Money and Banking: What Everyone Should Know

Michael K. Salemi, Ph.D.

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Michael K. Salemi, Ph.D.

Professor of Economics
and Chair of the Department of Economics
University of North Carolina at Chapel Hill

Professor Michael K. Salemi is Professor of Economics and Chair of the Department of Economics at the University of North Carolina at Chapel Hill. He has been a member of the faculty there since 1976 and a Professor of Economics since 1987. He has held three distinguished term professorships at UNC–Chapel Hill: Zachary Smith Professor of Economics from 1993 to 1996 and Bowman and Gordon Gray Professor of Economics from 1987 to 1990 and again from 2005 to 2010.

As an undergraduate, Professor Salemi studied Economics at St. Mary's College in Winona, Minnesota, and received his bachelor's degree in 1968. He earned master's degrees in Economics from Purdue University in 1969 and from the University of Minnesota–Minneapolis in 1973, and he earned his doctorate in Economics from the University of Minnesota–Minneapolis in 1976.

At UNC–Chapel Hill, Professor Salemi has taught a wide variety of undergraduate courses, including Money as a Cultural, Economic, and Social Institution, a first-year seminar he created. He routinely teaches Principles of Economics and has taught Intermediate Macroeconomic Theory and Money, Banking, and Financial Markets. To graduate students, Professor Salemi has taught Advanced Macroeconomic Theory, Monetary Theory, and advanced seminars in Macroeconomic Policy and Research on Monetary Policy.

Professor Salemi has completed a variety of international assignments during his career. He was a Research Associate and Visiting Professor at The Graduate Institute in Geneva, Switzerland, from 1982 to 1983 and 1985 to 1987 and in 2001 and 2002. The Asian Development Bank selected him as a contributor to seminars on monetary policy for transitional economies in Beijing in 1991 and in Lao in 1992. Under the aegis of the Swiss State

Secretariat for Economic Affairs, he designed and delivered a technical assistance and training program at the State Bank of Vietnam in Hanoi in 2004. More recently, he was a visiting fellow at the Hong Kong Institute for Monetary Research in 2007 and again in 2008.

Professor Salemi is the author of 2 books and more than 60 published articles in macroeconomics, domestic and international monetary theory, and economic education. He is the coauthor of *Discussing Economics: A Classroom Guide to Preparing Discussion Questions and Leading Discussion* and *Teaching Innovations in Economics*. His journal publications have focused on formulation and estimation of optimal monetary policies, explanations for high unemployment in Hong Kong, and strategies for effectively teaching economics to undergraduate students.

Professor Salemi has had a career-long interest in economic education. While a graduate student, he served as Assistant Director of the Center for Economic Education at the University of Minnesota–Minneapolis. In 1977, he created the Teacher Training Program for graduate student instructors of economics at UNC–Chapel Hill, a program that is widely described as one of the best of its kind in the world. Professor Salemi has taught in the program and has helped administer it throughout his career.

An acknowledged expert in economic education, Professor Salemi has served as an instructor, workshop director, and workshop program director for national programs in teacher education. He was co-principal investigator for "Interactive Teaching in Undergraduate Economics Courses: Bridging the Gap between Current and Best Practices," funded by the National Science Foundation from 2004 to 2010. The American Economic Association (AEA) selected him to serve on its Committee on Economic Education from1981 to 1988, 1990 to 2000, and 2001 to 2007 and to chair the committee from 1994 to 2000. More recently, the AEA chose him and William Walstad to design, administer, and teach a continuing education program in economic education.

Professor Salemi has been a featured speaker on the teaching of economics throughout his career. He has given talks at many colleges and universities,

including the University of Notre Dame, Michigan State University, Stanford University, Wellesley College, University of Kentucky, and Baylor University. He has been selected as a featured presenter at many conferences devoted to economic education.

Professor Salemi has received numerous teaching awards. From UNC–Chapel Hill, he received the Tanner Award for Teaching in 1980, the Instructor Excellence Award of the Young Executive Institute in 1986, the Economics Undergraduate Teaching Award in 1994 and again in 2000, and the Economics Graduate Teaching Award in 2002.

The recipient of a number of national awards as well, Professor Salemi was awarded the Bower Medal in Economic Education in 1998 from the Council for Economic Education. The National Association of Economic Educators awarded him the Villard Award for Research in Economic Education in 2001. The Gus A. Stavros Center named him a Great Teacher in Economics in 2007. He is also listed in Marquis *Who's Who in America*.

Professor Salemi is married to Ariana Pancaldo and is the father of Benjamin, Caitlin, and Chiara Salemi. He is an avid squash player and also an amateur photographer and woodworker. He enjoys hiking, particularly in the American Southwest. ■

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Money and Banking: What Everyone Should Know

Scope:

Most of us like money and believe we should have more of it. Economists think of money as an agreement—a social contract—among individuals that, if kept, makes our economic lives better and allows our economies to grow more rapidly. In this course, you'll learn much more about money as a social contract, as well as such topics as inflation and hyperinflation; financial institutions; stocks, bonds, and derivative securities; and central banks, exchange rates, and monetary policy coordination among developed nations. The last lecture considers the challenges that confront our monetary and financial institutions in the coming years.

Perhaps the most important point you will encounter in this course is that economies require efficient and ever-evolving financial institutions and markets in order to maximize their potential. The first lecture is a preview of the ways in which you will come to understand the connection between financial matters and economic well-being, focusing specifically on the interdependent relationship between Wall Street and Main Street. The second lecture looks at the evolution of money over time and its importance as a social contract that lowers the cost of trading. Lecture 3 continues the history of money with a look at the money creation process, from its original backing with gold to our current system of fiat money that is not backed by any commodity. Lecture 4 takes up the monetary history of the United States and the debates that have taken place since the founding of our nation about the proper role of the federal government in monetary and banking affairs. Lecture 5 closes your introduction to money with some interesting examples of local currencies and nonstandard banks.

In Lectures 6 and 7, you explore the topics of inflation and hyperinflation. You'll learn why it is rational to fear high rates of inflation and volatile inflation histories and why economists say that hyperinflation is the ultimate repudiation by a government of its money. Lecture 8 looks at the

connection between saving and investment and the importance of investment as a contributor to economic growth. Lecture 9 covers the concept of the real rate of interest and explore the connection between interest rates and inflation.

With Lecture 10, you begin a series of 3 lectures on financial firms and institutions, specifically, financial intermediaries, commercial banks, and central banks. You'll see that financial intermediaries—firms that channel funds from savers to investors and others—enable us to make financial provisions that we could not make on our own. You'll also learn how both commercial banks and central banks create money and look at the responsibility of central banks for the growth in the money supply of their nations.

In Lecture 13, you explore the process of moving money through time and the tool that allows us to compare the value of a dollar at 2 different dates: present value. Lectures 14 and 15 begin an investigation of decision making in the face of uncertainty, looking at the concepts of probability, expected value, and risk and risk aversion. These concepts also provide a background for investigating financial institutions, which routinely make decisions in the face of uncertainty when they decide whether to lend funds or to underwrite an initial public offering of stock

In Lectures 16 and 17, you get an introduction to bond markets, learn about the various types of government and non-government debt obligations, and see how bond markets determine interest rates. In Lecture 18, you zero in on interest rates, which we can think of as market-determined "prices" for a "good" we call "early use of funds." Then, in Lecture 19, you learn why interest rates tend to move together and look at the factors that account for differences in interest rates, including inflation and risk. Lecture 20 introduces us to a kind of crystal ball we can use to predict interest rates in the future—a combination of price information on Treasury securities and something called the "expectations hypothesis."

Lecture 21 begins a series of 3 lectures on the stock market. After an introduction to stock markets, we look at 2 models used by academics and professionals to study how stock prices should be connected to economic

events. We also explore the phenomena of stock market bubbles, which provide important insights into the workings of markets. In Lecture 24, you turn to derivative securities, the "toxic assets" of the financial market crisis that began in our country in 2008. As you'll see, these can also be useful tools that allow decision makers to lower the risk of their business operations. Lecture 25 focuses on the problem of asymmetric information—a situation in which one party in a transaction has more information than another—and learn how this problem affects financial markets. Then, in Lecture 26, you apply the concept of asymmetric information to understand how and why financial firms are regulated.

Lecture 27 brings us to a topic touched on throughout the course: the subprime mortgage crisis of 2008. Here, we consider the causes of the crisis, specifically, the contribution of mortgage-backed securities, as well as how the regulatory reform that followed is likely to change the financial landscape in the future. Lecture 28 considers the actions the Federal Reserve has taken to accelerate economic recovery and compare the Fed's policy with that of the European Central Bank. Lectures 29 and 30 ask what the objectives of monetary policy should be and whether central banks should follow rules or use discretion in conducting monetary policy. With Lecture 31, you return to the Federal Reserve, examining what constitutes "normal" policy for the Fed, the extraordinary actions undertaken by the Fed in the wake of the crisis of 2008, and the question of whether or not the Fed went too far. Lecture 32 looks at the topic of central bank independence and asks whether greater independence is associated with desirable economic outcomes.

Before the final lecture on challenges for the future, lectures 33 through 35 look at international monetary and financial relationships, including an introduction to exchange rates, the roles of financial institutions in international trade and finance, and the case for coordinated monetary policy among the nations of the developed world. Finally, in Lecture 36, we outline 3 questions and related challenges that will greatly affect the world's economies in the future: Will the United States solve its long-run deficit problem? Will the euro survive? And will regulators find a solution to the "too big to fail" problem? The resolution of these questions will

greatly affect future growth, inflation, and financial arrangements around the world. ■

The Importance of Money

Lecture 1

Economists are fascinated by the idea of money as a social institution—an agreement among individuals—that, if we keep it, makes our economic lives better and allows our economies to grow more rapidly. This contract is as important to modern society as the invention of the wheel, and in this course, you'll learn much more about this contract and what it means to keep it. By way of introduction to our study of money, this first lecture explores the intimate connection between Wall Street and Main Street; much attention has been focused on this relationship as the United States has attempted to recover from the subprime mortgage crisis and the Great Recession.

Wall Street versus Main Street

- Our nation's attempts to recover from the subprime mortgage crisis and the Great Recession were often discussed using the metaphor "Wall Street versus Main Street."

- On October 3, 2008, as the subprime mortgage crisis was going from bad to worse and the Great Recession was showing itself to be much worse than the typical downturn, Congress enacted the Emergency Economic Stabilization Act of 2008. That act created the **Troubled Asset Relief Program** (TARP), which provided funds for the bailout of troubled financial firms. Over the coming months, the Federal Reserve and the Treasury used TARP funds aggressively to keep banks and non-bank financial firms from failing.

- At the same time, there was a populist outcry that the federal government should do more for Main Street, that is, for the workers and firms that were suffering because of the Great Recession.

- The important lesson for us is that the "Wall Street versus Main Street" idiom is inherently flawed because the success of each of these entities is inextricably bound together. Neither can "win" without the other. Economies require efficient and ever-evolving financial institutions and markets in order to maximize their potential.

The Connection between Wall Street and Main Street

- Why is it that the fates of Main Street and Wall Street are so closely intertwined? The reasons for this connection between financial matters and economic well-being can be boiled down to four:

    - **Stable value money is essential to efficient trade:** Adam Smith, in his book the *Wealth of Nations*, argued that a nation becomes wealthy when it organizes its productive efforts to take advantage of specialization, but specialization is an inherently social activity. Producing an excellent product only makes sense if we can trade it for other things that we want but do not produce. Thus, trade is essential to wealth creation and improvement in the quality of life. Smith also tells us, however, that trade can be accomplished efficiently only in a society that has adopted money.

    - **Healthy banks are essential to the process of channeling funds from savers to investors:** At its core, a bank is an institution that channels funds from savers to investors. This process is fundamental to economic growth. If those with productive ideas had to wait until they accumulated sufficient funds from their own saving before they acted on their ideas, little growth would occur.

    - **Efficient asset markets are essential to establishing values for debt instruments, currencies, and shares of stock:** It's important to know the value of financial instruments. One of the key reasons for the subprime mortgage crisis that led to TARP and contributed to the depth of the Great Recession was

the simple fact that banks held large quantities of mortgage-backed securities.

- **A well-designed and well-executed monetary policy is essential for an economy to keep inflation low and steady and keep resources fully employed:** Monetary policy as we think of it today began with the creation of the Federal Reserve System in 1914. There is still, however, a great deal of disagreement, even among economists, about what constitutes a well-designed and well-executed monetary policy.

- In this course, you will learn how the Federal Reserve changes interest rates in order to pursue its policy objectives, and you'll see that sometimes, as in the years of the Great Recession, the Fed also loans directly to financial firms.

- In 2014, the Federal Reserve will celebrate its 100th anniversary. Some economists and politicians believe that the best thing we could do on that anniversary would be to eliminate the Fed or make significant changes to it.

- Some argue that the Fed wields too much power, and they are angered by the Fed's bailout of financial firms during the Great Recession. Others believe that the Fed has learned a lot about the proper conduct of monetary policy during its first 100 years, although even those who are champions of the Fed would like to see its operations fine-tuned.

- Upcoming lectures are devoted to creating a better understanding of central banks and central bankers, not only in the United States but also in the United Kingdom, China, and other developed nations. In this context, we will ask several important questions: What threatens the value of our money? Why is it important to preserve the value of money, and what can a central bank do to achieve that goal? And given that a central bank is committed to preserving the value of money, is there room for it to do more?

Important Term

Troubled Asset Relief Program (TARP): Provided funds for the bailout of troubled financial firms after the subprime mortgage crisis during the Great Recession.

Suggested Reading

Cassidy, "Anatomy of a Meltdown."

Federal Reserve Bank of San Francisco, "The Economy, Crisis and Response."

Greider, *Secrets of the Temple*.

Paulson, *On the Brink*.

Questions to Consider

1. How would you have handled the money problem faced by the 19th-century farmer?

2. What recommendations would you have offered to the neighbors on the Great Plains who were thinking about pooling their funds to build a windmill?

3. Now that you have been introduced to this course, what are the questions that you hope the course will answer? You might want to make a brief record of these and come back to them later.

4. How reasonable do you think it is to describe Ben Bernanke as one of the most powerful men in the world? Why?

Money as a Social Contract

Lecture 2

This lecture, begins with a basic definition of "money" and traces the evolution of money through five stages: barter, commodity money, coined money, paper money backed by coins, and fiat money, which is what we use today. Throughout this evolution, you'll see that money operates as a social contract—members of society agree to accept money in exchange for goods and services. As we'll see, this contract has developed as it has because members of society have constantly sought to meet 2 competing goals: to lower the cost of trade while ensuring that money retains its value.

"Money" Defined

- The standard definition of **money** used by economists is something that can be used as a medium of exchange.

- Money is valued, not because it is intrinsically useful, but because it can be exchanged for useful things.

- This connection between money and exchange helps us understand the most important point in this lecture: Money is a social contract that lowers the cost of trading and has evolved gradually through time.

Barter

- **Barter**, defined as exchange without money, is the first stage in the evolutionary history of money.

- In *Money and the Mechanism of Exchange*, the economist William Jevons stated, "The first difficulty in barter is to find 2 persons whose disposable possessions mutually suit each other's wants … there must be a double coincidence, which will rarely happen."

- The search for a narrowly defined trading partner is costly because it takes time and the costs of locating trading partners and negotiating trades are disincentives to specialization.

- Primitive societies faced tremendous incentives to lower the cost of barter and often settled on successful schemes, including credit arrangements.

Commodity Money

- The next stage in the evolution of money is the development of commodity monies. A society uses **commodity money** when individuals typically buy and sell goods by exchanging a particular commodity that is agreed upon in the society to be acceptable for exchange.

- Commodity money has taken many different forms, including salt, cowry shells, large stones, and bricks of tea.

- Government has often played a role in deciding which commodity would function as money. For example, if a ruler or leader favored a certain kind of shell or feather, it might become money, although the commodity chosen as money must be scarce.

Coined Money

- As primitive peoples traveled beyond the borders of their homelands, they frequently found that their local money was not accepted and sought alternative ways to facilitate trade. Metals, especially gold, silver, bronze, and copper, were found to be valued in many societies, leading to the next stage in the evolution of money: the use of metals, in particular, metal coins.

- Several forces favored the use of metal rather than other commodities as money. Metal could be used to make a variety of goods, such as knives; it was durable; and it was typically more valuable (per unit of weight) than other commodities, which lowers the cost of transporting money.

Photos courtesy of Classical Numismatic Group, www.cngcoins.com.

