tag{17}$$

and her saving rate is

$$s_1 = \frac{lay_1 - vPV_{lay}}{lay_1}. \tag{18}$$

The appendix to this chapter shows how to calculate v. In general,

1. When IES >1, v varies inversely with r and directly with ρ and when IES < 1, v varies directly with r and inversely with ρ.
2. v depends only on the size of ρ when IES = 1, in which event v varies directly with ρ.
3. When IES = 1, v approaches $\rho/(1 + \rho)$ in value as n approaches infinity.

Point 2 means that changes in r will not affect the fraction of PV_{lay} that is allocated to consumption, or saving when IES = 1. This goes to the relative strength of the income and substitution effects. The income and substitution effects must just offset each other when IES = 1. To see why, recall the example with which this chapter began. There we saw that a one-percentage-point rise in r this year would bring about a one percent rise in the funds available for consumption next year without the need to increase saving. The same applies here, but more generally: If ρ is constant and IES = 1, the percentage change in consumption from one year to the next will rise for every percentage point increase in r but without an increase in saving. This ignores the effect of a change in r on the present value of labor income, which we now consider.

How Changes in *r* Affect Saving

Remember that year 1 consumption equals v times the present value of labor income and that year 1 saving equals year 1 labor income minus year 1 consumption. A rise in r will reduce the present value of future labor income, and for that reason alone a rise in r will reduce current consumption and therefore increase current saving.

To put some numbers to this analysis, suppose that IES = 1 and that we are back to a two-period world. Then we know that Eve's desired percentage change in consumption from period 1 to period 2 will rise by one percentage point for every percentage point that r rises while ρ remains constant. Now let's make some more assumptions:

- $r = 5\%$
- $\rho = 2\%$
- $lay_1 = \$60,000$ and
- $lay_2 = \$42,000$.

We can use the information from the appendix to find *v*, which turns out to be 50.495 percent. (We observe below that v is usually very low. It is high in this instance because we are assuming that *n* is also low, which is to say equal to 2.) Table 4.1 shows the results for period-1 saving and for periods 1 and 2 consumption.

Now let the interest rate rise to six percent while all the other assumptions remain unchanged. Table 4.2 provides the results.

We see that saving rose, but not because *v* fell. Saving rose entirely because the present value of labor income fell. When IES = 1, a rise in the interest rate, therefore, does not affect current consumption or current saving, except insofar as it reduces the present value of income.

A rise in *r* will induce Eve to increase her saving rate because it will reduce PV_{lay} and therefore current consumption. Conversely, a fall in *r* will induce Eve to decrease her saving rate because it will increase PV_{lay} and therefore current consumption. It is just that the larger her IES the more her saving rate will change.

Table 4.1 Two-period model, r = 5%

PV_{lay}	\$100,000[a]
c_1	\$50,495[b]
sav_1	\$9,505[c]
s_1	15.8%[d]
$sav_1(1+r)$	\$9,980[e]
c_2	\$51,980[f]
$\Delta c/c$	2.94%[g]

a = \$60,000 + \$42,000/(1.05).
b = 0.50495 × \$100,000.
c = \$60,000 − \$50,495.
d = \$9,505/\$60,000.
e = \$9,505 × (1 + 0.05).
f = \$42,000 + \$9,980.
g = (\$51,980 − \$50,495)/\$50,495.

Table 4.2 Two-period model, r = 6%

PV_{lay}	\$99,623[a]
c_1	\$50,305[b]
sav_1	\$9,695[c]
s_1	16.2%[d]
$sav_1(1+r)$	\$10,277[e]
c_2	\$52,277[f]
$\Delta c/c$	3.92%[g]

a = \$60,000 + \$42,000/(1.06).
b = 0.50495 × \$99,263.
c = \$60,000 − \$50,305.
d = \$9,695/\$60,000.
e = \$9,695 × (1 + 0.06).
f = \$42,000 + \$10,277.
g = (\$52,277 − \$50,305)/\$50,305.

Suppose that IES equals 1.5. Eve will want the percentage change in her consumption to equal 1.5 percentage points for every percentage point rise in r (again, holding ρ constant). The substitution effect of the rise in r will more than offset the income effect.

Let's make our analysis more realistic now by assuming that Eve takes her first job on her 22nd birthday and that the job offers a starting salary of \$50,000. Eve expects to retire in 40 years, when she is 62 and expects to get a five percent raise each year she is on the job (which means she'll make about \$335,000 dollars the last year she works!). For convenience, we assume that the interest rate initially is also five percent. Finally, we assume that Eve has a rate of time preference of two percent.

Discounted over Eve's 40-year working life, the present value of her income is \$2,000,000. Given our assumptions, Eve's v is 2.77 percent, and her first-year consumption is \$55,400 (see Table 4.3 footnote a). She plans that during the first year of her career, her saving will be a negative \$5,400 and therefore her saving rate will be −10.8 percent. Her planned second-year consumption is \$57,893, which, given the values assigned to r, ρ, and IES, must be 4.5 percent greater than her year 1 consumption.

Now suppose that, just after Eve had planned out her current and future consumption, the interest rate rose unexpectedly to six percent. Eve's income stream remains unchanged, but her v falls to 2.53 percent and the present value of her income stream falls to \$1,672,452. Thus, she revises her plans so that she will consume \$42,313 the first year and \$44,852 the second. She will increase her first-year saving from −\$5,400 to \$7,687 and her saving rate from −10.8 percent to 15.4 percent. We summarize this in Table 4.3.

We can infer that, a given rise in the return to saving produces a larger rise in Eve's saving rate, as her IES exceeds 1. But whatever the value of her IES, v will always be small when the planning period is long. To see this, let's consider a few more examples. In Table 4.4, we assume that $\rho = 0.02$, $n = 40$, $r = 0.05$ and $lay_1 = \$50,000$. The larger Eve's IES, the smaller her v and the larger her s.

Table 4.3 Two period model: Effects of a rise in r

	r	v	PV1	c_1	c_2	sav_1	s_1
Initial values	5%	2.77%	\$2,000,000	\$55,400[a]	\$57,893[c]	–\$5,400[e]	–10.8%[g]
Values after r rises	6%	2.53%	\$1,672,452	\$42,313[b]	\$44,852[d]	\$7,687[f]	15.4%[h]

a = 0.0277 × \$2,000,000.
b = 0.0253 × \$1,672,452.
c = \$55,400 × (1 + [(5% − 2%) × 1.5]).
d = \$42,313 × (1 + [(6% − 2%) × 1.5]).
e = \$50,000 − \$55,400.
f = \$50,000 − \$42,313.
g = −\$5,400/\$50,000.
h = \$7,687/\$50,000.

Table 4.4 Effects of IES on the saving rate

IES	v	s_1
0.1	5.34%	−113%
0.5	4.52%	−81%
1.0	3.58%	−43%
2.0	2.08%	17%
2.5	1.52%	39%

Now let's return to the question of what Eve does after she hits the lottery. It is clear that, whatever the size of IES, given these assumptions, v_1 and therefore the immediate increase in Eve's consumption are going to be very small. If we assume an IES of 1.5, a ρ of two percent and an r of 1.5 percent, then v equals 3.73 percent. If r is 10 percent then v equals 1.72 percent.

So suppose that Eve hits the lottery and brings home $1,000,000. Return to the example detailed in the first row of Table 4.3 and assume that, given an r of five percent and a ρ of two percent, Eve's PV_{lay} rises from $2,000,000 to $3,000,000. Her current labor income, of course, remains constant at $50,000. Putting all this information together, Eve's current consumption will rise by $27,700, from $55,400 to $83,100. Eve will immediately spend 2.77 percent of her winnings. That's 2.77 cents on the dollar! This bears on the ability of government to achieve economic recovery through a fiscal stimulus—a matter to which we will return in Chapter 11.

As shown in the appendix, these calculations are greatly simplified if we assume that IES = 1 and n is large. Then:

$$v = \frac{\rho}{1+\rho}. \tag{19}$$

If, under these conditions, $\rho = 2$ percent, a million-dollar bonus in year 1 will increase consumption by $19,608 in that year and in every year to follow.

The Permanent Income Hypothesis

The above observations are consistent with the *permanent income hypothesis,* whereby people make spending decisions according to how a change in current-period income affects their permanent income. We see that if Eve experiences a change in her current income (even a change of $1 million!) she will adjust her current consumption according to how that change affects the present value of her current and future labor income and according to the size of v. And if Eve has a long planning horizon, even large changes in her current income will have small effects on this PV_{lay}. So then what is her *permanent income*?

One idea that motivates the concept of permanent income is that people will want to smooth out their consumption stream over their lifetimes to whatever degree is possible. The foregoing discussion provides examples in which the individual will have a consumption schedule that slopes steeply upward or steeply downward over her lifetime, depending on the size of r, ρ, and the IES. A high r and a low ρ indicate high saving at the beginning of the planning period but high consumption at the end. Just the opposite is true for a low r and a high ρ.

It means that actual income will vary from year to year, depending on a great many factors (including such things as lottery winnings), while consumption will follow a more or less steady path, depending on how the individual wants to structure his or her consumption over the planning period. Think of permanent income, then, as the individual's consumption stream, however arranged, over her future. Hitting the lottery will always have a much smaller effect on permanent income than on current income since the lucky winner will want to spread her winnings out more or less evenly over her future.

There is an argument to the effect that permanent income, so defined, will be flat over the future even as actual current income rises and falls. Let's see why the individual would not want to have a steeply rising or steeply falling consumption curve over her future.

If Eve is a high saver at the beginning of her life, her consumption will steadily rise over the course of her lifetime and the marginal utility of consumption will steadily decline. Using the notation developed above, MU_{c_t} would be high relative to $MU_{c_{t+1}}$. It seems that she would want to move some of her consumption from her later years, when the utility she would lose by taking a dollar out of consumption is low, to her early years, when the utility she would gain by adding a dollar to consumption is high. Were she to do this, MU_{c_t} would fall and $MU_{c_{t+1}}$ would rise until they were equal. But then, as we see from equation (7), ρ would have to rise until it was equal to r.

Conversely, if Eve is a high borrower at the beginning of her life, her consumption will steadily fall over the course of her lifetime and the marginal utility of consumption will steadily rise. MU_{c_t} would be low relative to $MU_{c_{t+1}}$. It seems that she would want to move some of her consumption from her early years, when the utility she would lose by taking a dollar out of consumption is low, to her later years, when the utility she would gain by adding a dollar to consumption is high. Were she to do this, MU_{c_t} would rise and $MU_{c_{t+1}}$ would fall until they were equal. This time ρ would have to fall until it was equal to r.

This logic argues for a saving strategy that brings the rate of time preference ρ into line with the interest rate r. Return to equation (14) and consider what it means if $\rho = r$. Mathematically, the individual sets $\%\Delta c$ equal to zero for all periods going forward and thus equalizes consumption from one year to the next over the entire planning period. What seems intuitively plausible is that Eve would want to even out her consumption over life as much as practicable. Every entrant into the labor force can reasonably expect his or her labor income to be low at first, then rise and later drop precipitously upon retirement.

Neither Adam nor Eve will, however, want to eat sardines when young or old but then gorge on filet mignon when middle aged. In the language of economics, the marginal utility of the individual's labor income will be high when he has a low labor income, that is when he is young and when he is old, and the marginal utility of his labor income will be low when he has a high labor income, that is when he is middle aged. Insofar as he wants to equalize the marginal utility of consumption across his lifetime, he will dissave (borrow) when young, save when middle aged and dissave (use up assets) when old. Operationally, in our planning model, this means adjusting ρ to be equal to r, so that consumption is equal across the individual's planning period.

This in turn means that in order for aggregate saving to be positive, we need to have a lot of middle-aged income earners who are accumulating assets even as younger and retired individuals dissave. It also means that we need tax policies that encourage saving—a matter taken up in Chapter 8.

Figure 4.1 illustrates the results of this strategy for the example provided in the first row of Table 4.3, with the difference that ρ and r are both assumed to be equal to five percent. There Eve's annual labor income rises from $50,000 in year 1 to $335,000 in year 40, after which it drops to zero. (We assume that Eve spends her golden years living with her children, who generously subsidize her consumption beyond her planning period to her death.) She fixes her annual consumption at $111,000 per year from year 1 to year 40.

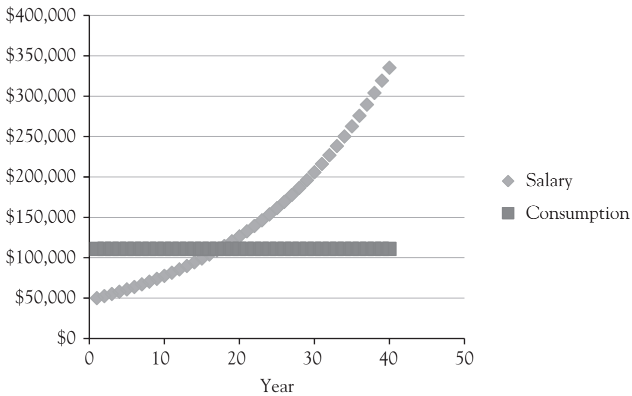

Figure 4.1 Illustration of permanent income hypothesis

This $111,000 per year is Eve's *permanent income*. It is the consumption she would enjoy if she equalized her consumption over her lifetime, given her earnings expectations and the value of *r*. Eve's permanent income is to be distinguished from her temporary income. If at some point in her life Eve wins $10,000 in the lottery, her temporary income will rise by $10,000, but her permanent income will hardly rise at all.

Eve would face myriad practical obstacles to a strategy that had her spending twice as much as she earns in her early years. There are practical obstacles to any consumption plan that requires borrowing against future labor income. In practice, young people dissave by taking out student loans, borrowing from relatives, and cashing in any inheritances they are lucky enough to receive. But a confident young Eve cannot go to her bank and take out a loan to buy a luxurious house, on the promise that she can pay off the loan without any problem in a decade or so. *Liquidity constraints* limit the practicality of any scheme requiring substantial borrowing against future earnings.

Yet the example is based on common sense and yields a handy tool for estimating the effect of an increase in current income on current consumption. As shown in the Appendix, v reduces to

$$v = \frac{r}{1+r} \qquad (20)$$

if we assume that $\rho = r$ and that n is large. Thus, if r equals five percent and if Eve wins $1,000,000 in the lottery, her spending in year 1 and in every year thereafter will rise by $47,619. This can be considered to be the classical analogue of the *marginal propensity to consume* of the Keynesian model.

There is one overriding conclusion about the effects of windfall gains that can be taken from this chapter; it is that any such gain will yield a small increase in current consumption because of the desirability of *consumption smoothing*—spreading the benefits over the future rather than just taking them all at once. This bodes ill for government policies aimed at stimulating current consumption through tax rebates and the like.

In the aggregate, saving is positive. But if aggregate saving is positive year after year then individual savers are regularly, and on balance, taking part of their labor income and putting it into income-earning assets on which they plan to draw in future years to finance their planned consumption. The existence of a positive national saving rate depends on the preponderance of individuals in the labor force who anticipate income increases over their future and who want to accumulate income-earning assets during their peak earning years in order to pay off loans taken when young and to save for retirement.

Policy Implications

We shall see in Chapter 6 that government policy that succeeds in raising the saving rate s can bring about an increase in real GDP per person. In Chapter 8, we will see how the government can increase the rate of return to saving r and thus increase the individual's saving rate by reducing taxes on capital income. The ability of the government to increase s by increasing r depends, as we have seen, on the size of the IES.

The greater the IES, the more effective are government policies aimed at increasing s. But is the IES large enough for those policies to be effective?

Economist Robert Hall has offered what is probably the most pessimistic assessment of the prospects for increasing the saving rate through the removal of tax deterrents to saving. As he puts it, his analyses provide "little basis for a conclusion that the behavior of aggregate consumption in the United States in the twentieth century reveals an important positive value of the intertemporal elasticity of substitution."

(Hall 1988, 356). See also Braun and Jakajima (2012). Hall finds that increases in *r* have almost no effect at all (and might have a negative effect) on saving.

In contrast, Jonathan Gruber finds that the "estimated EIS [elasticity of intertemporal substitution, same as the IES] is very large, larger than most estimates from the previous literature, and this estimate is robust to a wide variety of specification checks." (Gruber 2013, 4). Gruber finds the value to be around 2 (24). In his book *The Redistribution Recession*, Casey Mulligan puts the IES at 1.35 (Mulligan 2012, 152).

Perhaps, on the other hand, the size of the IES becomes less important when we consider the implications of the assumption, maintained throughout this chapter, that people base their current saving decisions on planned lifetime consumption. In this regard, David Romer considers the scenario in which "r is slightly larger than ρ and that the elasticity of substitution is small." These assumptions "imply that consumption rises slowly over the individual's lifetime. But with a long lifetime, this means that consumption is much larger at the end of the life than the beginning." Then, given that labor income is constant, "this in turn implies that the individual gradually builds up considerable savings over the first part of his or her life and gradually decumulates them over the remainder. As a result, when horizons are finite but long, wealth holdings may be highly responsive to the interest rate in the long run even if the intertemporal elasticity of substitution is small."(Romer 2012, 383 and 384).

This chapter delved into the saving calculus of an individual. In the next chapter, we consider how saving decisions match up with capital investment decisions to determine investment and the equilibrium capital stock.

Appendix

First we set the present value of utility equal to the individual's consumption stream discounted by ρ:

$$PVu = \frac{c_1^{1-z}}{1-z} + \frac{1}{1+\rho}\frac{c_2^{1-z}}{1-z} + \frac{1}{(1+\rho)^2}\frac{c_3^{1-z}}{1-z} + \ldots + \frac{1}{(1+\rho)^{n-1}}\frac{c_n^{1-z}}{1-z} \quad \text{(A1)}$$

Next we write out the formula for the present value of consumption:

$$PV_c = c_1 + \frac{c_2}{1+r} + \frac{c_3}{(1+r)^2} + \ldots + \frac{c_n}{(1+r)^{n-1}}. \tag{A2}$$

We can write the individual's utility maximization problem in terms of the Lagrangian expression:

$$Z = PV_u + \lambda\left(PV_c - \left(c_1 + \frac{c_2}{1+r} + \frac{c_3}{(1+r)^2} + \ldots + \frac{c_n}{(1+r)^{n-1}}\right)\right). \tag{A3}$$

Maximizing (A 3) we get

$$\frac{\partial Z}{\partial c_t} = \frac{{c_t}^{-z}}{(1+\rho)^{t-1}} - \lambda\frac{1}{(1+r)^{t-1}} = 0, \tag{A4}$$

for all $t = 1, \ldots, n$.

And

$$\frac{{c_t}^{-z}}{{c_{t+1}}^{-z}} = \frac{1+r}{1+\rho}, \tag{A5}$$

where

$${c_t}^{-z} = MU_{c_t} \text{ and} \tag{A6}$$

$${c_{t+1}}^{-z} = MU_{c_{t+1}}. \tag{A7}$$

Then

$$\frac{c_{t+1}}{c_t} = \left(\frac{1+r}{1+\rho}\right)^{1/z} \text{ and} \tag{A8}$$

$$c_{t+1} = \left(\frac{1+r}{1+\rho}\right)^{1/z} c_t, \tag{A9}$$

for all $t = 1, \ldots, n-1$.

We can further simplify this by taking logarithms of both sides of (A8):

$$\ln c_{t+1} - \ln c_t = \frac{1}{z}\left[\ln(1+r) - \ln(1+\rho)\right], \tag{A10}$$

to get

$$\frac{\Delta c}{c} = (r - \rho)\frac{1}{z}. \quad \text{(A11)}$$

Now we set the present value of consumption equal to the present value of labor income:

$$PV_{lay} = lay_1 + \frac{lay_2}{1+r} + \frac{lay_3}{(1+r)^2} + \ldots + \frac{lay_n}{(1+r)^{n-1}} = PVc. \quad \text{(A12)}$$

Letting

$$q = \left(\frac{1+r}{1+\rho}\right)^{1/z}, \quad \text{(A13)}$$

we can write:

$$PV_{lay} = c_1\left[1 + \frac{q}{1+r} + \left(\frac{q}{(1+r)}\right)^2 + \left(\frac{q}{(1+r)}\right)^3 + \ldots + \left(\frac{q}{(1+r)}\right)^{n-1}\right]. \quad \text{(A14)}$$

Then we can solve for c_1 by multiplying both sides of (A 14) by $\frac{q}{1+r}$ and subtracting, to get

$$\frac{q}{1+r}PV_{lay} = c_1\left[\frac{q}{1+r} + \left(\frac{q}{(1+r)}\right)^2 + \left(\frac{q}{(1+r)}\right)^3 + \ldots + \left(\frac{q}{(1+r)}\right)^{n}\right]. \quad \text{(A15)}$$

Solving,

$$PV_{lay}\left(1 - \frac{q}{1+r}\right) = c_1\left[1 - \left(\frac{q}{(1+r)}\right)^n\right], \quad \text{(A16)}$$

and

$$c_1 = \frac{1 - \frac{q}{1+r}}{1 - \left(\frac{q}{(1+r)}\right)^n} PV_{lay}. \quad \text{(A17)}$$

If we let

$$v = \frac{1 - \frac{q}{1+r}}{1 - \left(\frac{q}{(1+r)}\right)^n}, \tag{A18}$$

then

$$c_1 = vPV_{lay}.$$

Note that if the intertemporal elasticity of substitution, $\frac{1}{z}$, equals 1, q becomes $\left(\frac{1+r}{1+\rho}\right)$ and

$$c_1 = \frac{1 - \frac{1+r}{1+\rho}\frac{1}{1+r}}{1 - \left(\frac{1+r}{1+\rho}\frac{}{(1+r)}\right)^n} PV_{lay} = \frac{\frac{\rho}{1+\rho}}{1 - \left(\frac{1}{1+\rho}\right)^n} PV_{lay} \tag{A19}$$

Then, as n approaches infinity, (A 19) becomes

$$c_1 = \frac{\rho}{1+\rho} PV_{lay}, \tag{A20}$$

so that

$$v = \frac{\rho}{1+\rho}. \tag{A21}$$

We can also see that if $r = \rho$, then

$$v = \frac{\frac{r}{1+r}}{1 - \left(\frac{1}{(1+r)}\right)^n}. \tag{A22}$$

Finally, in that case, as n approaches infinity,

$$v = \frac{r}{1+r}. \tag{A23}$$

CHAPTER 5

Capital

An important issue that arises in macroeconomics has to do with how the economy performs, given that it is in a classical state of full employment. Recall Alan Blinder's comment, noted in Chapter 1, about utilizing "inputs more efficiently." This is called the efficiency or allocative problem in economics, and it is a problem that economic agents solve in the classical model. The efficiency problem can be seen as one aspect of the overall coordination problem.

In this chapter, we will see how individual economic agents solve this problem as it relates to capital. In the preceding chapter, we considered in detail how economic agents solve the problem of how much to save and therefore how much financial capital to provide to the users of financial capital, that is, producers. Here, we will combine that decision with the choice calculus of producers as it relates to the use of financial capital and thereby the acquisition of physical capital.

Decisions to Save and Invest

Let's return to the post-Garden-of-Eden world where Adam wants to borrow \$10,000 from Eve for the purpose of buying a pizza oven for Adam's Pizzeria. We say that Adam wants to sell Eve an IOU or a bond for \$10,000. We designate the nominal interest rate on this loan as R. The *nominal* rate is the rate specified on the IOU. Eve wants to charge five percent interest so that $R = 5$ percent.

Adam expects his investment in the oven to yield an increase in his income per dollar invested, which we designate MP_k, and he expects the oven to undergo economic depreciation annually at the rate of d. The cost to him of buying the oven in year 1 is $P_1\Delta k$, where P_1 is an index of year 1 prices, set equal to 1, and Δk is the cost of the oven. Then $P_1\Delta k =$ \$10,000, given that $P_1 = 1$ and $\Delta k =$ \$10,000.

We can make the underlying concepts more concrete by introducing some more numbers. Suppose that MP_k equals seven percent, so that every dollar sunk into the purchase of an oven yields 7 cents in new revenue. Also let economic depreciation d = 1 percent, so that the oven annually loses one percent of its value through wear and tear. If Adam expects prices to rise by, say, four percent over the course of the year, his expected P_2 will equal 1.04 and his expected $P_2\Delta k$ will equal \$10,400, the new value of the oven, given inflation. The oven will, however, have depreciated by one percent, leaving him with an oven worth \$10,296, which is \$296 more than he paid for the oven. By the first of the following year, Adam will have added \$728.00 ($= P_2\Delta k MP_k$) to his sales for having bought the oven. This adds up to a return of \$1,024 on a purchase of \$10,000. We can use this information to provide a formula for the nominal rate of return on Adam's investment:

$$\begin{aligned} NRR_k &= \frac{P_2(1 + MP_k - d)\Delta\text{k} - P_1\Delta k}{P_1\Delta k} \\ &= \frac{1.04(1 + 0.07 - 0.01)\$10{,}000 - 1(\$10{,}000)}{1(\$10{,}000)} \\ &= 10.24\%. \end{aligned} \tag{1}$$

Given that

$$P_2 = P_1(1 + \hat{P}_A), \tag{2}$$

where $\hat{P}_A$ denotes Adam's expectation of inflation,

$$NRR_K = \frac{P_1(1 + \hat{P}_A)(1 + MP_k - d)\Delta k - P_1\Delta k}{P_1\Delta k}, \tag{3}$$

which simplifies to

$$NRR_k = (1 + \hat{P}_A)(1 + MP_k - d) - 1 \tag{4}$$

or in this instance,

$$\begin{aligned} NRR_k = (1 + \hat{P}_A)(1 + MP_k - d) &= (1 + 0.04)(1 + 0.07 - 0.01) - 1 \\ &= 10.24\%, \end{aligned} \tag{5}$$

which simplifies still further to

$$NRR_k \approx MP_k - d + \hat{P}_A = 0.07 - 0.01 + 0.04 = 10\%. \tag{6}$$

So now let's see whether it is worth it to Adam to borrow the $10,000 from Eve. We recall that she intends to charge him a nominal interest rate of five percent. So it happens that Adam's expected nominal return exceeds Eve's required nominal return of five percent and it makes sense to both of them for Eve to lend him the money.

Then we can say that Adam will borrow from Eve and expand his capital stock if

$$NRR_k > R, \tag{7}$$

and that Adam will pay off his loans and do so by selling off his capital stock if

$$NRR_k < R. \tag{8}$$

If $NRR_k > R$ and Adam borrows and invests the money, the MP_k on his capital stock will fall, owing to the law of diminishing returns. If $NRR_k < R$ and Adam pays off his loans and disinvests, the MP_k on his capital stock will rise, owing to the law of diminishing returns. Thus in equilibrium

$$NRR_k = R. \tag{9}$$

Now let's return to Eve and recast the example in terms of the real rate of return to her of making the loan. We suppose that the price level, P_1, when Eve makes the loan is 1 and that Eve expects inflation to be two percent. So, she expects the price level to be $P_2 = 1.02$ when the loan comes due.

The real, expected, inflation-adjusted value of the bond to Eve when the loan comes due will be

$$b_2 = \frac{b_1}{P_2}(1+R) = \frac{\$10{,}000}{1.02}(1+0.05) = \$10{,}294. \tag{10}$$

Now if we designate Eve's expected inflation rate to be $\hat{P}_E$, we can rewrite (10) as

$$b_2 = \frac{b_1}{P_1}\frac{(1+R)}{(1+\hat{P}_E)} = \frac{b_1}{P_1}(1+r), \tag{11}$$

where

$$(1+r) = \frac{(1+R)}{(1+\hat{P}_E)}. \tag{12}$$

This permits us to calculate her expected *real* return on the loan as

$$r = \frac{(1+R)}{(1+\hat{P}_E)} - 1 = \frac{1+0.05}{1+0.02} - 1 = 2.94\%. \tag{13}$$

We can likewise use equation (13) to solve for her expected nominal rate of return:

$$R = (1+r)(1+\hat{P}_E) - 1. \tag{14}$$

With a little algebra and simplification, we can see how we can approximate her expected real return as

$$r \approx R - \hat{P}_E \tag{15}$$

or in this instance,

$$r \approx 0.05 - 0.02 = 3\%. \tag{16}$$

We need to distinguish between two ways of looking at this logic. If Eve lends the money to Adam for a nominal interest rate of five percent and if she expects inflation to be two percent, then she will expect real return of about three percent. On the other hand, if Eve expects the inflation rate to be five percent and wants to get a real return of three percent, then she has to charge a nominal rate of about eight percent. We can see that by using equation (15) to solve for *R*:

$$R \approx r + \hat{P}_E = 0.03 + 0.05 = 8\%. \tag{17}$$

Because Eve cannot predict inflation with complete accuracy, we have to allow that the realized real return on a loan may be different from the expected real return, depending on the rate of inflation that actually materializes.

With that in mind, let's substitute equations (4) and (14) in equation (9) to describe equilibrium, given each person's expectation of inflation:

$$(1+\hat{P}_A)(1+MP_k-d)-1=(1+\hat{P}_E)(1+r)-1. \tag{18}$$

At this point, the classical model makes a bold assumption, that is, $\hat{P}_A=\hat{P}_E=\hat{P}$ or more generally, that everyone has the same expectation of inflation. Wrong as this must be in practice, it has an intuitively plausible foundation, based on the idea of *rational expectations* in economics. Because everyone on both sides of the capital market must make some assessment of future prices in making a decision whether to provide or use financial capital, each actor will use the best information available. As discussed in Chapter 9, one model of expected inflation is that inflation equals the growth of the money supply. Thus, all that Adam and Eve, right along with Cain and Abel, have to do is watch the growth of the money supply, information on which is available to all, in order to form a rational expectation of $\hat{P}$. Thus, we now have

$$(1+\hat{P})(1+MP_k-d)-1=(1+\hat{P})(1+r)-1 \tag{19}$$

Note that no one has to be correct in his or her forecast. In fact, the actual $\hat{P}$ will always diverge somewhat from the expected $\hat{P}$, so that one or the other party will be disappointed over the inflation rate that actually materializes. If the actual $\hat{P}$ exceeds her expected $\hat{P}$, then lender Eve will be disappointed. If his expected $\hat{P}$ exceeds the actual $\hat{P}$, then borrower Adam will be disappointed. Yet capital transactions can proceed efficiently as long as both parties act on the same, commonly available, information. And under rational expectations, both parties will learn from their mistakes and expectations will tend to be aligned with reality.

Given that borrowers and lenders have the same estimate of $\hat{P}$, equation (19) reduces to

$$MP_k=r+d. \tag{20}$$

Borrowers expand their saving just to the point at which

$$MRS_{c_t c_{t+1}} = 1 + r. \tag{21}$$

Therefore, in equilibrium,

$$MRS_{c_t c_{t+1}} = 1 + MP_k - d. \tag{22}$$

More generally, we can think of Adam as wanting to expand his holdings of capital just to the point where the marginal product of capital equals the cost to him of obtaining that capital, however that capital might be obtained, whether through a loan or the offer of a partnership in the business to Eve or a sale of stock to her. We write this condition as

$$MP_k = cc, \tag{23}$$

where $cc = r + d$.

Now suppose

$$MP_k > cc. \tag{24}$$

Then it would pay Adam to obtain more financial capital from Eve inasmuch as the contribution of another dollar's worth of oven adds more to his income than his costs. Alternatively, he will want to let his stock of ovens shrink through depreciation (or by just selling off his ovens) if

$$MP_k < cc. \tag{25}$$

Adam will have adjusted his oven capital stock to just the right level when equation (21) is satisfied.

The Supply and Demand for Capital

Recall equation (21) from Chapter 2:

$$I + NX = S + (T - G). \tag{26}$$

Suppose now that NX is zero, as is $T - G$. Then we see that every dollar of capital spending (on pizza ovens) requires a dollar of private saving. Also, recall this statement from Chapter 4, where we observed that Eve will consume a smaller fraction of her net worth (and thus save a larger fraction) the greater her IES and the larger the r relative to her ρ. Which is to say that the greater her willingness to substitute future for current consumption and the lower her rate of time preference relative to the real return she gets on her saving, the more she will save. That chapter assumed that each person's IES and ρ was entirely a matter of choice whereas the r was determined in the marketplace for capital.

This is fine when we are talking about one saver at a time, but in the aggregate, the savers' willingness to substitute future for current consumption will fall *and* they will demand a higher real return on their saving as they expand their saving. Recall Chapter 3 in which we observed that the individual's marginal rate of substitution of period 1 consumption for period 2 consumption falls as he expands period 1 consumption. That is to say the individual is willing to give up less and less future consumption for another dollar of current consumption as current consumption rises. Conversely, the marginal rate of substitution rises as the individual contracts current-period consumption, which is to say he will demand more and more future consumption as current consumption falls (i.e., as current saving rises).

Now consider what happens when firms experience a rise in the marginal productivity of capital and their demand for capital therefore rises. As the demand for capital rises, savers will demand a higher and higher r in tandem with their diminishing willingness to substitute future for current consumption and rising rate of time preference. This means that the cost of capital (cc) curve for the entire economy, which represents the supply of capital, is upward sloping. We can therefore portray market equilibrium as in Figure 5.1, where r^* ($= cc^* - d$) is the equilibrium real interest rate and K^* the equilibrium capital stock.

Let's consider some features of this equilibrium. The equilibrium stock of ovens is designated as K^*, where the MP_k curve (the demand for capital curve) intersects the cc curve. Now suppose that technological progress or some other factor causes MP_k to shift outward, as in Figure 5.2. At the new equilibrium the capital stock will equal $K^{*\prime}$. If $K^* = \$1$ million, $K^{*\prime} = \$1.5$ million and $d = 1$ percent, then gross investment is

$$\Delta K + \mathrm{d}K = \$500{,}000 + 0.1 \times \$1{,}000{,}000 = \$510{,}000, \qquad (27)$$

which must be matched by an equal amount of saving.

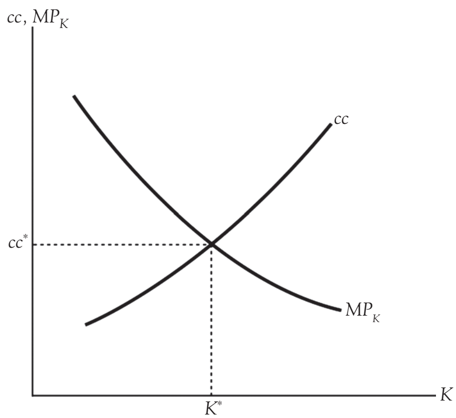

Figure 5.1 The supply and demand for capital

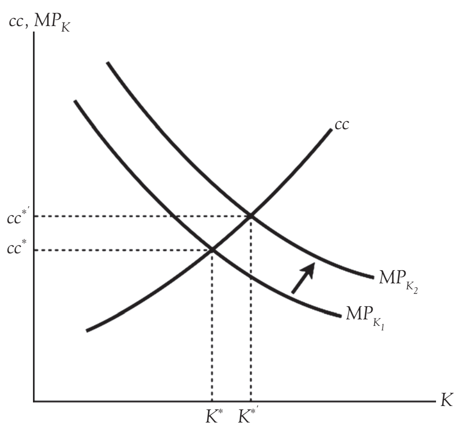

Figure 5.2 An increase in the demand for capital

In a static equilibrium, ΔK equals zero once $K^{*\prime}$ = \$1.5 million and saving equals depreciation dK. We will consider what a more realistic *dynamic* equilibrium looks like in the next chapter.

International Capital Movements

It is appropriate at this point to take into account the fact that capital flows across national borders in response to differences in interest rates and expectations of inflation and exchange rate variations. Now, considering the multiplicity of countries involved, it is necessary to enter an even more rarefied atmosphere in which there are only two countries. Let's call them the United States and Europe. Each country has its own currency, the dollar and the euro, and each country lets its currency fluctuate freely against the other. Borrowers and lenders can move financial capital and goods seamlessly across national borders.

The reader can probably see where this is headed, that is, toward the conclusion that there will emerge a single, global real interest rate *r.* But rather than just giving out the ending, let's see how we get there.