Coining money provided governments with revenues because the government typically owned the mints that converted raw metals into coins and collected fees from those who sold metals to the mint.

- There were, however, 2 disadvantages to using lumps of metal as money: It was costly to verify the true metallic content and purity of a lump of metal, and it was costly to weigh the lump.

- By creating coins from metal, governments lowered the costs of using metal as money.

- The mint owner could also raise revenue by lowering the metal content of its coins. The word **seigniorage** denotes the revenue that a government obtains by deflating the value of its money. Seigniorage could be as simple as shaving metal from the edges of the coin or as complex as changing the price that the mint offers for metal to be coined.

Paper Money Backed by Coins

- The transition from coins to paper money is rooted in the practice of allowing citizens to deposit their goods in temples and palaces, which were relatively secure, well-guarded structures and were able to protect the citizens' wealth. The origins of paper money are the "warehouse receipts" received for deposits of precious metals and other commodities.

- The receipts themselves began to function as money when third parties traded them for commodities, rather than withdrawing their deposits. This practice represents the next step in the evolution of money: using money backed by a metal money, such as gold or silver.

- The use of this paper money lowered exchange costs because it was easier to exchange warehouse receipts than deposits.

- The managers of depositories soon realized that they could make loans to new parties by issuing new warehouse receipts. The scheme worked because on any given day, only a small fraction of deposits were withdrawn from the depository.

Fiat Money

- The final step in the evolution of money is the creation of **fiat money,** money that is valuable in exchange because a government declares it is.

- In 1844, the Bank of England established a rigid link between the amount of paper money in circulation and the gold reserves of the Bank of England. This meant that the supply of money in England would fluctuate with the gold reserves of the bank and with the availability of gold in general. Discoveries of gold in the New World led to rising prices of goods in terms of gold.

- For the next 130 years, it was typical for Western economies to back their paper money with gold. In most cases, paper money was convertible; that is, holders of paper money could demand gold in exchange at a rate set by the government.

- In times of national emergencies, for example, in World War I and World War II, nations abandoned the gold standard and suspended the convertibility of their currencies. Suspending convertibility allowed nations to finance some of the costs of war by issuing more currency than their gold stocks would have previously permitted.

- At the end of both World Wars, nations returned to the gold standard but quickly experienced problems. The supply of gold grew too slowly and erratically to allow the supply of money to keep pace with growth.

- For a time, the International Monetary Fund supplemented the supply of gold with "paper gold" called "special drawing rights." But the gold standard ended with President Nixon's decision in 1973 to permanently suspend the convertibility of the U.S. dollar into gold.

- In Western economies today, we use pure fiat monies that are backed by no commodity. The money is valued partly because governments declare it to be "legal tender for all debts public and private." Ultimately, however, money is valued because people agree it is valuable; people agree to accept money in exchange because they believe they can use money to purchase useful things whenever they wish.

Four Takeaways from the Evolution of Money

- Money is a social contract in that members of society agree to accept money in exchange for goods and services.

- This social contract has developed gradually through history because it has taken time to develop the trust necessary to exchange something of intrinsic value (a pound of nails) for something of no intrinsic value (a pound note).

- The contract has developed as it has because members of society have constantly sought to meet 2 competing goals: to lower the cost of trade while ensuring that money retains its value.

- Government is essential to the organization of monetary arrangements. Throughout history, government has played a crucial role in the development of the money contract. Today, it allows us to operate in a highly efficient fiat money exchange system. But our fiat holds its value only if our Federal Reserve keeps the supply of money from growing too rapidly. If the Fed fails, inflation results—and inflation is the modern counterpart to seigniorage.

Important Terms

barter: Exchange without money.

commodity money: A particular commodity that is agreed upon in the society to be acceptable for exchange.

fiat money: Money that is valuable in exchange because a government has declared it to be.

money: Something that can be used as a medium of exchange.

seigniorage: The revenue that a government obtains by deflating the value of its money.

Suggested Reading

Einzig, *Primitive Money*.

Jackson, *The Oxford Book of Money*.

Radford, "The Economic Organization of a P.O.W. Camp."

Smith, *The Wealth of Nations*.

Questions to Consider

1. What would be the relative advantages of a monetary system based on coinage of a precious metal, such as gold, over a fiat money system similar to what we have in the United States today?

2. Would the United States be better off with money backed by gold than with fiat money?

3. Why is it reasonable to describe inflation as the "modern-day equivalent of seigniorage"? The lord of the manor benefited from seigniorage in times past. Who benefits from inflation today?

How Is Money Created?

Lecture 3

There was a time when producing money meant mining a metal, such as gold. But that process has evolved to the point that today, money is created out of thin air by the central banks of the world, including the U.S. Federal Reserve. Many public figures believe that the United States should return to the gold standard—an arrangement in which governments agreed to peg the value of their paper money to gold. In this lecture, you'll gain a better understanding of how that system worked and why it ended, as well as the costs and benefits of our modern money-creation mechanism.

T-Accounts and London Goldsmiths

- In thinking about the creation of money, it is helpful to use the **T-accounts**, which is a graphical representation of the balance sheet of an economic entity. The T-account lists assets on the left and liabilities on the right. **Net worth**, also listed on the right, is the value of assets minus the value of liabilities.

- Recall from the last lecture that warehouse receipts for gold were the earliest forms of paper money used in Western civilization. In London, individuals deposited their gold with goldsmiths for safekeeping. In return, the goldsmiths issued gold receipts, which people then used as a convenience when buying and selling goods. The receipts for gold were paper money backed by gold deposits.

- Under this system, goldsmiths quickly realized that, on any given day, they held more gold in their safes than they needed either for their work or to satisfy customers who wished to trade back their receipts for gold. They concluded that they could create new warehouse receipts and lend them at interest to other customers.

Joe's Balance Sheet

Assets:		Liabilities:	
Automobile	$4,000	Credit card Balance	$750
Checking	200		
Savings	500		
		Net Worth:	
		$4,700 - 750 = $3,950	

Source: Michael Salemi.

- The creation of warehouse receipts did not increase the net worth of the goldsmith until the amount borrowed was paid back with interest.

- The gold warehouse receipts are an example of a gold-backed paper currency. The warehouse receipts circulated as money as long as the goldsmith/bank continued to redeem the receipts for gold whenever customers demanded gold. In this scenario, each goldsmith/bank held its own gold reserves.

- Banks in the United States continued to make loans with paper backed by gold well into the 19th century. Each individual bank held its own warehouse receipts and issued its own currency, although individual banks and their currencies often failed.

The Gold Standard

- The **gold standard** was an agreement among participating countries to fix the price of each country's currency in terms of an ounce of gold. England adopted the standard in 1819, and the United States adopted it in 1834.

- Under the gold standard, the government promises to buy and sell gold in exchange for its currency in order to keep the currency price of the gold at the promised value.

- Under a credible gold standard, the national currency is "as good as gold" and banks hold it in reserve.

The Bank of England

- The typical English bank operated in much the same way under the gold standard as it did after the gold standard was eliminated.

- The bank held British pounds in reserve so that depositors could convert their deposits to pounds whenever they wished. Depositors

The Bank of England is the central bank of the British system, the equivilant of the U.S. Federal Reserve.

rightly thought of the deposits as equivalent to pound notes because the bank stood ready to redeem deposits for currency.

- The bank used its **excess reserves** to make new loans by creating new deposit accounts for borrowers. Excess reserves were those calculated to be beyond the amount required by law or prudence.

- The real difference between the period of the gold standard and earlier times, when each bank held its own gold reserves, centers on the role of the Bank of England, the central bank of the British system.

- Under the gold standard, the Bank of England held the gold that backed the British pound, and its gold holdings placed an upper limit on the supply of British pounds.

- How did the Bank of England fulfill its promise to fix the price of gold in terms of pounds so that the pound remained as good as gold? If the value of the pound began to fall in terms of gold (that is, if the pound price of gold began to rise), the Bank of England raised the interest rate it charged on loans to other banks, which raised interest rates in England and tended to create a gold inflow. This inflow made gold more plentiful in England, reducing the price of gold and increasing the price of the pound in terms of gold.

- If the value of the pound began to increase in terms of gold (that is, if the pound price of gold began to fall), the Bank of England lowered the interest rate it charged on loans to other banks, which lowered interest rates in England and created a gold outflow from England to other counties. The gold outflow made gold less plentiful in England, increasing the price of gold and reducing the price of the pound in terms of gold.

The Current System of Monetary Creation

- Under our current system, it is the law of the land that currency is a valid form of payment for all debts. As you recall, the paper money issued by the central bank of the nation is valuable by fiat, that is, by government declaration.

- For the individual bank, the T-account is unchanged because each bank continues to hold the national currency in reserve for deposits.

- The difference is that after the gold standard ended, the Bank of England no longer fixed the price of gold in terms of the British pound. Therefore, it no longer had to increase gold reserves to levels sufficient to make credible its promise to buy pounds with gold.

- The Bank of England was free to create currency by making loans to banks without increasing its gold holdings. Banks in England that received the increases in currency through the deposit process were, in turn, free to create new deposits by making new loans to customers.

- There were—and are—no limits on the creation of money beyond the self-imposed limits set by the Bank of England.

The End of the Gold Standard

- During World War I and World War II, the Bank of England (and the central banks of most other combatants) left the gold standard temporarily in order to finance war expenditures by issuing new currency.

- After World War II, under the so-called Bretton Woods system, the United States fixed the dollar price of gold at $35.00 per ounce. Other nations held the dollar as reserves.

- Led by the United States, the world finally left the gold standard on August 15, 1971, when President Nixon announced that the United States would no longer redeem U.S dollars for gold.

- The United States left the gold standard because it placed tight restrictions on our ability to increase the supply of paper money. These restrictions were incompatible with other U.S. policy objectives, such as financing the Vietnam War.

Costs and Benefits of Returning to the Gold Standard

- There appears to be only one benefit to returning to the gold standard: On average, inflation was lower under the gold standard than it was in periods when central banks could create money without adding to gold reserves.

- In contrast, a return to the gold standard brings with it numerous costs. For example, U.S. prices were more volatile during the gold standard period than after it. It is also expensive to maintain a gold reserve; Milton Friedman estimated this expense to be as much as 2.5% of GNP.

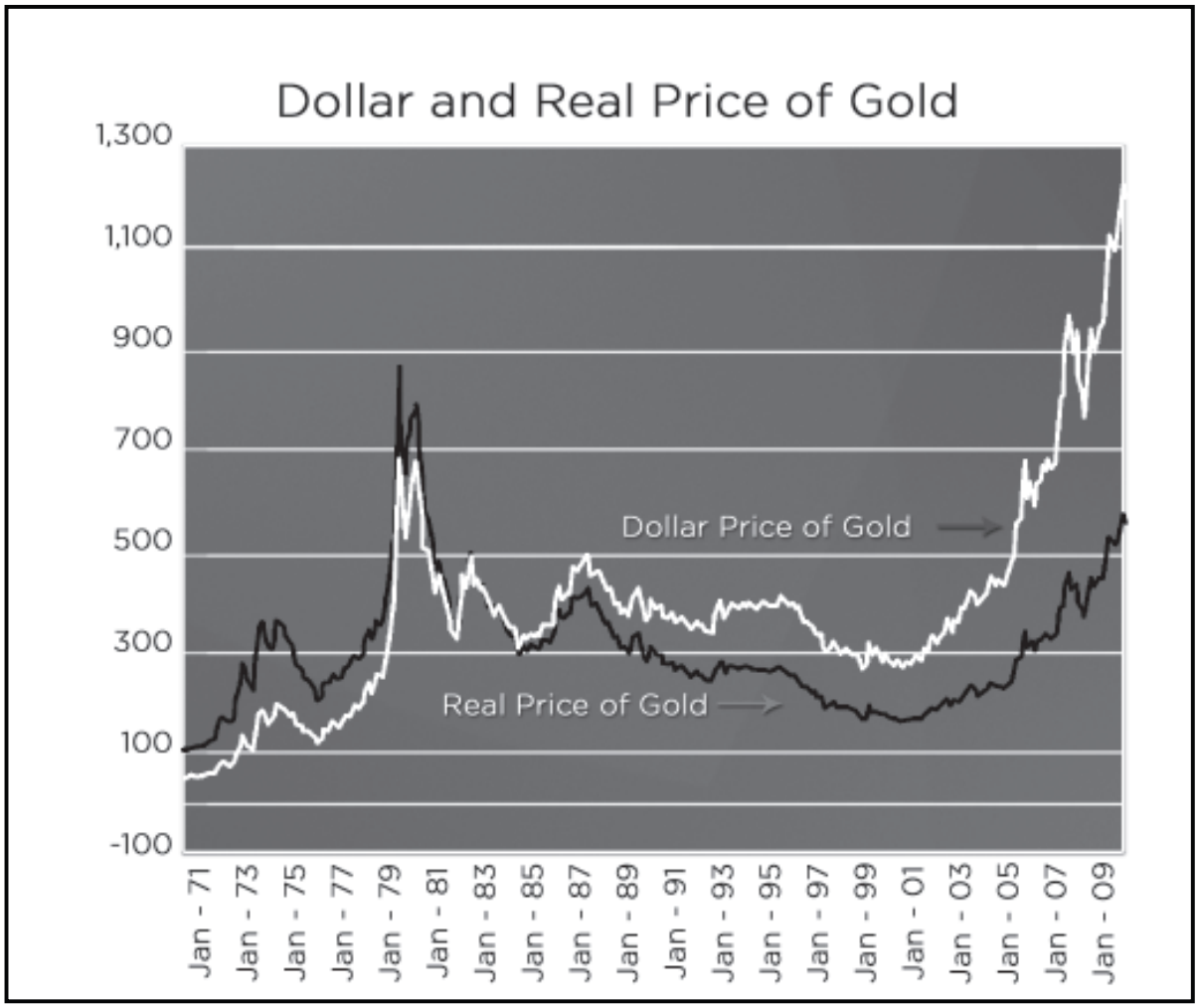
- Further, under a gold standard, central banks are not free to undertake counter-cyclical policies, and nations fix the values of their currency to gold, implying that all exchange rates are constant and do not adjust to market forces.

- Finally, gold discoveries are random events, and the United States accounts for only a small share of them. At the same time, the real price of gold is highly variable. If the United States were still on the gold standard, it would have been trying to keep the price of gold constant while world market forces dictated that it should be changing significantly.

- Consider what has happened to the price of gold since the United States and the world abandoned the gold standard: The dollar price of gold hit an all-time high in 2010 at more than $1230 per ounce. Compare that to the real price of gold in 2010 as seen in Figure 3.1

- The real price of gold has been highly variable; this is not a surprise: World demand and supply for gold varies a lot, and the real price of gold adjusts accordingly.

Figure 3.1



Source: World Gold Council, Federal Reserve Bank of St. Louis.

Important Terms

excess reserves: Reserves that were calculated to be beyond the amount required by law or prudence.

gold standard: An agreement among participating countries to fix the price of each country's currency in terms of an ounce of gold. England adopted the standard in 1819, and the United States adopted it in 1834.

net worth: Is the value of assets minus the value of liabilities.

T-account: A graphical representation of the balance sheet of an economic entity. The T-account lists assets on the left side and liabilities and the asset's net worth on the right.

Suggested Reading

Bordo, "Gold Standard."

Krugman and Obstfeld, *International Economics*.

Redish, "Anchors Aweigh."

Questions to Consider

1. During the gold-standard years, were British pounds and U.S. dollars "as good as gold"? Why or why not?

2. Does the dramatic increase in the price of gold documented in the last chart of the lecture constitute an argument for the gold standard or against it?

3. During the gold-standard years in the United States, it was illegal for a U.S. citizen to own gold bullion. Today, it is legal. Why do you think the U.S. government forbade citizens from owning gold during the gold-standard years?