To get there, let's add another strong assumption, whereby it is just as easy for you or me to buy things in Boston as it is to buy them in, say, Paris. That assumption permits us to assume *purchasing power parity*, whereby exchange rates will adjust in such a way as to make every good as costly in *real* terms in one country as they are in another. In the context of the current example, there is some exchange rate, ε, equal to the dollar price of a euro, that satisfies the equation

$$\varepsilon = \frac{P}{P*}, \tag{28}$$

where P is an index for the prices of goods in the United States and $P*$ is an index for the prices of goods in Europe. To give this further concreteness, let's return to our pizza-only world and assume that the dollar price of a slice of pizza is 1 and that the euro price of a slice of pizza is 0.5. Then the dollar price of a euro must be

$$\varepsilon = \frac{1.00}{0.50} = 2. \tag{29}$$

To understand what is going on here, imagine that the U.S. price of the pizza slice suddenly rose to $2.00. Then Bostonians would convert dollars into euros, buying 0.5 euros on the dollar, and use those euros to buy pizza in Paris, where a dollar's worth of euros buys them a whole slice of pizza, compared to the half of a slice that a dollar now buys in Boston. This would increase the demand for euros and decrease the demand for dollars until the exchange rate depreciated to

$$\varepsilon = \frac{2.00}{0.50} = 4. \tag{30}$$

So far, so good? Well, if so, let's break down equation (28) to read

$$\%\Delta\varepsilon = \%\Delta P - \%\Delta P^*, \tag{31}$$

shorthand for which is

$$\hat{\varepsilon} = \hat{P} - \hat{P}^*, \tag{32}$$

a relationship that goes by the name of *relative purchasing power parity*: If exchange rates can fluctuate, the exchange rate must undergo a percentage change equal to the percentage change in U.S. prices minus the percentage change in European prices. Consider the foregoing example in which the U.S. price of a pizza slice rose by 100 percent while the European price stayed constant. As a result, ε also rose by 100 percent from 2 to 4.

Now we introduce yet another assumption called the *interest parity condition*:

$$1 + R = (1 + R^*)(1 + \hat{\varepsilon}), \tag{33}$$

where, as mentioned before, R is the nominal U.S. interest rate, and now R^* is the nominal European interest rate. Equation (33) is an equilibrium condition, whereby arbitrageurs will move financial capital across national borders in such a way as to equalize the expected nominal return to capital.

Consider an example. Suppose that Eve can buy a bond in the United States for $1,000 and that the interest rate on the bond is 10 percent. She could also buy a bond in Paris that pays five percent. It seems that the U.S. bond is the better buy. But not so fast. Suppose that Eve expects the dollar to depreciate by seven percent before the bond matures in a year. Let's take $\hat{\varepsilon}$ to stand for the expected depreciation of the dollar. Then, as ε is the dollar price of a euro, $\hat{\varepsilon}$ equals seven percent. So what happens if Eve buys the bond in Paris? Well, if ε equals 2 when she buys the bond, her 1,000 American dollars will get her a bond whose face value is €500. At five percent, that bond will pay out €525. But when the bond pays off, those 525 euros will be worth $1,124, given that a euro now buys $2.14 in American money. She is better off buying the European bond than the American bond, which will pay out only $1,100. Now

$$1 + R = 1.1 < (1 + R^*)(1 + \hat{\varepsilon}) = 1.1235 \tag{34}$$

The nominal return to capital in the United States is 10 percent, while the nominal return to capital in Europe is 12.35 percent.

This means that money will flow from the United States to Europe, causing R^* to fall and R to rise until the two sides of the equation are equal. Conversely, if the U.S. bonds had been the better buy, so that $1 + R$ exceeded $(1+R^*)(1+\hat{\varepsilon})$, then money would move from Europe to the United States until equation (33) was satisfied.

Now we have all the information we need in order to establish the existence of a single, global r. We can expand and simplify equation (33) to get:

$$R = R^* + \hat{\varepsilon}\,, \tag{35}$$

whereby the nominal U.S. interest rate will equal the nominal European interest rate plus the expected depreciation of the dollar. Now substitute equation (32) in equation (35) to get

$$R = R^* + \hat{P} - \hat{P}^*, \tag{36}$$

which we can rewrite as

$$R - \hat{P} = R^* - \hat{P}^*. \tag{37}$$

But going back to equation (15), $R - \hat{P} = r$ and $R^* - \hat{P}^* = r^*$, where r^* is the real interest rate in Europe. So

$$r = r^*. \tag{38}$$

Voila! Real interest rates everywhere are the same. We have to distinguish again, however, between intentions and outcomes. For actual r to equal actual r^*, lenders and borrowers across the globe must converge on the same expectations of inflation and from there, the same expectation of currency movements. Also, there must be no difference in risk factors that can influence the direction of capital flows.

As far-fetched as these assumptions are, we have to figure that the logic of this chapter has major implications for government policy making. In particular, it implies that policies aimed at increasing domestic saving may have no noticeable effect on domestic investment insofar as increased saving will flow into whatever corner of the globe offers, momentarily, the highest rate of return. Furthermore, policies aimed specifically at pushing the real domestic interest rate down or up may have no effect when the domestic rate is tied into the global rate.

Arnold Harberger once summed this up as follows:

> If there is really only one capital market linking most of the economies of the world …, then there is presumably something called a world interest rate, which would become a datum (or exogenous variable) for nearly all of them. A shift of the investment schedule in any such country would simply result in an inflow of funds from the rest of the world-not in a rise in interest rates. An increase in saving, like-wise, would simply spill over the national boundary, and would not result in any change in local interest rates or investment. If, on the other hand, there is little relevance to the concept of a world capital market, then one would expect interest rates in the different countries to be governed by internal factors, being sensitive to shifts in investment and savings, and presumably being influenced by the relative scarcity of capital within each country. (Harberger 1980, 331)

The foregoing discussion applies to a world without population growth or technological change. We will next expand the discussion to consider a world in which population does grow and technology changes all the time.

CHAPTER 6

Labor, Production, and Economic Growth

Let's take stock of what we have accomplished so far. We have worked out the equilibrium condition in which workers adjust their work time to the real wage they get for their efforts. And we have worked out the equilibrium condition under which income earners adjust their saving to the return on saving. We have also worked out the equilibrium condition for matching the saving choices of income earners with the investment choices of firms.

Now it remains to do two further things: First, we have to work out the equilibrium condition for matching the work choices of individuals with the hiring choices of firms. Second, we have to move beyond the static analyses of previous chapters to take up the conditions for economic growth as they pertain to work and saving.

To that end, let's think again about production in terms of pizza. In fact, let's assume that the only thing the economy produces is pizza. To keep things simple, suppose again that pizza sells for $1 a slice and that the employment of an additional hour of labor permits the firm to produce two more pizzas or 20 more slices.

We say that the marginal product of labor MP_l is the additional amount of production that is forthcoming per additional amount of labor employed or in this instance,

$$MP_l = \frac{\Delta y}{\Delta l} = \frac{\$20}{1} = \$20. \qquad (1)$$

If the worker is paid a nominal wage W of $10 per hour, and as the dollar price of a slice of pizza P is 1, his real wage w is also $10.

$$w = \frac{W}{P} = \frac{\$10}{1} = \$10. \qquad (2)$$

The question is how much labor should the firm hire.

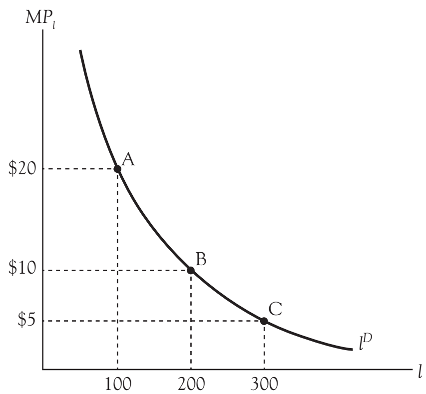

Figure 6.1 The demand for labor curve

Consider Figure 6.1, where the MP_l curve is the demand for labor curve. At point A, the firm is using 100 units of labor per day, at which quantity MP_l is \$20. At point C, where it uses 300 units of labor, MP_l is \$5. The pizza shop will want to adjust its use of labor to point B, where the firm is using 200 units of labor and where the real cost of an additional hour of labor just equals the MP_l. At any point to the left of B, the marginal product of labor would exceed the cost of hiring labor, and at any point to the right of B, the cost would exceed the marginal product. Thus, B is the profit-maximizing point.

Thus in equilibrium,

$$MP_l = w = \$10. \tag{3}$$

Now let's think about how much labor workers want to supply. Suppose that a worker can be expected to provide just eight hours of work per day if he is paid \$5 per hour. The \$5 that he would receive for providing the eighth hour is just high enough to compensate for the leisure that he sacrifices for working that hour. Thus, his MRS_{LeLay} = \$5. Now we suppose that when he provides 10 hours, his MRS_{LeLay} is \$10 and when he provides 15 hours it is \$20. If the wage rate is \$10, he will provide 10 hours. That is, the reward that he receives for the last hour of labor provided will just equal the reward that he must receive for the hour of leisure thus sacrificed (see Figure 6.2).

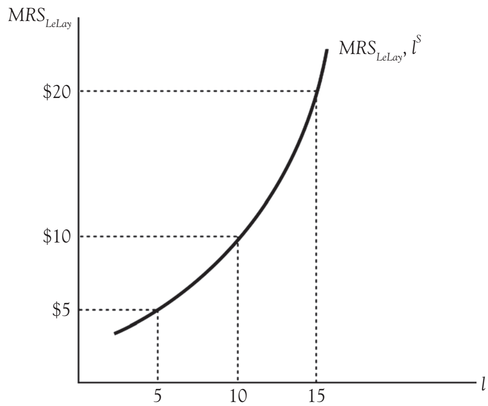

Figure 6.2 The supply of labor curve

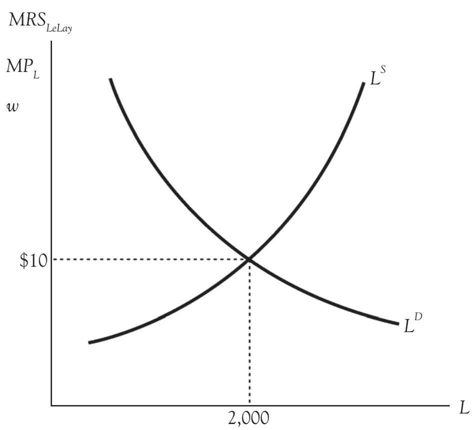

Figure 6.3 The supply and demand for labor

Suppose there are 10 firms of the kind described above and 200 workers. Figure 6.3 provides the aggregate supply and demand curves that are derived from the foregoing assumptions. In equilibrium, supply and demand equal the MRS_{LeLay} for each worker and the MP_L with the real wage rate so that

$$MRS_{LeLay} = MP_L = w \tag{4}$$

Now let's make this more concrete by assuming a particular production function applicable to the firm and the economy. A production function that offers convenience and simplicity is the Cobb–Douglas production function, specified as:

$$Y = ZK^{a} L^{1-a}, \tag{5}$$

where Z stands for *total factor productivity* and is a coefficient that represents the state of existing technology and the general legal and cultural conditions in which business operates. The coefficient α represents the share of income Y going to owners of capital and the coefficient $(1-\alpha)$ represents the share going to labor.

When we are using the Cobb–Douglas production function, we can calculate the MP_K and MP_L as follows:

$$MP_K = \frac{aY}{K} \tag{6}$$

and

$$MP_L = \frac{(1-a)Y}{L}.^{1} \tag{7}$$

With these fundamentals in place, we can now go on to consider the problem of economic growth.

Economic Growth

One of the most important challenges faced by policy makers is the question of how to increase economic growth. Developing countries stuck with low living standards strive to overcome centuries of poverty. Developed countries stuck in an extended economic slump search for an answer as to how to return to *normal* growth.

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[1] The marginal product of capital MP_K equals the additional output that will be forthcoming by applying another unit of capital to production, holding labor constant. We find MP_K by differentiating Y in equation (5) with respect to K: $\frac{\partial Y}{\partial K} = \frac{\partial\left(ZK^{a}L^{(1-a)}\right)}{\partial K} = aZK^{(a-1)}L^{(1-a)} = \frac{aY}{K}$. Similarly, $MP_L = \frac{\partial Y}{\partial L} = (1-a)$ $ZK^{a}L^{-a} = \frac{(1-a)Y}{L}$.

One of the enduring myths, exposed in vivid detail by William Easterly in his book, *The Elusive Quest for Economic Growth*, is that the path to more rapid growth lies in bringing more investment to bear on the problem (Easterly 2001). This is an appealing solution, based as it is on what amounts to a half-truth about the power of investment to propel an economy forward. It is also a misleading solution, based as it is on wishful thinking about the ability of the government to manage economic growth through top-down policies.

So what do we want to grow when we try to increase economic growth? The answer must be expressed in terms of measurable aggregates. There is no systematic way to address the problem of national happiness under this heading (see Chapter 2). The measurable aggregates that are ordinarily used and that give us a handle on the problem are output per person and consumption per person.

Let's continue with our practice of using the letter *C* to stand for aggregate consumption, and let *POP* stand for population. We can then say that the two most important measures of economic growth are the growth of *Y/POP* and *C/POP*. Output per person is important because it provides the broadest measure of economic performance, but economic welfare depends on how much of the output goes to consumption. As Adam Smith said, "consumption is the sole end of production." A benevolent dictator might set about doing what he could to maximize *C/POP* for his country.

As we work through this chapter it will be convenient to use the total number of people employed as a proxy for population. It is in fact a pretty good proxy. In 1953, 57.18 percent of the U.S. population of 16 years of age and above had jobs. In 2012, the number was 58.6 percent. The ratio began to grow substantially in the 80s and then reached a peak of 64.4 percent in 2000, after which it declined to its current level. Part of the reason for recent decline is the moribund economy, and part is the retirement of baby boomers, now in full sway. But the fact that the ratio is almost exactly the same now as it was 60 years ago is reassuring for our purposes here. Here we will talk interchangeably about *population* and *labor*, as if the two were the same.

Another convenient, probably necessary, procedure is to treat the quantity of labor *L* as the number of persons working and to assume that everyone who wants to work is working. There is no recognition here of the sensitivity of labor supply to current wages, future wages, and the interest rate. In effect, the world has reached an equilibrium in which everyone, young and old alike, is working. The fact that only about 60 percent of the people are working does not undermine the core message that this chapter is intended to convey.

Finally, we assume that the saving rate *s* is fixed, never mind the extensive discussion in Chapter 4 about how individuals adjust their saving rate according to parameters *r*, *p*, and IES. Whatever decisions or *propensities* determine the aggregate saving rate, those don't change here.

Proceeding in this spirit, two ratios become important: the size of the capital stock per person *K*/*L* and output per person *Y*/*L*. We will begin by focusing on *Y*/*L*.

In the preceding chapter, we established the links between saving and capital formation and between capital formation and production. Let's take the Cobb–Douglas production function,

$$Y = ZK^{a} L^{1-a}, \tag{8}$$

and divide both sides by *L* to get

$$\frac{Y}{L} = Z\left(\frac{K}{L}\right)^{a}. \tag{9}$$

Reconfigured in terms of economic growth, this equation becomes

$$\%\Delta\frac{Y}{L} = \%\Delta Z + a\,\%\Delta\left(\frac{K}{L}\right) \tag{10}$$

To grasp the relevance of this equation, imagine that *Z* doesn't change. Then, if a = 0.7, a one-percent increase in $\left(\frac{K}{L}\right)$ will bring about a 0.70 percent increase in $\frac{Y}{L}$. If capital and labor are rising at the same rate *and* if *Z* is constant, the left-hand side of equation (10) is zero.

And now we can see a dark and foreboding truth about economic growth: There is a *steady state* of the economy in which *K* and *L* are rising at the same rate and in which *Y* and *L* are also rising at the same rate so that *Y/L* is constant. Growth of the kind that everyone wants requires output to rise faster than population. So if the economy reaches a state in which both output and population are rising at the same rate, we have to see the economy as expanding only fast enough to keep living standards at what might well be the same, deplorably low, level.

To understand this let's think of what the steady state looks like in an economy in which the population is not rising. There is no growth of L.

Now consider the equation for the growth of the capital stock from period t to period $t + 1$:

$$K_{t+1} = K_t(1-d) + \Delta K. \tag{11}$$

We know that

$$sY_t = K_{t+1} - K_t(1-d) = \Delta K + dK_t, \tag{12}$$

which is to say that saving equals net investment plus depreciation of the capital stock. In the previous analysis, we ignored population and technological change, we found that profit-maximizing firms will reach an equilibrium in which ΔK is zero. When the firm has achieved this equilibrium,

$$sY_t = dK_t. \tag{13}$$

In order to prevent the capital stock from eroding, saving must equal the rate of economic depreciation times the capital stock. To put it differently, once the firm has reached equilibrium, the level of saving is only high enough to prevent the capital stock from eroding. Indeed, it is possible for governments to increase the capital stock through policies aimed at increasing the saving rate. And it is true that an increase in the capital stock would then bring about a new equilibrium, at a higher capital stock, where equation (13) is again satisfied. But note that this would be a once-and-for-all adjustment in K, which would not repeat itself without a further increase in the saving rate, and so on.

Now let's keep Z fixed but allow that L is growing at the rate L_g.

Then

$$L_{t+1} = L_t(1 + L_g), \tag{14}$$

and

$$Y_{t+1} = Y_t(1+Y_g). \tag{15}$$

Let's put some hypothetical numbers on this now. Let

- Y_t = \$500,000,
- L_t = 100,
- s = 20%,
- d = 2%,
- K_t = \$1,000,000 and
- L_g = 3%.

We note that the capital-to-labor ratio in period t is

$$\frac{K_t}{L_t} = \frac{\$1,000,000}{100} = \$10,000, \tag{16}$$

and the output-to-labor ratio is

$$\frac{Y_t}{L_t} = \frac{\$500,000}{100} = \$5,000. \tag{17}$$

Whether the capital-to-labor ratio actually falls, rises, or remains the same depends on what's going on with saving. Suppose, for now, that s = 0, which is to say that there is no saving in period t. Then the capital-to-labor ratio will fall by

$$\left(L_g + d\right)\frac{K_t}{L_t} = (0.03+0.02)\left(\frac{\$1,000,000}{100}\right) = \$500, \tag{18}$$

from \$10,000 to \$9,500. If the numerator of $\frac{K_t}{L_t}$ falls by two percent because of depreciation and if the denominator rises by three percent because of growth in the labor force, the ratio will fall by five percent.

Now let s = 20 percent and consider two scenarios. In the first scenario, saving per person is

$$s\frac{Y_t}{L_t} = \frac{0.2 \times \$500,000}{100} = \$1,000. \tag{19}$$

Thus,

$$s\frac{Y_t}{L_t} = \$1{,}000 > \left(L_g + d\right)\frac{K_t}{L_t} = \$500. \tag{20}$$

and there is more than enough saving per person to maintain the current capital-to-labor ratio. Hence the capital-to-labor ratio must rise.

Now consider scenario 2, in which the capital-to-labor ratio has tripled so that it equals \$30,000. Under the law of diminishing returns the output-to-labor ratio will rise by less than the capital-to-labor ratio. Suppose then that the output-to-labor ratio has risen by 10 percent, from \$5,000 to \$5,500.

Now

$$\begin{aligned} s\frac{Y_t}{L_t} &= (0.2)\$5{,}500 = \$1{,}100 < \left(L_g + d\right)\frac{K_t}{L_t} \\ &= (0.03 + 0.02)\$30{,}000 = \$1{,}500. \end{aligned} \tag{21}$$

Because saving per person is less than the amount needed to sustain the capital-to-labor ratio, the capital-to-labor ratio must fall.

The economy thus reaches an equilibrium when

$$s\frac{Y}{L} = \left(L_g + d\right)\frac{K}{L}, \tag{22}$$

that is, when the capital-to-labor ratio is just high enough that the actual saving per person equals the saving per person needed to keep the capital-to-labor ratio from either rising or falling. In this example, this could be where the capital-to-labor ratio is \$21,000 and the output-per-labor ratio is \$5,250:

$$\begin{aligned} s\frac{Y_t}{L_t} &= (0.2)\$5{,}250 = \$1{,}050 = \left(L_g + d\right)\frac{K_t}{L_t} \\ &= (0.03 + 0.02)\$21{,}000 = \$1{,}050. \end{aligned} \tag{23}$$

From this example, we can see that as long as s, L_g, and d are fixed, the output-per-labor ratio must remain fixed at \$5,250 and the capital-to-labor ratio must remain fixed at \$21,000. But if L_g is fixed at three percent, then the growth of output and of capital, which we can label Y_g and K_g, must also remain fixed at three percent. The economy is said to have reached a steady state when the growth of labor, capital, and output, L_g, K_g, and Y_g, are all equal.

Specifically, in that state K and L are growing at the same rate. If we go back to equation (10), we see that output per worker remains constant if Z remains constant (which we currently assume) and if K and L are rising at the same rate.

This is to be expected, given a Cobb–Douglas production function, which has built into it the assumption that a given percentage change in both labor and capital will yield the same percentage change in output.

From equation (8), we know that

$$\%\Delta Y = \%\Delta Z + a\left(\%\Delta K\right) + (1-a)\left(\%\Delta L\right). \tag{24}$$

Now by letting $\%\Delta Z = Z_g$, we can simplify this to read:

$$Y_g = Z_g + a\,K_g + (1-a)L_g \tag{25}$$

Equilibrium condition (22) requires that

$$Y_g = K_g = L_g. \tag{26}$$

From equation (25) we can see that if $K_g = L_g$ and if $Z_g = 0$, then the equilibrium condition is satisfied. But then, as equation (10) implies, $\%\Delta \frac{Y}{L}$ must be zero, meaning that output per capita cannot rise unless Z is rising. More generally

$$\%\Delta \frac{Y}{L} = \%\Delta Z. \tag{27}$$

The only way to bring about a permanent growth of per-capita output is to bring about a permanent growth of Z.

What Is Needed to Spur Growth

We are then left with the question of how to get output per capita to grow. There are two portals through which the government can exert its influence. We have seen that the government can directly affect s by instituting policies that either encourage or discourage saving. The other portal, its influence on Z, is harder to pin down.

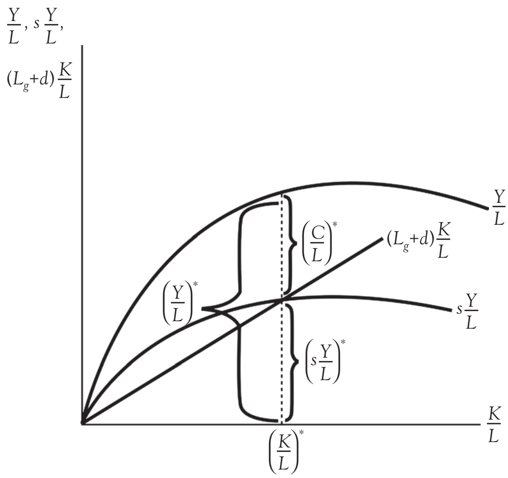

Figure 6.4 Determination of the steady state

Suppose the economy is in a steady state where $\left(\frac{K}{L}\right) = \left(\frac{K}{L}\right)^*$ in Figure 6.4. We might imagine that *K*, *L*, and *Y* are all growing by three percent annually. The $s\frac{Y}{L}$ line cuts the $\left(L_g + d\right)\frac{K}{L}$ line at $\left(\frac{K}{L}\right)^*$, which tells us that the amount of saving per person needed to sustain the indicated ratio of capital to labor is just matched by the amount of saving per person that is forthcoming. For points to the left of $\left(\frac{K}{L}\right)^*$, $s\frac{Y}{L}$ would exceed $\left(L_g + d\right)\frac{K}{L}$ and the capital-to-labor ratio would rise. For points to the right, $\left(L_g + d\right)\frac{K}{L}$ would exceed $s\frac{Y}{L}$ and the capital-to-labor ratio would fall. Only when $\left(\frac{K}{L}\right) = \left(\frac{K}{L}\right)^*$, does $s\frac{Y}{L} = \left(L_g + d\right)\frac{K}{L}$ and only then is the capital-to-labor ratio constant.

Now suppose that economic planners, or government officials responsible for tax policy as it affects *s*, decide to cut taxes on saving in order to increase *s*. The $s\frac{Y}{L}$ line rotates upward in a counterclockwise direction, pushing the economy up along the $\frac{Y}{L}$ line and along the $\left(L_g + d\right)\frac{K}{L}$ line, to a new steady state $\left(\frac{K}{L}\right)^{*\prime}$ lying to the right of $\left(\frac{K}{L}\right)^*$.

What has this action accomplished? Well, it has brought about a once-and-for all increase in output per capita (a higher ratio of *Y* to *L*).

In the transition from $\left(\frac{K}{L}\right)^{*}$ to $\left(\frac{K}{L}\right)^{*\prime}$, capital and output will rise faster than labor as the *K*/L ratio adjusts upwards. But once the capital-to-labor ratio reaches $\left(\frac{K}{L}\right)^{*\prime}$, the economy settles back into a steady state, in which, *K*, *L*, and *Y* are all rising at the same rate as before. Output per person is higher than it was at $\left(\frac{K}{L}\right)^{*}$, but the growth in output per person experienced during the transition to this higher capital-to-labor ratio comes to a halt.

This might seem to imply that the government could keep pushing the economy further up the $\frac{Y}{L}$ curve just by taking steps to increase *s*. That, however, is neither practical nor desirable. First, as we have seen, an economy that combines political with economic freedom will not respond, beyond a certain point, to government policies aimed at increasing the saving rate. Taxes on the return to saving are a deterrent to saving but if all such taxes were removed there would be little left in the government policy arsenal to encourage further saving. Under a command economy, political resistance to ever-higher *forced saving* would put practical limits on this policy. After all, people will not tolerate a state of affairs in which the government compels them to save 100 percent of their income.

Insofar as it is government policy to maximize consumption per person, there does exist a theoretically ideal saving rate. To see this, observe that the marginal product of capital per unit of labor measures the increase in output that results from adding another dollar to the stock of capital, holding labor constant. Suppose that the capital-to-labor ratio is at $\left(\frac{K}{L}\right)^{*}$ in Figure 6.4, so that the condition $s\frac{Y}{L} = \left(L_g + d\right)\frac{K}{L}$ is again satisfied. But suppose also the marginal product of capital MP_K is six percent but that $\left(L_g + d\right)$ equals five percent. Whereas saving per person is just high enough to preserve the existing ratio of capital to labor, the government could notch up consumption per person by raising the saving rate.

Let's see why. We assume that another dollar of capital (holding labor constant) will add 6 cents to output per person. But it is necessary to add only 5 cents to output per person to sustain the capital-to-labor ratio if that ratio rises by one dollar. Where would the other 1 cent go? The answer is—to consumption. (Recall that in this world $C + S = C + I = Y$. So every dollar of Y that does not go to S and therefore I must go to C.) Thus a policy aimed at increasing the saving rate [and therefore moving further up the $\left(L_g + d\right)\frac{K}{L}$ curve] would, for a while at least, increase consumption per capita.

Now consider another steady state, this one reached at $\left(\frac{K}{L}\right)^{*\prime}$. Here, we assume that MP_K is only four percent, the law of diminishing returns having operated in its ineluctable way. Now think about the *last* dollar added to the capital stock (per unit of labor). That dollar increased output per person by only four percent, whereas it is necessary for five percent of output to go to saving and investment in order to sustain the capital-to-labor ratio at this level. The missing one percent must come out of consumption.

There would be some intermediate capital-to-labor ratio, $\left(\frac{K}{L}\right)_{GR}$, at which the following equality is satisfied:

$$MP_K = L_g + d. \tag{28}$$

Given the Cobb–Douglas function, this would mean that

$$\frac{aY}{K} = L_g + d. \tag{29}$$

Equation (28) is called the Golden Rule of economic growth, and by satisfying it, the economy maximizes current consumption per person. The saving rate is brought just high enough so that any other equilibrium capital-to-labor ratio would yield a lower level of consumption per capita. This designation might not quite fit the meaning behind the Biblical Golden Rule, insofar as it might be more Godly for the current generation to save for the purpose of lifting the next generation's standard of living. Yet, the idea is clear. The Golden Rule has a degree of moral authority in that it puts individual welfare ahead of some central authority that might wish to distinguish itself by forcing growth on the current generation to create a kind of shrine to its command-and-control efforts. Recall Stalinist Russia.

This line of thought just reminds us, though, of the limited scope of efforts to influence the saving rate for the purpose of increasing economic growth. An increase in the saving rate will increase output per person but, once the new steady state is attained, it will not increase the growth of output per person.

Which leaves us with the hope to influence Z. Returning to equation (24), let's remove the assumption that Z is constant and assume instead that, through either public or private initiatives, Z rises by two percent annually.

Then $\frac{Y}{L}$ will also rise by two percent annually. This observation points to a truth that is both powerful and daunting, that is, living standards will steadily improve with technical progress (as well as other kinds of progress associated with Z) but will only improve slightly without such progress.

This should be seen as cautionary tale on the matter of economic growth. This book argues that the government can expand work and saving, and therefore output, by reducing taxes on work and saving. But a necessary condition for growth in living standards, as measured by output per capita, is steady growth in technology, combined with the institutional and legal environment that is needed to encourage innovation and entrepreneurship.

CHAPTER 7

Deficit Spending

One of the most contentious issues that arise in debating macroeconomic policy is the effect of deficits on the economy. We have seen Alan Blinder's argument that deficits are helpful in times of economic contraction but potentially harmful in times of full employment. Deficits, he argues, are helpful when the economy is operating below its long-run *normal* level because they expand aggregate demand and with it, employment. Deficits are not helpful when the economy is operating at full employment, however. At that point, deficits hurt the economy by raising interest rates and crowding out investment. This is the policy problem as economists of a liberal persuasion see it.

There is another view of the problem associated with conservatives. In this view, deficits are always bad because they impose a burden on future generations and risk the creditworthiness of the country.

We will see that both points of view, though possessing a kernel of truth, are naïve and misleading.

Let's first recognize the kernel of truth in Blinder's argument. As observed in Chapter 1 and as recognized in Chapter 9, there is a Keynesian argument for deficits in times of economic contraction. Assuming that the contraction stems from excess supply in the goods and labor markets, then increases in government spending and decreases in taxes, or some combination of the two, help expand the economy and lift it back toward a normal state. As we will also see in Chapter 9, exactly the opposite prescription applies when the cause of the contraction is excess demand for goods and labor, under which circumstances surpluses are called for. But the Keynesian argument for deficits is correct when the Keynesian condition—that is, a long-lasting excess supply of goods and labor—prevails.

At this point, however, Blinder and many others cause a lot of confusion. First, when Blinder says that deficits can be harmful in normal economic times, he is actually thinking in terms of a version of the Keynesian model that applies only when the economy is in a slump. In this version, fiscal policy is deemed to be ineffective for expanding the economy, inasmuch as any increase in government deficits will simply drive up interest rates and crowd out private investment, so that there is no increase in production but only an increase in interest rates. This line of thinking does not, however, presuppose long-run full employment at all. Indeed, in the same version of the Keynesian model, increases in aggregate demand brought about by increases in the money supply are highly effective for expanding the economy.

There is, to be sure, an intuitive argument that deficits raise interest rates. Government borrows money, and in doing so, competes with private sector borrowers. Because the government can pay whatever interest rate it must in order to borrow (the government has the power to tax and create money), it can always pay a high enough interest rate to push aside private borrowers in getting access to the limited amount of money that people make available through their saving.

The problem with this argument is that it presupposes that there is a fixed pool of saving available to borrowers and that lenders won't respond to the government's entry into the financial markets by saving more. This ignores the fact that people can figure out that if the government borrows now, it will have to raise taxes later in order to service the loans it is taking out now. Because these future higher taxes will reduce future take-home pay, rational taxpayers will want to provide for additional saving from which they can pay the increased taxes to come. This counterargument is sometimes called the Ricardian equivalence hypothesis, after the 19th century economist David Ricardo. The idea, as shown below, is that a government loan is equivalent to a government tax insofar as both impinge upon current consumption.

Thus, intuition alone won't get us to Blinder's crowding-out story. In order to make his story work, we have to recognize that it works only when the economy is going through a short-run spate of low employment brought about by a lack of aggregate demand. In this scenario, the government attempts to boost aggregate demand by running a deficit, only to be frustrated in its efforts by a dollar-for-dollar fall in private investment.

Recall the basic national income identity: GDP = $C + I + G + NX = C + S + T$. In calculating GDP, the expenditure flow equals consumption plus investment plus government purchases plus net exports, which equals the income disposition flow, consumption plus private saving plus taxes. By using just this simple identity, we can go a long way toward understanding these competing analyses.

Alternative Tax-Cut Scenarios

Consider the baseline scenario presented in Table 7.1. There we assume that the government runs a balanced budget, that is, $T = G$. And private saving S is just high enough to equal the sum of gross private domestic investment I and net foreign investment NFI. We assume throughout the following discussion that net exports equals net foreign investment (NX = NFI).

Now let's move to a two-period Keynesian scenario in which the government decides to run a deficit and to engineer this deficit by cutting taxes by $100, leaving spending G at its current level of $200. So now what happens? Table 7.2 illustrates the *crowding-out* hypothesis. Before the government runs a deficit, the economy is as illustrated in Table 7.1. After the government cuts taxes, leaving expenditures unchanged, we see that C rises but $I + NFI$ falls by the same amount. This represents the version of Keynesian thought mentioned above, according to which the deficit is successful in increasing consumer spending but drives up interest rates enough to crowd out an equal amount of domestic and foreign investment.

Table 7.1 Baseline scenario

C	I	G	NX = NFI	GDP	C	S	T	GDP
$1,000	$700	$200	$100	$2,000	$1,000	$800	$200	$2,000

Table 7.2 Crowding-out scenario with a cut in T

	C	I	G	NX = NFI	Total Exp.	C	S	T	Total Dis.
Before	$1,000	$700	$200	$100	$2,000	$1,000	$800	$200	$2,000
After	$1,100	$650	$200	$50	$2,000	$1,100	$800	$100	$2,000

In Table 7.2, the economy is operating *below* its full-employment level, and there is a fixed pool of saving from which borrowers, including the government, can draw before the government chooses to run a deficit. The deficit fails to increase GDP because, it is further assumed, people are unwilling to move out of cash and into government bonds as interest rates rise.[1] This is an exposition of the conditions under which fiscal policy is ineffective for expanding the economy in a Keynesian-type slump. It is not an exposition of how deficits affect investment in the long run.

After the government cuts taxes, consumers increase their consumption by the exact amount of the tax cut, as we see in both of the *C* columns. That is, consumption rises from $1,000 to $1,100 as taxes fall from $200 to $100. If there is a fixed pool of saving that consumption must come from somewhere, so it is deemed to come from gross domestic investment and NFI, each of which falls by $50.

Now let's consider the classical, Ricardian scenario, illustrated in Table 7.3, in which the government, as in Table 7.2, cuts taxes by $100. Suppose again that we live in a two-period world, with the baseline scenario presented in the first row of Table 7.3. Taxpayers know that the $100 tax cut they are getting is not a benefit at all, but just a switch in plans by the government for paying its bills. They know that, because the government hasn't changed its spending plans, it will be necessary for the government to pay for $100 worth of *G* by selling bonds, which will mature in the future. But because taxpayers will have to fork over $100 plus interest to cover this borrowing in the future, they might as well use the $100 not paid in taxes to buy the very bonds that the government has to sell in order to finance the deficit. When they buy that $100 in bonds,

Table 7.3 Ricardian scenario with a cut in T

	C	*I*	G	*NX* = NFI	Total Exp.	C	*S*	*T*	Total Dis.
Before	$1,000	$700	$200	$100	$2,000	$1,000	$800	$200	$2,000
After	$1,000	$700	$200	$100	$2,000	$1,000	$900	$100	$2,000

[1] See Chapter 9 for an explanation of how people adjust their willingness to hold interest-paying assets as interest rates change.

they increase private saving, *S*, by $100. Thus, the government gets the same amount in funds in the current period as it did before. It's just that this time, only half the funds are collected in the form of tax payments and the other half is through bond sales. There is no substantive difference between the two scenarios illustrated in Table 7.1 and in the second row of Table 7.3. They are *equivalent* for all intents and purposes.

The critical element in all of this is that taxpayers believe that the government intends to tax them to pay its debts. What is missing from the classical case is an understanding that the strength of this belief will wane as government debt grows relative to the government's ability to tax its citizens to pay the debt. See modern Greece and Italy. The classical argument thus assumes that savers will not falsely interpret a tax cut as government free lunch. They will adjust their saving in the light of certain, future tax increases. Once this understanding collapses, all bets are off and the country is poised to suffer a debt crisis.

Alternative Government Spending Scenarios

Now suppose that the government creates the same deficit, but this time by expanding *G*. Table 7.4 provides the crowding-out take on this. Now the government crowds out $100 in domestic and NFI by spending $100 more, rather than by taxing $100 less, as before. The effect is the same as in Table 7.2.

Table 7.5 provides one possible version of what happens when *G* rises in the Ricardian or classical model. Here people increase private saving and do so by reducing consumption. People just decide to cut consumption by the same amount that the government increases spending. As we show below, this will, in reality, be so approximately (but only approximately).

Table 7.4 Crowding-out scenario with an increase in G

	C	*I*	*G*	*NX* = NFI	Total Exp.	C	*S*	*T*	Total Dis.
Before	$1,000	$700	$200	$100	$2,000	$1,000	$800	$200	$2,000
After	$1,000	$650	$300	$50	$2,000	$1,000	$800	$200	$2,000

Table 7.5 Ricardian scenario with an increase in G

	C	I	G	NX = NFI	Total Exp.	C	S	T	Total Dis.
Before	$1,000	$700	$200	$100	$2,000	$1,000	$800	$200	$2,000
After	$900	$700	$300	$100	$2,000	$900	$900	$200	$2,000

Delving into the Mathematics: The Two-period Model

Now let's approach the problem in a more analytical fashion. Let's recall the two-period model of Chapter 3 in which Adam chose between current and future consumption. There we saw that his choice of consumption in the two periods had to satisfy the equation

$$c_1 + \frac{c_2}{1+r} = lay_1 + \frac{lay_2}{1+r}, \tag{1}$$

which can be rewritten as

$$c_1 = lay_1 + \frac{lay_2}{1+r} - \frac{c_2}{1+r}. \tag{2}$$

Now let's change the equation to recognize that Adam must pay taxes in periods 1 and 2.

The present value of his consumption is reduced by the taxes he pays in these two periods:

$$c_1 + \frac{c_2}{1+r} = lay_1 - t_1 + \frac{lay_2 - t_2}{1+r} \tag{3}$$

and

$$c_1 = lay_1 - t_1 + \frac{lay_2 - t_2}{1+r} - \frac{c_2}{1+r}. \tag{4}$$

Adam's period 1 saving is

$$sav_1 = lay_1 - t_1 - c_1 \tag{5}$$

To consider a numerical example, let

$$lay_1 = \$900, \tag{6}$$

$$t_1 = t_2 = \$100, \tag{7}$$

$$lay_2 = \$320, \tag{8}$$

$$c_2 = \$550, \tag{9}$$

and

$$r = 10\%. \tag{10}$$

Then

$$c_1 = \$900 - \$100 + \frac{\$320 - \$100}{1 + 0.1} - \frac{\$550}{1 + 0.1} = \$500, \tag{11}$$

and

$$sav_1 = \$900 - \$100 - \$500 = \$300. \tag{12}$$

Now suppose the government cuts taxes in period 1 by \$50 and borrows the same amount to make up for the lost taxes. In period 2, the government will have to raise taxes by enough to pay off the period 1 loan, principal and interest. Thus

$$\Delta t_1 = -\$50 \tag{13}$$

and

$$\Delta t_2 = -\Delta t_1 (1 + r) \tag{14}$$

or in this instance,

$$\Delta t_2 = \$50(1 + 0.1) = \$55. \tag{15}$$

Because the government is cutting taxes, Δt_1 is negative. The government borrows \$50 in period 1 but then has to pay back \$50 plus interest of 10 percent in a year. Thus, taxes in period 2 must rise by $-\Delta t_1(1 + r)$ or \$55. Now with the tax cut in place, we relabel and solve for consumption as follows:

$$c_1' + \frac{c_2'}{1 + r} = lay_1 - \left(t_1 + \Delta t_1\right) + \frac{lay_2 - \left(t_2 + \Delta t_2\right)}{1 + r}, \tag{16}$$

where Adam has to set his consumption, c_1', in period 1 and his consumption, c_2', in period 2 so that he satisfies equation (16). But does he have to change his consumption in either period? The answer is no. If we solve equation (14) for Δt_1 we get

$$\Delta t_1 = -\frac{\Delta t_2}{(1+r)}, \tag{17}$$

and if we insert equation (17) in equation (16), we see that

$$c_1' + \frac{c_2'}{1+r} = lay_1 - t_1 + \frac{lay_2 - t_2}{1+r}, \tag{18}$$

in which the right-hand side is exactly the same as the right-hand side of equation (3). Adam can set c_1' equal to c_1 and c_2' equal to c_2. All that has changed is that now his saving and his saving rate are higher. Adam must increase his year 1 saving by $-\Delta t_1 = \$50$ in order to pay his additional tax bill of \$55 in year 2: Thus his (relabeled) saving is

$$sav_1' = lay_1 - (t_1 + \Delta t_1) - c_1 \tag{19}$$

or here

$$sav_1' = \$900 - (\$100 - \$50) - \$500 = \$350. \tag{20}$$

His saving rises by

$$sav_1' - sav_1 = \$350 - \$300 = \$50. \tag{21}$$

or by exactly the amount by which his taxes were cut.

Now suppose that the government engineers a deficit by increasing expenditures. We retain the previous assumptions but introduce a new constraint on government spending. We assume, specifically, that the present value of government spending over the two periods must equal the present value of the taxes that are collected to finance government spending:

$$g_1 + \frac{g_2}{1+r} = t_1 + \frac{t_2}{1+r}. \tag{22}$$

Assume for now that the government balances its budget in both periods, so that $g_1 = t_1$ and $g_2 = t_2$. Then equation (3) applies, as it did before we took government spending into account:

$$c_1 + \frac{c_2}{1+r} = lay_1 - t_1 + \frac{lay_2 - t_2}{1+r}. \tag{23}$$

Next let the government decide to increase period 1 spending by some amount Δg_1, keeping period 1 taxes and period 2 spending constant.

We now have

$$g_1 + \Delta g_1 + \frac{g_2}{1+r} = t_1 + \frac{t_2 + \Delta t_2}{1+r}. \tag{24}$$

The government has to raise taxes by enough in period 2 to finance the loan taken out to pay for the new spending in period 1. Again, Adam has to juggle his own spending in periods 1 and 2 so as to pay the period 2 taxes that the period 1 deficit necessitates. We must now rewrite equation (16) as:

$$c_1' + \frac{c_2'}{1+r} = lay_1 - t_1 + \frac{lay_2 - (t_2 + \Delta t_2)}{1+r}. \tag{25}$$

This time the present value of his consumption is reduced by the present value of the change in his period 2 taxes, or by $\frac{\Delta t_2}{1+r}$. Adam can distribute the effect of this reduction across his consumption in both periods in any way he chooses. Just for the sake of argument, let Adam cut his period 1 consumption by exactly the amount that the government borrows in order to purchase the bond, so that $\Delta c_1 = -\Delta g_1$. (Maybe the government spends the new money on some service that replaces a service for which Adam previously paid out of his own pocket, so that Adam feels that he can rationally cut his consumption by the same amount.) Then

$$sav_1' = lay_1 - t_1 - (c_1 + \Delta c_1) = lay_1 - t_1 - (c_1 - \Delta g_1). \tag{26}$$

Given that Δg_1 in this example equals \$50, the effect on saving is the same as in the tax-cut scenario:

$$sav_1' = \$900 - \$100 - (\$500 - \$50) = \$350 \tag{27}$$

Once again his saving rises by exactly the size of the new deficit, which, in this instance, was brought about by a rise in government spending:

$$sav_1' - sav_1 = \$350 - \$300 = \$50. \tag{28}$$

Delving into the Mathematics: The *n*-Period Model

Unfortunately, in the preceding scenario, we can't just assume that Adam will cut his period 1 consumption exactly by the rise in period 1 government spending. We saw that, in the two-period model, Adam can distribute his consumption after a tax cut exactly as he did before the tax cut. And we saw that he can cut his current period consumption by the amount of the new government spending if he chooses to do so. But what exactly will he do? To address that question, we must generalize our analysis to *n* periods.

Let's write down a formula for computing the present value of Adam's consumption over the full length of his planning period:

$$PV_c = c_1 + \frac{c_2}{1+r} + \frac{c_3}{(1+r)^2} + \ldots + \frac{c_n}{(1+r)^{n-1}}. \tag{29}$$

Think of Adam (like Eve in Chapter 4) planning his consumption over some future that extends to *n* years. PV_c is the amount of money that he could put in the bank now, at a rate of interest equal to r, such that he could spend c_1 in year 1, c_2 in year 2 all the way to year *n* when he spends c_n. This hypothetical amount of money is just equal to the present value of his expected future after-tax labor income through year *n*:

$$PV_{lay} = lay_1 - t_1 + \frac{lay_2 - t_2}{1+r} + \frac{lay_3 - t_3}{(1+r)^2} + \cdots + \frac{lay_n - t_n}{(1+r)^{n-1}}, \tag{30}$$

where t_1 is his tax bill in year 1, t_2 his tax bill in year 2, and so on. In maximizing his utility, Adam must distribute his consumption across current and future periods to satisfy the constraint:

$$PV_c = PV_{lay}. \tag{31}$$

This requires us to rewrite equation (17) of Chapter 4 as

$$sav_1 = lay_1 - t_1 - vPV_{lay}, \tag{32}$$

where v is the factor by which we must multiply the present value of his after-tax income in order to compute his period 1 consumption and thus his period 1 saving. (See the appendix to Chapter 4.)

Now suppose that the government decides to give Adam a tax cut equal to $-\Delta t_1$. In order to keep its spending constant, the government must sell a bond for that amount and must service the bond over periods 2 through n, raising Adam's taxes in amounts Δt_2, Δt_3, …, Δt_n. Now the present value of his after-tax income is

$$PV'_{lay} = lay_1 - (t_1 + \Delta t_1) + \frac{lay_2 - (t_2 + \Delta t_2)}{1+r} + \frac{lay_3 - (t_3 + \Delta t_3)}{(1+r)^2} + \ldots + \frac{lay_n - (t_n + \Delta t_n)}{(1+r)^{n-1}}. \quad (33)$$

But, because the period 1 tax cut must be paid for over future periods out of higher taxes,

$$\Delta t_1 = -\left[\frac{\Delta t_2}{1+r} + \frac{\Delta t_3}{(1+r)^2} + \ldots + \frac{\Delta t_n}{(1+r)^{n-1}}\right], \quad (34)$$

Substituting equation (34) in equation (33),

$$PV'_{lay} = PV_{lay}. \quad (35)$$

Thus, there is no need for Adam to change his consumption plans. Adam's period 1 saving before the tax cut is as shown in equation (32). After the tax cut, his saving is

$$sav'_1 = lay_1 - (t_1 + \Delta t_1) - vPV'_{lay}. \quad (36)$$

But, because $PV_{lay} = PV'_{lay}$,

$$sav'_1 - sav_1 = -\Delta t_1. \quad (37)$$

His period 1 saving rises exactly by the amount by which his period 1 taxes are cut.

Now let's consider what happens when the government decides to run a deficit (or surplus) by changing government expenditures. The result is identical to what we got in the simpler, two-period example.

Now, as in that example, let the present value of government expenditures equal the present value of taxes before and after the change in government spending and taxes. Before the change, we have

$$PV_g = g_1 + \frac{g_2}{1+r} + \frac{g_3}{(1+r)^2} + \ldots + \frac{g_n}{(1+r)^{n-1}}, \tag{38}$$

$$PV_t = t_1 + \frac{t_2}{1+r} + \frac{t_3}{(1+r)^2} + \ldots + \frac{t_n}{(1+r)^{n-1}} \tag{39}$$

and

$$PV_g = PV_t. \tag{40}$$

Next, let there be a change in first-period government spending. Then

$$PV_g' = g_1 + \Delta g_1 + \frac{g_2}{1+r} + \frac{g_3}{(1+r)^2} + \ldots + \frac{g_n}{(1+r)^{n-1}}. \tag{41}$$

The change in period 1 government spending takes place without any change in period 1 taxes. But future taxes must rise, so that

$$PV_t' = t_1 + \frac{t_2 + \Delta t_2}{1+r} + \frac{t_3 + \Delta t_3}{(1+r)^2} + \ldots + \frac{t_n + \Delta t_n}{(1+r)^{n-1}}. \tag{42}$$

However, the present value of taxes must continue to equal the present value of government spending:

$$PV_g' = PV_t'. \tag{43}$$

It follows that

$$\Delta g_1 = \frac{\Delta t_2}{1+r} + \frac{\Delta t_3}{(1+r)^2} + \ldots + \frac{\Delta t_n}{(1+r)^{n-1}}. \tag{44}$$

Also,

$$PV_{lay}' = lay_1 - t_1 + \frac{lay_2 - (t_2 + \Delta t_2)}{1+r} + \frac{lay_3 - (t_3 + \Delta t_3)}{(1+r)^2} + \ldots + \frac{lay_n - (t_n + \Delta t_n)}{(1+r)^{n-1}}. \tag{45}$$

Substituting equation (44) in equation (45),

$$PV_{lay}' = lay_1 - t_1 - \Delta g_1 + \frac{lay_2 - t_2}{1+r} + \frac{lay_3 - t_3}{(1+r)^2} + \ldots + \frac{lay_n - t_n}{(1+r)^{n-1}} = PV_{lay} - \Delta g_1 \tag{46}$$

and

$$sav_1' = lay_1 - t_1 - v\left(PV_{lay} - \Delta g_1\right). \tag{47}$$

Thus,

$$sav_1' - sav_1 = v\left(\Delta g_1\right). \tag{48}$$

Thus, a more formal analysis shows that saving will rise by some fraction, v, of the rise in government spending. This assumes away the possibility that Adam might regard the new government spending as a substitute for current consumption. It has Adam simply distributing the burden of the future new taxes in a way that maximizes the present value of his lifetime utility, given that he must pay those new taxes.

In Chapter 4, we considered some v values in the neighborhood of 1 to 5 percent. Thus, if Δg_1 is positive, we could expect current consumption to fall and current saving to rise by an amount equal to 1 to 5 percent of the increase in government spending.

The foregoing mathematics apply to a single taxpayer Adam. In the real world, with many Adams and Eves, whose tax burdens depend as much on their tax brackets, as well as a myriad of other factors, the result in the aggregate will only approximate what we find here. Yet we must conclude that under certain conditions the simple crowding-out story won't apply—that is, unless, we want to assume away any modicum on rationality on the part of taxpayers.

Deficits versus Surpluses

The conditions assumed throughout the foregoing analysis include full employment and confidence in the government's promises to pay its debts. If a country suffers a downgrade in its credit rating or if the people just lose confidence in its ability to pay its debts, then the foregoing analysis will break down as the government scrapes for funds to finance its deficits and pay off its debt. We must also recognize that depending on whether the problem is excess supply or excess demand, a prolonged economic contraction provides conditions under which deficits or surpluses will be useful for restoring normal conditions.

The problem, as will be shown in Chapter 9, is deciding whether to run a deficit or a surplus in times of economic contraction. When the economy contracts, and when the cause is an excess supply of goods and labor, a deficit will operate to expand disposable income and with it, consumption, with attendant, beneficial multiplier effects.

When the economy contracts, and when the cause is an excess demand for goods and labor, a surplus will, by making workers feel poorer (taxes are higher and government spending is lower), cause the supply of labor to rise with attendant, beneficial effects.

In part because both taxes and safety-net expenditures are programmed to rise and fall with the economy, there is a built-in policy bias to let deficits occur when the economy contracts—and that is *even if* the contraction takes place in tandem with the emergence of excess demand, for which the appropriate remedy is surpluses, not deficits. It is to these nuances that we turn to in Chapter 9. But first, we need to talk more about taxes.

CHAPTER 8

Taxes and the Macroeconomy

In the introduction to this book, I mentioned the fact that economists have a reputation for disagreeing among themselves—a state of affairs that some believe disqualifies them from commenting on anything. In fact, there are many propositions on which economists generally agree, if only implicitly. One is the law of diminishing returns. You cannot, as someone has pointed out, grow all the world's wheat in a single flower pot. Presumably, also, no one would advocate raising the minimum wage to $100 an hour.[1]

There is another proposition that can't be doubted, and this one is that at some point a further increase in the tax rate on whatever it is that is being taxed will cause the government to bring in less revenue rather than more. The school incorrectly dubbed as *supply side economics* has stressed this principle and correctly so. If the government taxed income at 100 percent, it would collect no revenue because either no one would bother to earn income or anyone who did would not report any income. This is not "voodoo economics," as President George H.W. Bush called it to his eternal discredit, but economics you can believe in.

Of course, not even the most zealous progressive would advocate a $100 minimum wage or a 100 percent tax on income. Even less zealous progressives have to own up to an inconvenient (for them) truth, which is that as tax rates rise the base on which a tax is assessed (i.e., income)

[1] Senator Elizabeth Warren of Massachusetts once did suggest that the minimum wage should be $22 an hour. See Senator Elizabeth Warren: Minimum Wage Would Be $22 An Hour If It Had Kept Up With Productivity (2013). Retrieved August 18, 2013, from http://www.huffingtonpost.com/2013/03/18/elizabeth-warren-minimum-wage_n_2900984.html

will ultimately shrink and that, as the tax rate approaches 100 percent, revenues will shrink to zero.

It takes only a little math to illustrate this point. Let *Y* (here national income) be the tax base and let *t* be the rate at which income is taxed. We can then say that total tax revenue REV is simply the product of *t* and *Y*:

$$\text{REV} = tY. \tag{1}$$

We can use this equation to compute the percentage change in revenue that results from a given percentage change in *t* as

$$\%\Delta\text{REV} = \%\Delta t + \Delta\%Y. \tag{2}$$

To hear some progressives talk about tax policy, $\Delta\%Y$ is always zero or close to it. This is to say that if the tax rate goes up by 10 percent so will revenues. Thus, the government can make the tax rate as high as it wants without worrying that income, and eventually tax revenues also, will start to fall. When you hear people talk about *static* revenue estimates, this is what they mean. Such estimates presuppose a zero taxpayer response to any tax law change. A given percentage increase in the tax rate always yields an equal percentage increase in revenues. That any policy maker or policy advisor would endorse such a principle is bewildering but true.

Static estimates belong in the same category as arguments about getting all the world's wheat out of a single flower pot or raising the minimum wage to $100 an hour. Plausibly, when the tax rate is very low, a rise in the tax rate would have little effect on *Y* or might even, because of the income effect, cause *Y* to rise. But imagine that you are a worker making $50 an hour and already paying 75 percent of your hourly wage in taxes—only to learn that now the government wants to collect 85 percent. Currently, the sacrifice of another hour of leisure lets you take home only an additional $12.50. Now the government wants you to take home only $7.50. At some point in this process, you will surely discover that your time is better used in such untaxable pursuits as growing your own food or earning your income under the table.

If the government doesn't want to collect any tax revenue on income, it just sets *t* to zero. But it is inevitable that as *t* rises, *Y* will shrink at some point, that is, $\Delta\%Y$ will become negative. Once *Y* starts to shrink, the effect of an increase in *t* on REV depends on how much $\Delta\%Y$ offsets $\%\Delta t$.

At some point, the sensitivity will be so high that further increases in t will cause revenues to fall, that is, the numerical value of $\Delta\%Y$ will exceed that of $\%\Delta t$.

The Laffer Curve

This leads to the famous Laffer curve, which economist Arthur Laffer, by legend, drew on a cocktail napkin for Congressman Jack Kemp at a DC restaurant. (Jack Kemp took the supply-side ideas he got from Laffer to Congress where he cosponsored what became the Reagan tax cuts.) The napkin is lost to history, but Figure 8.1 provides a version of what Laffer drew.

The drawing captures the fact that when tax rates are low, in the region of t_1, further increases in the tax rate will bring about an increase in revenue. But when tax rates are high, in the region of t_2, it is reductions in the tax that will bring about an increase in revenue. Perforce there must be some tax rate t^{MAX} that will yield the most amount of revenue REV^{MAX}. The curve is tilted to the right in Figure 8.1 to reflect the apparent fact that in most instances the tax rate would have exceeded 50 percent before further increases would yield declining revenues.

The argument that the government could increase revenues by cutting the tax rate is also, however, too easily made. Supply-siders too often make this argument. The reality is that tax rates will usually be closer to t_1 than to t_2 along the horizontal axis of Figure 8.1, so that a cut in the tax

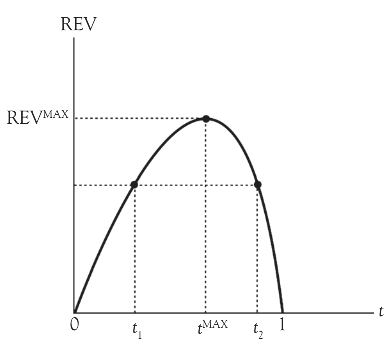

Figure 8.1 The Laffer curve

rate will cause revenue to fall. On the other hand, anti-supply-siders too often claim that a rise in the tax rate will bring about a proportional rise in revenues, whereas that also is almost never true. A rational approach to tax policy takes it as a given that the government must raise a certain amount of revenue and that the goal is to raise that revenue with minimum damage to the economy, in this simple example, with minimum shrinkage in *Y.*

It is important, in studying Figure 8.1, to keep in mind that t^{MAX} is not necessarily the optimal *t.* The optimal *t* will balance the benefits that a further rise in *t* would confer against the costs that it would impose. Imagine that the government has set *t* at t_1 and that it is considering a small rise in *t*. The question is whether the value of the additional government spending made possible by that rise in *t* would more than offset the harm inflicted by the resulting fall in *Y*. If not, then it should not raise *t*. Conversely, it should consider whether the good made possible through the resulting rise in *Y* would more than offset the harm, through reduced government spending, of a reduction in *t*. If so, then it should reduce *t*. Only if neither a rise nor a fall in *t* is called for, on that line of thinking, has the government imposed the optimal *t.*

It is important to keep one more important point in mind as we proceed. That point is that there is a huge difference between two kinds of tax law changes: those that affect the reward for choosing work over leisure and the reward for choosing saving over consumption and those that simply make the taxpayer poorer or richer. Probably the best examples of tax changes that exerted little influence on those rewards for work or saving were the tax rebates that were sent out under the administration of George W. Bush for the purpose of stimulating the economy.

If the government sends you a check in the mail, it can call that a tax rebate, but it is has exactly the same effect on your work and leisure decision or your saving and consumption decision that would occur if you received a lottery winning or a distribution from the estate of your late Aunt Edna, whom you never knew very well. It just makes you richer without affecting the reward for putting another hour into work or another dollar into saving.

A check in the mail or any economic windfall produces a pure *income effect* of the kind discussed in earlier chapters. Although economic windfalls do affect the work and saving calculus, they do not affect it by making work or saving more or less attractive relative to leisure or consumption *at the margin*. They do not affect the reward for choosing another hour of work over another hour of leisure or for choosing another dollar of saving over another dollar of consumption. They simply make current leisure and consumption look more attractive.

Conversely, if the individual gets a bill in the mail for some amount of money that is unrelated to his reward for working another hour or saving another dollar, it affects his work and saving calculus only by making him feel poorer. The bill makes current leisure or consumption less attractive.

In Chapter 9, we will see that the effects of tax changes under non-classical conditions—which is to say, a prolonged period of low production and employment—depend on how those conditions came about. Because there is a long-standing assumption that an economic downturn reflects general excess supply and because Keynes predicated his economic remedies on that very assumption, tax rebates are often seen to be appropriate whenever the economy falls into a prolonged downturn. But we will see that an economy can fall into a prolonged downturn for reasons opposite of what Keynes assumed—which is to say, for reasons stemming from general excess demand—and that the provision of economic windfalls through tax rebates may therefore be exactly the wrong remedy.

In this chapter, we assume the existence of classical conditions under which a gain or loss of cash, separate from any change in the reward for work or saving, exerts an income effect and that this income effect is registered under conditions in which aggregate supply equals aggregate demand. We will proceed on the assumption that there is no Keynesian excess supply or, conversely, any repressed-wages type excess demand to worry about. We relax these assumptions in the following chapter.

Tax laws exert many effects on behavior beyond their direct income effects. Take a look at your Internal Revenue Service Form 1040. If you subtracted *education expenses* to compute your adjusted gross income, then the availability of that deduction probably influenced your education spending. The deduction for *alimony* influenced your decision to get divorced or not (which one hopes you didn't have to do). Other items (deductions for student loan interest, charitable expenses, and personal exemptions) influenced other choices, which, presumably, they were intended to do. Some of these features of the law do influence decisions to work and save but their effects are so hard to separate from their income effects as to make it difficult to fit them into an analysis of how tax law affects the overall economy. It is therefore useful, in studying macroeconomics, to simply treat such deductions as if they were just checks in the mail, every bit the same as tax rebates.

Our job here is to understand how tax changes affect the economy and to do so by understanding how they affect decisions to supply and use labor and capital. We begin by considering labor.

Taxes on Labor Income

Recall the discussion of substitution and income effects in Chapter 3, where we considered Figure 3.8. In that example, Adam saw his wage rise from $50 to $100 per hour, only to have his boss extort $500 of income from him as his wage rose. There we saw that Adam would allocate more time to work at the new wage rate if he had to pay this extortion than if he did not. The extortion took away the income effect that would otherwise have led Adam to consume more leisure.

Now let's approach this situation from the other way around, and let the government take on the role of Adam's boss. Now Adam starts out by working 12 hours a day and making $100 per hour of labor income.

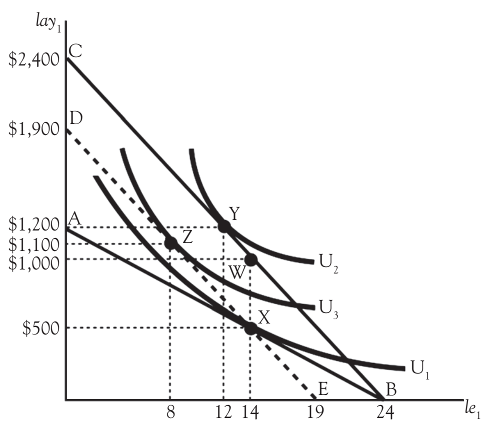

Figure 8.2 Effect of a tax on labor income

Then the government imposes a 50 percent tax on his income so that his after-tax wage rate falls to $50 per hour. He increases leisure by two hours from 12 to 14 hours per day, reducing his work from 12 to 10 hours per day. Of the $1,000 in before-tax income that he now earns, he pays $500 to the government, leaving the rest in after-tax labor income. His utility falls from U_2 to U_1.

The adjustment in his work effort is the product of competing substitution and income effects. Because his after-tax wage rate falls by 50 percent, the cost of leisure also falls by 50 percent and Adam wants more leisure to that extent. But he must also pay $500 in taxes on his $1,000 in before-tax income, as shown by point W, which means that he can afford less leisure than before. The income effect on work and leisure results from the downward shift of $500 of the budget line from BC to DE and from point Y to point Z. The substitution effect is illustrated by the shift from point Z to point X. Adam reduces his leisure time (and increases his work time) by four hours because of the income effect and increases his leisure time (and decreases his work time) by six hours because of the substitution effect. The expansion in leisure time (and contraction of work time) by two hours is the net result of these competing effects.

In this example, the work-increasing income effect of the tax offsets much of the work-decreasing substitution effect. It seems, in light of this example, that a tax on labor income might cause only a small reduction in the labor supply. Conversely, the removal or reduction of a tax on labor income might cause only a small increase in labor supply.

The discussion of Chapter 3 brings another point to light. Suppose that the government decides to collect its $500, not by taxing labor income, but by simply sending Adam a bill for $500, which he would have to pay irrespective of his work and leisure choice. This would be akin to the hypothesized *donation* that his boss expected him to make in the example of that chapter.

After he pays the government, Adam gets to keep the entire $100 in pay that he receives for every hour he works.

We illustrate that eventuality by an inward shift of his budget constraint from BC to DE. This action eliminates the substitution effect since it leaves take-home pay (once the tax bill is paid) unchanged. The cost of leisure does not go down and as a result there is no inclination on that account to substitute leisure for work. All that is left is the income effect, which, since Adam feels poorer now than he did at point Y, induces him to reduce his leisure from 12 to 8 hours (and increase his work from 12 to 16 hours) as he shifts from point Y to point Z. There is an argument from economic efficiency to go from the existing tax system to a more neutral tax under which income effects replace substitution effects in this manner. Adam is better off at point Z than he would be at point X. It also happens that his work time rises by four hours rather than falling by two hours as it does under the income tax.

Interestingly, this argument flies in the face of the *folk-economic* view that the harm from taxes results from the fact that they *take money out of people's pockets*. If *harm* is measured by a reduction in the willingness to work, then a tax that just takes money out of people's pockets and avoids exerting any substitution effect does good by increasing the willingness to work. It also, as we see, leaves the taxpayer better-off by eliminating the distortion in his after-tax wage rate that the income tax would cause.

The foregoing consideration assumes that the government is going to collect $500 in taxes so that the only question is how it collects those taxes and how its chosen means of collecting the taxes affect individual choices. But what does the government do with the tax revenue? The foregoing analysis disregards this question entirely. It assumes, in effect, that the government takes $500 of Adam's money—money that would have otherwise gone toward the purchase of useful consumer goods—and applies it to some entirely wasteful project. Perhaps the government pays workers to dig holes in the ground and fill them in again, diverting those workers from the production of previously enjoyed consumer goods. (Oddly, this possibility would work just fine in an economy characterized by Keynesian excess supply, but recall that we are assuming that there is no imbalance between aggregate supply and demand.)

Figure 8.3 illustrates an alternative scenario, one in which the individual is subjected to a 50 percent income tax but nevertheless rises to a higher level of utility because of the value to him of the government services paid for out of the tax revenue raised by the tax.

Now the government decides that it wants, instead, to provide a valuable service. Suppose that service is the provision of "free" healthcare, for

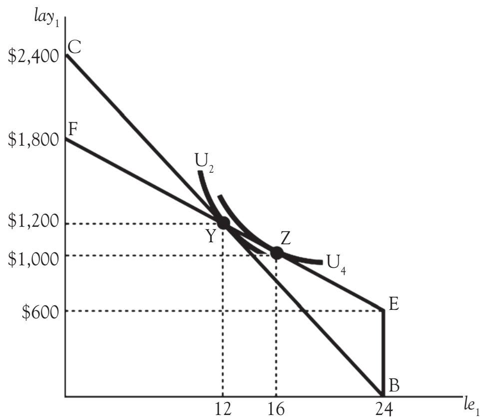

Figure 8.3 Effect of an income tax when tax revenue is not wasted

which Adam previously paid $600 out of his pocket. This can be thought of as a lump-sum benefit, which Adam gets without doing anything at all. This tax-benefit combination puts him on line EF. This line illustrates the fact that Adam can enjoy the $600 in consumption without working at all (point E). At the other extreme, he could enjoy $1,800 in consumption by working the entire 24 hours (point F). Now Adam also can have the same amount of consumption and the same amount of leisure that he had before the tax-benefit arrangement was instituted, which means that it permits him to return to point Y, where he has 12 hours of leisure, $1,200 in consumption, and the same level of utility U_2. In actuality, he adjusts to point Z and to a higher level of utility U_4.

Interestingly now, the government raises less in revenue than when it wasted the money, the reason being that the $600 windfall partially offsets the income effect of the income tax, causing him to expand leisure by two hours more than he would have if the revenue had been wasted. Thus, he ends up working only eight hours and paying only $400 in taxes. His eight hours of work leaves him with $400 in after-tax income, which, plus the value of the government benefit, permits him to consume $1,000 worth of goods. (Keep in mind that, in this example, it must be possible for the government to provide the aimed-for $600 in goods by raising only $400 in revenue.)

These examples relate to taxes on labor income, but they apply as well to taxes on capital income. They teach three lessons:

1. Income taxes that are applied to the provision of wasteful government projects generate offsetting substitution and income effects with corresponding offsetting effects on the supply of the activity that is being taxed (e.g., the supply of labor).
2. Insofar as it is possible to replace an income tax with a more neutral, lump-sum tax (and whether or not the revenue is spent on wasteful projects), the government will raise revenues in a fashion that eliminates substitution effects and leaves only income effects. This will result in an increase in the activity (e.g., work) that was previously taxed and an increase in individual welfare.
3. When the government imposes an income tax and applies the tax revenue it collects to the benefit of the worker through useful spending projects, it creates a positive income effect that offsets the negative income effect of the tax itself. If the benefit provided by the expenditure exceeds the amount of tax paid, individual utility will rise. Conversely, when the government reduces or eliminates an income tax rate, the resulting reduction in tax revenue for funding useful government projects will create a negative income effect that offsets the positive income effect of the tax change. If the value of the lost government spending exceeds the reduction in taxes paid, utility will fall.

It is important to note that the examples in which a higher income tax yields beneficial forms of increased government spending posit spending of the kind that translates into an equivalent reduction in the cost of some item on which the individual already spends. The converse example would be a tax cut that requires the individual to spend his own money on something previously provided *free* by the government. Because plausible examples are hard to find, it seems likely that income taxes will exert income as well as substitution effects. On the other hand, the substitution effect will more and more dominate the income effect as the tax rate approaches 100 percent.

The next question is how the imposition of an income tax will affect the demand for labor. Again, suppose that there is no income tax and Adam has a job that pays \$50 per hour. We know from Chapter 3 that Adam will adjust his work effort so that

$$MRS_{LeLay} = w = \$50, \tag{3}$$

and his employer will adjust the quantity of labor purchased from Adam so that

$$MP_L = w = \$50. \tag{4}$$

Thus, as shown in Chapter 6, the socially optimal amount of labor is provided, in as much as

$$MRS_{LeLay} = MP_L = \$50. \tag{5}$$

The income generated by another hour of labor time is just equal to the income that Adam would have to receive in order to be willing to provide that hour of labor time.

Now suppose the government imposes a 50 percent tax on labor income. Adam's after tax wage rate w_{at} now equals 50 percent of his before tax wage rate w_{bt}:

$$w_{bt} = \frac{w}{1 - t_{Lay}} = \frac{\$50}{1 - 0.5} = \$100. \tag{6}$$

Because he adjusts his work effort to his after-tax wage, he will set

$$MRS_{LeLay} = w_{at} = \$50, \tag{7}$$

while his employer sets

$$MP_L = w_{bt} = \$100. \tag{8}$$

It follows that

$$MRS_{LeLay} < MP_L. \tag{9}$$

The wage that Adam would have to receive, after taxes, in order to provide another hour of labor time is less than the additional income that

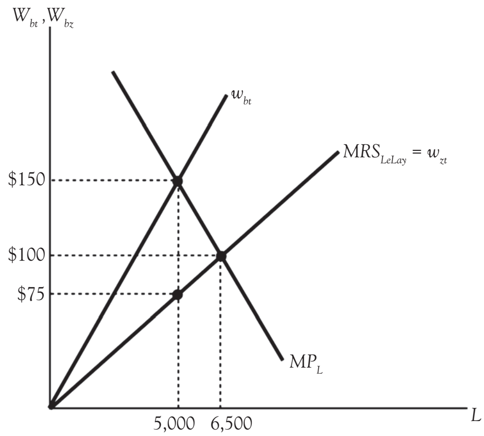

Figure 8.4 Effect of an income tax on the supply of labor

the firm would receive by using that hour of labor time. As a result, the firm hires less than the socially optimal quantity of labor. As previously observed, the tax on labor income imposes a bias in favor of leisure and against work. See Figure 8.4.

Without a tax, the quantity of work time hired by firms would be 6,500 hours at $100 per hour. Under a 50 percent income tax, the labor supply curve rotates in a counterclockwise direction so that the before-tax wage rate now diverges from the after-tax wage by $75 per hour. The quantity of labor hired falls to 5,000 hours and the government collects $375,000 (= $75 × 5,000) in revenue.

Taxes on Capital Income

Capital income is a reward for saving. Our hypothetical taxpayer has a certain amount of disposable income, which she—we are bringing Eve back into the story—uses for either consumption or saving. She saves by using after-tax income to buy saving instruments like bank CDs, bank passbook saving accounts, government or corporate bonds, or corporate stocks. (She can also save by putting her money in a cookie jar, but we postpone consideration of that option for later). What she doesn't save, she uses for consumption.

Earlier in this chapter, we expanded the framework of Chapter 3, where the individual had a certain amount of labor income that he had to divide between current and future consumption, to a revised framework in which the same individual had to take into account any taxes that were imposed on labor income.