Monetary History of the United States

Lecture 4

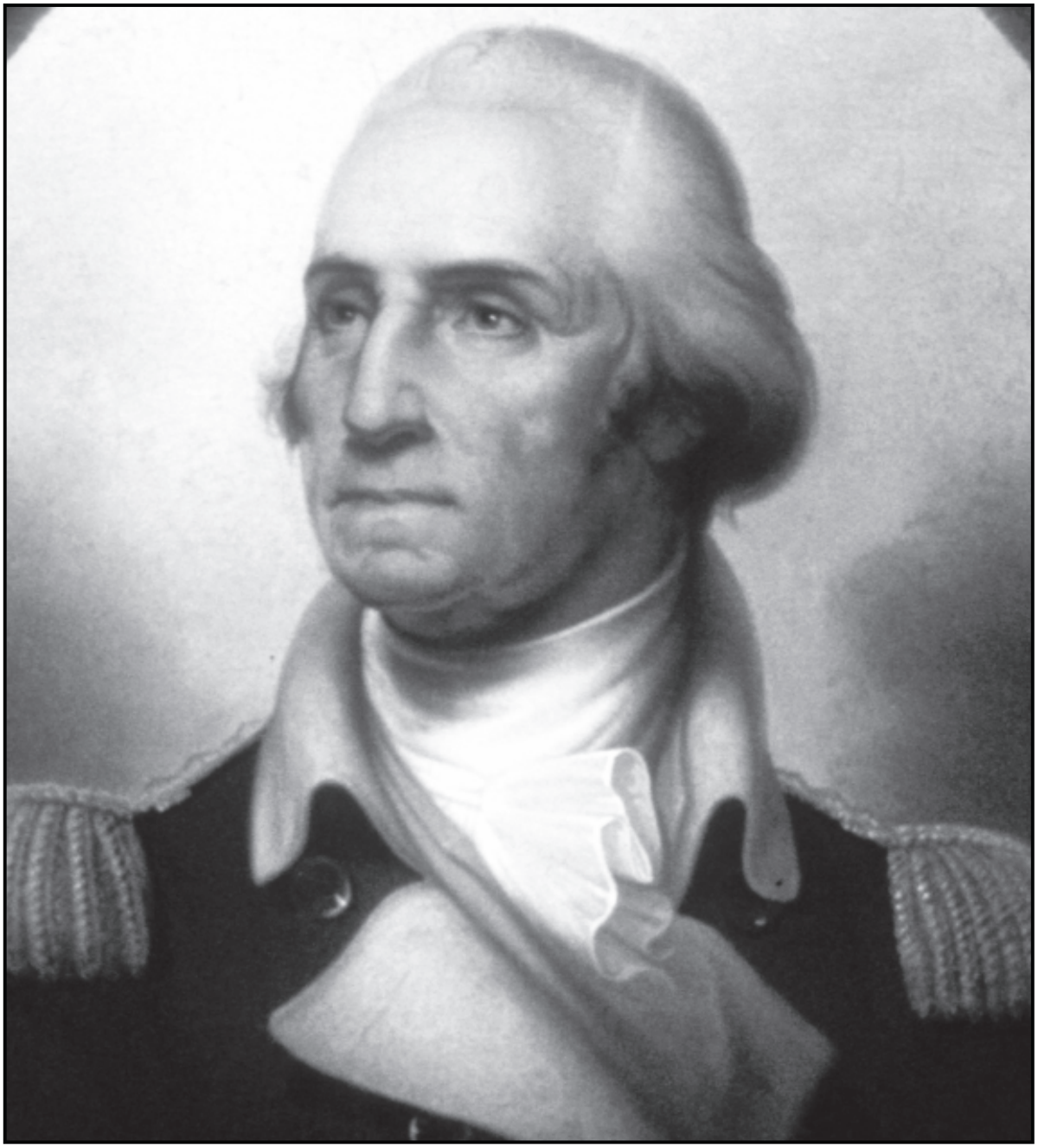
The proper role of the federal government in monetary and banking affairs was debated early and often in the history of the United States. The federal government tried twice in the 19th century—and failed both times—to create a central bank that would oversee banks and maintain a national currency. The question of whether or not a national bank would concentrate too much power in the hands of too few occupied the Founding Fathers as they wrote the Constitution and considered legislation in the first sessions of Congress. But others of our forefathers believed that creation of a national bank and paper money were essential to the development of our nation. In this lecture, we shall see that disagreements about financial arrangements in the United States were tantamount to disagreements between competing visions for our new nation.

The First Bank of the United States

- The first National Bank of the United States was authorized by the Senate and House in 1791. At the time the Bank was chartered, the forces arrayed in favor of it and opposed to it mirrored competing visions for the evolution of our nation.

- Some opposed the Bank on the grounds that the Constitution did not explicitly permit the federal government to create a bank or issue paper money. Some opposed the issuance of paper money itself, fearing that it would invariably lead to schemes in which debtors increased their wealth at the expense of creditors.

- Some opposition to the Bank stemmed from fear of allowing the federal government to set up perpetual institutions, which were considered to be a hallmark of British government and a threat to personal liberty.



President Washington intended to veto the bill authorizing the Bank but was convinced by Alexander Hamilton not to do so. Hamilton argued that the United States, to fulfill its potential as a great commercial nation, required financial and monetary systems that would facilitate payments and trade.

- Finally, some, including Thomas Jefferson, argued that the Bank was a threat to the agrarian way of life that they believed was the best way forward for the United States.

- Those who favored the creation of the Bank, notably Hamilton, believed that it would promote the development of commercial activity in the United States.

- Others supported the Bank because they saw advantages in the creation of paper money. For many farmers, economic activity amounted to raising crops and bartering the surplus with neighbors. These farmers feared that they might lose their lands if taxes were specified to be paid in gold, to which they simply didn't have access.

The Early Years of the First Bank

- In 1791, when the Bank of the United States was established, there was no single banking system in the United States. Four isolated systems existed in Boston, New York, Philadelphia, and Baltimore.

- After the establishment of the Bank, these systems coalesced into a single system that exchanged one another's obligations and maintained ongoing debtor-creditor relationships.

- The Bank of the United States functioned a lot like a central bank. Because it was the main government depository, it became an important creditor to state and local banks, and because it was their creditor, the Bank had the power to regulate local banks by pressing them for payment.

- In 1811, the bill to extend the charter of the Bank was allowed to lapse. Clearly, the country remained divided on the question of the role of the federal government in banking and financial matters. Important constituencies continued to disagree about whether the bank was an appropriate source of financial discipline or whether it amounted to an infringement by the federal government on individual and states rights.

The Second Bank of the United States

- A Second Bank of the United States was established in 1816, but it had operational difficulties almost from the beginning.

- When a panic and recession swept the United States in 1818, the Bank, rather than extending credit to offset the recession, was forced by its lack of reserves to call in credit and intensify the recession.

- The demise of the Second Bank came at the hands of President Andrew Jackson, who believed that it was corrupt and wanted it to cease operations even before its charter expired in 1836.

- Jackson instructed the secretary of the Treasury to deposit federal tax receipts in state banks. The Second Bank began to run at a loss, was converted to a regular bank when its charter was not renewed, and went bankrupt several years later.

The National Bank Acts of 1863 and 1864

- The federal government did not resume control over the monetary system in the United States until the National Bank Acts of 1863 and 1864.

- At the beginning of Lincoln's presidency, Treasury Secretary Salmon Chase had on hand approximately $2 million, a tiny fraction of what Congress had appropriated for war preparations.

- In 1861, the U.S. government suspended payment in gold. In 1862, it issued new legal tender, paper currency called "**greenbacks**."

- The National Banking Acts of 1863 and 1864 created a system of federally chartered banks (national banks) that were supervised by the newly created Office of the Comptroller of the Currency. These national banks were required to purchase Treasury bonds and were allowed to issue greenbacks for up to 90% of their bond holdings.

- The banking acts also created a tax of 10% on banknotes issued by state-chartered banks, with the intent of driving these banks out of existence.

- The creation of the first U.S. dollar can be fairly said to be a byproduct of the federal government's desire for a source of revenue to finance military action during the Civil War.

The Gold Standard and the Coining of Silver

- In the last quarter of the 19th century, 2 important questions faced the United States: When would it return to the gold standard, and would it permit the coining of silver?

- A dual monetary standard had existed during the greenback period, with both greenbacks and gold circulating as forms of payment. But there was no fixed exchange ratio of one for the other because the government did not offer to exchange gold for greenbacks at a fixed price of gold.

- The price of gold in terms of greenbacks rose dramatically during the Civil War. Once the war ended, the greenback price of gold declined gradually, until by 1872, it was only about 10% higher than its 1861 level.

- As the United States paid off its war debt, the greenback price of gold came closer to its prewar level. This touched off debate about when the country would return to the gold standard.

- At the same time, there was debate about whether the United States should allow the coining of both silver and gold. Although both were legally money, only silver circulated as money because gold was too expensive. In 1834, new legislation ended silver's dominance as money and made gold the metal of choice for coinage.

- As the United States was poised to leave the greenback period and return to a metal standard, the question became: Which metal—gold, silver, or both? The issue was settled by the Coinage Act of 1873, which eliminated free coinage of silver and cast the die for the gold standard in the United States.

The "Crime of 1873"

- Although the Coinage Act caused little controversy when it was approved, it proved to be detrimental to the U.S. economy during the last quarter of the 19th century. Indeed, Milton Friedman termed the act the "Crime of 1873."

- As a result of the act, gold became scarce, with the price of gold to silver more than doubling between 1873 and 1900.

- The elimination of silver from the money stock cause caused the money supply to grow too slowly to keep pace with potential growth in real output.

- U.S. price levels fell from 1876 to 1896 at a rate of 1.5% per year, a development that hit farmers particularly hard.

- Friedman blames the Coinage Act for recessions that occurred in 1892–1894 and 1895–1896 and for the banking panic in 1893.

- Increasing the money supply more rapidly through the resumption of silver coinage was a crucial issue in the presidential campaign of 1896. William Jennings Bryan was a leading proponent of free silver but was defeated in the election by William McKinley.

The Federal Reserve Act of 1914

- The role of the federal government in monetary affairs was settled with the passage of the Federal Reserve Act of 1914.

- But debate on the proper limits of federal authority in monetary affairs is hardly over. The Federal Reserve broke new ground in expanding its role in monetary affairs during the Great Recession of 2007–2009, and many are still questioning whether or not the Fed did too much.

Important Term

greenbacks: Paper currency issued in 1862; it was used as legal tender after the U.S. government suspended payment in gold in 1861.

Suggested Reading

Friedman, "The Crime of 1873."

Friedman and Schwartz, *A Monetary History of the United States*.

Hammond, *Banks and Politics in America*.

Rockoff, "The 'Wizard of Oz' as a Monetary Allegory."

Questions to Consider

1. Why were the opponents to the Bank of the United States successful in blocking the renewal of its charter? Would those same opponents have been against the establishment of the Federal Reserve in 1914?

2. Why do you think the issue of whether or not to coin silver was so hard fought? Who would have been for "free silver"? Who would have been against it?

3. Do you believe the National Banking Acts of 1863 and 1864 were good policies or bad?

Local Currencies and Nonstandard Banks

Lecture 5

Money and financial arrangements in the United States were hotly contested in the 19th-century political arena. Part of the debate centered on whether the federal government had the right, under the Constitution, to create a central bank and issue paper money. In this lecture, we'll learn that the institution of money is so important to economic welfare that citizens sometimes take the matter into their own hands. We will look at local currencies and microfinancing, both of which help us to understand and appreciate how financial arrangements, including money, are important to the economic welfare of individuals.

The Story of Wörgl

- During the Great Depression, a village in Austria initiated a controversial financial arrangement in the hope that it would solve some of the economic woes experienced by both the village itself and its citizens.

- Like much of the world in 1932, Wörgl was experiencing high unemployment, reduced tax revenues, and deteriorating public facilities. As a solution to its problems, the village created 32,000 Austrian schillings worth of a new local currency that it called "labor certificates" and used them to hire workers for public projects. The town also paid civil servants a fraction of their salaries with the labor certificates.

- The labor certificates depreciated at a rate of 1% per month, giving their holders an incentive to spend them and stimulate the local economy. Businesses accepted the certificates in payment and paid taxes with the certificates.

- The town of Wörgl agreed to convert the labor certificates to official Austrian schillings at a 2% discount and kept a deposit in a local bank for that purpose.

- The experiment ended after about a year and a half, when outside authorities opposed it, but during the time that it was in effect, tax and fee revenues increased substantially as a result of improved economic activity, many worthwhile public works projects were completed, and no inflation occurred.

- By issuing labor certificates, Wörgl was able to coordinate improved economic activity. To assuage concerns about accepting the certificates in exchange, Wörgl provided for the conversion of the labor certificates into Austrian schillings and agreed to accept them in payment of taxes.

- The Wörgl experiment underscores the idea that money is a social contract. During the Depression, Wörgl and its citizens used a local currency to create mutually advantageous exchanges that would not have occurred otherwise.

- Wörgl also helps us appreciate the importance of financial arrangements for the functioning of an economy and understand the difference between successful and unsuccessful financial institutions.

Cigarettes as Currency

- Another example of a local currency can be found in the elaborate trading system based on cigarettes established by prisoners at Stalag VIIA during World War II.

- Red Cross parcels provided a somewhat regular supply of cigarettes and foodstuffs to the 50,000 prisoners at the camp, and prisoners began to use the cigarettes from the parcels as money. They were even accepted in trade by nonsmokers, who understood that they could later exchange cigarettes for food; thus, both smokers and nonsmokers had confidence that cigarettes would hold their value.

- A disadvantage of using cigarettes as money was that prices fluctuated. When Red Cross parcels first arrived and cigarettes were plentiful, prices would rise. When a time had passed without new Red Cross parcels, cigarettes became scarce and prices fell.

"Deli Dollars"

- In 1989, Frank Tortoriello, owner of a delicatessen in Massachusetts, wanted to move his deli and sought a loan from a local bank, but his application was denied. With guidance from the Schumacher Society, Tortoriello issued "Deli Dollars." These were sold for $8.00 but were good for $10.00 worth of merchandise at the deli.

- Through this scheme, Tortoriello raised sufficient funds to move the deli, and because the Deli Dollars had staggered redemption dates, he was not forced to redeem them all in a short period of time.

- This example is an interesting amalgam of a local currency and a microfinance scheme. Deli Dollars permitted Tortoriello to borrow from his future customers. The discount they received functioned like interest on the loan. The promise of future meals served as security that the customers valued more than the bank that had turned down Tortoriello's loan application.

"Ithaca Hours"

- In 1991, Paul Glover spearheaded the movement to issue "Ithaca Hours" in Ithaca, New York. Glover issued 2 free Ithaca Hours (each with a face value of $10.00) to people who agreed to accept them and to be listed in a publication called "Hour Town."

- The purpose of the project is to promote the local economy. Because Ithaca Hours are not accepted outside the town, anyone who accepts an Ithaca Hours certificate in exchange for a good or service commits to spending that certificate with another local merchant or service provider.

- Unlike Deli Dollars, Ithaca Hours are not sold by a firm trying to raise funds for its own use. Instead, Glover gave Ithaca Hours away to "subscribers," who agreed to spend them locally and accept them from others.

- Ithaca Hours function like a real currency, staying in circulation among local citizens and businesses.

Cooperative Arrangements

- In addition to local currencies, there is another type of nonstandard financial arrangement that addresses the desire of individuals to coordinate their economic activity through the process of lending and borrowing funds. Such an arrangement is captured in a scenario in which 10 village families would each like to buy a bicycle.

- If each family saves $10.00 a year to buy a $100.00 bicycle, then they will all wait 10 years before they own bicycles. If they pool their money, however, one family will be able to buy a bicycle each year.

- One potential flaw in such an arrangement is that families that have received their bicycles have an incentive to stop making their annual contributions to the pool. If families doubt that others will continue to make payments, they may judge the cooperative arrangement to be risky and prefer the go-it-alone solution. Clearly, some enforcement mechanism is necessary to ensure that all promised payments are made.

Alternative Lending Institutions

- As the story of the villagers and the bicycles suggests, there are many situations in which every member of a group could benefit from a coordinated arrangement to save funds and lend them out to group members.

- The story also underscores another important theme: There are many groups of individuals who, for a variety of reasons, do not have access to traditional lending institutions and must seek alternatives.

- Pawn shops, for example, have traditionally provided credit to those who could not obtain it from banks.

- Another mechanism for providing credit to an otherwise underserved population is the Rotating Saving and Credit Association (ROSCA), similar to our example of the villagers and the bicycles.

- Two important issues faced by a ROSCA are how to determine the order in which participants receive funds and how to ensure that individuals fulfill their promises to make contributions. Many ROSCAs use lotteries to determine who will receive funds and social consequences to enforce the contract.

The Grameen Bank

- In 1976, Professor Muhammad Yunus, head of the Rural Economics Program at the University of Chittagong, launched a project to provide banking services targeted at the rural poor. The result of his project was the Grameen Bank.

- The classic model of this bank relies on group lending. Grameen clients are too poor to offer collateral but tend to have close ties to a community; thus, borrowers form groups whose members monitor and support one another. Two members of the group may receive a loan at any one time. If a group defaults, it is barred from receiving future loans.

- Yanus realized that the marginal productivity of the investment made possible by a small loan is very high; that is, borrowers can repay because the loans lead to profitable investments.

- Another enforcement mechanism used by the Grameen Bank model is progressive lending, which makes available larger loans to groups or individuals who have successfully paid back smaller loans.

- The Grameen model has been hugely successful, although the bank has recently come under scrutiny from a variety of government

agencies. Some critics question whether microfinance has the beneficial impact on poverty that the bank claims. Others are threatened by the growth of the bank and the power of Yanus. Still others criticize microfinance because some lenders charge high interest rates.

Financial Arrangements on Main Street

- As we have seen in this lecture, financial arrangements are not only the business of Wall Street. Citizens of Main Street understand the power of monetary arrangements to coordinate economic activity and, at times, have created monies to accomplish local economic objectives.

- Local currencies and microfinancing are 2 types of arrangements that thrive even amidst a multitude of highly financed traditional institutions.

Suggested Reading

Armendáriz and Morduch, *The Economics of Microfinance*.

E. F. Schumacher Society, "Local Currencies."

Glover, "A History of Ithaca Hours."

Unterguggenberger, "The End of the Woergl Experiment."

Questions to Consider

1. What is the difference between a store coupon and a local currency? Was the Deli Dollar a coupon or a currency?

2. In recent months, microfinance and the Grameen Bank have become very controversial? Why?

3. Is the establishment of a local currency a good tool to promote development of a local economy? Why or why not?

How Inflation Erodes the Value of Money

Lecture 6

Inflation is a lot like a snake: You know you're afraid of it but aren't quite sure why. Like snakes, some inflation is benign, some is poisonous, and it's important to know the difference. In this lecture, you'll learn that it is rational to fear high rates of inflation and volatile inflation histories, because high inflation rates erode the value of money and volatility makes planning for the future difficult. You begin by looking at the inflation history of the United States over the last 100 years. Then, you learn precisely what inflation is, investigate the connection between money growth and inflation, and discuss the reasons that inflation is costly.

The History of Inflation in the United States

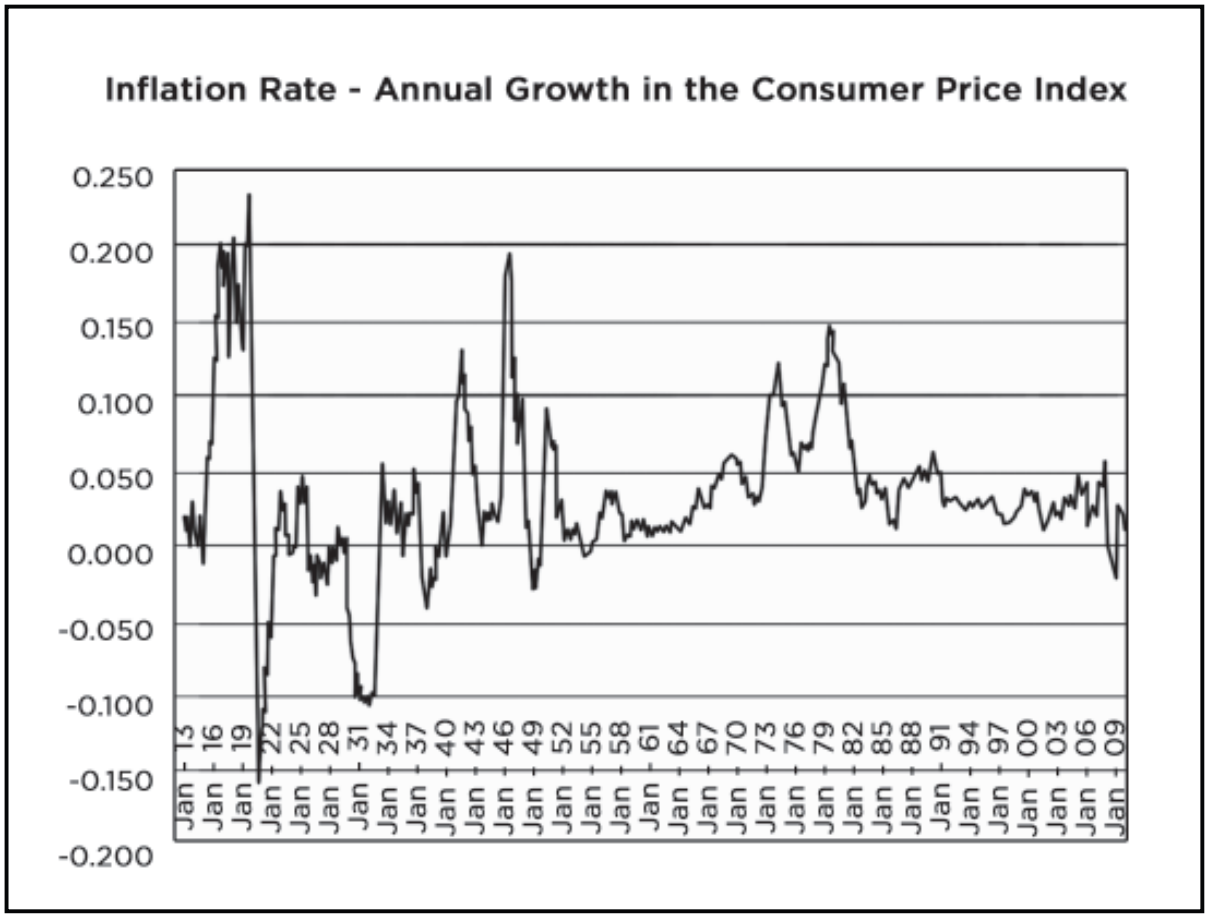
- In the post-World War II period, the United States has had decades when inflation was very high and volatile and decades when it was low and steady.

- In the high-inflation decades, individuals spent substantial time and energy devising strategies that would protect them from unforeseen increases in inflation. For example, they bought larger houses than they otherwise would, reckoning that house prices would keep up with inflation.

- In low-inflation decades, individuals saved that time and energy and planned for the future as if the inflation rate would remain steadily between 1–3%.

- Before the end of World War I, there were large swings in the inflation rate—a high in 1920 of 24% and a low in 1921 of nearly –16%. Such an enormous change played havoc with many business and household decisions.

Figure 6.1



Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

Graph of the inflation rate for the U.S. economy between 1913 and 2010 that shows our inflation experience has varied greatly.

- During World War II, when wage and price controls were in effect, and immediately after the war, inflation again varied greatly, swinging from about 13% in May 1942, to 0% in May 1944, to 18% in May 1947.

- After the 1940s, it appeared that inflation was under control. The inflation rate fell below 5% by the end of 1951 and stayed low for more than a decade. It rose gradually and was once more high and variable between 1970 and 1984.

- When the Volcker regime took hold at the Federal Reserve, inflation once more fell and fell quickly. Since 1985, the inflation rate has largely been captured between the band of 2–5%.

- Economists refer to the period since 1985 as the "Great Moderation" and the "Conquering of U.S. Inflation," but it never pays to assume that an enemy like inflation is vanquished forever.

The Consumer Price Index (CPI)

- **Inflation** is a persistent increase in the general level of prices. The **Consumer Price Index** (CPI) is an index of prices of goods and services (a bushel basket of goods) purchased by the typical household in the United States.

- The fact that the CPI is an index means that the bushel basket prices in each month are each divided by the bushel basket price in the base year, which is currently 1983. In the base period, the CPI is 100.

- The items in the bushel basket are determined by a survey of consumer purchasing behavior conducted by the Bureau of Labor Statistics. The contents of the basket change slowly, so that changes in the CPI are more attributable to changes in the prices of items already in the basket than to changes in the items themselves.

- The CPI is not truly a cost-of-living index. If the CPI grows by, say, 5% in a given year, the cost of living grows by a smaller percentage because savvy consumers will substitute away from items that have experienced high price increases and toward items that have experienced smaller price increases.

Computing the Inflation Rate

- Inflation is defined as the rate of growth in a price index, and there are many ways to compute an inflation rate. We can choose a different price index, a different period over which to measure changes in the chosen index, or perhaps, a different formula for computing the growth rate.

- The data presented at the beginning of the lecture used the CPI for all urban consumers and defined the inflation rate as the percentage change in the current month's index compared with the index 12

months earlier. By defining the inflation rate as the percentage change in the CPI over a 12-month period, we create a measure of the inflation rate that is less sensitive to temporary price changes.

- Note that a one-time price increase in an important commodity, such as oil, cannot cause inflation. Such an increase will cause the CPI to increase over a year or more as the increase in oil prices is incorporated into more of the items in the bushel basket.

- The OPEC price increases in the 1970s cannot explain the persistent differences in inflation rates observed in the data since that time. The OPEC cartel was able to raise the price of oil relative to other goods in the 1970s, but it was not able to continue to raise the relative price of oil as the years and decades passed.

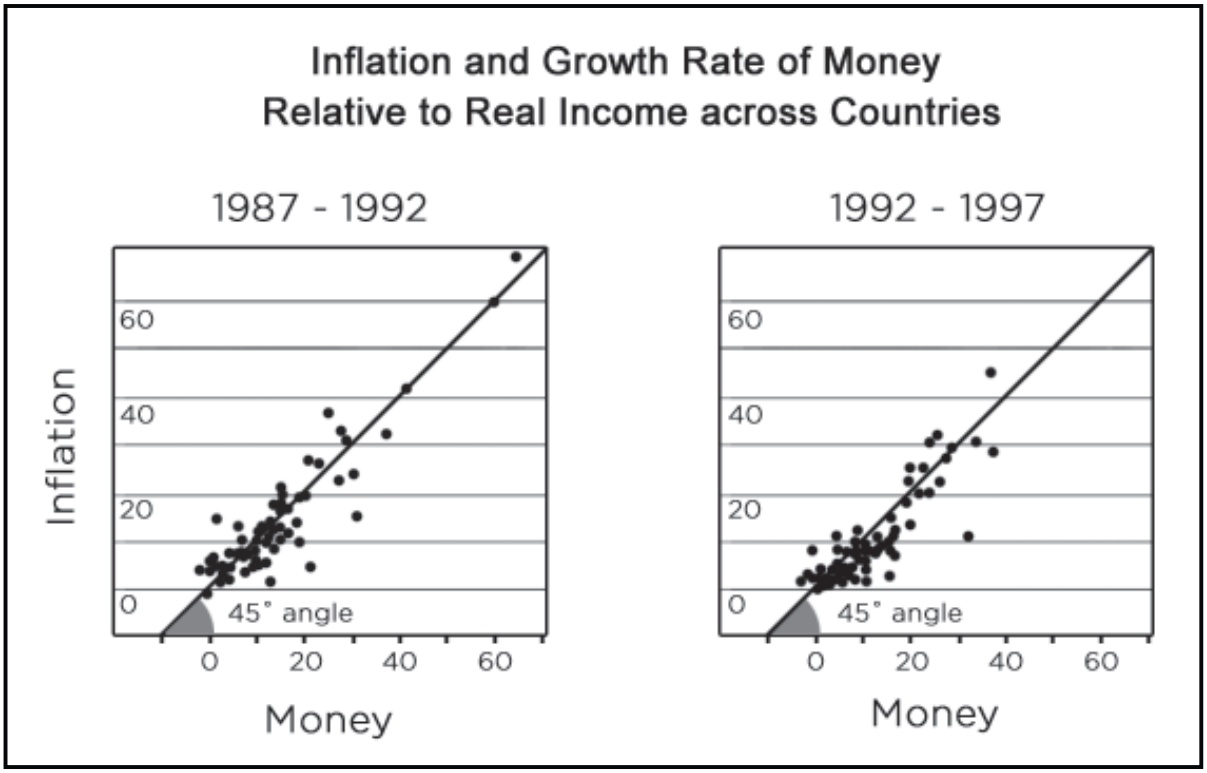
"A Monetary Phenomenon"

- The well-known economist Milton Friedman said, "Inflation is always and everywhere a monetary phenomenon in the sense that it is and can be produced only by a more rapid increase in the quantity of money than in output."

- What Friedman meant is that growth in the money supply is both necessary and sufficient to explain inflation, but not all growth in the quantity of money causes inflation. Growth in money at a rate that just keeps pace with the growth in real output will not cause inflation, but growth in money in excess of the growth in real output will cause inflation.

- Two charts showing money growth rates and inflation rates for 79 countries for 2 different 5-year periods reveal a virtually 1:1 relationship between these 2 measures. Each 1% increase in excess money growth leads to a 1% increase in inflation (see Figure 6.2).

Figure 6.2



Source: Federal Reserve Bank of Atlanta Economic Review.

- The data strongly support Friedman's claim that inflation is always and everywhere a monetary phenomenon. Countries with high excess money growth have high inflation rates. Countries with low excess money growth have low inflation rates. Put another way, excess money growth of *n*% causes an inflation rate of *n*%.

- Friedman explains the connection between money growth and inflation as follows: An increase in the growth rate of money puts additional purchasing power in the hands of potential spenders. For example, if the government increases defense spending, defense contractors and those who work for them will receive additional money. When they spend that money, they bid up prices on a wide variety of goods; thus, most prices increase and inflation results.

- Note that for this mechanism to work, the economy must be at full employment. If not, the increase in money could lead to higher employment without inflation or higher rates of output growth rather than higher rates of price growth.

The Costs of High and Variable Inflation

- High and variable inflation tend to occur together. Our original graph shows that bigger swings in the inflation rate occur when inflation is high (pre-World War II) than when it is low (post-1985).

- High and variable inflation makes it difficult for individuals to plan for the future, such as for retirement or a child's college education.

- Hedging inflation risk is costly in the sense that decision makers do things that they would not do if they could be sure that inflation would remain low and steady. In the 1960s, for example, young home buyers were often advised to buy as much house as they could afford because a house was considered a good inflation hedge.

- Individuals hold less money when they fear inflation. Money is a useful economic tool that facilitates trade, yet it loses value when inflation occurs. When inflation is high, people keep money holdings low and use other strategies for making transactions.

The Benefits of Low and Steady Inflation

- When inflation is low and steady, it is easier to plan for the future and to have confidence that our financial arrangements will work out as we planned. We also spend less of our resources hedging the risks associated with **volatile inflation** and use more of that wonderful invention, money.

- As we've seen, if inflation is high and variable, it is difficult to plan for the future, and we tend to invest more of our wealth in riskier assets in the hope that they will provide us some protection against inflation. We buy more house in the hope that house price gains will offset decreases in the value of our bonds and savings accounts. When inflation is high and variable, we also use less of that wonderful invention, money.

Important Terms

Consumer Price Index (CPI): An index of prices of goods and services (a bushel basket of goods) purchased by the typical household in the United States.

inflation: Persistent increase in the general level of prices.

volatile inflation: Inflation that oscillates between low and high rates.

Suggested Reading

Dwyer and Hafer, "Are Money Growth and Inflation Still Related?"

Friedman, *Money Mischief*.

Mishkin, *The Economics of Money, Banking, and Financial Markets*.

Questions to Consider

1. Given your current economic situation, would you be better off if the inflation rate suddenly increased to 10%? Why or why not?

2. Why is there a high positive correlation between the growth rate of a nation's money supply and the inflation rate experienced by the nation?

3. Of the reasons given in the lecture that inflation is costly, which is most important?

Hyperinflation Is the Repudiation of Money

Lecture 7

Hyperinflation is the ultimate repudiation by a government of its money. . When hyperinflation occurs, prices rise to such high levels that the outstanding stock of money issued by the government in earlier times will buy virtually nothing. Happily, the United States has never experienced a hyperinflation, but in this lecture, you'll see why our large national debt is a temptation to U.S. monetary and fiscal authorities to allow a massive inflation or, perhaps, even to cause one.

What Is Hyperinflation?

- Inflation is a sustained increase in the general level of prices. A one-time increase in oil prices, even a large one, is not, in and of itself, inflation. Inflation occurs when most items in a price index increase over time. The rate at which they increase is called the **inflation rate**.

- As we have seen, inflation is the modern-day counterpart of the ancient practice of seigniorage, whereby the monarch of a land would shave the coins he received in payment and use the shavings to mint new coins. The result is a decline in the value of the money held by private citizens—in effect, a transfer of wealth from citizens to the monarch.

- The term "**hyperinflation**" is used to describe episodes during which the monthly inflation rate exceeds 50%. At that rate, an item that cost $1.00 on January 1 of one year would cost $130.00 on the same day in the following year!