Here we expand the framework of Chapter 4, where the choice between current and future consumption depends on r, p, and the individual's IES, to a revised framework that takes into account taxes that are imposed on capital income. We do so by introducing taxes on the income made possible by saving. Savers receive capital income by making financial capital provided through bank deposits, corporate stock, and bond purchases available to firms. Businesses use financial capital provided through saving to engage in capital spending, that is, investment. In Chapter 5, we assumed that savers provided financial capital only through loans, which could be made via banks or directly to business investors. Here we expand the analysis to include financial capital provided via stock purchases.

In Chapter 5, the equilibrium r was determined through the interaction of a lender (Eve) and an investor (Adam). Recall that, in classical equilibrium, investment would expand until the marginal product of capital equals the real interest rate plus economic depreciation:

$$MP_k = r + d, \tag{10}$$

where $r + d$ equals the cost of capital cc.

Now let's consider what happens when the government imposes a tax t on interest income. We return to the Garden of Eden, after the fall, where Eve saves and Adam invests. In Chapter 5, we considered the conditions that would have to be met for Adam and Eve to reach equilibrium in their saving and investment calculus. But now we have to think about how the imposition of this tax might affect the cost of capital cc and what we will call the after-tax return to saving r_{at}. Let the before-tax interest rate enjoyed by Eve, which is to say, the interest rate that Adam actually pays, be r_{bt}. Then

$$r_{at} = r_{bt}(1 - t). \tag{11}$$

In order for Eve's after-tax return on her saving to match the return r she got before the tax was imposed, r_{bt} must be high enough so that $r_{at} = r$. Thus, it must be true that

$$r_{bt} = \frac{r}{1-t}. \tag{12}$$

What does this mean for the cost of capital? The answer is that it depends on whether Adam can deduct the cost of capital from his taxable income. Suppose that Eve passes on the full amount of the tax to Adam by charging the interest rate r_{bt} as defined in equation (12), and suppose that Adam can deduct both the interest he pays Eve and economic depreciation. (In fact, the amount of depreciation that can be deducted will differ from economic depreciation, but we ignore this distinction for now.) If Adam's business income is taxed at the same rate as Eve's interest earnings are taxed, then *cc* becomes

$$cc = \frac{r+d}{1-t}(1-t) = r+d. \tag{13}$$

There is no effect on the cost of capital if Adam uses debt financing to acquire the funds needed to buy his machine and if the cost of debt financing is fully deductible.

Now let's examine what Eve is doing about her saving decision. Eve adjusts her saving until

$$MRS_{c_t c_{t+1}} = (1+r). \tag{14}$$

For his part, Adam adjusts his capital holdings until

$$MP_k = cc. \tag{15}$$

Because

$$cc = r+d, \tag{16}$$

$$MRS_{c_t c_{t+1}} = 1 + MP_k - d, \tag{17}$$

which appeared as equation (22) in Chapter 5.

The value to the firm of another dollar of capital spending is just equal to the increment in future consumption that a saver would have to receive in order to make a dollar available to the firm for the purpose of buying new capital. Under these assumptions, the tax on interest has no effect on capital formation.

Taxing Corporate Income

The matter becomes more complicated when Adam obtains financing by offering ownership in the firm rather than just borrowing the money. The traditional arrangement is to form a corporation and use equity capital (i.e., to sell stock) to finance capital purchases.

Let's assume that the after-tax return to Eve for providing debt financing is five percent and that Adam already has four pizza ovens for his business but now wishes to secure equity financing to buy a fifth oven. He wants to make a stock offering that will bring in enough cash so he can buy an oven costing $1,000, which, we assume, depreciates at the rate of 10 percent per year. Adam plans to sell the stock to Eve and to compensate her for her stock purchase by paying out the entire return on the additional oven as a dividend.

If there were no taxes to be paid on this return and if Eve's stock purchase were for $1,000, Adam would pay her an annual dividend of $150, which would be just high enough to cover her expected after-tax return of five percent plus another 10 percent to cover the annual loss in share value owing to the depreciation of the oven.

However, there will be taxes to pay, which makes all the difference between this and the arrangement in which Adam relied on debt financing. In fact, there will be two taxes to be paid as the profit generated by the purchase of the fifth oven makes its way to Eve's pockets. First, there is the corporation income tax, imposed at a rate of t_c, which we will assume to be 35 percent (which is the top statutory rate on U.S. corporations). Then there is the individual income tax rate, t_{div}, that Eve will have to pay on the dividends she receives, which in her assumed tax bracket, would be 15 percent. (There would ordinarily be a state corporation income tax for Adam to pay and a state income tax for Eve to pay, but we will ignore those taxes here.)

So the question is what rate of return Eve would have to get on her stock in order to make it worth her while to buy that stock rather than put her money in the bank. This rate of return is now the cost of capital to Adam, in this instance the cost of raising financial capital by selling stock. As before, we will designate this cost of capital as *cc*. In order to determine *cc*, we need to figure out how much Adam and Eve will have to pay in taxes before Eve sees a dollar of reward for buying stock in Adam's company.

Let's start with the tax treatment of depreciation on the oven. If the IRS lets Adam depreciate the oven over a period of five years, he will be able to reduce his company's taxable income by one-fifth of $1,000, or by $200, for 5 years after he buys the oven, beginning with the first tax year for which he can take the depreciation. At a tax rate of 35 percent, that's an annual saving of $70 (= 0.35 × $200). If the discount rate is five percent, the present value of this saving on depreciation is

$$PV_d = \frac{\$70}{1.05} + \frac{\$70}{1.05^2} + \frac{\$70}{1.05^3} + \frac{\$70}{1.05^4} + \frac{\$70}{1.05^5} = \$303. \qquad (18)$$

In effect, the depreciation allowance reduces the cost of buying the oven by 30.3 percent, from $1,000 to $697. We will designate the fraction of the cost of buying a capital asset that the investor saves by depreciating that asset as f_d. We will ignore any tax saving that Adam might enjoy by taking advantage of an investment tax credit or some other such benefit that the tax laws might confer.

The fact that Adam can depreciate his capital for tax purposes makes it cheaper for him to raise financial capital. Let's imagine that the tax laws permitted Adam to depreciate a new oven in the manner just described. Because Adam, we assume, would have to pay corporate taxes on income yielded by other investments, he could still reduce his overall tax liability by $70 for each of the next five years just as we assumed previously. Adam could use the resulting stream of tax savings to reduce the amount of financial capital he needs to raise in order to buy the oven. Thus, in this example, he needs to raise only $697.

Now let's see where we are in computing the tax burden on Adam's business and on Eve's pocketbook that results when she provides enough financing in order for him to buy the oven. First, if the oven generates a profit, his corporate tax liability for receiving the income generated by the purchase of the oven will be

$$tax_c = t_c(inc), \qquad (19)$$

where t_c is the corporation tax rate that applies to income generated by this purchase and *inc* is corporate income or profits.

Because Adam distributes all of his after-tax corporate income as dividends, Eve gets a before-tax dividend equal to

$$div_{bt} = inc - tax_c. \quad (20)$$

So

$$div_{bt} = inc(1 - t_c). \quad (21)$$

Eve will pay a tax on her dividend of

$$tax_{div} = t_{div} div_{bt}. \quad (22)$$

Her after-tax dividend will then be

$$div_{at} = div_{bt} - tax_{div} = [inc(1 - t_c)][1 - t_{div}]. \quad (23)$$

We know that Eve has to end up with an after-tax dividend high enough to justify taking \$697 out of the bank and using it to buy pizza stock. That after-tax dividend is \$104.55 (= \$697 × 0.15). Thus, if p_c is the purchase price of the oven, Adam has to pay a high enough dividend so that Eve's after-tax dividend satisfies the equation

$$div_{at} = p_c(1 - f_d)(r + d), \quad (24)$$

which, given the foregoing assumptions, becomes

$$div_{at} = \$1{,}000(1 - 0.303)(0.05 + 0.1) = \$104.55. \quad (25)$$

We can now use equations (23) and (24) to solve for *inc* and *cc*:

$$inc = \left[\frac{p_c(1 - f_d)(r + d)}{1 - t_{div}}\right]\left[\frac{1}{1 - t_c}\right] \quad (26)$$

Using the information we have about this investment,

$$inc = \left[\frac{\$1{,}000(1 - 0.303)(0.05 + 0.1)}{1 - 0.15}\right]\left[\frac{1}{1 - 0.35}\right] = \$189.23 \quad (27)$$

The pizza oven must generate a profit of \$189.23 to leave Eve with her required after-tax dividend. We can see that it will generate the required profit, by virtue of the fact that Adam will pay 35 percent or \$66.23 in taxes on this amount, leaving \$123.00 to be distributed to Eve in dividends, on which she pays taxes of $18.45, leaving her with the required $104.55. Because $104.55/$697 = 15 percent, this leaves her with just enough to earn a 15 percent return on her purchase of $697 worth of Adam's pizzeria stock.

The cost of capital to Adam is

$$cc = \frac{inc}{p_c} = \left[\frac{(1-f_d)(r+d)}{1-t_{div}}\right]\left[\frac{1}{1-t_c}\right] \tag{28}$$

or, in this instance,

$$cc = \frac{\$189.23}{\$1{,}000} = \left[\frac{(1-0.303)(0.05+0.1)}{1-0.15}\right]\left[\frac{1}{1-0.35}\right] = 18.92\%. \tag{29}$$

The investment must yield a return of 18.92 percent to make it worthwhile for Eve to furnish her equity capital. We can compute the marginal effective tax rate (METR) on her stock purchase as

$$t = 1 - \frac{(1-f_d)(r+d)}{cc}\text{, or} \tag{30}$$

$$t = 1 - \frac{(1-0.303)(0.05+0.1)}{0.1892} = 44.75\% \text{ (rounded up).} \tag{31}$$

Note that total taxes are $84.68, which is 44.75 percent of the $189.23 in profit that the project needs to generate.

We can illustrate this graphically if we translate the foregoing results into their consequences for capital spending. See Figure 8.5. We have found that the cost of financing the purchase of the pizza oven per dollar of the purchase price of the oven is 18.92¢, of which 44.75 percent, or 8.47¢, is paid in taxes. This means that savers receive only 10.45¢, after taxes, for every dollar of capital expenditure. The tax wedge is 44.75 percent. The greater this tax wedge, the less capital that firms will want to have and savers will want to provide.

The cost of capital would be 15 percent but for the taxes, in which case the firm would want to have five ovens, inasmuch as MP_k = 15 percent when k = $5,000. Instead, the firm acquires only four ovens. The government receives 8.47¢ in taxes for every dollar of capital held by the firm, which in this example comes to $339, which is the size of the area ABCD.

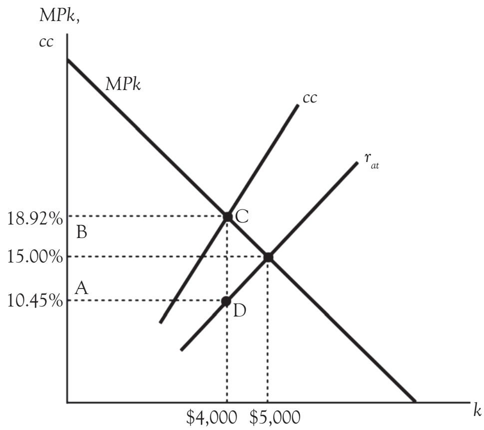

Figure 8.5 Effect of a corporation income tax on the capital stock

Table 8.1 Effects of alternative tax rates and depreciation periods

Given			*We can calculate cc and METR as follows:*	
Dividend tax rate (%)	*Corporate tax rate (%)*	*Depreciation period (years)*	*Cost of capital (%)*	*METR (%)*
15	20	5	18.24	42.68
15	35	10	19.81	47.23
20	35	5	20.10	48.00

Table 8.1 provides some alternative computations of cost of capital and the METR, for different assumptions about depreciation, the corporate tax rate, and the tax rate on dividends. One scenario cuts the corporate rate to 20 percent. A second lengthens the depreciation period to 10 years. The last raises the dividend tax rate to 20 percent, which would apply under current law if her taxable income reached $400,000.

We see that the cost of capital rises with the dividend tax rate, the corporate tax rate, and the length of the depreciation period. The greater the cost of capital, the smaller the desired number of pizza ovens. This has implications for economic activity in which GDP varies directly with investment.

Now let's see how these taxes discriminate against saving. In this example, Eve has to receive a 15 percent after-tax return to be willing to buy \$100 worth of pizza stock. Once Eve had adjusted her consumption and saving decision to maximize her utility, she would be just indifferent between using \$100 in after-tax income to engage in \$100 of consumption and buying \$100 worth of stock on which the return is 15 percent.[2]

Now suppose also that capital income is taxed as assumed in the foregoing example. As shown in Figure 8.5, the firm adjusts its capital stock until

$$MP_k = cc = 18.92\%. \tag{32}$$

But the saver offers financial capital only up to the point where

$$MRS_{c_t c_{t+1}} = 1 + r = 1.05. \tag{33}$$

But because

$$(1 + r) = 1.05 < (1 + MP_k - d) = 1.0892, \tag{34}$$

$$MRS_{c_t c_{t+1}} < (1 + MP_k - d). \tag{35}$$

In this example,

$$MRS_{c_t c_{t+1}} = 1.05 < (1 + MP_k - d) = 1.0892. \tag{36}$$

The value to the firm of another dollar of capital will now be greater than the amount of future consumption with which Eve would have to be compensated for providing that additional dollar, given the taxes imposed

[2] A point of clarification is needed here. Eve gets a 15 percent after-tax return (including depreciation of 10 percent), but Figure 8.5 shows an after-tax return of 10.45 percent (equal to the marginal product of capital minus the tax rate of 8.47 percent). This is because there is a difference between the return on Eve's purchase of \$697 in stock and on the firm's capital holdings. Eve gets \$104.50 in after-tax dividends, which is 15 percent of \$697, but the new capital employed by the firm comes to \$1,000. If we divide her \$104.55 in dividends into \$1,000, we get 10.45 percent, which is the after-tax return on the entire investment. The per-unit tax in this example is correctly seen as the 8.47 percent that separates the marginal product of capital and the after-tax return to capital as shown in Figure 8.5.

on her capital income. The taxes on capital income create a bias toward consumption and away from saving. In Figure 8.5, that bias is enough to discourage the firm from buying the fifth oven.

Toward a Rational Tax Policy

As shown earlier, the government could eliminate the bias against work created by the income tax by eliminating the tax on labor income. And it could eliminate the bias against capital formation by eliminating the tax on capital income. In either case, it could make up for the lost revenue by imposing a lump-sum tax.

This alternative is politically unfeasible and not to be recommended by anyone. But it reminds us of an important point, which is that government programs worth having must be funded by taxes collected somehow, with (so one hopes) minimum adverse effects on the allocation of time between work and leisure, and current income between consumption and saving. The idea of a lump-sum tax is just a reminder that some taxes are less welfare-destroying than others.

One consideration that arises in considering tax policy is that income effects can diminish the capacity of tax-rate cuts to expand work and saving. To consider such effects divorced from the question of how the government spends the revenue it collects is an error, however. Suppose the government were to cut the tax rate on labor and capital income and simply make do without the revenue it would thereby (probably) lose. If the government thereby had to cut back on the provision of some service (say, healthcare) on which taxpayers had placed a value, then taxpayers would have to use the revenue they no longer sent to the government to replace that service. There would then be no income effect. Absent the income effect, there would only be a substitution effect, and work and saving would expand.

Suppose, in contrast, that the loss of tax revenue causes the government to eliminate programs that were entirely wasteful (paying men to dig holes in the ground and fill them in again). Then there would indeed be an income effect, which would also diminish the effectiveness of a tax-rate cut to expand the economy. In and of itself, that would be all to the good, since the expanded leisure and current consumption thus enjoyed by taxpayers should be seen as a better goal than make-work for men with shovels.

The presence of strong income effects is, at any rate, evidence that whatever government expenditure it is that had to be cut, the money would be better spent by the taxpayers who earned it.[3] This fact is a reminder to be cautious when policy makers (often conservatives) wax eloquent over the capacity of tax-rate cuts to *put money back in people's pockets*. If the goal is to expand work and saving, then one must hope that taxpayers have to turn right around and use the money put back in their pockets to replace the government projects being ended.

Finally, we have to keep in mind that if the government simply wants to pass out money, through tax rebates, welfare checks and the like, and to do so without cutting tax rates, then the resulting increase in consumer spending (through consumption smoothing) will be small. Chapter 11 provides supporting evidence.

Untaxing Net Investment

Another approach to tax policy is to identify tax-rate changes that would keep tax revenues constant (i.e., be *revenue neutral*) but nevertheless expand the economy. If the government could reduce the rate at which capital income is taxed and simultaneously make up for the lost revenue by taxing labor income more heavily, then, so it is often argued, there would be no income effect and the economy would expand.

To see how this would work, let's begin with our stripped-down version of the NIPA income–expenditure equality from Chapter 2:

$$WAGES + NW + D = C + I + G + NX. \tag{37}$$

The left-hand side is wages plus nonwage income plus depreciation of private capital, and the right-hand side is the sum of all expenditures

[3] We do have to be careful here not to bias the argument against the government. It took years for the *peace dividend* yielded by defense expenditures under President Reagan to show up as defense cuts under President Clinton. Perhaps in a few years, we will pay for the defense cuts being orchestrated by President Obama by having to expand the defense budget yet again.

that make up GDP. Let's assume, for this purpose, that nonwage income is capital income.

Under the income tax, the tax base is wage plus nonwage income, which is to say the left-hand side of equation (37) minus the depreciation of private capital, or $WAGES + NW$.[4] Subtracting depreciation from both sides of the equation, we get

$$WAGES + NW = C + \text{Net } I + G + NX. \qquad (38)$$

National income and product accounting provides a reminder that taxes imposed on the income side of the equation, which is on the left-hand side of equation (38), must fall equally on the expenditure side, which is on the right-hand side.

Suppose, to begin with, that taxes are imposed on both wage and nonwage income and that Adam's pizza business has $1,000 in profits. In the preceding example, he would pay $350 in corporate income taxes. He would then have $650 left, which he could use to buy new capital or distribute to Eve in the form of dividends. If he chose to distribute the profits to Eve, she would, for her part, pay $97.50 [= 0.15 × ($650)] in taxes on her $650 in dividends. Adam's $1,000 in profits would leave Eve with $552.50 in after-tax income. The government would collect $447.50 (= 44.75 percent of the $1,000 in profits) in revenue.

Now suppose that the government decides to tax only labor income. The tax base would be *WAGES*. If Adam receives $1,000 in profits, he could distribute that amount to Eve in dividends, on which she would pay no taxes. Adam's $1,000 in profits would leave Eve with $1,000 in after-tax income, which she could apply either to consumption or to saving in the form of providing more financial capital to Adam. If she chose to use the same $1,000 to buy stock from Adam, he would be able to apply that entire amount to the purchase of a new capital, as if he had not distributed the profits to Eve in the first place. The tax base would be

$$WAGES = C + \text{Net } I + G + NX - NW. \qquad (39)$$

[4] In reality, the existing income tax provides numerous deductions for nonwage income and is, therefore, a kind of compromise between a *pure* income tax and a consumption tax.

Suppose, alternatively, that the government taxed both wage and non-wage income but permitted firms to deduct capital expenditures from their taxable income. This is known as *expensing* investment. The tax base would be

$$WAGES + NW - \text{Net } I = C + G + NX. \tag{40}$$

Note that, if $NW = \text{Net } I$, which would be the case if Adam used Eve's $1,000 to buy new capital, the tax base is the same, whether defined according to equation (39) or equation (40).

Given that the tax base is defined as in equation (40), the government untaxes net investment. It could do the same thing with a consumption tax, under which the tax base would be

$$C + G = WAGES + NW - \text{Net I} - NX.^{5} \tag{41}$$

The only difference between a policy that permits the expensing of net investment and a policy under which the government taxes consumption is that the latter policy untaxes net exports. Were net exports to equal zero, the policies would yield the same tax base.

The policy of permitting firms to expense net investment is the core feature of flat tax proposals, notably those put forward by Robert Hall and Alvin Rabushka and by Steve Forbes (Hall and Rabushka 2007) and (Forbes 2005). The best known proposal for a consumption tax is the FairTax, which would tax consumption through a national retail sales tax (FairTax).

Despite the hot dispute that can arise between *flat taxers* and *fair taxers*, the two ideas have in common the fact that they untax net investment, which is the crucial consideration for tax policy. The argument for this policy lies in the expectation that the expansive effect of untaxing net investment would more than offset the contractive effect of raising the tax on labor. Both approaches pose some issues for the monetary authorities, which we outline in the Appendix at the end of this chapter.

[5] Note that we assume that the tax would apply to personal consumption expenditures and to all government purchases, not just the portion identified as government consumption expenditures in the NIPA.

Evidence

David and Christina Romer argue persuasively that tax increases generally have negative economic effects:

> Our results indicate that tax changes have very large effects on output. Our baseline specification implies that an exogenous tax increase of one percent of GDP lowers real GDP by almost three percent. Our many robustness checks for the most part point to a slightly smaller decline, but one that is still typically over 2.5 percent. (Romer and Romer 2010, 799)

In another study, Romer and Romer conclude from the evidence "that taxes are indeed distortionary: the null hypothesis of no effect is overwhelmingly rejected." On the other hand, they find that "the distortions are small." Their "baseline estimate of the elasticity of taxable income with respect to the after-tax share is approximately 0.2. This is considerably smaller than the findings of postwar studies (though generally within their confidence intervals). Finally, the estimates are extremely robust."(Romer and Romer 2013, 39).

In a study on *How the Supply of Labor Responds to Changes in Fiscal Policy*, the Congressional Budget Office contrasted the effects of short-term and permanent tax changes:

> Suppose first that the hypothetical 2 percentage-point increase in the tax rate applied to all income is imposed for just one year. People's desire to work less during that year, combined with their willingness to substitute work and consumption between that year and future years, causes them to reduce the labor supply by 1.11 percent during the year of the tax surcharge, on the basis of CBO's central estimate of the Frisch elasticity. The proportional change in the overall labor supply is about equal to the change in the supply of labor by an average person, which would be 1.16 percent (the product of a Frisch elasticity of 0.40 and a 2.9 percent decline in the after-tax marginal wage rate). (Congressional Budget Office 2012b, 7)

For a permanent tax change, the result is far less robust:

> If, instead, the surtax is permanent, people's desire to work less causes them to reduce the overall labor supply by 0.83 percent, according to CBO's life-cycle model. That change equals what would result from a 2.9 percent reduction in the after-tax marginal wage rate and a substitution elasticity of just under 0.29 (2.9 * 0.286 = 0.83). (Congressional Budget Office 2012b, 7)[6]

Finally, Mathias Trabandt and Harald Uhlig estimated the Laffer curve for the United States and a group of 14 European Union countries. They found that

> for the US model 32 percent of a labor tax cut and 51 percent of a capital tax cut are self-financing in the steady state. In the EU-14 economy 54 percent of a labor tax cut and 79 percent of a capital tax cut are self-financing.

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[6] In any discussion of tax policy, it is important to distinguish marginal tax rates from average tax rates. Consider a married couple who set out to calculate their 2013 federal income tax bill, and suppose that their 2013 taxable income was $150,000. Using the IRS tax tables they find that they owe the government $29,466. Their average tax rate equals their tax bill divided by their taxable income, or 19.64 percent. But their marginal tax rate is 28 percent, given that they find themselves in the 28 percent income tax bracket. The distinction is important for assessing how their tax schedule affects their willingness to work. Suppose that our couple (Adam and Eve, of course) had to decide on January 1, 2013, whether one of them should take a consulting job that would pay $3,600. Because they are in the 28 percent tax bracket, they must compute the after-tax reward for taking that job on the assumption that doing so would add $1,008 (= 0.28 × $3,600) to their taxes. What mattered was their marginal, not their average tax rate. From this example, we see why economists who attempt to determine the effects of tax-law changes on economic behavior focus on changes in marginal, not average rates. Using evidence on changing average rates to measure economic effects is misleading because average rates are calculated by dividing tax liabilities by taxable income, which itself depends on how changes in marginal rates affect economic behavior.

> We show that lowering the capital income tax as well as raising the labor income tax results in higher tax revenue in both the US and the EU-14, i.e. in terms of a "Laffer hill", both the US and the EU-14 are on the wrong side of the peak [the side where the curve is downward sloping] with respect to their capital tax rates. (Trabandt and Uhlig 2009, 3)

On the basis of this finding, the United States could expand the economy *and* increase tax revenues by untaxing net investment.

Next we turn to a new topic entirely. Heretofore, we have implicitly assumed that the economy is operating at *full employment*, which is to say that aggregate supply equals aggregate demand. Chapters 9 and 10 take up the problems that arise when there is disparity between the two.

Appendix

Implications for Monetary Policy

Any change in tax policy has implications for monetary policy. Consider first, the implications of a policy change that replaces an income tax with a tax on consumption. Suppose that all income is labor income and that all production goes for either government or personal consumption. Let's further assume that all production is pizza production, that pizza sells for \$1 a slice and that pizza producers make 1,000 slices. The government collects taxes through an income tax of 20 percent. So we have

$$\text{GDP} = C + G = \$800 + \$200 = \$1{,}000. \qquad \text{(A1)}$$

Consumers receive \$1,000 in before-tax income but must pay \$200 to the government in taxes, which the government uses to buy 200 slices of pizza, leaving the remaining 800 for individual consumption. Let's also put some values to the equation of exchange:

$$MV = PY = \$1{,}000. \qquad \text{(A2)}$$

If the money supply is \$500, velocity must be 2, so that the left-hand side of (A2) matches up with the right-hand side.

Finally, we assume that workers are paid \$10 per hour and that they produce 10 slices of pizza for every hour worked. Thus,

$$WAGES = W^{*}L = \$10^{*}100 = \$1{,}000, \qquad \text{(A3)}$$

so that pizza workers work 100 hours to produce 1,000 slices of pizza. Each worker's after-tax wage rate is $8 per hour.

Now suppose the government decides to replace the income tax with a sales tax and with the intention of raising enough revenue to continue buying its 200 slices of pizza. The government must impose a tax on consumption that permits it to continue diverting 200 pizza slices from individual to government consumption. But what happens to the price of pizza?

Almost everyone would say that the price of pizza will rise by the amount of the sales tax. So if the government wants to be able to buy 20 percent of the pizza output, the sales tax rate must be 25 percent. The price of pizza before the sales tax is imposed remains at $1. With a 25 percent sales tax, the price rises to $1.25. Total wages remain at $1,000 and now workers get to put that entire $1,000 in their pockets. But with nominal output now equal to $1,250, that $1,000 buys only 800 [(=$1,000/$1,250) × 1,000] slices, just as before. The government collects $250 (= .20 × $1,250) in tax revenue, with which it buys the remaining 200 slices.

Because *PY* now equals $1,250, *MV* must also equal $1,250. And, if *V* is constant, that can happen only if government expands *M* by 25 percent to $625.

Suppose, alternatively, that the government does not expand *M* at all. Then, because *V* and *Y* are assumed to remain constant, price can't change either.

Thus, something must happen to wages. Specifically, the wage rate has to fall by 20 percent to $8 per hour. Recall that there is no income tax now, so take-home pay would also equal $8, just as it did before, under the income tax. Now also the price of pizza, exclusive of the sales tax, falls to $0.80. (If workers receive only $8 per hour to make 10 slices of pizza, the firm can cover the costs of producing those 10 slices by collecting only $0.80 cents for every slice sold.) If a 25 percent sales tax is imposed on pizza, the price to the consumer will remain at $1.00 (25 percent of $0.80 is $0.20). Given that their wages now equal $800, workers can, once again, buy 800 of the 1,000 slices produced. The government collects

$0.20 in revenue for each slice sold and, given that 1,000 slices are sold, it collects $200 in revenue that it uses to buy 200 slices.

So we have two scenarios: (1) Prices rise by 25 percent, as enabled by a 25 percent increase in the money supply. (2) Prices remain constant, as made necessary by the fact the money supply is kept unchanged, in which event wages fall by 20 percent. More generally, the extent to which the switch from an income to a sales tax results in a rise in the price level depends on the degree to which the Fed wants to *accommodate* the imposition of the sales tax by permitting the money supply to rise. The greater the increase in the money supply, the greater the increase in prices, and the smaller the decrease in wages that must take place in order to keep real output from changing. However, this turns out, government consumes the same amount of pizza as it did under the income tax.

It is necessary to go into this detail in that one approach to tax reform that gets a lot of attention is to junk existing federal taxes in favor of a national sales tax. It is useful to consider the possible implementation of this idea because it presents an example of the interdependence between monetary policy and tax policy, or more generally, between monetary policy and any policy change that would give rise to needed, large-scale adjustments in prices and wages.

In a sense the Fed would have to choose between two equally problematical ways to adjust to the policy change considered here. If it accommodates the change by permitting prices to rise, it will reduce the real value of government bonds held by the public. If it does not accommodate the change, then it will be necessary for workers to accept nominal wage cuts, which they might resist (to their own detriment).

The adoption of a flat tax softens, but does not eliminate, this dilemma. Because a flat tax necessitates an increase in the tax rate on labor income, it would push down after-tax nominal wages unless the Fed accommodated by expanding M and letting the resulting rise in prices bring about the necessary reduction in real after-tax wages.

CHAPTER 9

Excess Supply and Excess Demand

We have seen the conditions under which the market for labor clears: Firms hire labor up to the point where the marginal product of labor equals the real wage rate. Workers, in turn, expand their provision of labor until the marginal rate of substitution of leisure for labor income equals the after-tax real wage rate.

In the classical model, this brings about an outcome called *full employment*. Corresponding to this state is *full-employment GDP*.

We can think of full employment as a state in which the number of job openings just equals the number of workers who want jobs. This does not mean that everyone who wants to work has a job. There will always be some openings that temporarily go unfilled and therefore some workers who temporarily go jobless. Thus, unemployment will never be zero. One type of unemployment that is found in the classical model is *frictional unemployment*—unemployment that exists because some workers are between jobs or because they just entered the labor force and are searching for a job that meets their expectations. Another, more problematical, type of unemployment is *structural unemployment*—unemployment that exists because unemployed workers' skills do not match the requirements of the jobs that are open.

The best way to think of unemployment that exists when there is "*full employment*" is to contrast it with unemployment that is attributable to imbalance between the aggregate demand and the aggregate supply of labor. In the Keynesian model, such unemployment is called *involuntary*, in the sense that workers want to take jobs but can't induce employers to open up job opportunities at any wage at which they might be willing to work. In the *repressed wages* model, which is about to be considered, the problem will be that employers can't get workers to take a job at any wage they might offer them.

In the *classical* model, the market for labor automatically clears through real wage adjustments in the event of temporary imbalances between supply and demand. If the real wage rises above the equilibrium level, the resulting excess supply of labor will cause it to fall until equilibrium is restored. If it falls below the equilibrium level, the resulting excess demand for labor will cause it to rise again, until equilibrium is restored.

Keynes wanted to revise economics to account for the fact that the economy can fall into a non-self-correcting state of low employment. Keynes was right about one thing concerning the Great Depression, which was the worst period of low employment in U.S. history: Real wage adjustments of the kind needed to restore *full employment* either did not occur or were not working, and the result was a long-lasting state of affairs in which there was an excess supply of both goods and labor.

There is a question of how to call such a state of affairs. It could be seen as a disequilibrium, since it was characterized by an imbalance between supply and demand. Here it will be designated an *equilibrium*—though certainly one not to be wished for. During the Depression up till World War II, the United States suffered a long period of low employment. At this writing, the United States has suffered from low employment (though not of the kind experienced during the Great Depression) for more than five years.

Equilibrium is an economic state that is not self-correcting. The long-run/short-run dichotomy is meant to recognize a distinction between an equilibrium in which aggregate supply equals aggregate demand and an equilibrium in which it does not. Keynes taught a generation of economists to believe that a low-employment equilibrium would always be one in which there was excess supply: The aggregate supply of labor would exceed the aggregate demand for labor, and the aggregate supply of goods would exceed the aggregate demand for goods. One purpose of this chapter is to show that a low-employment equilibrium can just as well be characterized by excess demand. In this short-run equilibrium, the aggregate demand for labor exceeds the aggregate supply of labor, and the aggregate demand for goods exceeds the aggregate supply of goods.

As mentioned earlier, the name ordinarily given to this rarely considered condition is called *repressed inflation*, usually associated with episodes in which countries impose price controls or *forced savings* measures on their citizens. I prefer, for reasons soon to be made clear, to dub this state of affairs as *repressed wages*. In this chapter, we will see how this state could stem from a failure of wage and price adjustments to occur as needed to equilibrate supply and demand.

Keynesian unemployment occurs when there is a downward *stickiness* of nominal wages and prices, which in turn creates an excess supply of labor and goods. Conversely, what I call repressed wages occurs when there is an upward stickiness of nominal wages and prices, which in turn creates an excess demand for labor and goods. It turns out that either condition causes low employment and that either can be the result of errors made by workers or firms in a free-market system unaffected by any sort of government intervention (though we will see later how government policies can have similar effects).

Either condition creates a case for government intervention in the form of discretionary monetary or fiscal policy. It is just that, of the two, the first is by far the most familiar as the scenario that became the most recognized interpretation of Keynes's *General Theory.* Also, the two conditions call for opposite responses from the government. Keynesian unemployment calls for expansive monetary and fiscal policy. Repressed wages calls for contractive monetary and fiscal policy.

There is a useful way of distinguishing how changes in aggregate demand can lead to deviations from full-employment GDP (which is to say, a state of affairs in which actual production either falls below or exceeds full-employment GDP). The distinction will lie in whether a change in aggregate demand causes workers or employers to fail to make needed adjustments in nominal wages. In what are usually called Keynesian scenarios, a fall in aggregate demand will be characterized by an unwillingness on the part of workers to accept needed wage cuts, whereas a rise in aggregate demand will be characterized by a reluctance on their part to demand needed wage increases. In the first instance, the result will be a fall in Y below Y_{FE}, and in the second a rise in Y above Y_{FE}.

In contrast, in *repressed-wages* scenarios, such deviations occur because of an unwillingness of employers to offer needed wage increases or demand needed wage cuts. In the first instance, a rise in aggregate demand will cause Y to fall below Y_{FE}, and in the second, a fall in aggregate demand will cause Y to rise above Y_{FE}.

Thus, the division occurs around the question of who's responsible when a change in aggregate demand puts pressure on wages to fall or rise and when the needed changes in wages do not occur. In all four instances, wages lag behind prices in adjusting as needed. The only question is whether it is workers or employers who create the lags responsible for impeding the needed adjustments.

Aggregate Supply and Demand in the Classical Model

In the classical model, in which the aggregate supply of labor equals the aggregate demand for labor, there are exactly as many employment opportunities as there are age-eligible people who want to be employed. (More specifically, the number of hours of labor time that employers want to fill with workers is exactly equal to the number of hours of labor time that age-eligible people want to supply.) As pointed out previously, it is important not to infer that, in the classical case, every hour of time offered by workers is in fact filled with an hour of employment or that every hour of time demanded by employers is filled with an hour of work. Mismatches between supply and demand can still occur because of *frictional* or *structural* imbalances. But the number of work opportunities just matches the number of work hours available (if properly matched) to fill those opportunities.

The analysis begins with the assumption that people hold their wealth in the form of cash. Real cash balances equal nominal money cash balances M divided by the price level P. Let's assume that there is \$1 million in circulation and that $P = 1$. Then the real money supply is

$$\frac{M}{P} = \frac{\$1{,}000{,}000}{1} = \$1{,}000{,}000. \qquad (1)$$

Now we need a few assumptions about labor and goods. To make life as easy as possible, let's assume that there is one good, pizza, which sells for \$1 a slice. Let's also assume that workers receive a nominal wage of \$10 per hour. Finally, let's set the price level P equal to the price of a slice of pizza.

The worker's real wage w is his nominal wage W divided by P:

$$w = W/P = \$10/1 = \$10. \tag{2}$$

In other words, the worker is rewarded the equivalent of 10 slices of pizza for every hour of work.

Now what happens to that \$1 million that people have in their pockets? Well, they use it to buy pizza. How much do they spend? That depends on the velocity of money. Suppose that the velocity V is two, which is to say that the average dollar turns over twice in a year. Thus, nominal income equals

$$\Psi = PY = 1 \times \$2{,}000{,}000, \tag{3}$$

which is to say that people buy \$2,000,000 worth of pizza slices and make \$2,000,000 producing them. This is the same Ψ that we called nominal as GDP in Chapter 2.