The Cause of Hyperinflation

- The ultimate cause of hyperinflation is a government's decision to finance large deficits by creating new money. The most well known instance of hyperinflation in the 20th century occurred in Germany between 1921–1923.

- On average, between August 1922 and November 1923, prices in Germany rose at a monthly rate of 322%. In the last days of German hyperinflation, the inflation rate was much higher—41% per day in October 1923.

- During the hyperinflation, the German government increased the money supply at an average rate of 314% per month. Why?

- As a result of the treaty ending World War I, Germany ceded equipment and territory and was required to pay substantial reparations. The treaty specified that the reparations must be paid in gold, which placed a great strain on Germany because its gold stocks were depleted and its export sector was operating at a very low level.

- The situation worsened in January 1923, when the French occupied the Ruhr Valley because German payments had fallen below treaty-specified levels. With the occupation, Germany lost access to both natural resources and the taxes that derived from their use.

- Germany responded to the occupation with a form of "passive resistance" that included direct payments to German citizens in the Ruhr. It paid its citizens not with gold but with paper money.

- The German government kept printing money to pay for expenditures in excess of those that could be financed by tax revenues. The connection between the high rates of money printing and ever-rising inflation rates was not acknowledged in Germany at the time.

- Of course, economists today see the causal role of money growth in hyperinflation. Once it becomes clear that the government has committed to printing money to finance a substantial deficit, people expect inflation to occur and are reluctant to hold paper money because they fear the loss of value that will result. Paper money is spent as fast as people get it.

- Of course, the increasing inflation rates that result from people bidding up the price of goods cause further damage to government finances and lead to even higher rates of money creation; thus, the hyperinflation spiral is underway.

- The result is a decrease in the ratio of money to prices as individuals rationally decide to hold less wealth in the form of money.

- Notice how causality works in hyperinflation: The belief that prices will increase ever more rapidly causes individuals to act in advance of actual price increases and lower the quantity of money they hold. People purposely lessen their money balances, thereby driving prices up all the more rapidly as they spend the money they have.

The End of Hyperinflation in Germany

- Hyperinflation ended in Germany with monetary reforms that occurred late in 1923. According to economist Thomas Sargent, the end was brought on by 3 simultaneous occurrences: "additional borrowing by the government from the central bank stopped, the government budget swung into balance, and inflation stopped."

- Notice how Sargent links the ends of hyperinflation to a change in government spending and borrowing. How can we square Sargent's view with Friedman's claim that inflation is "always and everywhere a monetary phenomenon"?

- Sargent points out that the root cause of hyperinflation is a government's decision to spend amounts far in excess of what tax revenues permit. In Germany, the government made direct payments to citizens as part of its "passive resistance" to the French occupation of the Ruhr.

- The government begins by borrowing funds through the issuance of bonds. Money growth occurs when the central bank buys the government bonds—perhaps in an attempt to keep their prices from falling and their yields from rising.

- Fiscal reform is necessary to end hyperinflation because without it, the government will continue to borrow and the central bank will have a strong incentive to continue to buy government bonds.

Other Cases of Hyperinflation

- The German hyperinflation may be the most studied, but it is not the only case of this phenomenon or the most recent. Argentina, Bolivia, Brazil, Chile, Peru, and Uruguay each experienced hyperinflations between 1970 and 1987.

- During hyperinflations in these Latin American countries, dollarization occurred as citizens used U.S. dollars in an attempt to avoid the loss of wealth inherent in holding their own currencies.

- The Bolivian hyperinflation is an interesting case that further illustrates Sargent's point. In 1982, Hernan Siles Zuazo took power as head of a leftist coalition that wanted to satisfy demands for more government spending on domestic programs but faced growing debt-service obligations and falling prices for the country's tin exports.

- The Bolivian government responded by issuing bonds that were purchased by the central bank of Bolivia. In effect, the Bolivian government (its treasury and its central bank together) printed money to finance the Siles-Suazo regime expenditures.

- Faced with a shortage of funds, the Bolivian government raised revenue through the inflation tax instead of raising income taxes or reducing other government spending.

- One of the reasons that dollars are held throughout the world is that citizens of many nations consider the dollar to be a more dependable store of value than the currency of their own nations. When citizens of other nations hold dollars, the United States collects a modest amount of seigniorage from them (an amount approximately equal to the rate of return on U.S. Treasury bills) because holding dollars is equivalent to making the U.S. government an interest-free loan.

Individuals around the world willingly pay that tax to avoid the risk of loss by holding their domestic currency.

- Although the German hyperinflation is better known, the current hyperinflation in Zimbabwe is actually worse. Between January 2007 and November 2008, Zimbabwe experienced an average monthly inflation of 1124%.

- Hyperinflation numbers are so staggering that reporting them presents a challenge. The danger is "zero dazzle" because there are so many zeros necessary to report, say, the monthly rate of inflation in a hyperinflation country. Another approach is to report the time necessary for prices to double.

The Damage and Temptation of Hyperinflation

- Hyperinflation destroys wealth that is held in the form of money or in any asset with a value fixed in terms of the depreciating currency.

- Hyperinflation destroys the efficiency that results from the social contract inherent in the use of paper money. In Germany, it reduced most people to barter.

- It also creates tremendous psychological costs as individuals worry about an uncertain future.

- Finally, hyperinflation allows a government to collect revenues outside of the political process.

- Perhaps some of the citizens and politicians in the United States who are currently worried about our federal deficits and our accumulated national debt see our debt as a temptation to create inflation in this country. Such a move would be a repudiation not only of our debt but also of the dollar.

Important Terms

Hyperinflation: Episodes during which the monthly inflation rate exceeds 50%.

inflation rate: The rate at which the price index increases over time.

Suggested Reading

Cardoso, "Hyperinflation in Latin America."

Hanke and Kwok, "On the Measurement of Zimbabwe's Hyperinflation."

Salemi, "Hyperinflation."

Sargent, "The Ends of Four Big Inflations."

Questions to Consider

1. Why would a nation ever allow a hyperinflation?

2. What is the connection between the end of a hyperinflation and a credible commitment by government to end deficit spending?

3. We have worried a great deal in recent history about our large government deficits. Is a hyperinflation in the United States a possibility?

Saving—The Source of Funds for Investment

Lecture 8

Beginning in the summer of 2008, General Motors spent billions of dollars retooling its production facilities to manufacture an electric car—the Chevrolet Volt—which was rolled out in the fall of 2010. Some of the money for this venture came from GM's profits, but much of it came from ordinary American citizens. This lecture is about the connection between saving and investment—between decisions made every day by ordinary folks to put aside some of what they earn for future use and decisions by entrepreneurs to create new capital, such as the capital needed to produce an electric car. As you will see, saving makes investment possible. If there were no saving, there would be no investment, no new products, no technological advances in the workplace, and no growth.

A Definition of "Investment"

- When used by an economist, **investment** means the dollar value of increases to a nation's **capital stock**—its factories, equipment, software, and other durable goods used as part of the production process, as well as human capital.

- Many use the term "investment" to describe stocks, bonds, and other financial products that individuals purchase as part of a financial plan. Economists call such activity "**financial investment**" to distinguish it from economic activity that increases the nation's capital stock.

- A simple example explains why it is important to recognize the difference between investment and financial investment: Every day, millions of dollars worth of shares in GM are sold on the New York Stock Exchange; however, the ability of GM to retool its plant to manufacture the Volt is unaffected by these sales.

- Almost all of the sales are Peter-Paul transactions from which GM derives no funds. Still, both Peter and Paul would describe their purchases and sales of GM stock as part of their "investment strategies."

- At the same time, the value of GM shares is certainly important to GM. An increase in share prices indicates market approval of the company's decisions.

- A comparison of investment data for the years 2006 and 2009 shows a significantly lower share of U.S. gross domestic product (GDP) going to investment in the midst of our recession. This lower share was a serious indication of the pessimism with which business decision makers viewed the near-term prospects of the U.S. economy.

Capital Stock and Economic Growth

- A strong relationship exists between a nation's capital stock (which is a cumulative measure of all past investment activity) and economic growth (which makes it possible for each citizen to consume more and higher-quality goods).

- Cross-country data reveal a strong positive relationship between a nation's capital stock and its productivity. Simply put, nations with more capital are more productive; their workers have access to more and better "tools."

What Is Saving?

- **Saving** is the difference between a decision maker's income and consumption. Our economy saves when a household, firm, or government sector consumes less than the income that sector earns.

- Consider the Jones family. In a given year, the family earned after-tax income of $90,000 and spent $85,000 on food, clothing, rent, fuel, and other consumer goods. The Jones family saved $5,000, or 5.5%, of what it earned.

- Perhaps this is not the way you think of saving in your household. You may think about increases in the value of your assets, such as your retirement portfolio, as part of your saving.

- This is a case, however, where a valid point of view for one is not a valid point of view for all. It may be completely rational for you to count your capital gains when you consider your savings plans, but the economy as a whole cannot do that. The economy as a whole has funds for investment only if we save in the traditional way—by spending less than our income.

- Here's another example: Frank's Espresso Bar and Café has yearly after-tax profits of $150,000. Frank has decided to use $50,000 of those profits to purchase new kitchen equipment and the remainder to pay off some of the loans he obtained to start the company. In this situation, Frank is saving $150,000. It does not matter whether the business is using its savings to buy new equipment or to lower debt. Both actions constitute saving.

- Finally, let's look at the city of Whynot, North Carolina. The city has revenues from fees and sales taxes of $1.6 million and expenditures of $1.5 million in its most recent fiscal year. Whynot has decided to add the remaining $100,000 to the city's rainy-day fund. Again, Whynot is saving.

The Relationship of Saving and Investment

- One reason that economists study saving is that for the economy as a whole, saving makes investment possible. The amount of investment spending that an economy can undertake in a given period of time equals the sum of saving by firms, households, and governments in that economy plus any borrowing from the rest of the world.

- Every dollar's worth of goods produced in a nation generates a dollar's worth of income for someone. For the economy as a whole, total income in a year is just sufficient to purchase the goods produced. If every member of the economy spent all income on consumer goods and services, there would be nothing left over for investment.

- The only way that the economy can release resources for the production of investment goods is if consumers, firms, and government entities spend less than their income on consumer goods and services.

- Keep in mind that investment means the purchase of new capital. When households add funds to their 401(k) accounts, they are saving, but the act of adding to a 401(k) account does not in and of itself add productive capital to the economy.

Figure 8.1

Saving and Investment in the U.S.
(Billions of Dollars)

Year	Housholds	Firms	Federal Government	State and Local Government	Total Saving
2007	178.9	316.1	-236.5	21.7	280.2
2009	458.6	423.4	-1226.5	-19.2	-363.7

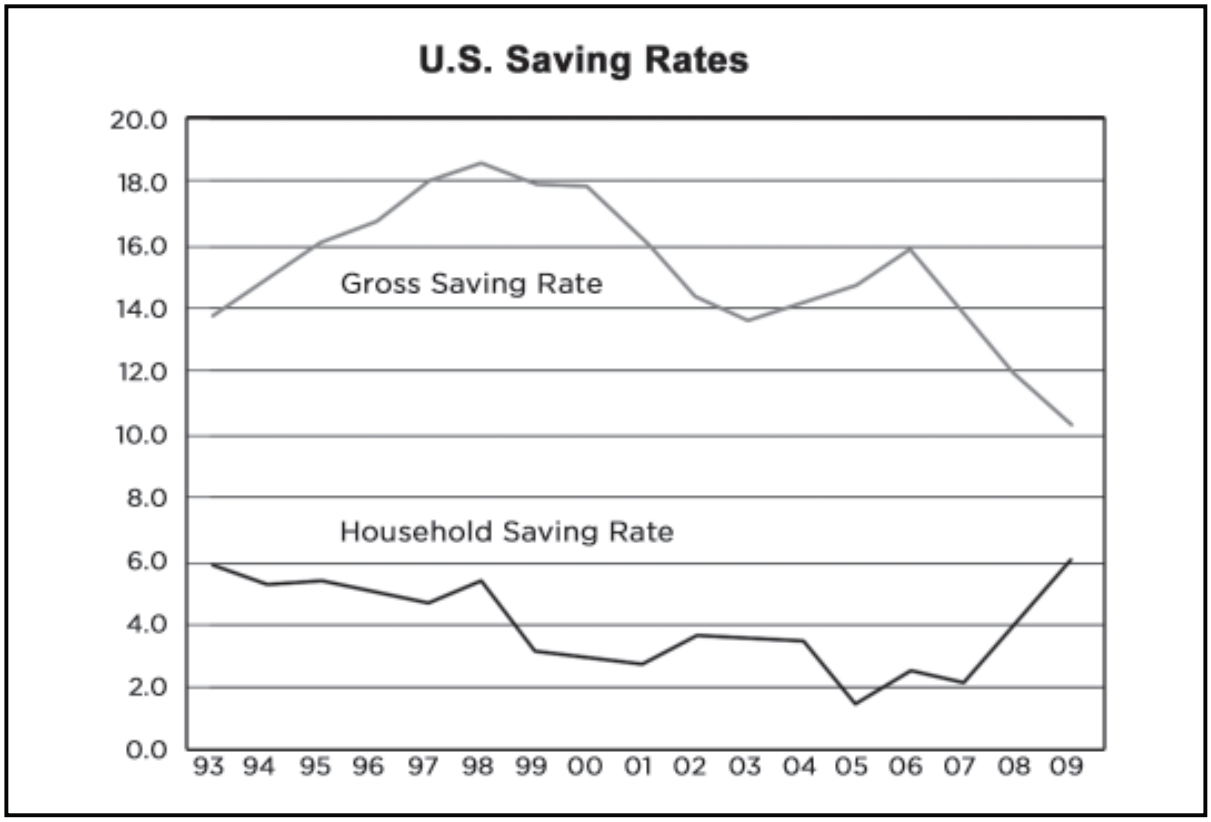
Year	Foreign Borrowing	Investment
2007	726.8	990.0
2009	428	278.6

Source: Federal Reserve.

Data comparison of 2007 and 2009 to illustrate how savings limits investment.

- Savings rates in the United States have varied significantly in the last 25 years. During the Great Recession, gross saving fell rapidly, reaching a 20-year low of just over 10%.

Figure 8.2



Data based on OECD (2010), "National Accounts at a Glance," OECD National Accounts Statistics (database), http://dx.doi.org/10.1787/data-00369-en accessed 3/16/2011.

Competition for Investment Funds

- Investors compete with households and government entities for funds.

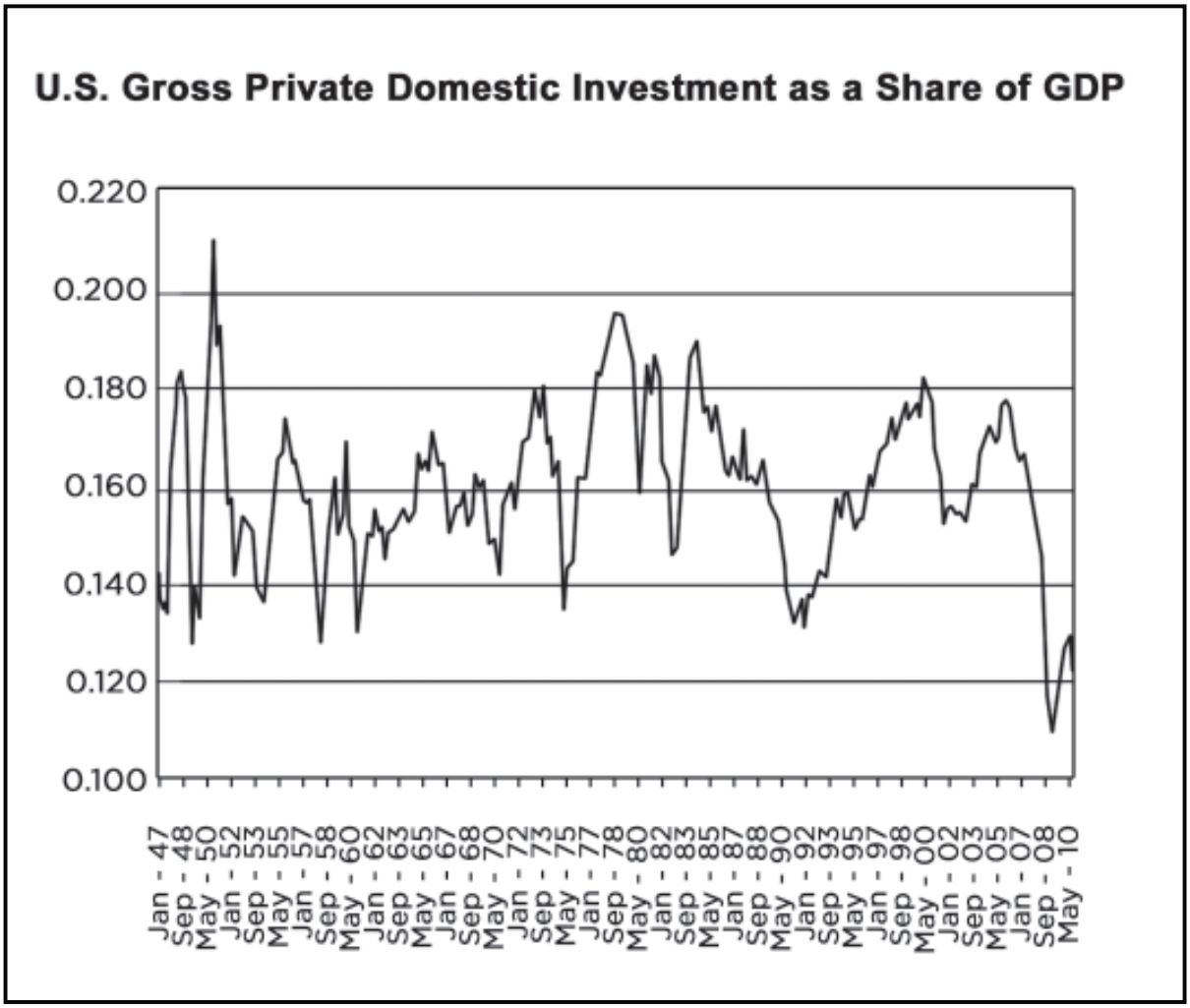
- Federal government deficits use up savings that could be used for investment. Thus, government deficits curtail growth.