Real income equals

$$Y = \Psi/P = \$2{,}000{,}000/1 = \$2{,}000{,}000, \tag{4}$$

which reflects the fact that people produce and buy 2,000,000 pizza slices a year.

We can recast these numbers in terms of the *quantity theory* equation,

$$MV = PY, \tag{5}$$

$$\$1{,}000{,}000 \times 2 = 1 \times \$2{,}000{,}000.$$

So far, all we have is a string of identities illustrated with hypothetical values of the variables involved.

Now we can introduce theoretical content by writing down the *Cambridge equation*,

$$M = kPY, \tag{7}$$

where k is the inverse of the velocity of money and assumed to be constant. We can think of the left hand-side of equation (7) as representing the supply of nominal cash balances and the right-hand side as representing the demand for nominal cash balances. The sense of equation (7) is that the demand for cash balances rises with nominal income, PY. Later in this chapter, we will consider the possibility that a fall in k, which is to say a rise in V, can occur because of a rise in the nominal interest rate.

Rewriting equation (6) to conform to this format, we get

$$\$1{,}000{,}000 = 1/2(1 \times \$2{,}000{,}000). \tag{8}$$

The left-hand side of this equation tells us that people have $1,000,000 in cash at their disposal. The right-hand side says that people want to hold exactly that much in cash. Supply equals demand.

Now suppose that the government reduces the money supply by 50 percent from $1 million to $500,000. If the left-hand side of (7) falls by 50 percent, so must the right-hand side. If k is constant, then P and Y must adjust in such a way as to restore balance between supply and demand. For the time being, before the right-hand side adjusts, the supply of nominal cash balances is less than the demand for nominal cash balances.

$$M < kPY. \tag{9}$$

Because consumers find themselves with only half as much in nominal balances as they did before, they try to rebuild those balances in order to bring their money holdings, on the left-hand side of the equation, back into line with their demand for money holdings, on the right-hand side of the equation. But because the only way that they can accomplish this is by spending less on goods supplied by each other, something has to give on the right-hand side. Given that k is constant, that something must be a fall in P, a fall in Y, or some combination of the two. In the classical case, the adjustment consists entirely of a fall in P. As M falls by 50 percent, P falls by 50 percent and balance between the two sides is restored.

The nominal wage rate must also fall, however. Because P has fallen by 50 percent, the real wage would double if the nominal wage did not also fall by 50 percent. There is no logical reason why workers would not accept the required cut in their nominal wages. Workers would understand that if they were unwilling to accept this wage cut, employers would be compelled to reduce the amount of labor time employed. They would also understand that, with the price of a slice of pizza now at $0.50, they could accept a 50 percent decrease in their nominal wage and still be paid, in effect, ten slices of pizza per hour of work.

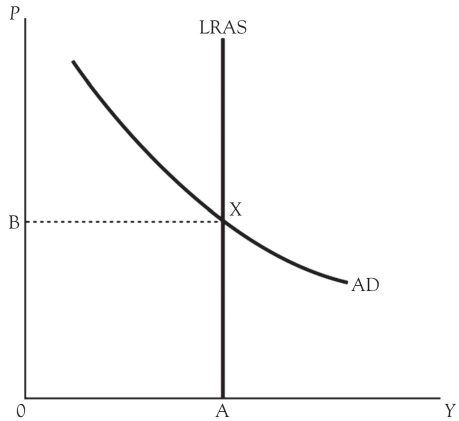

Figure 9.1 Long-run equilibrium price and output

In the classical case, therefore, a change in *M* brings about a proportionate change in *P* and *W* in the same direction and leaves the real wage rate and real output unchanged. We can encapsulate some of this information in a single graph by thinking of the left-hand side of equation (5) as the level of aggregate demand, AD. Consider Figure 9.1. The AD curve represents aggregate demand and the LRAS curve represents long-run aggregate supply.

If *MV* rises, aggregate demand rises. If *MV* falls, aggregate demand falls. For a given level of *MV*, the AD curve shows the different combinations of *P* and *Y* that will satisfy equation (5). The aggregate demand curve then becomes a rectangular hyperbola, in that the product of the vertical axis variable and the horizontal axis variable is always the same and equal to AD.

The LRAS supply curve is vertical to indicate that that level of output is constant for any level of aggregate demand.

To check this, let a rise in *M* bring about a rise in aggregate demand, from AD_1 to AD_2 in Figure 9.2. The AD curve shifts up and *P* rises in proportion to *M*, from OB to OC. There is no change in *Y*.

If *M* alone rises and *V* remains constant, temporarily,

$$M > kPY. \tag{10}$$

Because *k* and *Y* are constant *P* must rise in proportion to *M*. The economy moves from point X to point W.

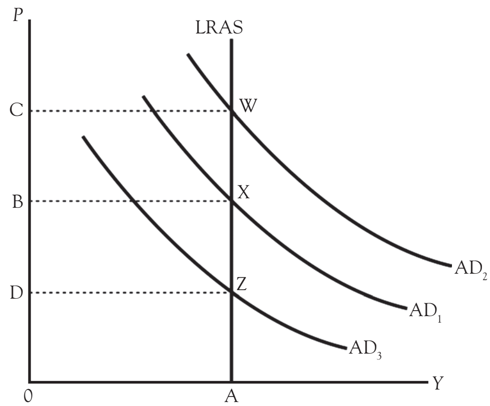

Figure 9.2 Shifts in aggregate demand (AD) along the long-run aggregate supply (LRAS) curve

Alternatively, if M falls, and with it AD, temporarily,

$$M < kPY. \tag{11}$$

P falls in proportion to M from OB to OD, and the economy shifts from point X to point Z as the aggregate demand curve shifts down the LRAS curve from AD_1 to AD_3.

The reality is that the seamless adjustments to changes in M assumed in the classical model are in fact just simplifying assumptions that work well for considerations of the long run but seldom apply in the short run. The fact that information about observed changes in demand is often imperfect means that there can be maladjustments to these changes. The question, then, is whether those maladjustments are short-lived or protracted. It is to this question that we turn next.

Short-Lived, Self-Correcting Maladjustments: Keynesian Scenario

For output to be independent of the level of aggregate demand, both prices and wages must adjust instantaneously in proportion to changes in AD. But what if prices and wages do not adjust in this way? What sort of maladjustments might occur and what processes will work toward their correction?

Macroeconomists use the expression *money illusion* to connote a blind refusal by workers to recognize that what matters is their real wages, not their nominal wage. If workers suffer from money illusion, they will refuse to take wage cuts in the face of falling prices, even if they know that by refusing to do so, they will cause the cost of labor to rise and force their employers into making layoffs. Likewise, they will hesitate to demand wage increases in the face of rising prices, even if they know that by failing to do so, they may end up working longer hours for a lower real wage.

It is possible to consider the problem of price and wage rigidity, however, without assuming this kind of blind unwillingness on the part of workers to realize that their real wages are what matter. Assume the existence of multiple pizza shops selling different brands of pizza. As before, the government reduces the money supply and pizza consumers cut back on their purchases unless and until store owners cut their prices. In this process, suppose the local Domino's franchise tells its workers that they have to accept 50 percent wage cuts, but not to worry since prices are also falling by 50 percent and that they will continue to get their ten pizza slices per hour of work in compensation if they are willing to accept the wage cuts. The workers are, however, skeptical. They have heard rumors that Pizza Hut has improved its product and that the reason Domino's is losing customers is competition from Pizza Hut. There is not any change in monetary policy but rather, increased competition from Pizza Hut—or so they believe. The falloff in demand for Domino's pizzas could be a localized shift in consumer demand from Domino's to Pizza Hut.

Meanwhile, Pizza Hut workers arrive at a similar conclusion when they are told that they have to accept a wage cut. They likewise refuse to go along with this wage cut—and so forth for all the pizza workers. Each worker reasons that he would rather see what other workers do before he takes it on faith that all he has to accept a lower wage in order to keep his job, and at the same time make the same real wage as before. This general refusal to take nominal wage cuts is not based on a failure of workers to understand that it is their real wages that matter, but rather a misperception about the underlying cause of a falloff in demand for whatever product their employer is selling. The result is that when aggregate demand falls, so does *Y*.

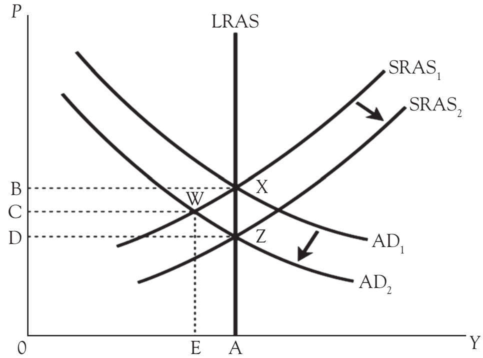

Figure 9.3 Decrease in AD and increase in short-run aggregate supply (SRAS): Keynesian case

In Figure 9.3, the downward shift in AD moves the economy from point X to point W along short-run aggregate supply curve 1 ($SRAS_1$). Prices fall from OB to OC, but wages do not fall in proportion. This leads to a reduction in quantity of labor supplied and a reduction in output from OA to OE, along $SRAS_1$. Prices do not fall in proportion to the fall in *M* since the fall in *Y* in and of itself reduces the demand for money. Yet the percentage fall in prices exceeds the percentage fall in nominal wages for reasons explained. The result is that the cost of labor, equal to *W*/*P*, rises, and employers eliminate some workers and in the process, reduce output.

Because AD is temporarily less than LRAS, this may be dubbed a Keynesian scenario. We will consider later how this scenario can turn into a protracted period of low employment.

So far, however, the reduction in output can be seen as a short-lived phenomenon. All that is needed is the Domino's and Pizza Hut workers to realize that their refusal to accept wage cuts was based on a misunderstanding about why their employers' business was falling off. Once workers understand what really happened, they will accept the necessary nominal wage cuts. With workers accepting wage cuts, short-run supply will rise, which is to say the short-run aggregate supply curve will shift from $SRAS_1$ to $SRAS_2$, which intersects the LRAS curve at Z. Output will return to OA, where, as before, AD equals LRAS, and prices will fall to OD.

There can be misperceptions also about the cause of a rise in demand. Suppose the government increases *M* and thus causes aggregate demand to rise. Pizza buyers will line up in front of pizza shops demanding more pizza, and pizza sellers will ask their workers to put in longer hours to accommodate the rise in demand.

Because consumers find themselves with increased nominal cash balances, they try to spend down those balances in order to bring their holdings of nominal balances, on the left-hand side of equation (7), back into line with their demand for nominal balances, on the right-hand side of the equation. But because the only way they can accomplish this is by spending more on goods supplied by each other, something has to give in. Given that *k* is constant, that something must be a rise in *P*, a rise in *Y*, or some combination of the two. In the classical case, the adjustment consists of a rise in *P* and a proportionate rise in *W*, with no rise in *Y*. If *M* rises by 50 percent, *P* and *W* rise by 50 percent, and balance between the two sides is restored.

Because *P* has risen by 50 percent, the real wage would be cut in half if the nominal wage did not also rise by 50 percent. With pizza now priced at $1.50 per slice, workers would be unwilling to work at current levels unless their nominal wage rate rose by enough (from $10 to $15 per hour) so that they continue to earn a real wage of ten pizza slices per hour. Employers, for their part, would be willing to offer this pay increase since they can also raise their prices by 50 percent. Production would remain unchanged.

Suppose, however, that Domino's workers are reluctant to demand a 50 percent wage increase since they believe that the increase in demand for Domino's pizzas reflects a shift in consumer demand from other pizza brands to Domino's. If these workers think that the rise in the price of Domino's pizza is limited to that brand, then they might perceive a less than 50 percent wage increase as a rise in their real wage. They might also then be willing to put in more hours of work, with the result that Domino's would produce more pizza. Given that all pizza employers experience this reluctance on the part of their workers to demand higher wages, production will rise.

Now consider Figure 9.4. The rise in AD causes the economy to move out along $SRAS_1$, from point X to point W, with the result that Y expands from OA to OE and prices rise from OB to OC. Output expands because workers provide more of their services on the false assumption that the

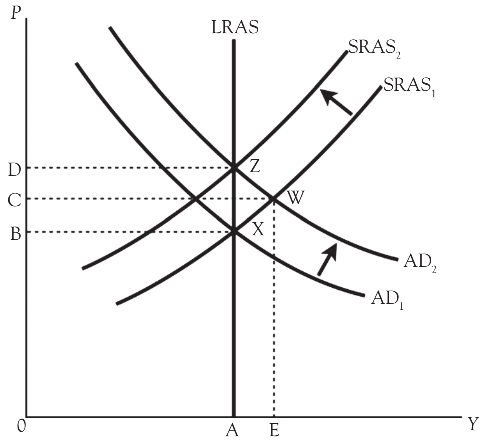

Figure 9.4 Increase in AD and decrease in SRAS: Keynesian case

nominal wage increases being offered to them are high enough, relative to the rise in *P* to permit their real wages to rise. Prices rise but their rise is mitigated by the fact that the demand for money rises with the rise in *Y*. Again wages are stickier than prices, with the result that real wages fall.

This state of affairs lasts only briefly, however. Once the workers realize that their nominal wages have risen less than in proportion to *P* they pull back on their services. The short-run average supply curve shifts from $SRAS_1$ to $SRAS_2$. As *Y* falls back to OA, prices rise to OD, and the economy now adjusts to point Z.

Short-lived, Self-correcting Maladjustments: Repressed Wages Scenario

Now let's consider the consequences for the economy of employer misperceptions, as they can arise after a change in aggregate demand. Suppose again that the money supply rises and this time suppose that employers are reluctant to raise wages in proportion to prices. Perhaps the Domino's manager wrongly believes that the increase in demand for his pizzas has resulted from the success of the Domino's chain in its efforts to market a better pizza. The manager might not think it necessary to pay his workers more since what he is observing is not a general increase in the demand for pizza but a localized shift from his competitors' stores to his.

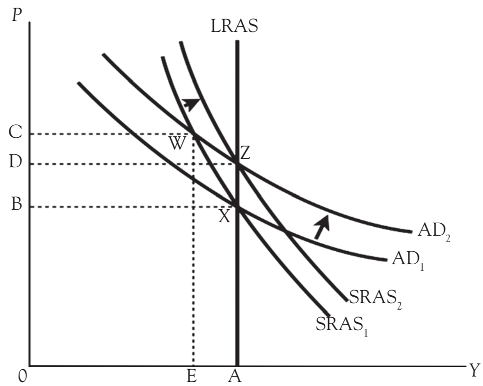

Figure 9.5 Increase in AD and increase in SRAS: Repressed wages case

But then the Pizza Hut manager, acting on the same unfounded supposition, also refuses to raise nominal wages, as do all the other store managers, with the result that workers, facing a reduction in their real wage as a result of an expected general rise in the price of pizza, decide to withhold their services. This in turn causes store managers to cut back on production, which is to say, the supply of pizza. Figure 9.5 provides an illustration. The rise in demand moves the economy from point X to point W on $SRAS_1$. Prices rise from OD to OC and output falls from OA to OE, the reason being that employers refuse to offer wage increases proportionate to the rise in prices. The rise in prices is more than proportionate to the rise in *M* since output falls. Again, wages are stickier than prices but this time it's because of an unwillingness on the part of employers to match the rise in prices with higher wages. The consequent unwillingness of workers to put in as many hours as they did before causes output to fall.

This scenario closely resembles what is called *repressed inflation* in the macroeconomics literature. "One of the most striking characteristics of repressed inflation is that the demand for labor at the price paid for labor is always greater than the supply, since that price [paid for labor] is below equilibrium." (Charlesworth 1956, 26). The convention adopted here is to brand this state of affairs *repressed wages*, rather than repressed inflation. The reason is that in the absence of price controls, the phenomenon under consideration is more likely to arise from restraints over wages. Later we will see how *safety-net legislation* can create a restraint of this kind.

In the modern economy, there are few price controls (except, notably, for the healthcare sector), but limitations on the wage incentives to supply labor are entirely possible. Suppose that there is a government-engineered increase in aggregate demand that takes place simultaneously with a government-engineered decrease in after-tax or *net*, wages. Aggregate demand would rise, and the supply of labor and therefore the supply of goods would fall, inducing people to allocate their increased disposable income to saving.

In the pizza example, the underemployment brought about by repressed wages will be short-lived, however, if employers quickly realize their mistake and offer wage increases commensurate with the rise in prices. As employers offer higher wages, short-run aggregate supply will shift to the right from $SRAS_1$ to $SRAS_2$ in Figure 9.5. In response to the rise in output, prices will fall from OC to OD, equilibrium will shift to point Z, and output will return to its long-run, full-employment level OA.

We would get the reverse of this case if aggregate demand fell and if employers were reluctant, for parallel reasons, to reduce the wages they pay, in line with falling prices. Perhaps the employer believes that the fall in demand is localized to his own pizza brand and he cannot expect his employees to take wage cuts as demand falls off. This turn of events is illustrated in Figure 9.6. Aggregate demand falls, shifting the economy from point X to point W along $SRAS_1$. Prices fall from OB to OC. Even though aggregate demand has fallen, the reluctance of employers to cut wages in tandem with falling prices causes workers to offer more of their services and causes output to rise temporarily from OA to OE.

Once employers realize that their reluctance to cut wages is unwarranted, they will cut wages in tandem with the fall in prices. Short-run aggregate supply will shift from $SRAS_1$ to $SRAS_2$, prices will rise to OD and output will return to its long-run equilibrium level as the economy adjusts to point Z.

From this section there emerges a general presumption in favor of relative wage *stickiness*, which is to say a pattern, whereby when maladjustments occur, wages lag prices until either workers or employers are able to see their error and make the needed correction. The logic here flows from the fact that when people find themselves holding more money or less money, whichever it is, there is no need to diagnose what has occurred.

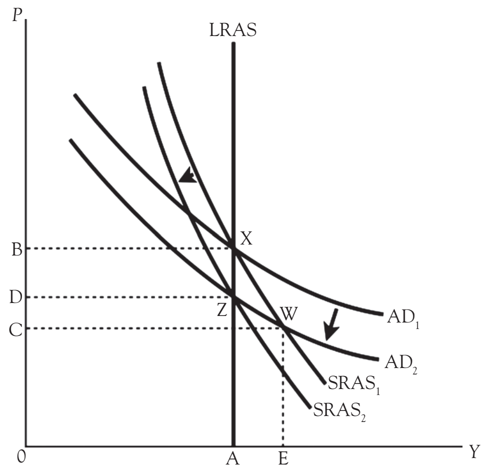

Figure 9.6 Decrease in AD and decrease in SRAS: Repressed wages case

They will collectively attempt to bring their actual money holding into line with their desired money holding, the effect of which is to cause aggregate demand to rise or fall. Workers and employers must then diagnose what the change in demand means to their particular part of the economy. It is the possible lag between when workers and employers feel the impact of the change in aggregate demand and when they determine that the impact was in fact attributable to a change in aggregate demand that causes the maladjustment.

The maladjustments considered in this section were shown to be self-correcting. Let's now identify the appropriate policy responses to Keynesian unemployment and repressed-inflation unemployment, when those conditions are not self-correcting.

Protracted Maladjustments: Keynesian Scenario

In the previous section, we saw two scenarios in which output could fall below the full-employment level. In the first, aggregate demand fell, and workers refused to accept wage cuts commensurate with falling prices. In the second, aggregate demand rose, and employers refused to offer wage hikes commensurate with rising prices. In both instances we saw how corrective shifts in short-run aggregate supply could move the economy back to full employment without government intervention. Here we consider how either of these scenarios could become non-self-correcting if they are accompanied by multiplier effects of the kind that Keynes popularized.

Let's return to the first scenario. Figure 9.3 illustrates the effects of an unwillingness by workers to take wage cuts. At first, this wage rigidity causes output to fall as the reduction in *M* causes aggregate demand to fall. Then, however, as workers discover their mistake and signal their readiness to take wage cuts, short-run aggregate supply rises until output returns to its full-employment level.

Consider, however, the possibility that as workers take time to figure out their mistake and signal their readiness to take wage cuts, aggregate demand will fall yet again owing to the layoffs that the original reduction in aggregate demand brought about. Employers, having laid-off some of their workers, experience an additional fall in demand owing to the fact that the laid-off workers have no income with which to buy their goods.

This next reduction in aggregate demand will bring about yet another reduction in the work force, and then yet another, and so forth until the resulting shrinkage in output reaches some limit. This is the Keynesian multiplier at work. This is also what we might call a depression scenario—an economic downturn of unusual length and severity.

What distinguishes this scenario from the one illustrated in Figure 9.3 is that the needed wage cuts take too long to head off a multiple round of job cuts, for which no automatic correction remains possible. The Keynesian solution: expansive fiscal or monetary policy.

To see how this remedy works, let's write down the expenditure approach formula for GDP:

$$Y = C + I + G + NX, \qquad (12)$$

where C is consumption, I is gross private domestic investment, G is government purchases, and NX is net exports. Where Keynesian low employment prevails, supply exceeds demand, which means that goods are going unsold, factories are operating below capacity and workers cannot find jobs. In this state of affairs, the demand side of the market determines how much will be produced, the degree to which production capacity will be utilized and the number of workers who will be hired (more exactly, the amount of labor time that will be used).

With Keynesian unemployment, consumers are unable to convert their labor time into goods. Factory owners are unable to convert their production into sales and are thus unwilling to invest in new capacity or even to maintain existing capacity. Store owners cannot convert their inventories into sales. Gross private domestic investment is low and net private domestic investment may be negative, as existing capacity is allowed to depreciate. Consumers are constrained from buying goods by the lack of demand for their labor services. Factory owners are constrained from buying capital goods, and store owners are constrained from building inventories by virtue of the lack of demand for their goods.

In this state of affairs, the assumptions of the classical model no longer apply. In particular, people can no longer decide how to allocate their time between work and leisure and their current income between consumption and saving on the assumption that they can provide as much of their labor services as they choose to provide to employers at the current wage rate. Because people are constrained to provide fewer such services than they would wish, they are left in a state of affairs in which the reward for giving up another hour of leisure, that is, the real wage rate, is greater than the amount of labor income with which they would have to be compensated in order to willingly give up that hour of leisure:

$$MRS_{LeLay} < w. \tag{13}$$

The reason that the worker doesn't sacrifice leisure and expand work is that the work is not to be found. This leaves him with less disposable income than he would have had in classical equilibrium and, with less income at his disposal, he is less willing to consume.

In an earlier discussion, we saw that a temporary decrease in income would lead to only a small decrease in consumption and that, conversely, a temporary increase in income would lead to only a small increase in consumption. Here things are different: The worker has less labor income and therefore enjoys less consumption than he would prefer and, as a result, any increase of disposable income would have a substantial effect on his consumption, which in turn would provide a needed *injection* into the economy.

In the same earlier discussion, we saw that people make saving decisions according to the utility that they attach to current and future consumption and their preference for current utility over future utility. Saving is the willful postponement of consumption to the future, and as such, frees up resources to be allocated to investment. In the Keynesian model, saving reduces the size of the injection brought about by an increase in disposable income, however that increase is brought about. Saving (and imports) creates a *leakage* out of the economic system that reduces the stimulative effect of an increase in income.

In this analysis, with labor in excess supply, consumption depends on the quantity of labor that gets hired:

$$C = C^D(L) \tag{14}$$

and the quantity of labor that gets hired depends on disposable income:

$$L = L^D(Y - T) \tag{15}$$

A second behavioral relationship is between investment and the real interest rate. Keynes saw investment as a function of the real interest rate:

$$I = I(r), \tag{16}$$

where a fall in r brings about a rise in I. The representation of the demand for investment as a function of the real interest rate is another departure from the classical model, in which the demand for *capital* is a function of the real interest rate. In the Keynesian system, the ability of the monetary authorities to reduce the real interest rate provides a portal through which the government can inject new demand into the economic system through increased investment.

That ability rests on the opportunity that the monetary authorities have in a time of low-employment equilibrium to push down the nominal interest rate R through monetary expansion. Return to the Cambridge equation,

$$M = kPY. \tag{17}$$

In the classical model and under full employment, an increase in M will bring about an increase in P. But suppose that PY (nominal GDP) does not rise in tandem with M. Temporarily, again,

$$M > kPY \tag{18}$$

Something has to give in, but what will it be?

The answer is that k must rise, which is to say that velocity must fall. The mechanism needed to get velocity to fall is a fall in the nominal interest rate, which will cause the demand for money to rise, bringing the right-hand side of equation (18) into line with the left hand side. We can construct a demand function for money that provides the necessary linkage between an expansion in M and a fall in R.

Consider the fact that people will normally want to hold more money the greater their real income and the lower the nominal return on income-earning assets. Our Eve in an earlier chapter held only income-earning assets. But she will also want to hold some of her assets in the form of cash, as recognized throughout this chapter. The question is what determines the utility-maximizing mix of cash and income-earning assets. Part of the answer lies in the convenience and liquidity of cash and part lies in the fact that cash provides no income (we assume that cash consists of currency plus non-interest-paying checking accounts).

We can specify a demand equation for money, in which the demand for money varies positively with income (as already acknowledged) but negatively with R:

$$M^D = M^D(Y, R). \tag{19}$$

Now as R rises, Eve will want to hold less in cash and more in income-earning assets and as R falls she will want to hold more in cash and less in income-earning assets. How can the monetary authorities then get R to fall? Well, by creating more cash. Figure 9.7 illustrates.

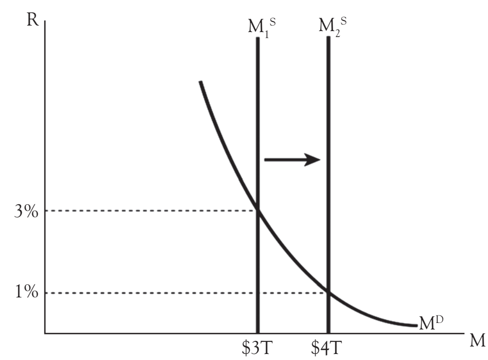

Figure 9.7 Increase in the money supply

We begin with an equilibrium in which $R = 3$ percent and the money supply equals \$3 trillion. Then the Fed expands it to \$4 trillion. People will use their new money holdings in part to buy income-earning assets. If we define those assets as *bonds*, then bond prices will rise and their yield, R, will fall by enough (here, by 2 percentage points) to cause people to expand their demand for cash by \$1 trillion. This will translate into a fall in velocity as people shift the composition of their portfolios toward cash. Let's see how.

Suppose Eve is paid \$4,000 at the start of every month and that she spends the entire amount on consumption over the course of the month, spreading her expenditures evenly from day to day. When $R = 3$ percent, she decides to hold only one week's worth of spending money (\$1,000) at the start of each week in order to keep her remaining assets in bonds. Since her money holdings over the course of the month average \$1,000 and her spending equals \$4,000, her velocity is four.

Now suppose that the nominal interest rate falls. Because it costs her less in forgone interest to hold her assets in the form of cash, she decides to hold \$2,000 in cash at the start of the month, putting the rest in bonds, and then to cash in those bonds halfway through the month to finance the rest of her expenditures. Now her money holdings average is \$2,000 and her velocity has fallen to two. Monetary expansion brought about the needed decrease in velocity and increase in k and did so by pushing down the nominal interest rate R.

But according to equation (16) investment varies with the real interest rate. Does the fall in R bring about a fall in r?

Well, suppose that prices are fixed. In Chapter 5, we saw that real interest rate equals the nominal interest rate minus expected inflation:

$$r = R - \hat{P}. \tag{20}$$

So if P is fixed and if $\hat{P}$ therefore equals zero, a fall in R will bring about a fall in r, and investment will expand. Thus, we see how monetary policy can affect I, which in turn affects aggregate demand.

Monetary policy can also affect net exports through changes brought about in the real interest rate and in the exchange rate. Under flexible exchange rates, an increase in the money supply will have a limited effect on *I*, insofar as the monetary authorities have little control over the home country interest rate. But when the monetary authorities push down the interest rate by expanding *M*, capital flows out of the home country into other countries, which is to say that *NFI* rises. As investors move funds from dollars into other currencies, the dollar depreciates. The resulting rise in ε will cause exports to rise and imports to fall. We can then write an equation for net exports *NX*, expressed as a function of ε:

$$NX = NX(\varepsilon) \tag{21}$$

Now returning to equation (12) and recognizing that production is determined on the demand side of the market, we can write

$$Y = C^D\left[(L^D(Y-T))\right] + I^D(r) + G^D + NX^D(\varepsilon). \tag{22}$$

We see that there is a behavioral relationship between C^D and L^D and between L^D and $Y-T$. When we combine these relationships into a single expression we get

$$b = \frac{\Delta C^D}{\Delta L^D}\frac{\Delta L^D}{\Delta(Y-T)} = \frac{\Delta C^D}{\Delta(Y-T)}. \tag{23}$$

The change in C^D that results from another dollar of disposable income equals the change in C^D that results from the provision of an additional unit labor multiplied by the change in the amount of labor demanded per dollar change in disposable income.

The coefficient b is what Keynes called the marginal propensity to consume or MPC. Frequently, economists specify equation (22) as

$$Y = a + b(Y-T) + I^D(r) + G^D + NX^D(\varepsilon), \tag{24}$$

which becomes

$$Y = \frac{1}{1-b}\left[a - bT + I^D(r) + G^D + NX^D(\varepsilon)\right] \tag{25}$$

Suppose the government wants to engineer a certain change in Y^D in order to move production closer to its full-employment level. Then it can use the equation

$$dY = \frac{1}{1-b}\left[a - b(dT) + dG^D + \frac{\Delta I^D}{\Delta r}dr + \frac{\Delta NX^D}{\Delta \varepsilon}d\varepsilon\right] \qquad (26)$$

to determine the desired combination of monetary and fiscal policy for achieving the desired change in Y. The expression $\frac{1}{1-b}$ is the Keynesian *demand multiplier*, which tells us how much Y will increase for every dollar increase in the bracketed items on the right-hand side of equation (26). We can think of the bracketed items as representing the policy instruments available to the government for manipulating aggregate demand. The government can bring about changes in Y through its ability to control T, G, r, and ε. Changes in these variables bring about changes in Y through the Keynesian multiplier.[1]

A couple of examples will be helpful. Let's assume that the MPC = 0.5 and that the government decides to buy \$1 million more worth of Patriot missiles from the Raytheon Corporation in Massachusetts. That creates another \$1 million in output right off the bat. This purchase by the government requires Raytheon to hire additional labor for which it pays the \$1 million, which in turn leads to the expenditure of 50 percent of that amount on goods by the newly hired workers. Given that the MPC = 0.5, these workers spend \$0.5 million at local businesses for food, furniture, and other items. That adds another \$0.5 million to output. Local stores have to hire additional labor to provide those goods, and the providers of that labor in turn spend \$0.25 million (= 0.5 × \$0.5 million) on goods, adding another \$0.25 million to output, and so forth. The entire process can be laid out as follows:

$$\begin{aligned} dY &= dG^D(1 + b + b^2 + b^3 + \ldots + b^n) \\ &= \$1 \text{ million}\left(1 + 0.5 + 0.5^2 + 0.5^3 + \cdots + 0.5^n\right) = \$2 \text{ million.} \qquad (27) \end{aligned}$$

[1] Note that the MPC and the multiplier will get smaller as Y rises. Because changes in Y require changes in L, Y rises at decreasing rate as L rises. Additional units of labor will provide additional dollars of disposable income and therefore additional dollars of consumption, but the additional consumption that results from the provision of additional units of labor will decline as the amount of labor hired expands.

Voila! By spending an additional $1 million, the government creates $2 million in new output and with it the new jobs that became needed in order to make this new output possible.

Equation (27) provides the long way of calculating the effect on output. The shorter way is to take advantage of the formula presented in equation (26) to get:

$$dY = \frac{1}{1-b} dG^D = \frac{1}{1-0.5} \$1 \text{ million} = \$2 \text{ million}. \tag{28}$$

There are other policy instruments available to the government. An alternative strategy would be to cut taxes, thus putting money in people's pockets. Now suppose that instead of purchasing goods or services, the government cuts taxes by $1 million or equivalently, sends out checks to individuals in this amount.

A tax cut of $1 million does not immediately *inject* $1 million into the economy. The reason is that taxpayers save 50 percent of that amount. They spend only the remaining 50 percent. But again, we are not finished, because there are the same unemployed workers who will be put to work as taxpayers spend that 50 percent of their tax cut, and so forth. The process can be laid out as follows (keeping in mind that a tax cut means that the change in taxes dT is negative):

$$\begin{aligned} dY &= -dT(b + b^2 + b^3 + \cdots + b^n) \\ &= \$1 \text{ million}\left(0.5 + 0.5^2 + 0.5^3 + \cdots + 0.5^n\right) = \$1 \text{ million}. \end{aligned} \tag{29}$$

The shortcut solution is:

$$dY = \frac{-b}{1-b} dT = \frac{-0.5}{1-0.5}\left(-\$1 \text{ million}\right) = \$1 \text{ million}. \tag{30}$$

This illustrates the use of the policy instruments available to the fiscal authorities. For the monetary authorities, in the Keynesian system, the trick is to take advantage of the stickiness of prices and the opportunity that presents to increase investment and net exports through expansive monetary policy. A change, dr, in the real interest rate through monetary expansion leads to an increase in investment. Suppose r is reduced from 3 to 1 percent. If investment rises by \$100 for every percentage point fall in r (i.e., if $\frac{\Delta I}{\Delta r} = \$100$), then the reduction in r brings about a \$200 rise in investment, and through the multiplier, a \$400 rise in output.

It is also necessary, in analyzing the role of r in this process, to consider how an expansion in the economy brought about by a rise in G or a cut in T can itself influence r. Recall that the demand for money depends not only on the interest rate but also on the level of real income. If the government uses fiscal policy successfully to expand Y, the demand for money will rise. Because, under these assumptions, the supply of money remains fixed, something has to give in order to bring the demand for money back in line with the existing supply of money. That something is the interest rate. The interest rate will be under pressure to rise as Y expands, and a rise in the interest rate will cause investment to fall, thus dampening the positive effect of an expansive fiscal policy on output. This possibility, carried to the extreme in which Y doesn't rise at all owing to the fall in investment, is the *crowding out* scenario considered in Chapter 7.

Given the sensitivity of international capital flows to variations in the interest rate, the effectiveness of fiscal policy might be quite limited. An upward push on the home-country interest rate will cause capital to flow into the home country and put pressure on the dollar to appreciate (i.e., for ε to fall). This will in turn cause NX^D to fall and, with it, Y, bringing the demand for money back into line with the supply of money.

Also important are the channels through which monetary policy works. In a closed economy, a reduction in r, orchestrated through a rise in M, will cause investment and therefore output to rise. In an open economy, however, a reduction in r can be only temporary since it will spur an outflow of capital. Then, as mentioned, it is this outflow of capital that causes output to rise as the home currency depreciates and exports rise.

Now let's illustrate graphically how the government can use fiscal policy in a closed economy (i.e., one in which we can ignore exports, imports and global capital flows) to expand Y and L.[2] See Figure 9.8, where the failure of W to adjust to a downward shift in aggregate demand

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[2] The following exposition is based on (Barro and Grossman 1976) and (Heijdra and Ploeg 2002).

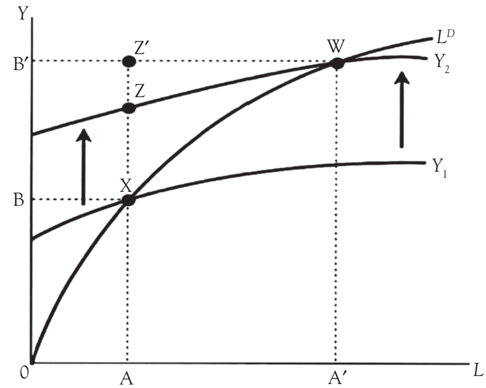

Figure 9.8 Increase in government spending: Keynesian case

has resulted in a quasi-permanent below full-employment equilibrium at point X. The L^D and Y^D curves show the different combinations of labor and income that satisfy equations (15) and (22), respectively, with the economy resting at point X on curves L^D and Y_1. We imagine that G takes one value along curve Y_1 and a higher value along curve Y_2. The L^D curve shows the different quantities of labor that firms will demand for given levels of output that they can sell. The Y curves show the different amounts of goods that firms can sell for different amounts of labor that are employed.

At point X, OA workers have found jobs and firms have been able to find buyers for OB units of production. Point X represents an equilibrium, insofar as OB represents just enough in product sales to make it necessary to employ OA units of labor, and OA represents just enough employment to find buyers for OB units of output. But, we assume, point X also represents a below-full-employment equilibrium. If OA′ represents full-employment output, there is a case for the government to intervene by increasing purchases by XZ (= dG). This causes the Y curve to shift up by XZ, so that the economy now finds itself on Y_2 and at a new equilibrium W. Employment increases to OA′ and production to OB′. The Keynesian demand multiplier is XZ′/XZ.

Note that in an open economy and under flexible exchange rates, this process is likely to reverse itself as the rise in G and the consequent rise in Y cause the demand for money and interest rates to rise. The resulting appreciation of the dollar will cause the Y^D curve to shift downward, causing Y to fall back to OB and L to fall back to OA.[3]

On the other hand, the government could bring about a permanent rise in production and employment through expansive monetary policy. The rise in M puts downward pressure on r and thus increases I until the resulting depreciation of the dollar causes net exports to rise and r to return to its previous level. Monetary policy is more effective than fiscal policy for bringing about an expansion of output under integrated global financial markets and flexible exchange rates.

Protracted Maladjustments: Repressed-Wages Scenario

Now let's turn to what we labeled as *repressed wages* previously. Because, in this case, employers are constrained with respect to the quantity of labor offered to them by workers, we are interested in the policy variables that affect people's willingness to work. The question is which policy changes will cause either a tightening or a loosening of the constraint on labor supply.

In this scenario, real, net wages (wages net of any tax or safety-net incentives to choose leisure over work) are too low to motivate people to work as much as they would work at market-clearing wages. The result is a low-employment equilibrium parallel to the low-employment equilibrium experienced in the Keynesian case, the difference being that the low real net wages bring about an excess demand for workers. Also because workers are in short supply, fewer consumer goods are produced and there is likewise an excess demand for consumer goods.

The government can address this problem by taking steps either to increase the after-tax nominal wage or to increase the production of consumer goods. Here we focus on the second option.

First, consider what it takes to get more consumer goods on the shelves. The conditions described here are the opposite of the Keynesian case. In that case, an expansion of G, I, or NX causes the demand for

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[3] Fiscal policy would be effective for expanding aggregate demand in an open economy and under fixed exchange rates. The expansion in output and the resulting rise in R would put pressure on the dollar to appreciate, forcing the monetary authorities to expand the money supply and thus to expand output.

goods and labor to rise, thus causing the excess supply of goods and labor to fall. But here there is excess demand, not excess supply. Every dollar of production that goes toward government purchases, business investment or net exports is a dollar less that goes toward the production of consumer goods. We can write

$$C^S = Y - \left[I(r) + G + NX(\varepsilon) \right], \tag{31}$$

whereby the quantity of consumer goods supplied equals production of all goods minus the production of capital goods, government goods, and net exports. Also, the amount of labor used in production equals the amount of labor supplied by workers, which is a function of the consumer goods available to them to buy and of taxes.

$$L^S = L^S(C^S, T)\,. \tag{32}$$

Labor supply varies positively with C and T. It varies positively with C because a greater abundance of consumer goods makes it more worthwhile for workers to sacrifice leisure for labor income. It varies positively with T because higher taxes make workers feel poorer and thus more inclined to work.

Here we assume that taxes take the form of lump-sum taxes—taxes that the individual must pay irrespective of his work/leisure and his consumption/saving choices. In effect, the government sends the individual a bill, which when paid, leaves him free of any additional tax liability. In short, the tax is imposed in such a way as to have only an income effect—to make the individual feel poorer and therefore to induce him to contract leisure and expand work. Not that this is a reasonable policy option. The analysis, however, does make it clear that in an excess demand scenario, the idea of putting money in people's pockets is just the opposite of what is needed.

In this analysis, production depends on how much labor workers are willing to supply:

$$Y = Y\left(L^S\right). \tag{33}$$

Substituting equation (32) in equation (33), we get

$$Y = Y\left[L^S\left(C^S, T\right)\right]. \tag{34}$$

Production depends on the quantity of labor supplied, which in turn, depends on the quantity of consumption goods supplied and on taxes, both of which affect the quantity of labor supplied positively.

Now substitute equation (31) in equation (34) to get

$$Y = Y\left[L^S\left[Y - \left(I(r) + G + NX(\varepsilon)\right), T\right]\right]. \tag{35}$$

We see that a decrease in I, G, and NX leads to an increase in the production of consumer goods, which leads to an increase in the supply of labor, which then leads to an increase in production. We can specify these relationships as follows:

Let

$$c = \frac{\Delta Y}{\Delta L^S}, \tag{36}$$

which equals the change in the supply of production per unit change in the supply of labor,

$$d = \frac{\Delta L^S}{\Delta C^S}, \tag{37}$$

which equals the change in the supply of labor per unit change in consumption and

$$e = \frac{\Delta L^S}{\Delta T}, \tag{38}$$

which equals the change in labor supply per unit change in taxes.

Then we can combine these parameters to get:

$$f = \frac{\Delta Y}{\Delta L^S}\frac{\Delta L^S}{\Delta C^S} = \frac{\Delta Y}{\Delta C^S}, \tag{39}$$

which equals the change in the supply of goods per unit change in consumption, and

$$g = \frac{\Delta Y}{\Delta L^S}\frac{\Delta L^S}{\Delta T} = \frac{\Delta Y}{\Delta T}, \tag{40}$$

which equals the change in the supply of goods per unit change in taxes.

Now suppose that the government decides to increase output by *reducing* spending (keeping in mind that dG is assumed to be negative) or by *increasing* taxes. Then

$$dY^S = f\left(dY^S - dG\right) + g\left(dT\right), \tag{41}$$

$$dY^S(1-f) = -f(dG) + g\left(dT\right) \tag{42}$$

and

$$dY^S = \frac{1}{1-f}\left[-f(dG) + g\left(dT\right)\right]. \tag{43}$$

We can give the coefficient f its own name. Let's call it the *marginal propensity to produce* (MPP), by which we mean the increase in production that will take place because workers get another dollar of consumption goods.

Production will rise by $\frac{f}{1-f}$ for every dollar that government purchases are reduced. We can think of the coefficient $\frac{f}{1-f}$ as the output supply multiplier that applies to decreases in aggregate demand. Similarly, production will rise by $\frac{g}{1-f}$ for every dollar that tax burdens are increased.

Suppose that the MPP equals 0.9. Then a \$1 million reduction in government spending will lead to an increase in production of \$9 million. First, the \$1 million in reduced government purchases frees up resources that flow into the production of consumer goods, permitting consumers to buy \$1 million more in goods. There is so far no effect on production: The government has, by its action, simply caused producers to replace \$1 million of government goods with \$1 million of consumer goods. Now, however, workers, seeing \$1 million in new consumer goods on store shelves, provide more labor time to employers, enough to induce the production of an additional \$0.9 million in goods, which in turn, causes consumers to provide more labor time and production to rise by \$0.81 million (= $0.9 \times 0.9 \times$ \$1 million), and so forth. Output supply expands as a geometric progression (similar to the expansion of output demand in the Keynesian case):

$$dY = \$1 \text{ million}\left(0.9 + 0.9^2 + 0.9^3 + \cdots + 0.9^n\right) = \$9 \text{ million}. \tag{44}$$

Alternatively, we can use equation (43) to solve for the change in *Y*. Given that $dT = 0$,

$$dY = \frac{-f}{1-f}(dG) = \left(\frac{-0.9}{1-0.9}\right)(-\$1 \text{ million}) = \$9 \text{ million}. \qquad (45)$$

We can infer that a $1 million reduction in *I* or *NX* brought about by an increase in *r* or appreciation of the exchange rate would yield the same result.

To figure out the effect of a tax increase, we would have to know the value of *g*, the increase in output per unit rise in taxes. Suppose that $g = 0.5$, and that there is a $1 million increase in taxes. Workers, feeling poorer, expand their labor time by enough to bring about $0.5 million in new production. Given that $f = 0.9$, the resulting increase in production then leads to $0.45 million in further new production, then to another $0.405 million, and so forth. Ultimately, production rises by

$$dY = 0.5 \times \$1 \text{ million}\left(1 + 0.9 + 0.9^2 + 0.9^3 + \cdots + 9^n\right) = \$5 \text{ million}, (46)$$

which we can calculate, using equation (43) as follows:

$$dY = dT\frac{g}{1-f} = \$1 \text{ million}\left(\frac{0.5}{1-0.9}\right) = \$5 \text{ million}. \qquad (47)$$

These results are the opposite of what we found for the Keynesian scenario. In that case, the corrective for low employment lay in expansive monetary and fiscal policy. In this case, it lies in contractive monetary and fiscal policy.

We illustrate this in Figure 9.9. This time we have an L^S curve, representing equation (32), which shows the different quantities of labor that workers will be willing to supply, given the amount of goods that are available to them to consume. And we have a *Y* curve, representing equation (35), which shows the different amounts of production that will be forthcoming, given the quantity of labor that workers are willing to provide to employers. Point X represents an equilibrium, insofar as OB represents just enough in output to make it worthwhile for workers to apply OA units of their effort to production, and OA represents just enough employment to make it possible for firms to produce the quantity OB.

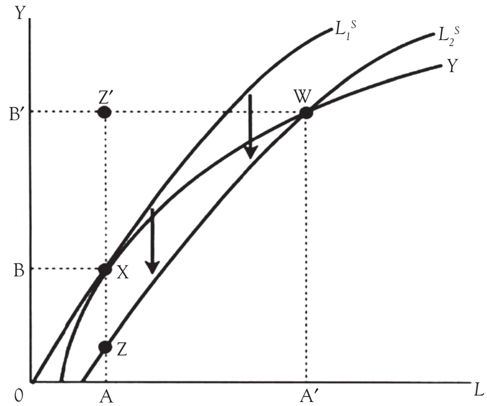

Figure 9.9 Decrease in government spending: Repressed wages case

Now suppose that point X, where the L_1^S curve intersects the Y curve, represents a below-full-employment equilibrium. The government intervenes by reducing government purchases by dG (= XZ). This causes the L^S curve to shift down by XZ, so that the economy now finds itself on L_2^S and at a new equilibrium point W. Employment increases to OA′ and production to OB′.

The reduction in government purchases causes the L^S line to shift down as workers see that they can get more consumer goods by working more. This results in the provision of more labor services, causing the excess demand for labor services to fall. As more labor services are provided, income rises and with it, the production of consumer goods, leading workers to provide even more labor services, in a reverse of the process described earlier where we posited an increase in government purchases. This leads to an expansion of output equal to $Z'X$. The supply multiplier is $Z'Z/ZX$.

As before, however, we have to consider what an increase in output means for interest rates. In this instance, a contractive fiscal policy will cause Y to rise and with it the demand for money and (temporarily) the nominal interest rate. The higher interest rate will bring about some combination of reduced investment and net exports, further increasing the volume of goods available to consumers and further increasing output and employment.

Summing Up

When there is excess supply of goods and labor, workers can't find as many jobs—and their employers can't sell as much in goods—as they could if prices and wages were adjusting as in the classical case. When there is excess demand for goods and labor, employers can't find as many workers and workers can't find as much in goods as they could if prices and wages were adjusting as in the classical case.

The existence of either excess supply or excess demand in the labor and goods markets, will therefore cause employment and production to fall below some *normal*, market-clearing level. But which is the cause? Excess supply or excess demand?

The tradition, ever since Keynes, has been to cite the cause as excess supply. As we see, however, the existence of a low-employment equilibrium can just as well happen because supply has fallen short of demand. An economic downturn may reflect the fact that supply does not necessarily create its own demand but it may also reflect the fact that demand does not necessarily create its own supply.

Blinder puts the debate over economic policy as between supply-siders on one side and Keynesians on the other. That, however, is not the correct debate. The correct debate begins by recognizing that there is low output and low employment and therefore an unwanted state of affairs attributable to either general excess supply or general excess demand. If it is excess supply, then Blinder is right: The cure is larger deficits combined with continued monetary expansion. But if it is excess demand, then those prescriptions will worsen the problem and are, in fact, the opposite of what is needed.

The following chapter takes up the task of correctly diagnosing the problem as either excess supply or excess demand. As we will see, that task is often a difficult one to perform.

CHAPTER 10

Equilibrium Low Employment

In the foregoing chapters, we saw that in the *classical* case of freely adjusting wage rates and prices, a full-employment equilibrium would emerge under which aggregate supply equaled aggregate demand and under which changes in aggregate demand would affect only prices and wages. Increases in aggregate demand would bring about proportionate increases in prices and wages and decreases in aggregate demand would bring about proportionate decreases in prices and wages, but output would not change.

In this chapter, we review the problem faced by the government in adjusting the rate of growth of the money supply to the underlying conditions relating to the labor market and to the growth of real GDP. There are, to be sure, many goals to which macroeconomic policies can, and should, be applied. Among them are price stability, economic growth, exchange rate stability, some measure of equity, and so forth. Here we focus on the problem of calibrating monetary and fiscal policy in a fashion that keeps real GDP at its full-employment level.[1]

Consider the diagram provided in Chapter 9, in which we presented the classical equilibrium between aggregate supply and aggregate demand. We have considered how tax policy affects the point at which the LRAS line cuts the horizontal axis, shown as point A in Figure 10.1. Reductions in tax rates and in minimum wages (and generally, the elimination of government-imposed distortions in the price system) shift the LRAS curve to the right. The opposite policies shift it to the left.

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[1] Although all the discussion is in terms of monetary policy, every point made in this chapter concerning the use of monetary policy can be generalized to encompass fiscal policy as well.

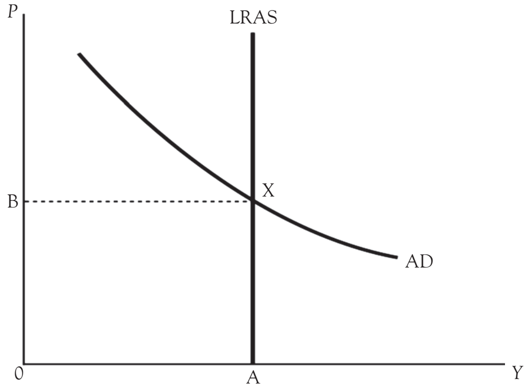

Figure 10.1 Long-run equilibrium price and output

In Chapter 9, we reviewed the circumstances that can give rise to a state of affairs in which output Y deviates from full-employment output (Y_{FE}). In the short run, a rise or fall in aggregate demand can cause actual Y to exceed or fall below Y_{FE}. What happens to Y depends on whether workers or employers misdiagnose the change in aggregate demand as an event localized to their particular portion of the market, when in fact it is an economy-wide event. If there is a misdiagnosis, wages will lag behind prices in adjusting to the change in aggregate demand, causing Y to fall temporarily below Y_{FE}.

When a misdiagnosis leads to a fall in Y below Y_{FE}, the problem may or may not be self-correcting. It will be self-correcting if caught early enough. It will not be self-correcting if it leads to an irreversible shrinkage in employment opportunities or worker availability. If workers refuse to accept (or are deterred from accepting) nominal wage cuts in the face of falling aggregate demand *and* if they fail (or are unable) to correct the problem, the layoffs that result will bring about a spiraling reduction in demand of goods and labor. If employers refuse to grant (or are deterred from granting) wage increases in the face of rising aggregate demand *and* if they fail (or are unable) to correct the problem, the withdrawal of workers from the work place will bring about a spiraling reduction in the supply of goods and labor.

This means that policy makers have three problems to solve. The first is whether and how to eliminate distortions in the price system that reduce Y_{FE}. The second is to determine whether at any time Y has fallen below Y_{FE} and, if so, whether the fall is self-correcting or (quasi) permanent. Then if that problem is not self-correcting, the third problem is deciding whether to use the policy instruments at its disposal to increase or to decrease aggregate demand.

Neither workers nor employers have a monopoly on the inclination to misdiagnose a change in aggregate demand. The government can misdiagnose a fall in output and employment and, in doing so, provide a remedy opposite of that which is called for. The most likely misdiagnosis, given the Keynesian bias that runs through policy making and analysis, is that it will engineer an increase in aggregate demand when a decrease is called for. Or, on the long-run supply side of its policy-making, the government can make it more difficult for workers to accept wage cuts or for employers to grant wage increases, just when a shift in aggregate demand makes it important for wages to adjust rapidly to the changing conditions.

In this chapter, we generalize conclusions of the preceding chapter to account for the fact that policy makers adjust their actions to changes in the growth of real GDP and to labor market indicators, particularly the unemployment rate (*UR*). The goal is to increase Y_{FE} to the degree that is politically feasible and always to keep Y as closely aligned with Y_{FE} as possible. Here we consider how policy makers will and should calibrate their actions to observed changes in the money supply, to real GDP, and to prices and wages.

In Chapter 9, we observed that, in equilibrium,

$$M = kPY. \tag{1}$$

Now let's think of how we have to adjust this equality to reflect growth in each of the variables. We can write:

$$\%\Delta M = \%\Delta k + \%\Delta P + \%\Delta Y, \tag{2}$$

or, to simplify the notation,

$$\hat{M} = \hat{k} + \hat{P} + \hat{Y}, \tag{3}$$

which says that, if the supply of money equals the demand for money, as in equation (1), the percentage change in M must equal the percentage change in k plus the percentage change in P plus the percentage change in Y. There must be a match between the growth of the supply of money (left-hand side of the equation) and the growth of the demand for money (right-hand side of the equation). If k is constant, we can interpret the equation to say that a change in the growth of M requires a commensurate change in the growth of PY in order to equilibrate the supply and demand of money.

Let's put more flesh on this analysis before we go forward.

Let's use the symbol $\hat{Y}_{normal}$ to stand for the normal growth rate of real GDP, Y. We saw in Chapter 6 that there would be some normal growth of Y in an economy where the growth of Y just matched the growth of L (assuming that Z is constant). Here we call this growth $\hat{Y}_{normal}$. Say, for example, that we expect L to grow by 3 percent annually, so that expected $\hat{Y} = \hat{Y}_{normal} = 3$ percent. Now let's also suppose that there is some desired inflation rate $\hat{P}_{desired} = 2$. Then, in order to maintain full employment, the growth of the nominal wage rate $\hat{W}$ must be 2 percent so that the real wage rate remains constant. This assumes that the labor force is growing in tandem with Y, so that there is no change in labor productivity Y/L. Given that $\hat{k}$ is zero, we can use equation (3) to solve for the required growth in M:

$$\hat{M}_{required} = \hat{Y}_{normal} + \hat{P}_{desired} = 3\% + 2\% = 5\%. \qquad (4)$$

The required annual growth of the money supply equals the normal annual growth of real GDP (which until recently in the United States, was about 3 percent) plus the desired rate of inflation.

If $\hat{Y} = \hat{Y}_{normal}$, then at any moment real GDP, Y, equals the full-employment real GDP, Y_{EF}. As long as Y sticks to its normal growth path, the labor force participation rate (*LFPR*) will stay at its corresponding *normal* level, as will the *UR*: Everyone in the age-eligible population who wants to work will be in the labor force. Everyone in the labor force will have a job except for temporary mismatches owing to *frictional* or *structural* factors.

When $\hat{Y} = \hat{Y}_{normal}$, the resulting *UR* is called the *natural UR* or, more descriptively, the *non-accelerating inflation rate of unemployment* (or *NAIRU*). This is the rate of unemployment that exists when nominal wages are changing at the same rate as prices and when they are changing in tandem so as to maintain equality between $\hat{Y}$ and $\hat{Y}_{normal}$. In the

Keynesian model, the *UR* falls below the *NAIRU* when prices rise faster than wages and when workers expand their work effort even though their real wages are falling.

We can coin an analogous term to represent the rate of labor force participation when wages are changing at the same rate as prices. Let's call that rate the *non-accelerating inflation rate of labor-force participation* or *NAIRP* (ugly, true, but hardly worse than *NAIRU*). *NAIRP* is the labor-force participation rate that exists when nominal wages are changing at the same rate as prices and when they are both changing just fast enough to keep $\hat{Y} = \hat{Y}_{normal}$. The labor-force participation rate falls below the *NAIRP* when prices rise faster than wages and when people leave the labor force as a result.

Full employment is the level of employment that exists when the *UR* and the labor-force participation rate are both at their *natural* or *non-accelerating* levels. Such unemployment as exists is frictional or structural in nature but not the result of any imbalance between aggregate supply and demand.

The Phillips Curve

Consider now a scenario in which the growth of the money supply rises so that

$$\hat{M} > \hat{k} + \hat{P} + \hat{Y}. \tag{5}$$

Suppose that $\hat{k}$ is zero, that $\hat{W}$ lags behind $\hat{P}$, causing the cost of labor to fall, and that workers nevertheless expand their work effort. Then $\hat{Y}$ will temporarily rise above $\hat{Y}_{normal}$, and the *UR* will fall below *NAIRU*. In an essay on *NAIRU*, Laurence Ball and N. Gregory Mankiw say that "there is wide agreement about the fundamental insight that monetary fluctuations push inflation and unemployment in opposite directions. That is, society faces a tradeoff, at least in the short run, between inflation and unemployment" (Ball and Mankiw 2002, 116). The rationale here is that wages are stickier than prices and workers misperceive such wage increases as increases in their real wage.

This relationship is known as the Phillips curve, as shown in Figure 10.2. There we draw a short-run Phillips curve ($SRPC_1$) that intersects

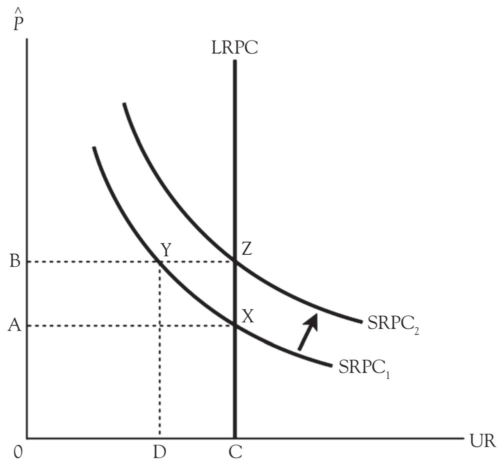

Figure 10.2 Shifts in the short-run Phillips curve

the long run Phillips curve (LRPC) at point X where the *UR* is OC and equal to *NAIRU*. The rise in the inflation rate from OA to OB causes the *UR* to fall to OD and the economy to move up the SRPC to point Y.

In the long run, as workers demand wage increases commensurate with the existing rate of inflation, the short-run Phillips curve shifts to SRPC$_2$, which intersects the LRPC at point Z, and the actual *UR* returns to the *NAIRU*.

The Labor-Force Participation Rate Curve

Now let's explore a repressed wages scenario. Again, let the growth of the money supply rise and let $\hat{W}$ lag behind $\hat{P}$. But this time workers react by signaling an unwillingness to work. That reaction would show up as a reduction in the labor-force participation rate.

This leads us to consider the *labor-force participation rate curve.* In Figure 10.3, we draw a short-run labor-force participation rate curve (SRPRC$_1$) that intersects the long run participation rate curve (LRPRC) at point X where the labor-force participation rate, OC, equals the non-accelerating inflation rate of labor-force participation, *NAIRP*. The rise in the inflation rate from OA to OB, causes the labor-force participation rate to fall to OD as wages fall behind and causes the economy to move up the SRPRC$_1$ to point Y. In the long run, as employers grant wage increases commensurate with the existing rate of inflation, the

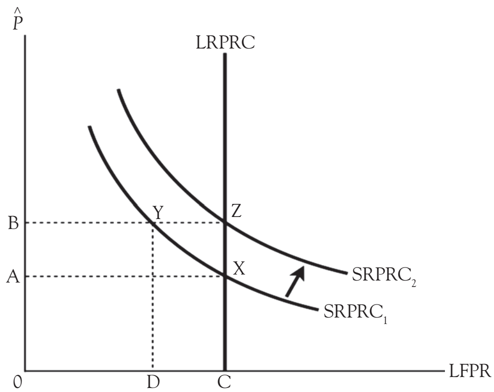

Figure 10.3 Shifts in the short-run labor-force participation rate curve

SRPRC shifts up to SRPRC$_2$, which now intersects the LRPRC at point Z, and the actual labor-force participation rate returns to *NAIRP*.

In Figure 10.2, the *UR* returns to *NAIRU* in the long run. In Figure 10.3, the labor-force participation rate returns to *NAIRP* in the long run.

What about the short run, though? There is a close connection between the *UR* and the labor-force participation rate. If the Phillips curve relationship holds, as Mankiw and Ball assert, then a rise in the growth of aggregate demand will cause the *UR* to go down temporarily. Under repressed wages, however, the same rise in the growth of aggregate demand will cause the labor-force participation rate to go down temporarily. But recall that the *UR* is defined as

$$UR = \frac{LF - L}{LF}, \tag{6}$$

where we define the labor force (*LF*) as the number of people in the civilian population of 16 years of age or older who are either working or looking for work and *L* as the number of people who are employed. Then the labor-force participation rate is

$$LFPR = \frac{LF}{POP_{16}}, \tag{7}$$

where POP_{16} is the size of the civilian population 16 years old or over.

We can use equations (6) and (7) to solve for the number of workers:

$$L = LFPR \times POP_{16}(1 - UR). \tag{8}$$

It is important not to interpret a fall in *UR* as a sign that employment must be rising. A fall in *UR* causes *L* to rise, as does a rise in *LFPR*. But the same forces that cause *UR* to fall can also cause *LFPR* to fall. This is because both employed and unemployed workers may leave the labor force as they succumb to the lure of safety-net benefits (taken up in the following chapter). Thus, we cannot infer from a fall in *UR* that a policy of increasing aggregate demand is working. It is possible that the same policy is having just the opposite effect, if rising wages lag rising prices.

Misdiagnosing Changes in Real GDP Growth

Just as Y can remain stuck below Y_{FE} if the required price and wage adjustments do not take place, $\hat{Y}$ can get stuck below $\hat{Y}_{normal}$ for the same reason. This means that once the economy is in a prolonged slump, recovery may require government intervention in the form of increased or decreased aggregate demand, whichever corrective is called for. In a Keynesian slump, the appropriate intervention is an increase in aggregate demand relative to supply. In a repressed-wages slump, the appropriate intervention is a decrease in aggregate demand relative to supply.

The question arises, though, just how the government knows what kind of slump the economy is suffering. A symptom of a slump is a prolonged period of time over which $\hat{Y}$ is less than $\hat{Y}_{normal}$. The symptom of a Keynesian slump is an *UR* persistently greater than the *NAIRU*. The symptom of a repressed-wages slump is a labor-force participation rate persistently less than the *NAIRP*. But in any slump, it is likely to be true that both problems will exist—a high unemployment rate and a low labor-force participation rate. So just what kind of slump is it?

The answer is that there is no way to tell except through trial and error. It is possible to address both problems—high unemployment and low labor-force participation—through policies aimed at removing disincentives to work or at creating jobs. Such policies shift the LRAS curve to the right, increase Y_{FE}, increase $\hat{Y}_{normal}$, reduce *NAIRU* and increase *NAIRP*.

Return to the example in which $\hat{M} = 5$ percent, $\hat{Y} = \hat{Y}_{normal} = 3$ percent, $\hat{k} = 0$ and $\hat{P}_{desired} = 2$ percent. Now suppose that the actual growth in M temporarily falls below 5 to 4 percent. Then

$$\hat{M} = 4\% < \hat{k} + \hat{P} + \hat{Y} = 5\%. \tag{9}$$

Given the fall in $\hat{M}$ and given that $\hat{k}$ remains unchanged, both $\hat{P}$ and $\hat{W}$ must fall by 1 percentage point in order to keep $\hat{Y}$ from falling. This is just a dynamic version of the case in which we implicitly assumed that Y was constant. The only difference is that now it is not a once-and-for-all proportional fall in W and P that is needed, but a proportional fall in their growth (again, from 2 to 1 percent). If this did not occur, then the economy could ratchet itself into a slump, as described in the previous chapter. The policy remedy would be as before—an expansion of government purchases or the money supply to pull the economy back to its normal growth curve.

We can present a parallel example of *repressed wages*. Suppose that the growth in M temporarily rises from 5 to 6 percent. To close the gap, the growth of P (currently 2 percent) must rise by 1 percentage point, to 3 percent. And likewise, in order keep the real wage rate from falling, the growth of W (also currently 2 percent) must rise by 1 percentage point to 3 percent.

This is a dynamic version of the case reviewed previously, in which we assumed that Y was constant. The only difference is that now it is not a once-and-for-all proportional rise in W and P that is needed, but a 1 percentage point rise in their growth rate. Were this not to occur, the policy remedy would be, as before, a contraction of the money supply growth rate to pull the economy back up to its trend growth curve.

Casting the discussion in terms of growth rates brings to light the complexities that arise in diagnosing a case of high unemployment or low labor-force participation. First, the growth of the money supply is not tightly controlled from some command post at the Federal Reserve. Controlling the money supply requires answering questions about what definition of the money supply to use, about how tightly the Fed can control the money supply through asset purchases and sales and about what kind of assets the Fed will choose to buy and sell in conducting its policy.

Second, the growth path of Y changes with innovation booms, Middle East wars, elections, and so forth. Finally, controlling inflation involves the choice of price indexes, distinctions between actual and *core* inflation and the need to anticipate and correct for the numerous forces at work in the economy, outside the orbit of monetary policy, that cause growth rates to fluctuate unpredictably.

The problem is that it might be hard to tell whether any developing problem of long-term underemployment resulted from a failure of $\hat{P}$ and $\hat{W}$ to adjust downward or upward. We cannot assume that there is a failure of these indicators to adjust downward because of an ill-advised decrease in $\hat{M}$. Or that a failure to adjust upward is because of an ill-advised increase in $\hat{M}$. Rather, the problem of fine tuning monetary policy has to do with the behavior of $\hat{M}$ relative to observed changes in $\hat{Y}$.

Suppose that the monetary authorities are keeping $\hat{M}$ fixed at 5 percent and $\hat{P}$ fixed at 2 percent but that $\hat{Y}$ unexpectedly falls from 3 percent to zero, which is to say that, temporarily, at least

$$\hat{Y} = 0\%. \tag{10}$$

Assume that $\hat{M}$ remains unchanged, which is to say,

$$\hat{M} = 5\%. \tag{11}$$

Now recall that, at the moment before $\hat{Y}$ fell,

$$\hat{k} + \hat{P} = 2\%. \tag{12}$$

The question then is whether it continues to be true that

$$\hat{Y}_{normal} = 3\%, \tag{13}$$

so that what we see in equation (10) is just anomaly, or whether it is now true that

$$\hat{Y}_{normal} = 0\%. \tag{14}$$

Ultimately the economy will adjust in such a way as to satisfy equation (3). If policy makers see equation (13) as still true, they might interpret the fall in $\hat{Y}$ as having resulted from a temporary rise in the growth of the demand for money relative to the supply of money, as manifested by a rise in $\hat{k}$. Were that the case, employers and workers should (i.e., they *should* from their own self-interested point of view), agree to bring about proportional decreases in $\hat{P}$ and $\hat{W}$. (Note that $\hat{k}$ is the rate at which people are increasing the fraction of their real income that they want to hold as cash, so that a rise in $\hat{k}$ brings about a rise in the demand for money relative to the supply and the need for the growth of prices and wages to fall.) If these adjustments do not occur and if $\hat{Y}$ fails to return to normal, then the appropriate policy response, so it would appear, would be to increase $\hat{M}$ until $\hat{Y}$ returns to normal, if it ever does.

Suppose, however, that this is a misdiagnosis, which is to say that for some reason now $\hat{Y}_{normal} = 0$ and $\hat{k}$ did not rise. That means that the growth of the supply of money must ultimately fall relative to the growth of the demand for money. In order to restore equality between the growth of the supply and demand for money, the monetary authorities must permit $\hat{P}$ to rise from 2 to 5 percent, cut $\hat{M}$ from 5 to 2 percent, or bring about some combination of the two. Then also, if $\hat{P}$ rises, $\hat{W}$ must rise in tandem with $\hat{P}$.

If $\hat{P}$ rises and if $\hat{W}$ does not keep pace with $\hat{P}$, the stage will be set for a repressed-wages scenario. The economy can sink into a *supply-side* downturn in which $\hat{Y}$ falls below the new (and lower) normal $\hat{Y}$. In this case, $\hat{Y}$ would become negative. Why? Again, because, barring a reduction in monetary growth, nominal wages must rise in proportion to prices in order to keep workers from wanting to cut back on their labor services.

We are back to the situation in which pizza shop managers generally refuse to grant wage increases to their workers, not understanding in this instance, that, despite the shrinkage in business that took place because of the downturn in $\hat{Y}_{normal}$, the demand for pizza is growing faster than the supply (this is because the growth of M exceeds the growth of Y). While the idea of acceding to wage demands in a slumping economy seems perverse, doing so is in fact necessary here to keep workers on the job, given that workers correctly understand that the underlying upward pressure on $\hat{P}$ will otherwise cause their real wages to fall. Now if workers do not get faster raises, they will pull out of their jobs and production will slump even further. The further slump in production will lead workers to pull back still more as the availability of consumer goods (pizzas) further shrinks, and so forth. At this point, monetary and fiscal contraction becomes an even more pressing policy.

The trick is to determine whether an observed decline in $\hat{Y}$ is attributable to some shift in preferences such as a rise in $\hat{k}$ or to a decrease in $\hat{Y}_{normal}$ itself. If the former and if the decline is long-lasting, then the correct remedy is a governmental-engineered increase in aggregate demand as through an increase in $\hat{M}$. If the latter, then it is necessary to see how prices and wages adjust. If $\hat{P}$ and $\hat{W}$ rise in tandem, then the economy will slump to its new normal without further, unnecessary decline in output growth. If they do not rise in tandem, then the economy will slump even below its new normal until a government-engineered *contraction* in aggregate demand is implemented.

Since the onset of the recession that began in December 2007, the growth of U.S. real GDP has remained well below its previous *normal* of about 3 percent. The government reacted to the recession by adopting expansive monetary and fiscal policies. The economy's tepid response raises the question whether these policies were too weak or just the wrong policies entirely. We delve into that question in the next two chapters.

CHAPTER 11

The Great Contraction

The Great Contraction is the recession of December 2007 to June 2009, so named because of the severity of financial crisis by which it was precipitated and the severe contraction in GDP and employment that took place over the period following its onset. The crisis affected dozens of countries around the world. In this chapter, we focus on the United States and on the policies it adopted in reaction to the crisis. We expand the discussion to include 20 additional countries in the following chapter.

Origins of the Contraction

The crisis resulted from the collapse of housing prices and the resulting losses experienced by holders of subprime mortgages. The S&P Case–Shiller 20-City Home Price index fell by 34 percent from its peak in April 2006 to its bottom in January 2012. See Figure 11.1.

The delinquency rate on residential mortgages went from 2.03 percent in the first quarter of 2007 to 11.27 percent in the first quarter of 2010. See Figure 11.2.

The result was the rapid descent toward bankruptcy of financial institutions that held trillions of dollars in mortgage-backed securities. By January 2009, Lehman Brothers had declared bankruptcy, Bank of America had acquired Merrill Lynch and JP Morgan Chase had acquired Bear Sterns. Both Merrill Lynch and Bear Sterns had been driven close to bankruptcy by the mortgage crisis. Lehman Brothers went bankrupt because it couldn't find a buyer.

The United States sank into recession. GDP fell by 4.3 percent from the fourth quarter of 2007 to the second quarter of 2009. It was 3.0 percent lower in the fourth quarter of 2009 than it was at the onset of the recession. In the fourth quarter of 2008 alone, real GDP fell at an annual rate of 8.6 percent (see Figure 11.3). Employment fell by 8.6 million from December

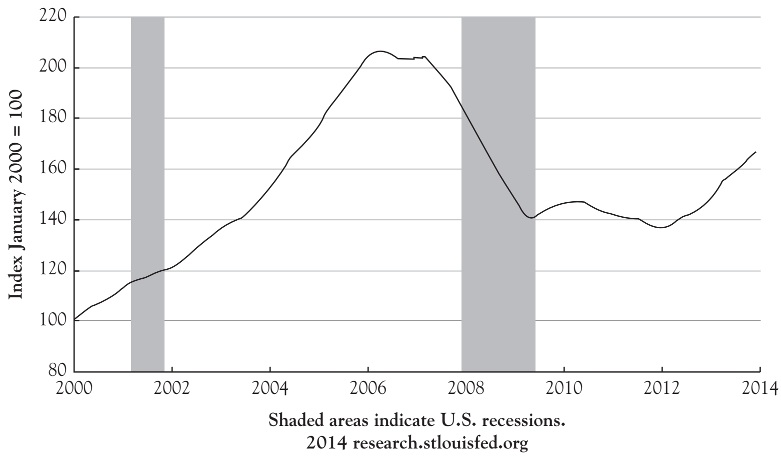

Figure 11.1 S&P Case–Shiller 20-city home price index

Source: Federal Reserve Bank of St. Louis (www.stlouisfed.org), S&P Dow Jones Indices LLC.