- A trade deficit means that the rest of the world allows us to "borrow" their productive capacity by sending to us a volume of goods and services of greater value than the goods and services we send back. In this sense, we are borrowing from foreign nations when we run a trade deficit.

- Foreign borrowing allows investment to be larger than it would have been otherwise. But foreign nations eventually expect to be paid back in goods and services, meaning that we will face a situation of negative foreign borrowing in the future.

- U.S. investment has averaged about 16% of GDP in the years since 1947. It has fallen dramatically during the Great Recession—far more than in other recessions.

Figure 8.3



Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

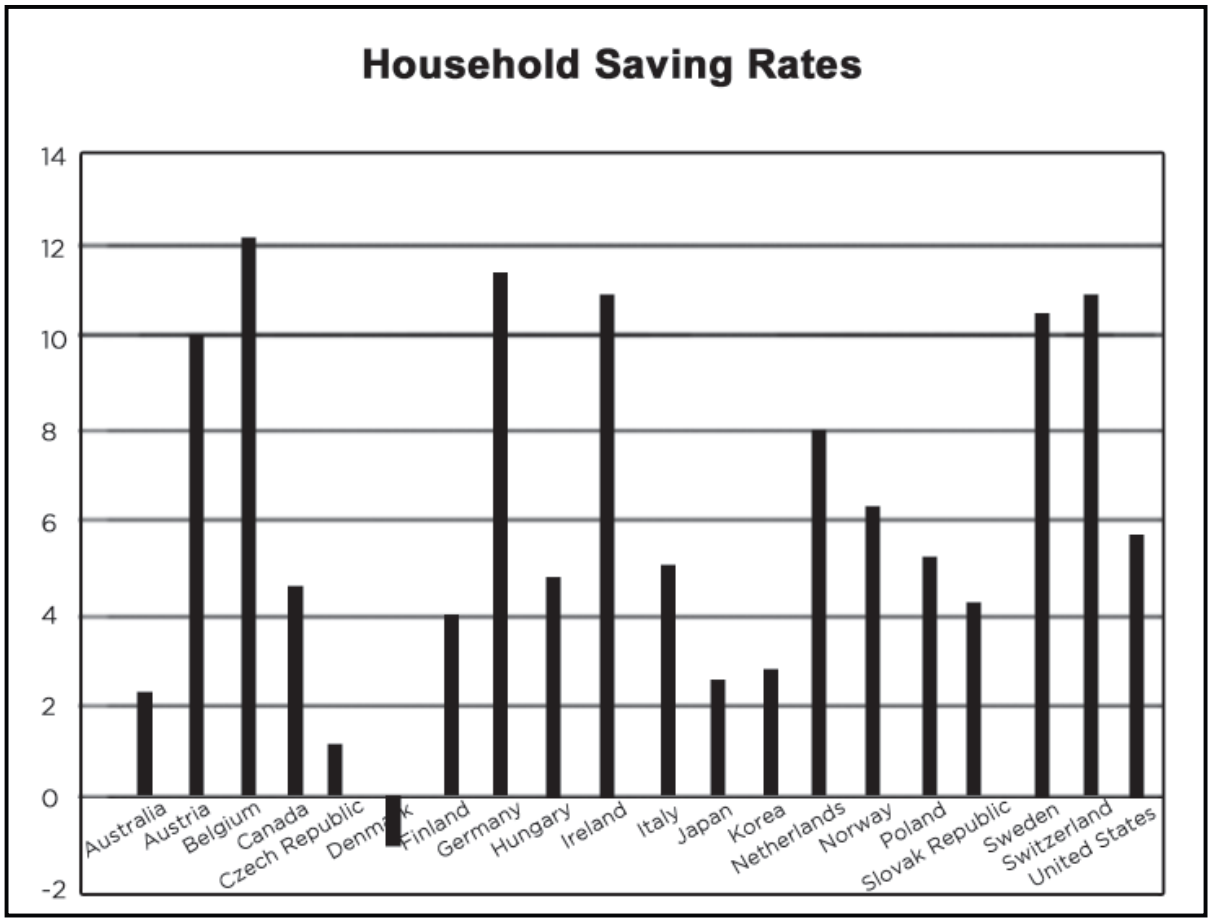
Savings Rates in Developed Countries

- Household savings rates vary a great deal across nations. For example, in 2010, while Belgium had a 12% household savings rate, Denmark's rate was –1.0. This negative rate means that Danish households consumed more than their income, with households borrowing to finance their extra consumption.

- Research suggests that this pattern was a response to a large increase in the price of the typical house in Denmark that occurred after financial markets there were liberalized. Danish households felt richer and spent some of their perceived wealth increase immediately.

- Denmark is not unique in this situation of dis-saving. Changes in the prices of assets held by U.S. households are frequently cited as one explanation for changes in U.S. saving rates.

Figure 8.4



Data based on OECD (2010), "National Accounts at a Glance," OECD National Accounts Statistics (database), http://dx.doi.org/10.1787/data-00369-en accessed 3/16/2011.

- The household saving rate for the United States in 2010 was 5.7%, which was much higher than it had been prior to the Great Recession.

- Low household saving rates in the United States that are reinforced by large government budget deficits imply that our country faces an unpleasant choice: It can either borrow from the rest of the world to engage in investment projects, or it can allow investment to fall as a fraction of GDP, which means that both growth and standards of living in the United States will fall.

- No other alternative is possible because, for a nation, investment must equal the sum of saving by households, saving by businesses, and borrowing from other nations.

The Silver Lining in the Great Recession Cloud

- One legacy of the Great Recession may be that the American household rediscovers the virtues of saving. American consumers had come to believe that growth in the value of their homes provided a dependable source of growth in their wealth, enough growth that saving from their income was not necessary.

- The bursting of the housing bubble in 2007 may have taught American households that to provide for their futures, they must return to traditional forms of saving—setting aside something from every paycheck.

Important Terms

capital stock: The cumulative measure of all past investment activity.

financial investment: Stocks, bonds, and other financial products that individuals purchase as part of a financial plan.

investment: The value of increases to a nation's capital stock, such as its factories, equipment, software, and other durable goods used as part of the production process, as well as human capital.

saving: The difference between a decision maker's income and consumption.

Suggested Reading

Fisher, *The Theory of Interest*.

Mishkin, *The Economics of Money, Banking, and Financial Markets*.

Questions to Consider

1. How much does your household save? How would you go about deciding whether your household saves enough to meet its goals for the future?

2. Many economists believe that the increase in household saving that has occurred during the Great Recession is bad news in the short run and good news in the long run. Why can an increase in saving be both bad news and good?

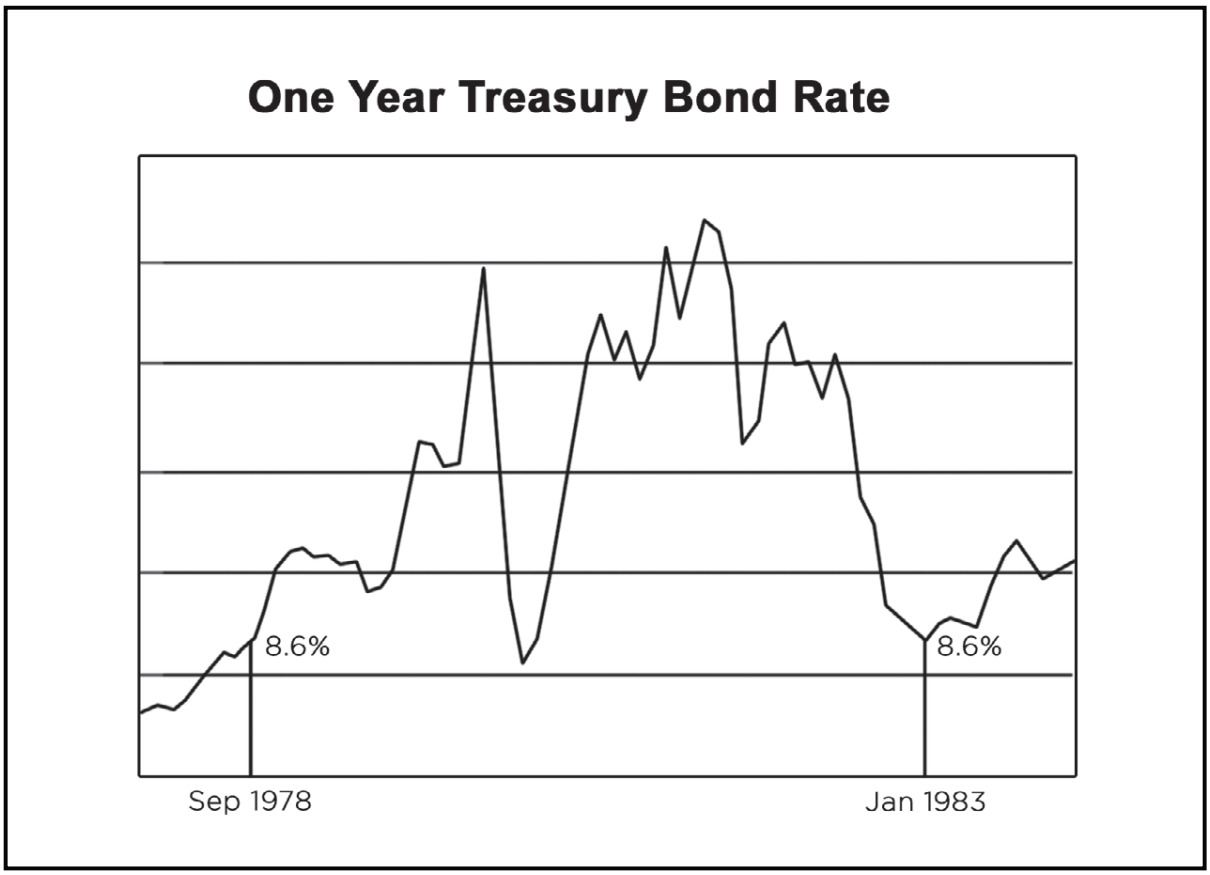
3. Should the United States create additional tax incentives to promote saving?

The Real Rate of Interest

Lecture 9

In September 1978, nominal interest rates were high; for example, the one-year Treasury bond rate was 8.6% and on the way up. This rate would continue to increase until it peaked at more than 16% in August 1981. After that, the T-bond rate began to fall and would again hit 8.6% in January 1983. Despite the fact that nominal interest rates were the same in those 2 months, it was much more expensive to borrow in January 1983 than in September 1978. In this lecture, you'll learn the key to resolving this apparent paradox—a concept called the real rate of interest—that will give you a new perspective on the true cost of borrowing.

Figure 9.1



Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

The Nominal Rate of Interest

- The **nominal rate of interest** is what most of us think of when we think of an interest rate. It is typically expressed as a percentage, but in fact, it specifies the number of dollars that a borrower must pay to borrow funds.

- For example, if the nominal rate is 10%, a person who borrows $1000 for one year on January 2 must pay back $1100 on January 2 of the following year. By the same token, a person who lends $1000 at 10% will give up $1000 and receive $1100 one year later.

- Why does the borrower pay interest, and why does the lender receive interest? The simple reason is that the lender gives up something of value to the borrower—in our example, the right to use $1000 one year earlier.

- Consider the case of Joe and Jan. Joe suddenly discovers that his car needs a major repair. He can't function without his car for a year while he saves up the money, so he agrees to pay interest and obtain the right to use in the present funds that he will not earn until a year later. Jan is saving for her daughter's college education. She prefers the future purchase of tuition to purchases she can make in the present. If Jan lends funds to Joe, she will receive a reward for her patience.

- Borrowers typically pay a higher rate of return than the rate received by savers. The difference is compensation received by financial institutions, such as banks, that function as intermediaries between borrowers and lenders. We will return to this issue later in the course.

The Concept of Interest

- Most of us tend to think that the payment and receipt of interest are natural transactions, but some cultures and religious codes frown on the payment of interest. The view that collecting interest on a debt is somehow wrong can be traced to the Greek philosopher Aristotle,

who argued that money does not "produce" anything; therefore, borrowing money should not cost anything.

- What Aristotle did not acknowledge, and what is of great importance, is that no one borrows money unless he or she intends to use it. Like someone who rents land to grow a crop, the borrower receives something of value—the right to purchase goods earlier rather than later. This opportunity to use funds sooner is both valuable and productive.

The Real Rate of Interest

- The number of dollars paid (or received) in interest is an inaccurate measure of the cost of borrowing (or the reward from lending). The right way to describe what the lender receives and what the borrower gives up in this transaction is with a concept known as the real rate of interest.

- The real rate of interest measures the size of the "goods bonus" that savers receive by agreeing to defer use of their income. It likewise measures the size of the "goods penalty" that borrowers pay for the right to use that income early.

- Returning to our earlier example, Joe would like to borrow $1000 from Jan at 10% interest to fix his car. Jan would like to lend $1000 to Joe at 10% interest because she is saving for her daughter's college education. What happens if the CPI increases by 6% during the year of the loan?

- When Joe repays the loan, he repays with dollars that have lost 6% of their purchasing power relative to the dollars he borrowed, and Jan receives dollars that can purchase 6% less than the dollars she lent.

- A good estimate of the "goods penalty" that Joe pays by borrowing is 4%—the nominal rate of interest rate minus the inflation rate during the period of the loan. A good estimate of the "goods bonus" that Jan receives by lending is likewise 4%.