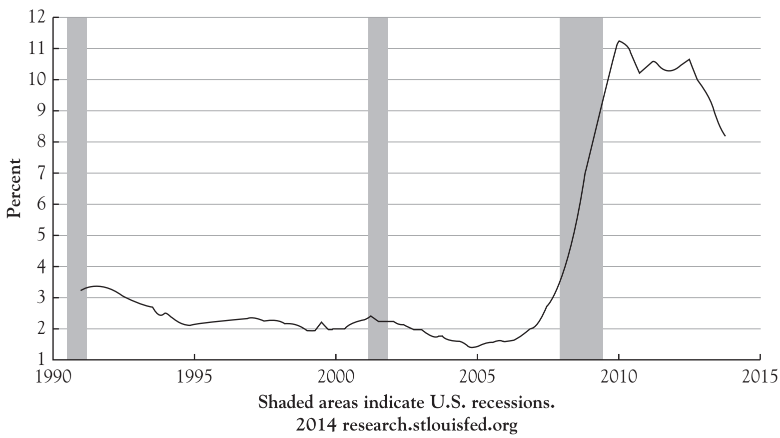

Figure 11.2 Delinquency rate on single-family residential mortgages, booked in domestic offices, all commercial banks

Source: Federal Reserve Bank of St. Louis (www.stlouisfed.org, Board of Governors of the Federal Reserve System.

2007 to December 2009 (see Figure 11.4). The Dow-Jones Industrial Average fell by 32 percent from November 4, 2008 to March 9, 2009.

The U.S. Government Intervenes

Over this period, the federal government intervened with numerous emergency measures. In October 2008, Congress passed and the President

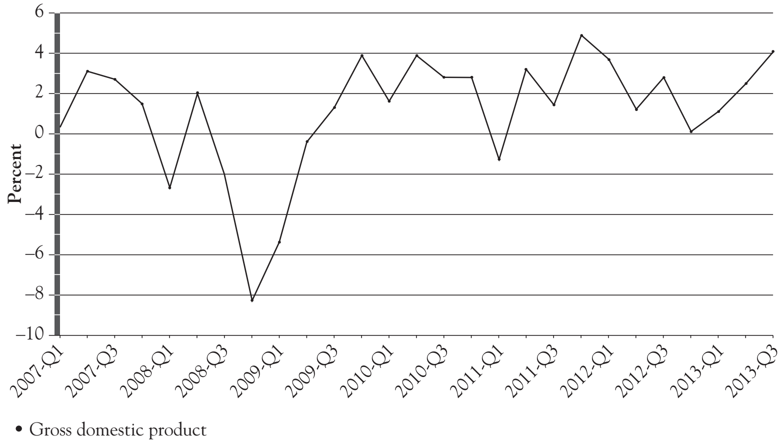

Figure 11.3 Percentage change in U.S. real GDP

Source: U.S. Bureau of Economic Analysis (www.bea.gov)

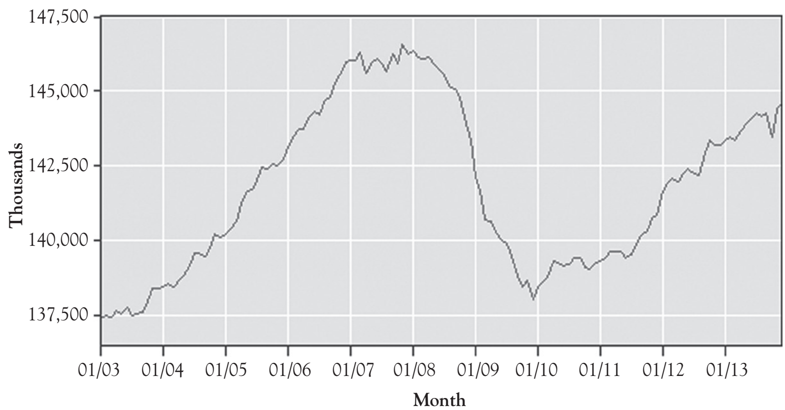

Figure 11.4 Employment level

Source: U.S. Bureau of Labor Statistics (www.bls.gov).

signed The Emergency Economic Stabilization Act, which created the Troubled Asset Relief Program (TARP) and authorized the U.S. Treasury to buy up to $700 billion (later reduced to $475 billion) in troubled assets. TARP funds were spent for the purpose of *stabilizing* the U.S. auto industry, shoring up credit markets, providing mortgage relief and rescuing the insurance company American International Group from bankruptcy, along with numerous major banks, including Morgan Stanley and Goldman Sachs.

In tandem with these interventions, the U.S. Federal Reserve undertook a policy of *quantitative easing*. Traditionally, the Fed responded to an economic downturn by buying short-term government securities in order to bring down short-term interest rates. With short-term interest rates already near zero and the financial sector in crisis, the Fed switched to a policy of buying long-term assets and, as part of its strategy, focusing on assets in markets in particular need of rescue.

Thus, on November 25, 2008, the Federal Reserve kicked off what became known as quantitative easing 1, QE1, under which it announced its intention to purchase $500 billion in mortgaged-back securities and $100 billion in debt held by Fannie Mae and Freddie Mac, which had suffered huge losses because of the subprime crisis. The Fed followed with another round of asset purchases in March 2009. After a hiatus of several months, the Fed initiated QE2 with the purchase of $600 billion in U.S. Treasuries. QE3 followed in late 2012 with a promise to buy $40 to $85 billion per month in mortgage-backed securities. On June 19, 2013, the chairman of the Fed announced a plan to scale back these purchases, thus beginning an era of planned or expected *tapering*. Altogether, under quantitative easing, Fed assets rose from just under $1 trillion in September 2008 to just over $4 trillion in January 2014. See Figure 11.5.

As an additional rescue effort, Congress passed the American Recovery and Reinvestment Act (ARRA) in February 2009. When the act was under consideration, congressional researchers estimated that it would cause budget deficits to rise by $787 billion over the period FY 2009–2019. In a report of February 12, 2012, the Congressional Budget Office (CBO) revised the estimate to $831 billion. "More than 90 percent of ARRA's budgetary impact was realized by the end of December 2011" (Congressional Budget Office, 2012a). By the end of the first quarter of 2013, the impact had reached $787 billion.

Figure 11.6 shows the amount spent (in billions of dollars at annual rates) by calendar quarter from the first quarter of 2009 to the first quarter of 2013. The categories and percentage of the total are as follows:

- Government investment expenditures—2.2 percent.
- Capital transfers (including grants for infrastructure and green energy projects)—10.0 percent

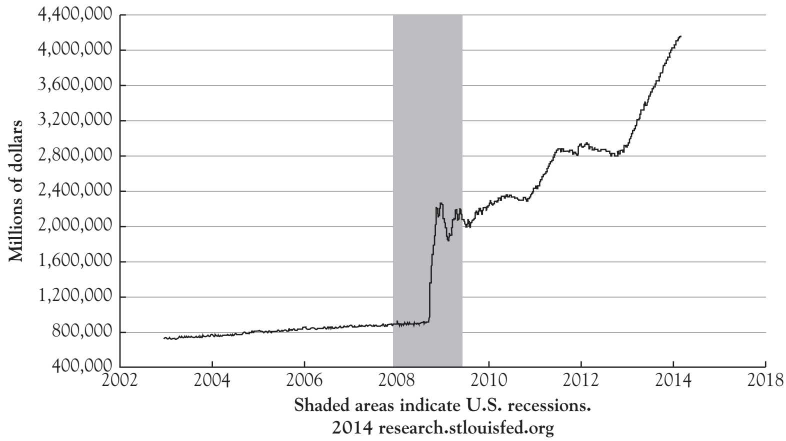

Figure 11.5 All Federal Reserve Banks-total assets, eliminations from consolidation

Source: Federal Reserve Bank of St. Louis (www.stlouisfed.org), Board of Governors of the Federal Reserve System.

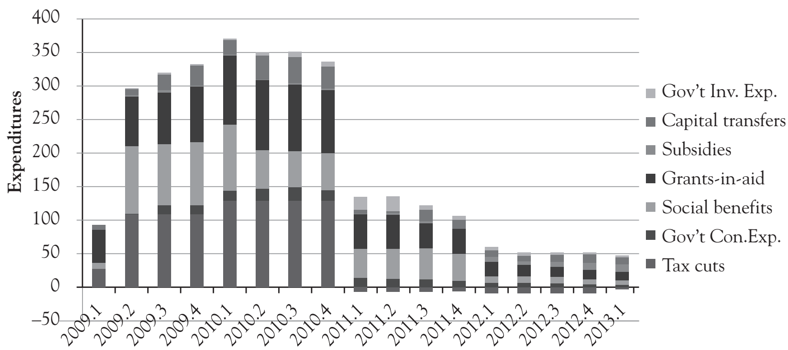

Figure 11.6 Stimulus expenditures by type ($ billions seasonally adjusted at annual rates)

Source: U.S. Bureau of Economic Analysis (www.bea.gov)

- Subsidies (includes subsidies for Section 8 housing and for use of renewable energy)—2.3 percent
- Grants-in-aid to state and local government (includes grants for Medicaid and education)—29.7 percent
- Social benefits [includes Supplemental Nutrition Assistance Program benefits (previously "food stamps") and extensions of unemployment benefits]—24.7 percent

- Government consumption expenditures—5.5 percent
- Tax cuts (including a Make Work Pay tax credit and deductions for on business equipment)—25.7 percent

Effects of the Intervention

In a report on the ARRA, the CBO provided high and low estimates of the act's economic effects on real GDP and employment. Table 11.1 provides the average of these estimates for the years 2009–2013. (Congressional Budget Office 2012a, 3).

The CBO reports that it

> used various economic models and historical data to guide its estimate of the way in which output and employment are affected by increases in outlays and reductions in revenues under ARRA. CBO's assessment is that different elements of ARRA (such as particular types of tax cuts, transfer payments, and government purchases) have had different effects on economic output per dollar of higher spending or lower tax receipts. Multiplying estimates of those per-dollar effects by the dollar amounts of each element of ARRA yields an estimate of the law's total impact on output (Congressional Budget Office 2012a, 4).

The estimates of *per-dollar effects* are Keynesian multipliers, which CBO determined to run from a low of 0.2 for "extension of first-time home buyer credit" to 2.5 for "purchases of goods and services by the federal government" (Congressional Budget Office, 2012a, 6).

Table 11.1 CBO estimates of the economic effects of the ARRA

Year	Increase in real GDP (%)	Increase in number of workers (millions)
2009	1.10	0.55
2010	2.40	2.0
2011	1.35	1.50
2012	0.45	0.65
2013	0.25	0.30

Source: Congressional Budget Office (www.cbo.gov)

John Taylor has argued that the effects of the ARRA were negligible. In a statistical analysis of the act, he found that "the temporary stimulus payments had a very small effect on consumption and that this effect is not statistically significantly different from zero." He found that "the Keynesian multiplier for transfer payments or temporary tax rebates was not significantly different from zero for the kind of stimulus programs enacted in the 2000's" (Taylor Undated, 9).

Taylor reflects upon the fact that the government purchases amounted to a small share of ARRA spending (and a negligible share of GDP), compared to grants and aid to state and local government. While CBO reports that these grants increased GDP by $0.40 to $2.20 for every dollar spent, Taylor concluded that the grants had the effect principally of encouraging the state and local governments receiving them to increase saving. Thus, "The ARRA had no effect on the sum of purchases and other expenditures" (Taylor Undated, 15).

In a subsequent article, Taylor reported that there was a sharp increase in rebate payments in 2008, during the recession that began in December 2007. The rebates brought about an equally sharp increase in disposable income but had no effect on consumption. He observed that "these results are consistent with the permanent income theory or life-cycle theory of consumption" (Taylor 2009, 552). Based on his review of this experience, he could "see no empirical rationale for a revival of discretionary countercyclical fiscal policy" (Taylor 2009, 553).

Another indication of the ineffectiveness of the expansionary policies adopted by the United States is the increase in the saving rate that took place in tandem with those efforts. One study observes that "in the United States, for example, the increase in household saving since 2007 was generally sharper than after any other postwar recession…, and the personal saving rate has remained well above its pre-crisis value for the past five years" (Carroll, Slacalek, and Sommer 2012, 4).

Matthew D. Shapiro and Joel Slemrod studied the effects of a stimulus measure adopted in 2001, when the federal government sent tax rebate checks of up to $300 for single individuals and up to $600 for households. According to their findings,

> only 21.8 percent of households reported that the tax rebate would lead them to mostly increase spending. There was no evidence

> that the spending rate was higher for low-income households. The aggregate data in 2001 show a spike in the saving rate precisely at the same time the tax rebates were mailed in July, August, and September 2001 (Shapiro and Slemrod 2003, 381).

In another study, Shapiro and Slemrod concluded that "because of the low spending propensity, the rebates in 2008 provided low "bang for the buck" as economic stimulus (Shapiro and Slemrod 2009, 379). These findings are consistent with Taylor's findings regarding the ineffectiveness of the ARRA to stimulate spending and of the importance of the permanent income hypothesis in explaining the meek results.

See Figures 11.7, 11.8, and 11.9 for illustrations of the surge in saving that began with the onset of the recession. From this evidence, it is possible to argue that the multiplier effects of the stimulus were so small that the government might well have not bothered at all to undertake discretionary countercyclical policies. But it is equally possible to argue that, because those effects were so small, the government should have been all the more aggressive in adopting its expansionary efforts. We take up this issue again in the following chapter.

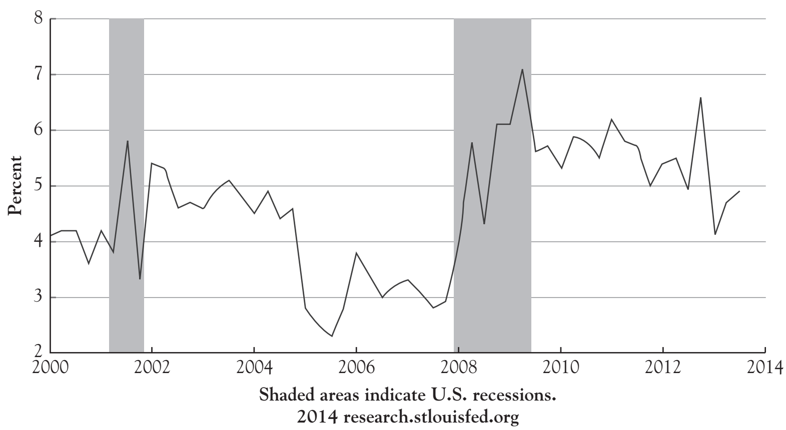

Figure 11.7 Personal saving as a percentage of disposable personal income

Source: Federal Reserve Bank of St. Louis (www.stlouisfed.org), U.S. Bureau of Economic Analysis (www.bea.gov).

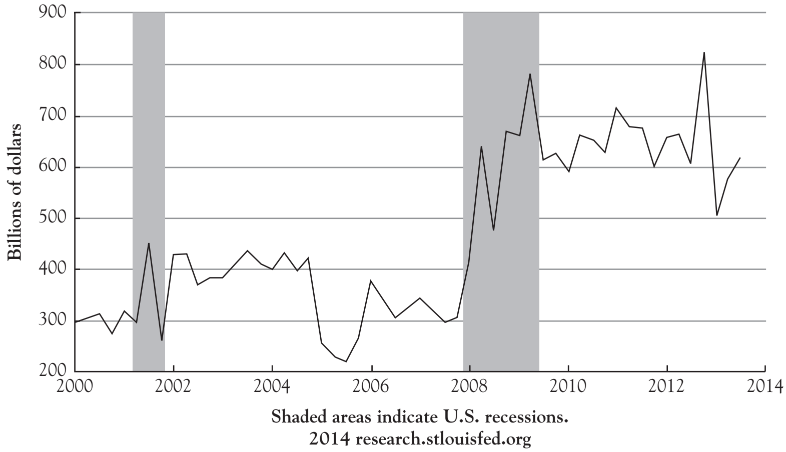

Figure 11.8 Net private saving: households and institutions

Source: Federal Reserve Bank of St. Louis (www.stlouisfed.org), U.S. Bureau of Economic Analysis (www.bea.gov).

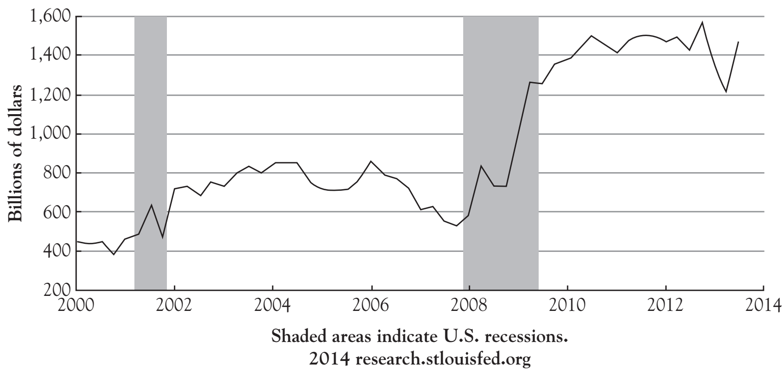

Figure 11.9 Net private saving

Source: Federal Reserve Bank of St. Louis (www.stlouisfed.org), U.S. Bureau of Economic Analysis (www.bea.gov).

Decomposing the Employment Effects

In order to examine more closely the contrasting analyses offered by the CBO and by John Taylor, it is useful to decompose the decline in employment over the course of the recession into the contribution of the unemployment rate and the labor-force participation rate. First, consider

Figure 11.10, which shows employment as a fraction of the population age 16 and older over the last few years. The employment-population ratio rose gradually over the middle of the previous decade and then fell precipitously from 63.4 percent in December 2007 to 58.3 percent in December 2010, after which it has remained fairly constant. From equation (8) in Chapter 10, we can write

$$\frac{L}{POP_{16}} = LFPR \times (1 - UR), \tag{1}$$

according to which the employment-population ratio equals the labor-force participation rate × (1–the unemployment rate).

Figure 11.11 shows the unemployment rate and Figure 11.12 shows the labor-force participation rate for the period 2003–2013. Notably, we see that, the unemployment rate rose sharply and labor-force participation rate fell sharply over the course of the recession.

The unemployment rate has since declined, but the continued decline in the labor-force participation rate has caused the employment-population ratio (Figure 11.10) to show little improvement.

Earlier, we considered the CBO's assessment of the ARRA and John Taylor's critique of that assessment. While there can be no doubting the depth of the recession, there is strong evidence that the recovery has been exceptionally tepid. The question is whether this fact is rooted in the nature of the downturn or in choice of a bad policy mix by the government.

The argument that the fault lies in the nature of the downturn has well-known defenders. Carmen Reinhart and Kenneth Rogoff famously

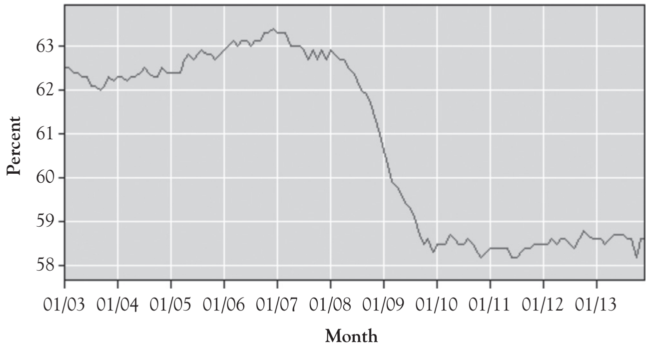

Figure 11.10 Employment-population ratio

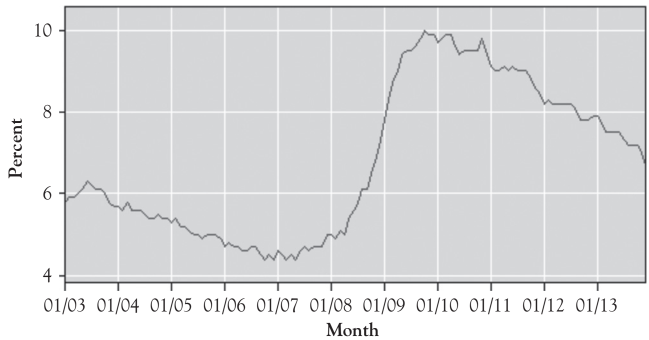

Figure 11.11 Unemployment rate

Source: U.S. Bureau of Labor Statistics (www.bls.gov)

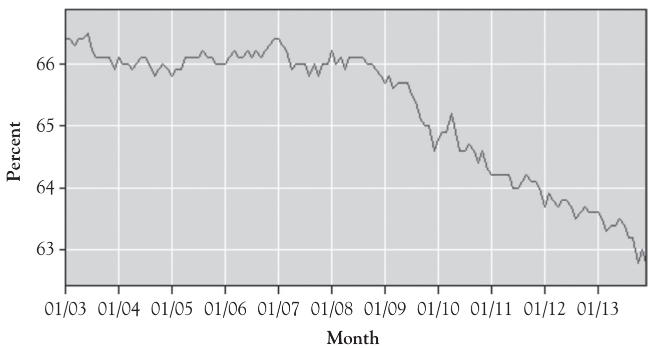

Figure 11.12 Labor force participation rate

Source: U.S. Bureau of Labor Statistics (www.bls.gov).

argued that "banking crises tend to be protracted affairs." Their take on the evidence is that severe postwar financial crises "have had a deep and lasting effect on asset prices, output, and employment" (Reinhart and Rogoff 2009, 238, 289). This finding has led to claims that the U.S. economy is recovering comparatively well from the 2007–2009 recession, considering that it resulted from a financial crisis. See, for example, Rampell and Dewan (2014)

However, Michael Bordo and Joseph Haubrich draw a distinction between: (1) the length and depth of recessions caused by financial crises and (2) the speed with which countries recover from those crises (Bordo and Haubrich 2012). There is agreement that recessions caused by financial crises are longer and deeper than other recessions. But, as

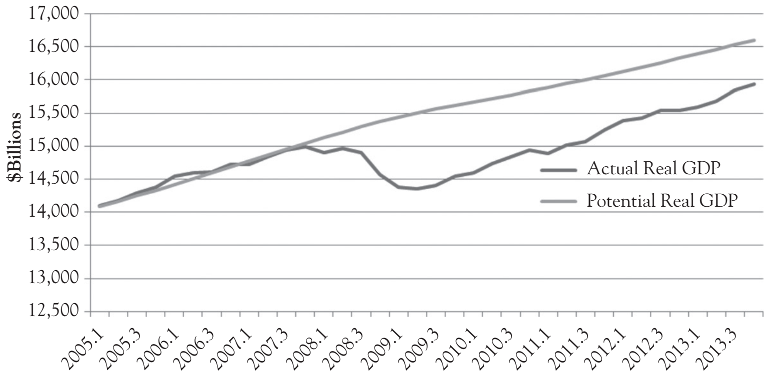

Figure 11.13 Actual and potential real GDP

Source: Congressional Budget Office (www.cbo.gov), Federal Reserve Bank of St. Louis (www.stlouisfed.org) and U.S. Bureau of Economic Analysis (www.bea.gov).

Bordo reports in an opinion editorial published in *the Wall Street Journal*, data going back to the 1880s show that recoveries from financial crises have exhibited average growth rates of 8.0 percent while recoveries from other recessions have exhibited average growth rates of 6.9 percent (Bordo 2012).

Figures 11.13 and 11.14 provide an idea of how slowly the economy is recovering from the recession. Figure 11.13 contrasts actual GDP with potential (full-employment) GDP, as calculated by the CBO, for the period starting with the first quarter of 2005 and running through the fourth quarter of 2013.

Figure 11.14 compares actual employment with *potential employment*, calculated for December 2005 to December 2013. Potential employment represents what the actual level of employment would have been had the actual GDP equaled the potential GDP over this period.[1]

[1] Potential employment is assumed to equal what employment would have been had employment equaled the fraction of the working-age population (as measured by the Organization for Economic Co-operation and Development) employed in December 2005 multiplied by the working-age population estimated for December of each year. The year 2005 is used as a benchmark because actual and potential real GDP were approximately the same that year.

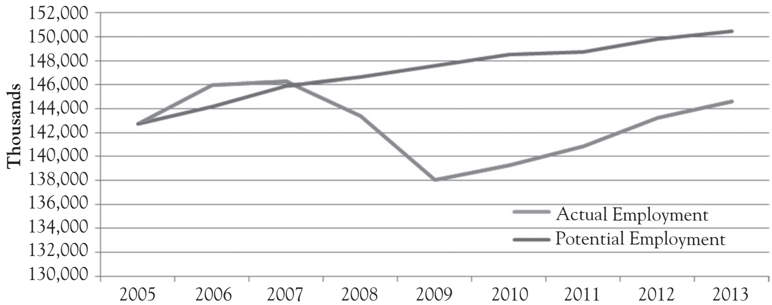

Figure 11.14 Actual and potential employment

Source: Organization for Economic Cooperation and Development (www.oecd.org), Main Economic Indicators, Complete Database; Federal Reserve Bank of St. Louis (www.stlouisfed.org) and U.S. Bureau of Labor Statistics (www.bls.gov).

Economists at the Federal Reserve Bank of Minneapolis have examined the 11 recessions that took place in the United States since World War II and found that the recovery from the 2007–2009 recession was weak—in some instances, exceptionally weak—compared to the other 10. Consider the state of the current recovery, at this writing, some five years after the recession ended. This recovery, as measured by the percentage change in real GDP, is weaker than for the other 10 recoveries. The recovery, as measured by percentage change in employment, is weaker than for nine of the other ten recoveries (the recession of 2001 being the exception). (Federal Reserve Bank of Minneapolis 2014). Figures 11.15 and 11.16 contrast the recoveries from the 1981, 2001, and 2007–2009 recessions.

The Fall in U.S. Labor Supply

In his book *The Redistribution Recession*, Casey Mulligan shows that the explanation lies in part in the fact that government policies subsidizing leisure have caused a reduction in the supply of labor (Mulligan 2012). In order to understand his reasoning, it is necessary to see how the government can subsidize leisure and how, when it does, workers will expand leisure and contract work.

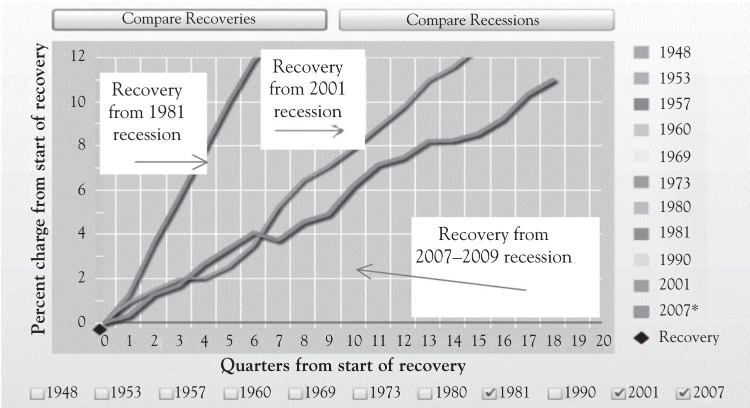

Figure 11.15 Change in U.S. output: Recoveries

Source: Federal Reserve Bank of Minneapolis (www.minneapolisfed.org).

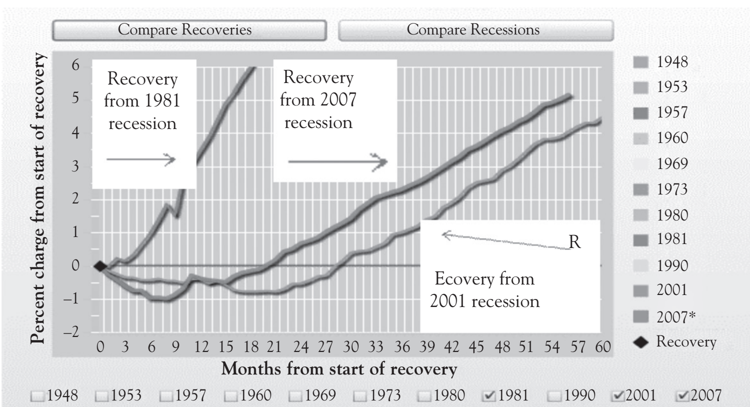

Figure 11.16 Change in U.S. employment: Recoveries

Source: Federal Reserve Bank of Minneapolis (www.minneapolisfed.org)

Let's return to our worker Adam. Figure 11.17 shows how Adam offers less labor when government-provided benefits replace part of his wage. We assume that Adam pays no taxes. In the absence of government benefits, he would be on curve AB, along which his wage rate is \$50 per hour and along which he chooses point X, where he works 12 hours and earns \$600 and thus reaches his highest attainable level of utility U_1.

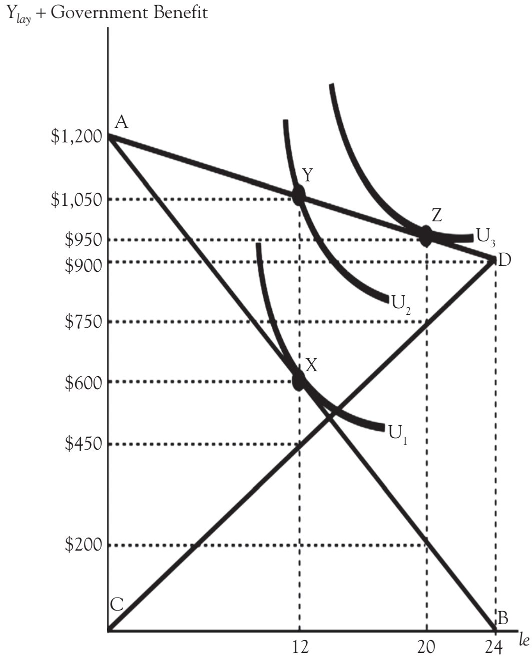

Figure 11.17 The income-leisure choice with safety net benefits

Now the government institutes a system of benefits under which he receives $900 if he doesn't work at all (i.e., sets his leisure at 24 hours) and gives up $0.75 in benefits for every dollar he earns. Under this system, he reduces his benefits to zero if he works all 24 hours.

Curve CD shows how his benefits increase with leisure. Now Adam must find the optimal point on curve AD, which we obtain by adding curves AB and CD vertically and which shows the actual leisure/income choices before him. Adam could increase utility by keeping work and leisure constant and moving to point Y. But the fact that leisure is cheaper now causes him to move to point Z, where he now works only four hours. His total income rises to $950, of which $200 is labor income and the remaining $750 government benefits.

In Mulligan's terminology, Adam undergoes a rise in his *replacement rate* and a fall in his *self-reliance rate*. The replacement rate is "the fraction of productivity that the average nonemployed person receives in the form of means-tested benefits," and the self-reliance rate is "the fraction of lost productivity not replaced by means-tested benefits—and is merely 1 minus the replacement rate" (Mulligan 2012, 75). Thus, in the foregoing example, the replacement rate (*rr*) rose from zero to 75 percent (= \$37.50/\$50), and the self-reliance rate (*srr*) fell from 100 to 25 percent (= \$12.50/\$50) or to 1–*rr*.

Note that when the government benefits are introduced the individual's MRS_{LeLay} temporarily exceeds the amount Adam must sacrifice for another hour of leisure. Thus, he will expand his leisure and will continue to do so until he reaches point Z, where his MRS_{LeLay} has adjusted downward by enough so that

$$MRS_{LeLay} = w(1-rr) = \$50(1-0.75) = 12.50, \qquad (2)$$

which equals the slope of curve AD.

Figure 11.18 illustrates this for a labor market in which the demand curve for labor is assumed (unrealistically) to be horizontal. Assume that there are 100 workers, all identical to Adam in their wages and preferences. Then the labor supply curve rotates upward from curve L_1^S to curve L_2^S.

Note that S_1^L can also been seen as the community's MRS_{LeLay} curve. At any quantity of labor, w now lies above MRS_{LeLay} by $\frac{rr}{1-rr}MRS_{LeLay}$. For example, in order to be willing to continue providing 1,200 units of labor, where MRS_{LeLay} was \$50 before the benefits program, workers would now have to receive a wage of \$200 $\left(=\frac{1}{1-0.75}\$50\right)$, so that w would exceed MRS_{LeLay} by \$150 $\left(=\frac{.75}{1-.75}\$50\right)$.

In Figure 11.18, the quantity of labor falls from 1,200 hours to 400 hours. This is exactly parallel to what we could have expected if the government had imposed a 75 percent tax on Adam's labor. We can think of the reduction in Adam's MRS_{LeLay} from w to $w(1-rr)$ as having the same behavioral impact as the imposition of a tax on labor equal to rr, in which case we would write his after-tax wage rate as $w(1-t) = w(1-rr)$.

Figure 11.18 assumes a horizontal demand for labor curve, which means that the creation of the benefit program causes the quantity of labor to fall but leaves the market wage rate unchanged at \$50. Figure 11.19 presents the same example but with a more realistic, downward sloping labor demand curve. There the market wage rate rises from \$50 to \$80 as a result of the institution of the benefit program. Now MRS_{LeLay} falls to \$20 [= \$80 × (1–0.75)] and the quantity of labor falls from 1,200 to 560.

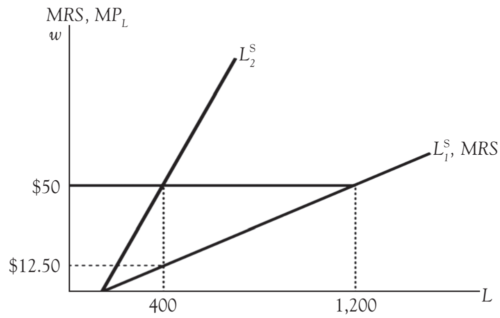

Figure 11.18 Decrease in labor supply I

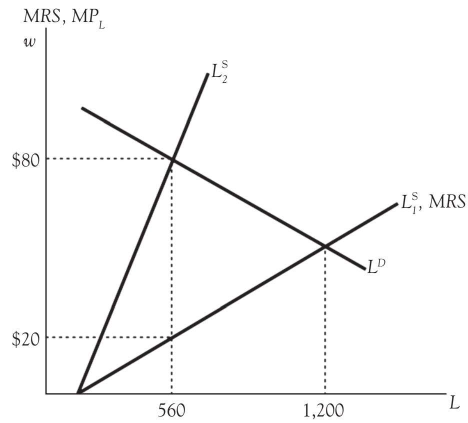

Figure 11.19 Decrease in labor supply II

Mulligan uses this reasoning to estimate how the expansion of safety-net programs over the period 2008–2009 reduced the self-reliance rate and with it, the number of hours people were willing to work. Included in the safety-net programs he considers are SNAP (food stamp benefits), extensions of unemployment insurance benefits, and programs that offer debt forgiveness to home owners. Another team of economists found "that most of the persistent increase in unemployment in the great recession can be accounted for by the unprecedented extensions of unemployment benefit eligibility" (Hagedorn, Karahan, Manovskii, and Mitman 2013, 1).

Mulligan determines that the self-reliance rate was 59.6 percent before the recession began but then fell to 51.6 percent by the end of the recession in mid-2009. This was a change of

$$\ln(0.596) - \ln(0.516) = 14.4\%. \tag{3}$$

Mulligan finds that this decrease in the self-reliance rate caused hours to be 10.5 percent less in the fourth quarter of 2009 than it would have been without the safety-net expansion.

Using Mulligan's data, we can estimate the effect of the safety-net expansion on total hours worked. Table 11.2 reports total hours worked for (1) actual hours worked in the fourth quarter of 2007, (2) an estimate of what would have been hours worked in the fourth quarter of 2009 had there been no expansion in the safety net, (3) actual hours worked in the fourth quarter of 2009, and (4) an estimate of what would have been hours worked in the fourth quarter of 2009 under Mulligan's assumptions about the sensitivity of hours worked to the calculated change in self-reliance rate.