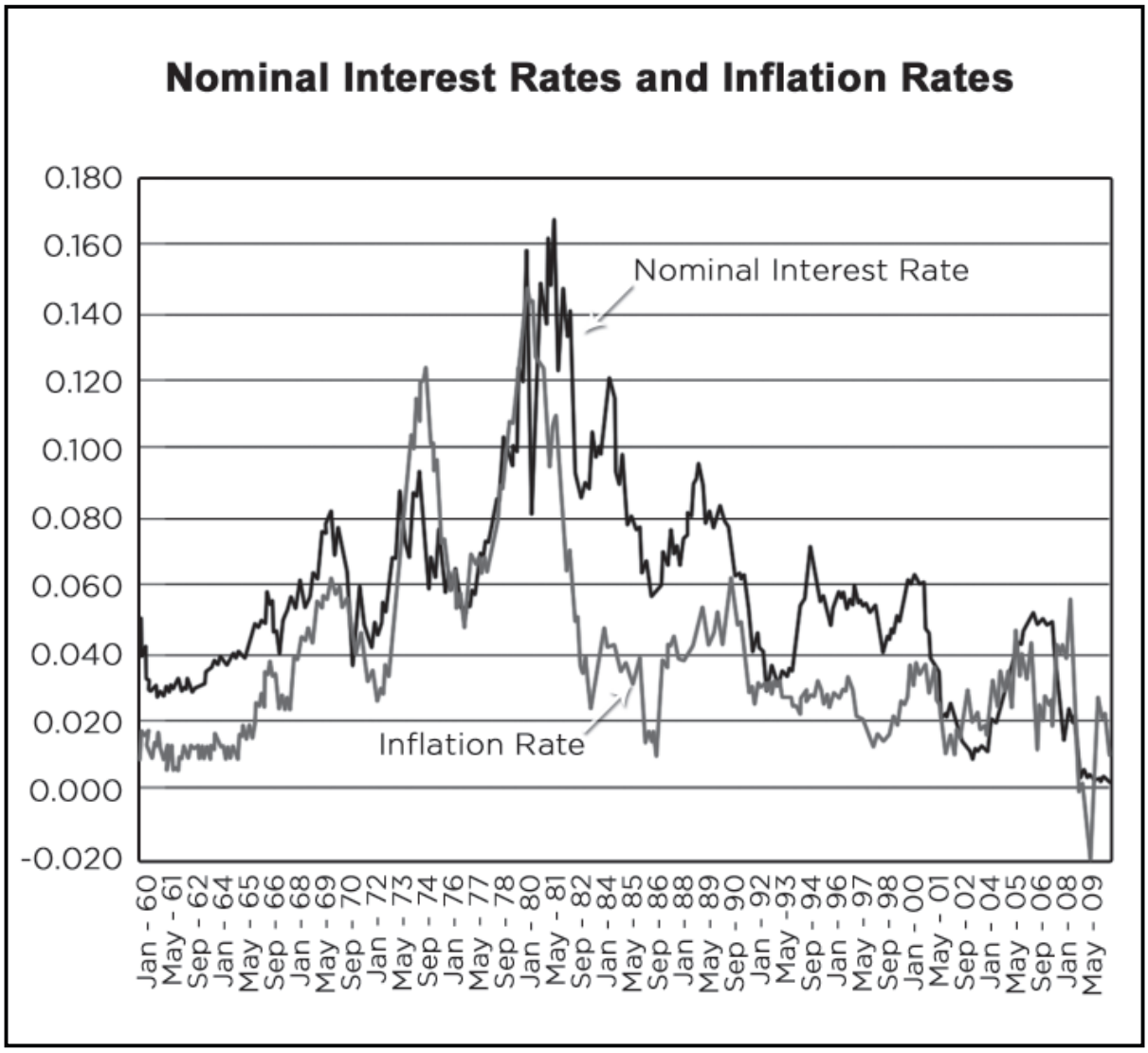
- Computation of the real rate of interest involves adjusting the nominal interest rate for the rate of inflation during the period of the loan. Note, however, that at the time of the original loan, Joe and Jan did not know what the rate of inflation would be.

The Connection of Interest Rates and Inflation

- Data show that the nominal rate of interest rises and falls with the inflation rate and varies more than the real rate of interest.

- A graph tracking the one-year Treasury bond rate and the rate of CPI inflation over a period of 50 years shows that the interest rate and the inflation rate tend to rise and fall together, but they do not

Figure 9.2

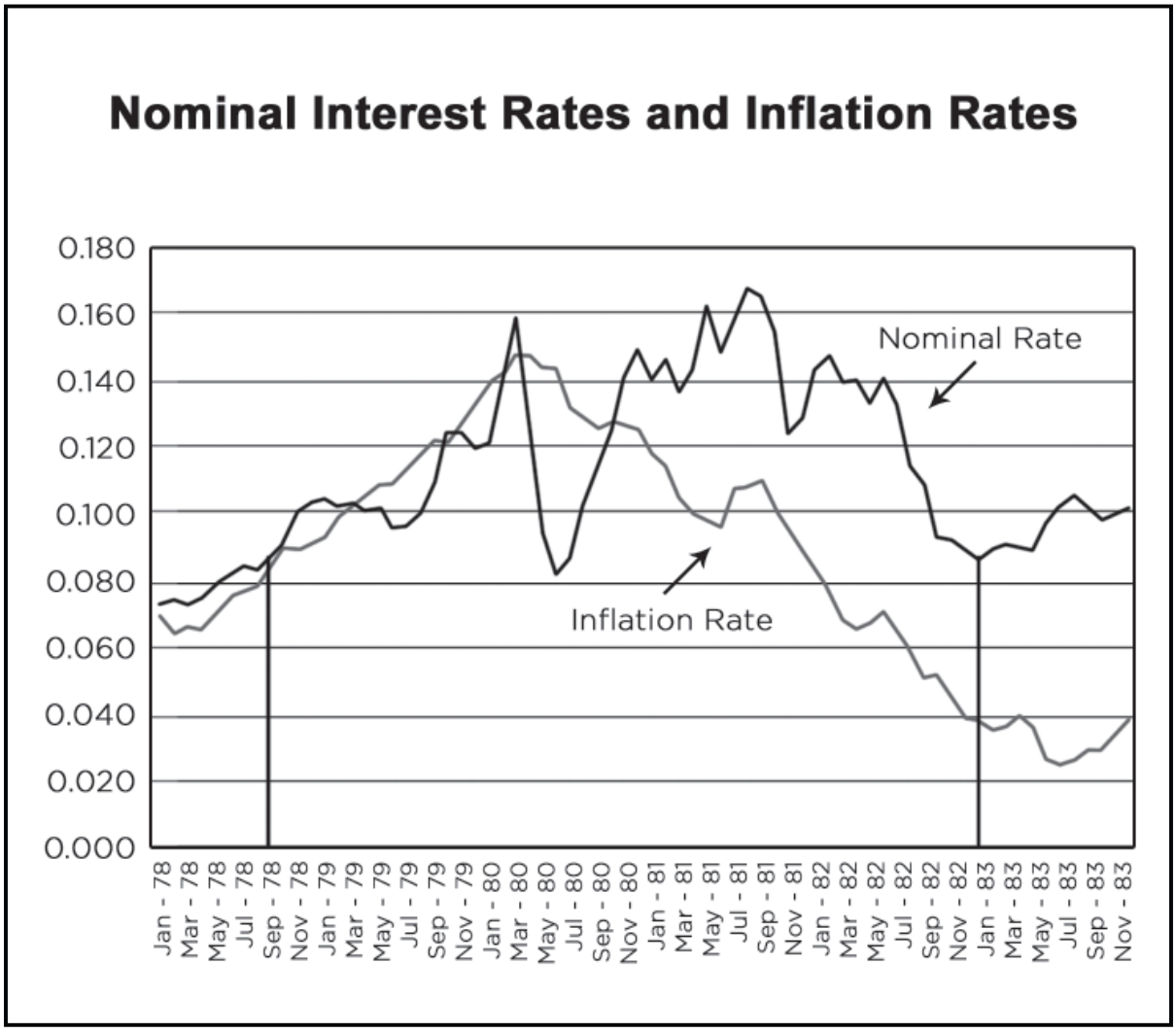


Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

move in lockstep. The correlation between the nominal interest rate and the rate of inflation is 72%.

- Zooming in on a portion of the graph shows that in September 1978, the inflation rate was almost as high as the interest rate, which makes the real rate of interest small. In contrast, in January 1983, the nominal interest rate was about 5 percentage points higher than the inflation rate, making the real rate of interest higher.

Figure 9.3



Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

Calculating the True Cost of Borrowing

- The real rate of interest is defined as the nominal interest rate minus the rate of inflation expected (on average) over the life of loan.

- The graph of the Treasury bond rate and the rate of CPI inflation compares nominal interest rates and inflation rates at the same dates, but that comparison is not quite correct. Borrowers and lenders both care about what happens to the purchasing power of the dollars they borrow and lend over the life of the loan.

- The correct inflation rate is not known at the time the loan is consummated. Both borrowers and lenders must guess the future course of inflation in order to estimate the real rate of interest and the true cost of borrowing.

- Consider a graph showing the real rate of interest between 1978 and 1983. Technically speaking, this graph shows, for each month, the one-year nominal interest rate minus the inflation rate that was realized over the year of the loan. That inflation rate is computed as the percentage change in the CPI that occurred between the date the loan was initiated and the date the loan was repaid.

- We can see that the real rate of interest was actually negative between 1978 and 1980 because inflation was higher than individuals expected when they agreed to the terms of their loans.

- Beginning in 1980, nominal interest rates caught up and surpassed the inflation rate; the real rate of interest began to increase until it peaked at just under 12% in 1981.

- Thus, for the two months we are comparing with the same nominal interest rates, the real interest rate was –3.5% (September 1978) and 4.4% (January 1983)—a 7.9% difference!

- Because of its connection to the rate of inflation, the real rate of interest can never be known for sure at the time that borrowing and lending decisions are made.

The Distinction between Nominal and Real Interest Rates

- Why is the distinction between nominal and real rates important? To answer this question, we return again to Jan, who is saving for her daughter's college education.

- Suppose Jan ignores inflation and bases her saving decisions on the nominal rate alone. By doing so, she ignores the likely increases in tuition that will occur between the present and the time that her daughter matriculates.

- By using the real rate of interest in her saving calculations, Jan is using forecasts of CPI inflation as a proxy for changes in tuition. The forecasts may be imperfect, but it is far wiser to assume that tuition will increase along with the CPI than to assume that no increases in tuition will occur.

- Understanding the real rate of interest also helps us better understand why it is important for the Federal Reserve to keep the inflation rate low and steady, making it far easier for borrowers and lenders to estimate the real rate of interest at the point of their credit transaction.

Important Term

nominal rate of interest: Specifies number of dollars borrower must pay to borrow funds.

Suggested Reading

Federal Reserve Bank of New York, "Interest Rates."

Fisher, *The Theory of Interest*.

Kennedy, "Eight Reasons Why"

Mishkin, *The Economics of Money, Banking, and Financial Markets*.

Questions to Consider

1. The U.S. Treasury sells a bond called TIPS that provides holders with regular interest and maturity payments and, in addition, a payment equal to the rate of inflation that has occurred over the life of the bond. What sort of individual would prefer this bond to a regular Treasury bond?

2. Suppose you are convinced by this lecture that you should use the real rate of interest when calculating how much to save for your retirement. How would you go about estimating the real rate of interest to use in your calculations?

Financial Intermediaries

Lecture 10

Many people believe that it is smart to cut out the middleman. Wouldn't it be great, for example, to swap houses with someone and avoid the fees of real estate agents that eat up 5–10% of property value? But avoiding the middleman isn't always the best course of action. Imagine how much time it would take you to manage your own portfolio of stocks in the absence of mutual funds or how difficult it would be to arrange to borrow funds to purchase a home without the services of a bank or thrift institution. This lecture looks at an important group of middlemen—financial intermediaries—and the role they play in a modern economy.

The Middlemen: Financial Intermediaries

- **Financial intermediaries** are firms, such as banks, that channel funds from savers to investors and other decision makers who have decided to spend more than their current income permits.

- As we saw in the example of Joe and Jan in the last lecture, some financial transactions occur directly, without the intervention of financial firms. But these transactions may carry a degree of uncertainty or risk. How will Joe find someone who is willing to transact with him? What will Jan do if Joe doesn't repay the loan and she doesn't have enough money for her daughter's tuition?

Direct and Indirect Finance

- The essential difference between direct and indirect finance is that with direct finance, the lender holds the IOU of the borrower; with indirect finance, the lender holds the IOU of the financial intermediary.

- In both cases, the lender's cash winds up in the hands of the borrower.

Repackaging IOUs

- A financial intermediary can be viewed as "repackaging" the IOUs of its borrowers. Many lenders prefer exchanging their cash for repackaged IOUs rather than exchanging it for IOUs of specific borrowers. The primary reason that lenders prefer to hold a diversified portfolio of IOUs is to avoid the risk of putting all their eggs in one basket.

- Consider a situation in which 1,000 lenders each wishes to lend $1,000, and 1,000 borrowers each wishes to borrow $1,000. With direct finance and no middleman, the borrowers and lenders pair up, but if 5% of the borrowers cannot repay their loans, then 5% of the lenders lose interest and their entire principal.

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Most financial transactions involve a financial intermediary, such as a commercial bank, thrift institution, or investment bank.

- In the same situation with indirect finance, there is no pairing. Each borrower holds an IOU issued by the financial intermediary. That IOU, in turn, is backed by a portfolio of borrower IOUs.

- Because the financial intermediary will charge borrowers a high enough rate of interest to allow for a normal number of defaults, individual lenders will all be paid in full by the intermediary.

- A loan to the intermediary is less risky because, in effect, each lender holds a diversified portfolio of IOUs.

Lender and Borrower Time Horizons

- Consider the same situation with 1,000 lenders and 1,000 borrowers. In this case, however, the borrowers want to borrow for two years, but the lenders want to lend for only one. With direct finance, it may not be possible for any borrower-lender pair to negotiate a mutually agreeable transaction.

- Indirect finance can bring borrowers and lenders together. The financial intermediary can lend funds for two years and borrow funds for one provided that, after one year, it replaces old lenders with new lenders.

- In other words, the financial intermediary finds a sequence of one-year lenders who collectively provide the funds desired by the multi-year borrower.

- Some financial firms specialize in maturity intermediation and bear risks when they do. There are not many lenders who want to lend for 30 years.

Liquidity

- Lenders may be more willing to lend if they know that they can quickly and without loss reconvert the IOUs they own to cash.

- A financial asset is said to be "liquid" if it can be rapidly converted to cash with no loss of value.

- Lenders value liquidity because liquid funds are available to the lender if some rainy-day scenario occurs. Jan will be even more willing to lend if she knows that she can trade in her IOU for cash if her own car requires repairs.

- Financial intermediaries create **liquidity**. That is, they offer lenders IOUs that are more liquid than the IOUs that borrowers exchange for the cash they receive. Intermediaries create this liquidity by holding some cash in reserve.

- The intermediary does not know in advance which lender will want to reconvert to cash but can know how much cash will be desired by the lenders as a group. By holding sufficient reserves for the group, each lender can rationally behave as if it can reconvert its IOUs to cash even though few will actually do so.

- It is an amazing cooperative outcome that we can all think of bank deposits as fully liquid.

The Business of Financial Intermediaries

- Financial intermediaries specialize in the evaluation of borrowers and their projects and, therefore, can better assess the riskiness of a borrower than a small lender can.

- A financial intermediary receives many loan applications and develops specialized processes for evaluating and monitoring them.

- Intermediaries also employ specialized legal skills to design and enforce borrowing contracts.

- The government provides oversight of financial intermediaries and, in some cases, special assistance to them that protects individuals who lend them funds.

- Commercial banks are financial intermediaries that also provide their customers with transaction services. Many customers prefer to hold their liquid funds as bank deposits because it is easy to pay them out by writing checks or authorizing electronic transfers.

Specialized Intermediation Services

- Commercial banks accept deposits from household and business depositors, who treat those deposits as transaction balances that they can spend at any time. Commercial banks normally hold about 10% of deposits in the form of cash reserves for depositors who wish to reconvert their deposits to cash. The balance of bank funds is used to make business and consumer loans, thereby earning a

profit. Commercial banks create liquidity, provide diversification to their customers, and are specialists in assessing credit worthiness.

- Thrift institutions, such as savings banks and credit unions, accept deposits from depositors who are willing to defer use of their funds for a period of time in order to receive a higher interest rate than they could get on checkable deposits. Thrift institutions use their funds to make consumer loans and issue mortgages. Thrift institutions intermediate maturities, create diversification, and assess credit worthiness of borrowers, especially mortgage borrowers.

- Mutual funds receive funds from those who buy shares. Those shares are sold along with a promise to use the obtained funds to pursue specific financial objectives. The funds are used to construct a portfolio of assets that fund managers believe will achieve the promised objectives. Mutual funds provide diversification and asset management

- Money market funds receive funds from those who buy shares. The shares are sold along with the fund's promise to purchase only assets that are highly liquid and will revert to cash within a short period of time. The funds are used to construct a portfolio of short-term debt instruments. Money market mutual funds create liquidity and provide diversification.

- Insurance companies receive funds from premiums paid by policyholders. They use these funds to pay claims to policyholders and to make long-maturity investments that earn profits to support future claims and cash redemptions. Insurance companies provide policyholders with the opportunity to hedge risk by paying relatively small premiums on a regular schedule in exchange for the right to be repaid if some calamity occurs.

The Benefits of Financial Intermediaries

- Financial intermediaries exist because they provide valuable services to their customers, such as managing stock portfolios, enabling diversification of financial investments, lending funds to purchase homes, or enabling us to provide for our families in the event of disaster. We could not make many of these provisions alone, but we can make them as a group.

- However, financial intermediaries may also create liabilities for an economy—liabilities that are occasionally very costly and require a complex system of regulations.