According to these data, workers put in 5.685 billion fewer hours of work in the fourth quarter of 2009, because of the safety-net expansion, than they would have put in, had there been no safety-net expansion. If we use the December 2007 data on average weekly hours for private

Table 11.2 Changes in hours worked under safety net expansion[2]

Quarter	Total hours worked (billions)	Reduction from no-safety net hours (billions)	Reduction from no-safety net hours (%)
2007.Q4 actual hours	52.043	–	–
2009.Q4 estimated (no-safety net expansion)	54.137	–	–
2009.Q4 actual hours	47.245	6.892	12.73%
2009.Q4 estimated (safety-net expansion)	48.452	5.685	10.50%

[2] The percentages shown here are slightly different from Mulligan's owing to rounding that took place in converting his estimates into hours.

sector workers, this translates into the equivalent of 12.6 million workers who stayed out of the labor force in the fourth quarter of 2009 because of the safety-net expansion.[3]

Had the safety-net legislation not been adopted, the labor force participation rate (*LFPR*) would, according to these findings, have been 68.1 percent in the fourth quarter of 2009, substantially greater than the actual *LFPR*, which was 64.8 percent (and slightly greater than the *LFPR* of 67.3 percent, which prevailed during the first quarter of 2000). The *LFPR* was 62.8 percent in October 2013, the lowest since January 1978.[4]

Mulligan puts the shrinkage in output from the fourth quarter of 2007 to fourth quarter of 2009 at 3.9 percent. His model shows a predicted 2.7 percent shrinkage in output (Mulligan 2012, 103). He attributes the difference to factors not explained by his model.

Why Has the U.S. Recovery Been So Weak?

We are left to conclude that expansive fiscal policy adopted by the United States in response to the downturn was weakened by the low multiplier effects at work, by the surge in saving that it engendered and by the shrinkage in the supply of labor brought about by the expansion of the safety net. The next chapter will compare the experience of 21 countries, including the United States, in their efforts to recover from the downturn.

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[3] According to the U.S. Bureau of Labor Statistics, average weekly hours for private sector workers was 34.6 in December 2007. If the number of hours lost by the fourth quarter of 2009 was 5.6 billion, then the equivalent number of lost workers is 12.6 million (= 5.685 billion/13/34.6).

[4] The graph shows the *LFPR* began what appears to be a long-term decline in the early 2000s. The start of the decline coincided with the recession of 2001 and has picked up speed since 2011 with the onset baby boomer retirements. Importantly, Mulligan adjusted for the aging of the population in making his estimates for 2007–2009.

CHAPTER 12

Lessons from Recent Macroeconomic Policy Making

A core argument of this book is that there are both long-run and short-run causes of low-employment equilibrium. The long-run causes are distortions in the price system that push the long-run aggregate supply curve to the left. The short-run causes are price and wage rigidities that bring about distortions in aggregate demand and aggregate supply, sometimes leading to a need for corrective stabilization policies by the government. In this chapter, we will see how the long-run causes can frustrate the short-run stabilization policies.

Traditionally, in macroeconomic policy analysis (and as evidenced in an opinion editorial by Alan Blinder, much quoted in the previous chapters), macroeconomists see the distinction between the long run and the short run as a distinction between supply and demand: In the long run, the problem is inadequate supply. In the short run, the problem is inadequate demand and therefore excess supply. (Blinder, as we saw, confused this distinction by wrongly putting the *crowding-out* phenomenon in the *long-run supply* category.) This is in accord with the received view of prolonged economic contractions, according to which the task of the government is to engineer just the right increase in aggregate demand while avoiding *too much* inflation.

Yet if we look back to the Barro–Grossman book of 1976 and other writings, we see that the short-run problem could just as well reflect the existence of excess demand as it could indicate excess supply. Barro and Grossman give full shrift to the argument that a decrease in aggregate demand can lead to a Keynesian-type contraction, if prices and nominal wages don't adjust downward in tandem with the fall in aggregate demand. Their unorthodox claim was that the economy could just as well contract because of an *increase* in aggregate demand combined with a failure of prices and wages to rise in tandem. This possibility has been reinterpreted here in terms of a *repressed wages* scenario, in which wages fail to keep pace with rising prices.

Barro–Grossman's work implies that when the economy contracts, it is necessary to determine whether the contraction is a matter of excess supply or excess demand in order to determine what kind of monetary and fiscal policy—expansive or contractive—is called for. It further implies that just as the government can run deficits and an expansive monetary policy to address the problem of short-run excess supply, it can also run surpluses and a contractive monetary policy to address the problem of short-run excess demand.

These considerations go ignored despite the fact that the repressed wages scenario is exactly parallel to the Keynesian scenario. The problem of short-run macroeconomic stabilization is in part the problem of teasing out the cause of the contraction before figuring out just how to intervene.

Chapter 10 showed how a misdiagnosis of a slowdown in economic growth could lead to the wrong policy response. The government could misinterpret a permanent decrease in economic growth as just temporary, thus adopting expansive monetary and fiscal policies when contractive policies are called for.

Then the preceding chapter raised one final issue: Suppose that the government attempts to alleviate a downturn by adopting measures that reduce aggregate supply and that, by doing so, worsens the downturn it intended to alleviate. How do policy makers take into account the effects of distortions in the price system on their ability to alleviate a downturn through macroeconomic stabilization policies?

Pulling It All Together

Chapter 9 argues that, but for wage and price rigidities, a mismatch between aggregate supply and demand would correct itself without the need for government intervention. These rigidities can arise from an inclination on the part of employers or workers to misinterpret a rise or a fall in aggregate demand as a development that affects only their particular businesses or jobs rather than the broader economy.

Rigidities can also arise from business and labor practices that limit wage and price flexibility. These practices include reluctance on the part of firms to change menu prices in the face of fluctuations in demand, up or down. Long-term labor contracts limit the ability of workers and firms to adjust wages to current realities. Both management and labor appear to favor layoffs over wage cuts in responding to decreases in demand.

Government-induced distortions in the price system provide another source of wage and price rigidity. Minimum wage laws reduce the demand for labor and on that account, reduce long-run aggregate supply. But they have an additional effect: If there is a decrease in aggregate demand, the same laws impede the downward wage adjustments needed to avoid a short-run excess-supply scenario. So do any number of laws that have similar effects, among them prevailing wage laws for construction workers and *equal-pay-for-equal work* laws intended to protect minorities and women.

The traditional explanation for the emergence of an excess demand scenario is wartime wage and price controls. But there can be other causes. Safety-net laws of the kind documented by Mulligan and taxes on labor income slow the rise in net wages needed to avoid an excess-demand, repressed-wages scenario in the face of a rise in aggregate demand relative to supply.

Whatever the cause, economic contractions often bring about political pressure for more generous redistributionist policies, included among them, increases in the replacement rate (*rr*) brought about by the adoption of more generous safety-net benefits and a rise in the minimum wage. Because contractions are generally seen as Keynesian in nature, such measures are considered helpful because they *put money in people's pockets* and thus spur consumption.

Missing from this logic is an understanding of the obstacles the same measures pose for economic correction. One purpose of an expansive monetary and fiscal policy is to correct for excess supply by simultaneously expanding consumer demand and raising prices. Raising prices relative to wages makes labor cheaper and increases the demand for labor. Raising the minimum wage makes this more difficult.

While raising the minimum wage makes it more difficult for the government to get firms to create more jobs, raising the replacement rate makes it harder for firms to find people who want to take the new jobs that the government's expansionist policies are aimed at creating. Thus, it is counterproductive to raise either the replacement rate or the minimum wage during a Keynesian contraction.

In the event of a contraction manifested by an excess demand for labor, raising the replacement rate simply causes a further shrinkage in labor supply and a further widening of the gap between aggregate supply and demand. If the government raises the minimum wage in an excess-demand scenario, it will reduce the number of jobs that firms will be willing to offer in response to any increase in the supply of labor that the government can bring about.

Thus, the government can confound its efforts to reverse a short-run contraction by yielding to political pressure to impede the flexibility of prices and wages, whatever the nature and cause of that contraction.

As mentioned, politicians usually want to increase the replacement rate and the minimum wage in dealing with a contraction. A country that does not increase the replacement rate or the minimum wage is therefore suppressing a politically driven impulse to undermine its intended goal of economic correction, whatever stabilization policy it might have undertaken to achieve that goal. It is exercising restraint of a kind that will help facilitate the correction.

A Country-by-Country Analysis

These considerations raise the question whether we can discern, in the recent Great Contraction, a connection between the success of the countries affected by it in bringing about economic recovery, on the one hand, and the policies they adopted in response to the contraction, on the other hand. The answer is that it is in fact possible to tease out some generalizations from the data.

Before proceeding, we need to adopt a consistent terminology. The expression *fiscal expansion* traditionally connotes an increase in government spending or reduction in taxes. Fiscal contraction then means a decrease in government spending or increase in taxes. Sometimes the

Table 12.1 Policy options

<table>
<tr><th>Problem</th><th>Excess supply</th><th>Excess demand</th></tr>
<tr><td rowspan="2">Corrective measure</td><td>Expansive government policy</td><td>Contractive government policy</td></tr>
<tr><td colspan="2">Restraint in raising the replacement rate and the minimum wage</td></tr>
</table>

expression *fiscal restraint* is used synonymously with fiscal contraction. Here *restraint* will mean limiting the growth of the replacement rate or the minimum wage in response to political pressures to increase both.

Table 12.1 provides a taxonomy of policy responses based on the foregoing points.

We can find some clues as to which combination of policies is (or was) called for, given the circumstances underlying the contraction, by comparing the circumstances faced by different countries and the policies adopted by those countries over the course of a global contraction.

The recent and lingering Great Contraction provides an opportunity to do this, using databases provided by the Organization for Economic Cooperation and Development (OECD). The OECD has 34 member countries and exists "to promote policies that will improve the economic and social well-being of people around the world" (OECD, 2014a).[1] Figure 12.1 shows the percentage change in real GDP and in employment between the first quarter of 2008 and the third quarter of 2009 for 31 countries (most of them OECD countries). As the numbers show, very few of the countries avoided a decrease in both real GDP and employment.

This record provides a useful starting point for applying the principles summarized previously. It was possible to find data for 21 of the OECD member countries on changes in the replacement rates, the minimum

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[1] The member countries are Australia, Austria, Belgium, Canada, Chile, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States. Data are not available for every country for every indicator considered here.

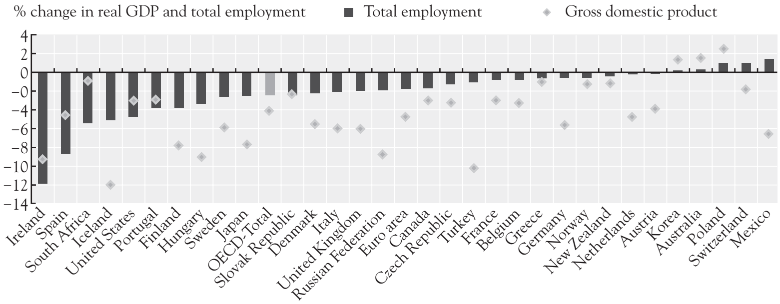

Figure 12.1 Changes in GDP for selected countries Q1 2008–Q3 2009

Source: Keeley and Love 2010, 37.

wage law, government spending, and real GDP for the period around the Great Contraction.[2]

The OECD periodically publishes reports on its member countries and other countries as well. These reports are useful in establishing the source of the contraction (if it occurred) in each country and that country's response to the emerging crisis. Following are excerpts from these reports for 20 of the countries (omitting the United States, which was considered in the preceding chapter) (OECD, Various Years and Countries).

- Australia: "After a mild downturn at the end of 2008, activity is picking up on the back of strong commodity exports and a rebound in domestic demand" (2010, 11).
- Belgium: "After four years of strong growth, the Belgian economy entered a deep recession during the second half of 2008 under the impact of the international crisis. The economy was first affected by the turmoil in the banking sector and subsequently by the collapse in international trade" (2009, 8).
- Canada: "The authorities responded aggressively to the onset of the crisis to keep credit flowing, which it did, particularly to households, making both consumer spending and housing

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[2] Some countries such as Switzerland were omitted because they do not have a minimum wage law. Greece and some others were omitted because of a lack of data for some variables.

investment remarkably resilient throughout the recession. The recession … was mainly externally driven, the result of a high degree of openness, in particular heavy exposure to the U.S. housing and auto sectors and to commodity prices, which declined quite sharply during the global downturn" (2010, 8, 11).

- Czech Republic: "The severity of the contraction primarily reflected the collapse of world trade that followed the onset of the global financial crisis and the economy's integration in international supply chains" (2010, 20).
- Estonia: "The ongoing recession was triggered by declining real estate prices and construction activity … and amplified by credit tightening, plummeting consumer confidence, and a slowdown of export growth" (2009, 21).
- France: "While the initial problems sparked by the subprime crisis date back to May 2007, their adverse impact on the real economy did not really make itself felt until about a year later. During the 12 months that preceded the sudden seizing-up of the financial system in September 2008, growth was already losing steam, initially under the combined effect of sharply slowing housing investment and the increasingly negative contribution of external trade … and then under the impact that the commodities price shock had on inflation and on household purchasing power …" (2009, 20).
- Hungary: "Hungary's economy suffered from a trade collapse just like other transition economies in the region, but the global crisis has been compounded by a collapse in investor confidence in forint-denominated assets" (2010, 9).
- Ireland: "A fast expansion of bank credit encouraged a boom in construction activity and property prices, which fuelled domestic spending more widely. This cycle has now reversed dramatically. Output is expected to contract sharply and unemployment is likely to reach 14 percent. The banking sector, which was at the heart of the credit expansion, has been severely hit by the crisis in international financial

markets and faces large losses on heavy property-related lending" (2009, 17).

- Japan: "Although Japan was not at the epicenter of the crisis, its export-dependent economy was vulnerable to the collapse in world trade, which resulted in its most severe recession of the post-war era….Financial market conditions deteriorated as credit conditions tightened and the capitalization of the Tokyo Stock Exchange fell by half" (2009, 11).
- Korea: "Korea's trade-dependent economy had initially been hard hit by severe global financial distress in late 2008, leading to exceptionally sharp declines in exports and output. The recession was accompanied by financial turbulence that widened risk premia and tightened bank lending attitudes" (2010, 11).
- Luxembourg: "Luxembourg has experienced a severe recession, as its international links exposed it to the financial crisis and the steep fall in world trade. The very open financial and industrial sectors contracted sharply. The financial impact of the crisis has been primarily on internationally-oriented banking and fund management activities. However, there is little evidence of serious credit constraints facing the domestic economy" (2010, 9).
- Netherlands: "Growth came to an abrupt halt in mid-2008 as the economy was hit by the global crisis, although the increase in the unemployment rate was smaller than anticipated. The economy exited recession in mid-2009, as the effects of the fiscal stimulus, easier monetary policy, improved financial conditions and an emerging recovery in world trade began to revive activity" (2010, 9).
- New Zealand: "When the recession began in early 2008 it could be attributed to domestic monetary tightening, the early stages of an overdue housing market correction and temporary drought conditions. As international turmoil intensified, however, it became clear that New Zealand would not escape a deeper recession, and in early 2009

macroeconomic indicators deteriorated significantly. New Zealanders had in fact been caught in much the same spiral of global excess liquidity, surging leverage, soaring asset prices and under-valuation of risks by lenders and borrowers that had taken hold globally" (2009, 8).

- Poland: "Resilient final demand and the solidity of the financial system helped to contain the contagion of the economic crisis, which hit some other countries in the region so harshly. At the outset the economy had been suffering from significant excess demand, which has been eliminated by the slowdown" (2010, 11).
- Portugal: "Helped *inter alia* by the absence of a real estate bubble in the years preceding the crisis and low exposure to toxic assets, the financial sector has remained sound.... After several years of sluggish growth, the Portuguese economy entered into recession in late 2008 as a consequence of the global crisis. The absence of a real estate bubble in the years preceding the crisis and the overall good shape of the financial sector, as confirmed for the main banks by the recent EU-wide stress tests, partly explains this relative resilience. In addition, the larger weight of Portuguese private consumption and a vigorous increase in public consumption helped cushion the fall in foreign demand" (2010, 9, 20).
- Slovak Republic: "The Slovak economy experienced a deep recession which led to a fall in real GDP of 4.7 percent in 2009. This was primarily due to the tight trade links with western European countries, notably Germany, which exposed Slovakia to the sharp fall in world trade. In addition, demand was particularly weak for the goods in which Slovakia specializes, namely cars and consumer electronics. By contrast, the domestic fundamentals of the economy were comparatively solid" (2010, 22).
- Slovenia: "The Slovenian economy was severely affected by the global financial crisis and associated economic downturns. This is attributable to four main factors: *i)* a collapse in

external demand …; *ii)* an unfavorable structure of exports …; *iii)* a sharp fall in construction activity …; and *iv)* restricted access to borrowing and external finance for the banking and non-financial sector" (2011, 18).

- Spain: "After a decade of rapid growth, Spain entered a recession of unprecedented (in the last 50 years) depth and length. The recession was triggered by the global crisis but has been compounded by the sharp domestic adjustment already underway related to the oversized residential construction industry" (2010, 22).
- Turkey: "It was an external shock that triggered the recession, and not domestic macroeconomic imbalances as was the case in the past crises. The financial sector, which was re-capitalized and strongly supervised after the 2001 meltdown, proved very robust….The massive contraction in GDP is largely explained by the unprecedented collapse in foreign demand, which was aggravated in Turkey by negative confidence effects and structural problems with competitiveness prior to the crisis" (2010, 14, 19).
- The United Kingdom: "The UK economy, like many advanced economies, has entered a deep recession, which is likely to shape economic events for a number of years. The downturn is the result of a global credit shock, the related downturn in the world economy and partly the correction of past economic imbalances" (2009, 22).

The impression one gets from these reports is that, while not all countries fell into a recession, most did and that the cause was a collapse in demand owed to the credit crisis and to falling exports.

Our task now is to see what lessons these countries teach us about the interaction between macroeconomic stabilization measures, on the one hand, and interventions that increase or decrease distortions in the price system, on the other (as discussed previously). A country that avoided raising either the replacement rate or the minimum wage by more than a small amount can be said to have exercised restraint over the political impulse to worsen such distortions. Evidence relating to restraint of this kind permits us to determine whether there was such a restraint and whether it did or did not contribute to economic recovery.

Column 1 of Table 12.2 lists the 21 OECD countries for which a full data set was available. Column 2 reports the percentage change of the replacement rate (*rr*) from 2007 to 2011 for each country, where the replacement rate is defined as "the average of the net unemployment benefit (including SA [social assistance] and cash housing assistance) … for two earnings levels, three family situations and 60 months of unemployment." Column 3 reports the percentage change in the minimum wage (Min. Wage) "relative to average wages of full-time workers." Column 4 reports the average annual growth rates of general government final consumption expenditures (G) from the fourth quarter of 2007 to the first quarter of 2011, and column 5 reports the average annual growth rates of real GDP over the same period.[3]

The purpose of the table is to see whether there is a pattern that links the data on GDP growth to the policy data in the other columns. To that end, Table 12.3 provides an economic scorecard for the 21 countries, separating (with an X) countries for which G grew by at least two percent, from the others. Similarly arbitrary conventions were used to separate the countries according to their treatment of the three policy variables (*rr*, Min. Wage, and G) over which they could exercise control. We note with an X countries for which the replacement rate was increased by more than one percent, the minimum wage was increased by more than 2.50 percent, and real GDP rose by at least 1.50 percent. We could say that countries without an X exercised restraint in raising the replacement rate or the minimum wage. We also indicate with an X countries that underwent a recession, defined here as two consecutive quarters of over which real GDP declined.

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[3] The OECD defines government final consumption expenditure as "expenditure, including imputed expenditure, incurred by general government on both individual consumption goods and services and collective consumption services" (OECD, 2014b). The growth rates are the average of annualized quarterly growth rates over the period.

Table 12.2 Recovery from the great contraction: comparative country data

1	2	3	4	5
Country	***rr* (%)**	**Min. Wage (%)**	***G* (%)**	**GDP (%)**
Australia	–7.47	–0.66	3.23	1.95
Belgium	1.13	0.00	1.43	0.52
Canada	2.35	9.14	3.00	0.89
Czech Republic	2.30	–4.00	1.73	0.59
Estonia	9.54	7.42	0.16	–2.71
France	0.31	–0.40	1.63	0
Hungary	–16.12	3.31	0.56	–0.94
Ireland	3.04	–2.01	–2.55	–1.93
Japan	2.99	11.74	1.42	–0.83
Korea	0.92	9.84	4.17	3.45
Luxembourg	2.13	0.59	2.63	–0.81
Netherlands	–1.28	–1.21	2.22	0.15
New Zealand	–7.07	2.43	2.05	–0.01
Poland	–8.63	15.61	3.44	3.60
Portugal	–2.36	8.99	0.36	–0.34
Slovak Republic	–1.95	2.87	2.88	2.04
Slovenia	–4.09	12.38	2.17	–1.30
Spain	–1.77	–3.61	3.31	–0.92
Turkey	5.16	0.00	4.30	3.37
United Kingdom	–0.80	0.00	0.84	–1.28
United States	40.33	19.15	1.06	–0.08
Average	0.89	4.36	1.91	0.26

Source: OECD 2014c, 2014d and 2014e

A few patterns can be discerned:

- Of the 11 countries that increased government spending by more than two percent, about half (five) registered real GDP growth of at least 1.50 percent.
- Every country that experienced GDP growth of at least 1.50 percent increased government spending by at least 2.50 percent. Every one of these countries exercised

Table 12.3 Economic scorecard for the 21 countries

	Recession	*rr* > 1.00%	Min. Wage > 2.50%	G ≥ 2.00%	GDP ≥ 1.50%
Australia				X	X
Belgium	X	X			
Canada	X	X	X	X	
Czech Republic	X	X			
Estonia	X	X	X		
France	X				
Hungary	X		X		
Ireland	X	X			
Japan	X	X	X		
Korea			X	X	X
Luxembourg	X	X		X	
Netherlands	X			X	
New Zealand	X			X	
Poland			X	X	X
Portugal	X		X		
Slovak Republic			X	X	X
Slovenia	X		X	X	
Spain	X			X	
Turkey	X	X		X	X
United Kingdom	X				
United States	X	X	X		

restraint with respect to the replacement rate, the minimum wage, or both.

- Of the four countries that increased both the replacement rate by more than one percent and the minimum wage by more than 2.50 percent, none registered real GDP growth of at least 1.50 percent.
- Of the nine countries that increased the replacement rate by more than one percent, eight failed to show real GDP growth of at least 1.50 percent.

- Of the 17 recession countries, seven raised the minimum wage by more than 2.50 percent. None of these seven countries registered real GDP growth of at least 1.50 percent.

What Does It Add Up To?

We noted earlier that positive replacement rates and minimum wage laws reduce long-run aggregate supply and impede the downward or upward adjustment of wages needed to avoid a slump. Let's consider the consequences for the countries that chose to raise both the replacement rate and the minimum wage. Given that the recession was Keynesian in nature, raising the minimum wage (or, more precisely, letting the minimum wage rise relative to average wages) impeded the downward adjustment of wages needed to mitigate the effects of the reduction in aggregate demand brought about by the credit crisis and falling exports.

What effect did it have to raise the replacement rate? Countries that raised their replacement rates caused the supply of labor and long-run aggregate supply to decrease. This narrowed the gap between aggregate demand and aggregate supply, but it also had the effect of reducing the full-employment equilibrium level of GDP. Perversely, government policy makers congratulated themselves over the decline in "involuntary unemployment," as workers voluntarily accepted safety-net benefits over pay checks.

The United States stands out as Exhibit A for this analysis. The United States appears to have expanded government spending too slowly and in a fashion that brought about little improvement in GDP growth. One article sums it all up in the title: "The Net Fiscal Expenditure Stimulus in the U.S., 2008–2009: Less than What You Might Think, and Less than the Fiscal Stimuli of Most OECD Countries." The article argues that "the aggregate fiscal expenditure stimulus in the United States, properly adjusted for the declining fiscal expenditure of the fifty states, was close to zero in 2009" (Aizenman and Pasricha 2011, 1). This mirrors the finding of John Taylor noted in Chapter 12 (Taylor Undated, 15).

At the same time that the United States was conducting an anemic effort to engage in fiscal expansion, it registered sky-high increases in the replacement rate and the minimum wage. These developments substantially neutralized whatever expansive effects the increased spending and other policy efforts were exerting.

It is fair to say that, if expansive monetary and fiscal policies were called for during the contraction, then government spending, as defined here, represents only a narrow component of the full-range of policy options utilized by countries experiencing a growth slowdown. It is beyond the scope of this book to attempt a full accounting of the comparative effectiveness of the policy options actually utilized.

Yet it is possible to conclude that monetary policy in the United States and other countries did not contribute to the aimed-for expansive efforts by the government. This possibility has been emphasized repeatedly by economist William A. Barnett. According to Barnett, the Fed has suffered from two problems over recent decades: (1) its adoption of interest rate targets, instead of money supply targets and (2) the techniques it has used for measuring the money supply—techniques that are too narrow and that have caused the Fed unwittingly to alternate between overly contractive and overly expansive money-supply policies, especially since the early 1980's (Barnett 2012).

Steven H. Hanke echoes Barnett's argument. Hanke sums up his argument in another article with a suggestive title: "It's the money supply, stupid." Hanke argues that the Fed's money supply measurement technique is misleading because it fails to recognize the distinction between "private money" (which is produced outside of the Fed and which consists of assets of varying liquidity such as Treasury bills and commercial paper) and "public money" (which is also called "Fed money" and which consists of bank reserves and currency). The problem is that, while the Fed is focused on interest rate targets and public money, private money, which is much more important in magnitude than public money, has behaved in a way contrary to the Fed's stated goals. According to Hanke, this led to perverse policies during the contraction.

It is clear that while Fed-produced money has exploded, privately produced money has imploded. The net result is a level of broad money that is way below where it would have been if broad money would have followed a trend rate of growth. The post-crisis monetary policy mix has brought about a massive opening of the public money-supply spigots, and a significant tightening of those in the private sector. Since the private portion of the broad money supply in the U.S. is now five and a half times larger than the public portion, the result has been a decrease in the money supply since the Lehman Brothers collapse. So, when it comes to money in the U.S., policy has been, on balance, contractionary—not expansionary. This is bad news, since monetary policy dominates fiscal policy.

The problem was not confined to the United States. "The picture for the Eurozone, absent Germany, looks very similar to that of the U.S.," says Hanke (Hanke 2012).

Short Circuits and the Philosophy of Macroeconomic Causation

In an article published in 1965, philosopher J. L. McKie asked what condition we would expect an event to satisfy if we were to think of it as causing a result. His answer was that if the event can be deemed to be "an insufficient but necessary part of a condition which is itself unnecessary but sufficient for the result," then, he said, "it is often a condition … that we have in mind" as the cause of some result. Thus, he coined the INUS condition for causality.

As an example, McKie considered the possibility that investigators would determine that a short circuit was the cause of a house fire. What is obvious is that a short circuit, in and of itself, would be insufficient to cause a fire. The investigators are not saying that the short-circuit was a sufficient condition for this house catching fire; for if the short-circuit had occurred, but there had been no inflammable material nearby, the fire would not have broken out, and even given both the short-circuit and the inflammable material, the fire would not have occurred if, say, there had been an efficient automatic sprinkler at just the right spot. Far from being a condition both necessary and sufficient for the fire, the short-circuit was, and is known to the experts to have been, neither necessary nor sufficient for it.

"In what sense, then," asked McKie "is it said to have caused the fire? The answer is that, although the short circuit was insufficient to cause the fire, it was nevertheless necessary as part of a general set of circumstances (presence of inflammable material and absence of a sprinkler) that were, in their entirety, sufficient for the result. But these circumstances were also unnecessary: A fire could be caused by an entirely different combination of circumstances (e.g., "lightning striking a barn where straw is stored") (McKie 1965, 245, 250).

In an article entitled, "Econometrics as Observation," economist Kevin Hoover cites the INUS condition as relevant to the discussion of the effectiveness of "policy interventions." A proposed cause of some macroeconomic result should satisfy the INUS condition if it is to be legitimately designated a cause of that result (Hoover 2008, 298–299). It is just that if any one proposed cause does satisfy the INUS condition, there might well be other causes that would satisfy that condition.

As pointed out, it seems safe to say that an increase of government spending of at least 2.50 percent per year was part of an INUS condition for recovery. It was not a sufficient condition. It had to be accompanied by restraint in raising the replacement rate and the minimum wage. Nor was it, even if accompanied by such restraint, necessary: A genuinely expansive monetary regimen might have worked just as well or better.

And then there is an entirely different interpretation of what caused the U.S. recovery to be so poor: Perhaps the dramatic increase in the replacement rate shrank the supply of labor so that it brought about a state of excess demand, for which an expansive monetary and fiscal policy was exactly the wrong prescription.

At the conclusion of Chapter 10, we considered a scenario in which a fall in the normal growth of real GDP would require either a contraction in the growth of the money supply or a proportionate rise in prices and wages in order to restore equilibrium. Failing one or the other, the decrease in the growth of real GDP could be all the more pronounced. This too presents itself as another INUS explanation for the behavior of the U.S. economy over recent years.

The broad lesson is that, given an economic contraction, governments have a choice between numerous, competing policy options, all of which must be weighed in terms of their combined effect on the economy. As a policy line, macroeconomic stabilization of any sort must be conducted with a view toward how government policies affecting market incentives will either reinforce or undermine the stabilization efforts under way.

CHAPTER 13

The Macroeconomic Challenge

The performance of the economy at the macro level depends on the ability of the decentralized price system to coordinate billions of decisions concerning the allocation of time between work and leisure, and the allocation of current income between consumption and saving. Government policies as they affect these decisions should be calibrated to be as welfare enhancing as possible, recognizing that such policies, though well intended, can be the opposite of what is called for—this is because of the possibility of misdiagnosis some underlying problem.

There *are* some principles of macroeconomic policy making that are well grounded in both theory and evidence. One is that government policies that narrow the wedge between before-tax and after-tax wage rates, and between the before-tax and after-tax return to saving are welfare enhancing. Policies that narrow that wedge reduce the cost of labor and capital and thereby induce firms to hire more of both. They likewise induce workers to work more and savers to save more and thus, on that account as well, expand work and the availability of financial capital.

There is, in the debate over taxes, the question of just how effective tax-rate reductions are for expanding work and saving (and therefore investment). If the income effects of cutting tax rates are strong, then the result might be only a small increase in work and saving. Paradoxically, the income effect of a cut in tax rates will be smaller the more useful the government program that must be sacrificed because of the loss in tax revenue. Proposals to untax net investment and to recoup the lost revenue by raising taxes on labor income offer a promising approach to tax reform for the very reason that they avoid revenue losses and therefore the income effects that would diminish the expansive effects of untaxing net investment.

In times of protracted low employment, the government faces the problem of coming up with the correct diagnosis of what caused the problem. If the cause is excess supply, then the correct response is monetary and fiscal expansion. If it is excess demand, the correct response is monetary and fiscal contraction.

When there is excess supply, there is a need to increase demand. That argues for the government as Santa Claus (lower tax burdens and more spending all around!). But when there is excess demand, there is a need to increase supply. That argues for the government as Scrooge (higher tax burdens and less spending all around—no Christmas holiday for you, Cratchit!).

We began this book by citing an opinion editorial by Alan Blinder, as an example of how badly economists have been missing this point. The short-run, low-employment problem does not call automatically for government policies aimed at expanding aggregate demand. Rather, it calls for a diagnosis aimed at determining whether the government should increase aggregate demand relative to aggregate supply or to increase aggregate supply relative to aggregate demand. *Supply-side* policies can be as germane in the short run as in the long run. This is so important a point that we should abandon the whole expression *supply-side economics* in order to make clear the fact that there is a need to choose between supply-side and demand-side remedies in the short run. The short run has to do with short-run aggregate supply and demand curves that move up or down in response to government policies and market forces. The long run calls for classical prescriptions for moving the long-run aggregate supply curve to the right.

The recent U.S. recession provides an object lesson in the importance of these distinctions. The safety-net expansion addressed by Casey Mulligan shrank the supply of labor causing the long-run aggregate supply curve for aggregate output to move to the left and perhaps also reduced economic growth to a new, lower *normal*. Even had there been no recession, output and employment would have gone down as a result of this policy. But there was a recession, and from the evidence, the safety-net expansion further shrank the supply of labor. This became one factor in causing the recession to be as deep as it was and the recovery to be as slow as it has been.

We have seen that an increase in the saving rate will increase output per capita. But it will not put output per capita on a higher growth path. For output per capita to grow steadily, there must be steady growth in the *Z* of Chapter 6. And this *Z* stands for, not just technology, but for all the factors—the quality of the country's legal system, confidence in the government and in government policies, a strong system of property rights—that businesses need in order to invest their capital. As I complete this book and see the rule of law eroding day by day in the face of ad hoc policy making from the White House, I suspect that the greatest need when it comes to macroeconomic growth is to restore confidence in our federal government. That need calls for a renewed emphasis on economic growth as a policy goal and on the kind of policies that are likely to bring it about.

A renewed emphasis on economic growth will not, however, eliminate economic contractions. Stabilization policies will continue to be an important part of the government's policy arsenal. What we have learned in the course of the preceding chapters is that it is no easy matter to identify the correct stabilization policy to apply. The correct policy may be either expansive or contractive, depending on how wages and prices have failed to adjust in tandem with each other. And what would otherwise be the correct stabilization policy might fail if undermined by government policies that limit wage-price flexibility.

The standard argument is that macroeconomic policy requires policy makers to walk a fine line between full employment and price stability. The goal, according to this argument, is to orchestrate just the right expansion in monetary and fiscal policy, to the end of nudging the economy back to full employment without threatening inflation.

We have found that the problem is more complicated than that. For one thing, we have seen how a contraction could occur because prices and wages are *not* rising as they should in order to restore balance between aggregate supply and demand.

The slowness with which the United States and much of Europe are recovering from the recent Great Contraction portends a new era of protracted low employment, one for which it remains an open question whether expansive or contractive monetary and fiscal policies are called for.

We saw in Chapter 10 that a Keynesian slump manifests itself directly in an increase in the unemployment rate and that a repressed-wages slump manifests itself directly in a decrease in the labor-force participation rate. Yet either kind of slump can produce a decrease in both. This illustrates the problem of diagnosing a slump and identifying the appropriate policy response.

All we can hope to do is to group different strands of policy into different categories of causes—INUS causes—without any sure way to determine which category of causes best fits the facts. In macroeconomics, it's not a choice between a short circuit or a lightning strike in determining the cause of a fire. More than likely, there will be a short circuit as well as a lightning strike to consider in sorting things out.

So it is not just that policy makers have to walk a fine line. It is also that the line is blurred and constantly shifting. The only policy line that seems to be as important in the short run as in the long run is the one that minimizes distortions in the price system created by taxes, welfare benefits, minimum wage laws, and the like.

Sustained real GDP growth requires price and wage flexibility of the kind that will permit the economy to avoid long-lasting, deep contractions of the kind just experienced. Absent such contractions, the task of achieving price stability is reduced to one of bringing about the correct rate of monetary growth. When a contraction occurs, the task becomes one of choosing between policy options that include contractive monetary and fiscal policy. And whatever option is called for, its successful implementation requires attention to price and wage rigidities—some introduced by the government—that can undermine the effectiveness of any stabilization policy in moving the economy back to full employment.

The task of macroeconomic stabilization, to use one last metaphor, is akin to that faced by the sailor passing through a narrow channel who has to tack just enough in either direction in order to avoid the dangers on both sides. That great sailor Odysseus tied himself to the mast in order to resist the call of the sirens, who would have lured him and his crew to their demise. What policy makers who put a high value on economic growth must do is avoid the siren call of redistributionist measures that make their task of tacking between the rocks more difficult.

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David G. Tuerck is professor of economics and executive director of the Beacon Hill Institute for Public Policy Research at Suffolk University in Boston. He received his PhD in economics from the University of Virginia, and has over four decades of experience in teaching and research, including serving on the senior staff at the American Enterprise Institute and serving as a director in the Economics Consulting Group of Coopers & Lybrand in Washington, DC. On the national stage, he has testified before the Senate Labor and Human Resources Committee on U.S. welfare policy, before the House Committee on Oversight and Government Reform on construction union issues, and, most recently, before the House Committee on Ways and Means on national tax policy.

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