Important Terms

financial intermediaries: Firms, such as banks, that channel funds from savers to investors and other decision makers who have decided to spend more than their current income permits.

liquidity: A financial asset is said to be "liquid" if it can be rapidly converted to cash with no loss of value.

Suggested Reading

Kolb and Rodriguez, *Financial Institutions*.

Meulendyke, *U. S. Monetary Policy and Financial Markets*.

Mishkin, *The Economics of Money, Banking, and Financial Markets*.

Questions to Consider

1. What are some of the ways in which you take advantage in your domestic or business life in the specialized services provided by financial intermediaries?

2. Have you ever been involved, as either borrower or lender, in a direct loan arrangement with another person? If so, what were some of the problems you faced? How does a bank provide solutions for those problems?

Commercial Banks

Lecture 11

This lecture takes a dispassionate look at banks and the functions they perform in a modern economy. You will investigate bank balance sheets and learn the role that banks play in channeling funds from savers to investors. You will also see why banks are the only private financial institutions that can create money, and you'll study the process by which that occurs.

The Balance Sheet

- A good place to begin studying the modern bank is with a look at its **balance sheet**. Recall that a balance sheet is a list of the assets, liabilities, and net worth of a firm or individual and that "net worth" is defined to be the value of the firm's assets minus the value of its liabilities. By construction, balance sheets always balance..

Sources of Funds for Banks

- Where do banks get the funds they use to acquire various assets? Part of the answer is that they accept deposits of several types.

- **Transactions deposits** are those against which checks can be written. **Non-transactions deposits** are deposits in savings accounts, from which funds can be withdrawn at any time; banks also accept **time deposits**, which have fixed maturity dates. Large-denomination time deposits are certificates of deposit in amounts at or over $100,000 that are generally purchased by corporations and other banks.

- Banks also borrow funds from other banks, the Federal Reserve, Federal Home Loan Banks, and corporations. In December of 2005, total liabilities of the commercial banks in the United States amounted to slightly more than $8 trillion.

Figure 11.1

Consolidated Balance Sheet of Commercial Banks

December 2005 (Billions of Dollars)

Assets		Liabilities	
Treasury and Agency Securities	1,134	Transaction Deposits	656
Other Securities	907	Large Time Deposits	1,418
Commercial and Industrial Loans	1,045	Other Non-transaction Deposits	3.657
Real Estate Loans	2,904	Borrowing from US Banks	361
Consumer Loans	705	Borrowing from Others	1,360
Security Loans	262	Other Liabilities	568
Other Loans	525		
Interbank Loans	278	Total Liabilities	8,020
Cash Assets	311		
Other Assets	636		
Total Assets	8,707	Net Worth	687

Source: Federal Reserve.

T-account depicting the consolidated balance sheet of commercial banks in the United States at the end of December 2005, when the U.S. and world economies were in the midst of an expansion.

Uses of Funds for Banks

- How do banks use the funds they acquire? They hold Treasury and other government agency securities, as well as other securities, including those of private corporations.

- Banks also lend funds to businesses, for real estate purchases, to consumers in the form of auto loans and other consumer loans, to those who use the borrowed funds to purchase securities, and for some other loan-type activities.

- Banks hold cash assets of two sorts—actual currency and coin in their vaults and deposits at the Federal Reserve.

- In December 2005, total assets held by commercial banks amounted to a bit more than $8.7 trillion. At the same time, U.S. bank net worth (bank capital) equaled $687 billion.

The Relative Importance of Various Sources and Uses of Bank Funds

- Despite the fact that banks actively borrow funds, they are still primarily depository institutions in that 70% of their liabilities are deposits of one sort or another. Note that commercial banks are required to hold reserves only against transactions deposits, and these account for only 8% of liabilities.

- Despite the fact that banks hold various kinds of securities, they are primarily lending institutions in that 62% of their assets are loans of one sort or another.

- In December 2005, banks had net worth or capital equal to 8.6% of their liabilities (and about 8% of their assets). Banks and bank regulators have worked hard, especially in recent years, to determine minimal levels of bank capital needed to ensure bank safety.

- Bank capital drops quickly in bad economic times because the market value of securities falls and, more importantly, because the "true" value of loans falls.

- Banks are always susceptible to **bank runs**, situations in which depositors all try to withdraw deposited funds at the same time.

- In December 2005, commercial bank deposit liabilities totaled $5.7 trillion, of which $656 billion was "demand deposits." Bank cash assets totaled $311 billion—far less than what would be needed to redeem even those deposits that depositors have the right to redeem for cash at any time. It's easy to see that banks are fragile, no matter how well they are managed.

Which Assets Are Money in the United States?

- Keep in mind as we go through the various definitions of money that these definitions share a common intuition: **Money** is an asset that its owners rightly believe they can, quickly and without loss of value, convert to purchasing power. That is, money comprises those assets that can be used to buy the goods, services, and other assets that people wish to buy.

- The narrowest definition of money for the United States and other developed nations is M1, which equals currency held by the public, plus traveler's checks of non-bank issuers, plus demand deposits at commercial banks, plus other checkable deposits.

- A less narrow definition of money and the one favored by economists when they study the relationship between the quantity of money and economic behavior is M2, which equals M1 plus the following: (1) savings deposits, including money market deposit accounts; (2) small-denomination time deposits at depository institutions (except for IRA and Keogh balances); and (3) balances in retail money market deposit accounts (except for IRA and Keogh balances).

- The broadest definition of money is M3, which equals M2 plus the following: (1) balances in institutional money market mutual funds; (2) large-denomination time deposits; (3) large repurchase agreements of depository institutions on

Figure 11.2

Money Stock Measures for the U.S.
December 2005 (Billions of Dollars)

Components of M1	
Currency	724
Travelers Checks	7
Demand Deposits	321
Other checkable Deposits	317
M1	1,369
M2	6,676
M3	10,154

Source: Federal Reserve.

Table providing data of the quantity of money in the United States in December 2005.

U.S. government and federal agency securities; and (4) Eurodollars held by U.S. addressees.

- Notice that bank loans are not counted in any of the definitions of money, but as we shall see, banks create money when they lend to their borrowers.

The Creation of Money

- Commercial banks are the only private financial institutions that create money. The key to understanding this idea is knowing that transactions balances at commercial banks are money.

- Demand deposits at banks (and other depository institutions) are money because economic decision makers regard them as money, using them to buy what they want and to pay what they owe. Sometimes, decision makers have a strong preference for currency, but often, they regard balances in their checking accounts (and, to a lesser extent, their savings accounts) as money. Again, they can easily use savings account and money market balances to buy what they want and pay what they owe.

- To understand how banks create money, let's look at a sequence of stylized balance sheets. The sequence begins with a deposit of $1,000 by a customer who finds it convenient to exchange currency for a bank deposit. The bank faces a legal requirement to hold reserves equal to at least 10% of deposits, but the customer's decision to deposit cash has left the bank with excess reserves; that is, the bank is required to hold only $100 in cash as a reserve against the new deposit but has $1,000.

- The bank now uses its excess reserves to support a new loan of $9,000. It picks one of its loan applicants that it deems to be worthy and lends that individual $9,000, crediting the borrower's deposit account. Thus, the bank has created money.

- Note that the largest increase in deposits that the bank could accommodate with $900 in excess reserves was $900/0.10 = $9,000.

- This scenario assumes that none of the cash "leaks" out of the bank vault when the borrower spends it. If it does leak out, then the leak is captured by another bank, and the "multiplication process" transfers from one bank to another.

- At the end of the day, the deposit of $1,000 in cash increases the money supply by $9,000 because commercial banks use the cash as reserves to support the deposits they create when they write new loans.

- Because banks are required to keep only a fraction of their deposits in the form of reserves (currently, 10%, by law), they create liquidity. That is, they can use $1,000 of currency to support more than $1,000 of deposits.

- The ability to create liquidity is the ability to lend. If banks were required to hold 100% reserves against their deposits, then they would not be able to lend.

Our Image of Bankers

- Our image of bankers as ruthless businessmen may be moderated when we know what bankers really do. They help customers realize plans to purchase homes, cars, and equipment for businesses.

- Of course, our newfound realization of the business of bankers does not completely rehabilitate their image. Banks and bankers came under a tremendous amount of valid criticism for banking practices that contributed to the subprime mortgage crisis. In a later lecture, we will look at that crisis and revisit the role of banks and bankers.

Important Terms

balance sheet: A list of the assets, liabilities, and net worth of a firm or individual and that "net worth" is defined to be the value of the firm's assets minus the value of its liabilities.

bank runs: Situations in which depositors all try to withdraw deposited funds at the same time.

money: An asset that its owners rightly believe they can, quickly and without loss of value, convert to purchasing power.

non-transactions deposits: Deposits in savings accounts, from which funds can be withdrawn at any time.

time deposits: Deposits which have fixed maturity dates.

transactions deposits: Deposits against which checks can be written.

Suggested Reading

Kolb and Rodriguez, *Financial Institutions*.

Meulendyke, *U. S. Monetary Policy and Financial Markets*.

Mishkin, *The Economics of Money, Banking, and Financial Markets*.

Questions to Consider

1. It has sometimes been proposed that banks be required to hold $1.00 of reserves for $1.00 of deposits they accept. In your view, what would be the costs and benefits of such a restriction on commercial bank activity? Would you favor the proposal?

2. Is it a benefit to society that banks are able to create liquidity by holding only a fraction of their deposits in the form of reserves?

3. Commercial loans are inherently illiquid because borrowers use the funds they borrow to undertake business activities that do not immediately produce sufficient cash to pay off the loan. Should banks be allowed to make commercial loans? Why or why not?

Central Banks

Lecture 12

This lecture looks at the most important financial institution in the United States, the institution that is entrusted to maintain and protect the wealth of our nation, guard the value of the U.S. dollar, and exercise regulatory control over commercial banks and other financial firms: The Federal Reserve. This powerful bank—and other central banks around the world—does not offer banking services to private citizens; instead, it provides banking services to commercial banks. It also enforces some of that laws that regulate financial firms, but the real source of its power is that it is entrusted with the ability to control our economy's interest rates and the responsibility to fight inflation and recessions.

Central Banks around the World

- Although the U.S. Federal Reserve is widely considered to be the most powerful of central banks (in part because people around the world hold dollars as part of their financial strategies), other central banks are also important.

- The Bank of England was founded in 1694 to act as the government's banker and debt manager. It is the oldest central bank that we will consider in this lecture series.

- Also of great importance is the European Central Bank (ECB), which was created by the Treaty of Amsterdam in 1998 to oversee monetary policy in the euro area. The ECB is located in Frankfurt, Germany.

- A central bank that is increasingly important in the 21st century is the People's Bank of China in Beijing.

A Brief History of the U.S. Federal Reserve

- President Woodrow Wilson signed the Federal Reserve Act in December of 1913. Its stated intent was "to provide for the establishment of the Federal reserve banks, to furnish an elastic currency, to afford means of rediscounting commercial paper, to establish a more effective supervision of banking in the United States, and for other purposes."

- As you recall, the United States had tried earlier to create a federal bank entity. It chartered the First Bank of the United States in 1791 and the Second Bank of the United States in 1816. Both banks were given initial charters of 20 years, but neither saw its charter renewed.

- The Federal Reserve Act has been amended many times. In the 1930s, for example, it was amended to create the Federal Open Market Committee (FOMC), which is empowered to conduct monetary policy. This committee oversees purchases and sales of government bonds by the Federal Reserve in the open market; it also decides on interest rate targets.

- An announcement by the FOMC of an increase in the federal funds rate quickly tightens credit markets and raises interest rates. A decrease in the federal funds rate is a harbinger of lower interest rates and looser credit markets.

- In 1978, President Carter signed the Humphrey-Hawkins Act into law. This act requires the Federal Reserve chairman to report twice annually to Congress on the Fed's monetary policy goals and objectives. It also explicitly instructs the nation to strive toward four ultimate goals: full employment, growth in production, price stability, and balance of trade and budget.

- In 1999, President Clinton signed the Financial Services Modernization Act, which effectively repealed some of the restrictions placed on banks in the 1930s after the Great Depression.

What Does a Central Bank Do?

- One way to explore the role and responsibilities of a central bank is to take a look at its balance sheet.

- The balance sheet of the Federal Reserve as of December 28, 2005, shows that it holds gold certificates, a holdover from the period of the gold standard.

- The Fed's most important asset item is Treasury securities.

- The Fed also holds special drawing rights. These are assets created by the International Monetary Fund in 1969 in an attempt to support the gold standard. They functioned like paper gold and were used by central banks as a substitute for gold holdings.

Figure 12.1

Balance Sheet of the Federal Reserve

December 28, 2005 (Billions of Dollars)

Assets		Liabilities	
Gold Certificates	11.0	Federal Reserve Notes	759.2
Special Drawing Rights	2.2	Reverse Repurchase Agreements	30.4
Coin	0.7	Depository Institution Deposits	17.1
US Treasury Securities	744.2	US Treasury Deposits	4.2
Federal Agency Securities	0.0	Foreign Official Deposits	0.09
Repurchase Agreements	45.3	Other Deposits	0.3
Loans	0.1	Deferred Availability of Cash Items	6.7
Items in the Process of Collection	7.8	Other Liabilities	4.4
Bank Premises	1.8	Total Liabilities	822.4
Other Assets	37.3		
Total Assets	850.4	Net Worth	28.0

Source: Federal Reserve.

- The Fed often conducts monetary policy using a derivative called a repurchase agreement.

- A look at the other side of the balance sheet shows that the Fed's most important liability is Federal Reserve Notes. This is the paper currency of the United States, which is issued by and is the liability of the Federal Reserve.

- Note, too, that the Federal Reserve is the bankers' bank. Banks hold deposits at the Fed that totaled $17.1 billion on December 28, 2005. Commercial banks sometimes borrow funds from the Fed, and when they do, the Fed credits their deposit accounts.

- The Fed balance sheet helps us understand what economists mean when they say that governments sometimes print money to finance their deficits. The Treasury issues bonds and bills to finance its deficits, but the Fed sometimes buys those bonds and bills. When it buys them, it finances those purchases by creating new deposits.

- In the previous lecture, we learned that commercial banks create money. When a commercial bank makes a new loan to a customer, it adds funds to the customer's deposit account. Because the money supply of the United States includes checkable deposits, the commercial bank increases the supply of money when it makes a new loan.

- When the Federal Reserve buys a Treasury security, it pays for the security by adding funds to the deposit account of a commercial bank. That, in turn, makes it possible for the bank to make new loans and create new deposits.

- The Fed also helps commercial banks clear checks: The entries in the balance sheet labeled "Items in Process of Collection" and "Deferred Availability of Cash Items" result when the Fed receives a check from a commercial bank and holds it for a time until it can be presented to the commercial bank of the individual that wrote the check in the first place.

- Finally, the Fed functions as the paymaster of the Treasury. The Treasury actually has a "checking account" at the Fed.

The Balance Sheet of the Bank of England

- The balance sheet of the Bank of England tells a similar story, with a few differences.

- Assets equal liabilities for the Bank of England because, under British law, the Bank of England's net worth is the property of the British Treasury.

- The largest asset and liability items on this balance sheet are securities owned by the bank and currency issued by the bank.

- Both commercial banks and private citizens may have deposits at the Bank of England. The Bank of England also makes loans to commercial banks.

- The Bank of England maintains separate accounts for deposits that commercial banks hold as reserves and other deposits.

Figure 12.2

Balance Sheet of the Bank of England

December 28, 2005 (Billions of Pounds Sterling)

Assets		Liabilities	
Government Securities	15.5	Pound Streling Notes in Circulation	40.3
Other Securities	26.9	Public Deposits	0.8
Advances	15.7	Deposits of Banks	3.3
Bank Premises and Equipment	7.7	Deposits in Reserve Accounts	21.4
Total Assets	65.8	Total Liabilities	65.8

Source: Bank of England.

The Most Powerful Financial Institutions in the World

- Central banks are considered the most powerful financial institutions in the world because they are responsible for the growth in their nations' supplies of money.

- When the Fed creates additional money and, thus, increases the money supply at an appropriate rate, it helps the economy grow by providing the new dollars necessary to support the transactions associated with growth.

- When the Fed increases the money supply too rapidly, the rate of inflation increases and the value of the dollar, in terms of other currencies, falls. In later lectures, we will look in more detail at how central banks stimulate and de-stimulate economies.

Figure 12.3

Excessive Money Growth Results in Inflation
Ten Year Growth Rates in Annual Terms

Period	Money Base Growth	Real GDP Growth	Inflation
1955 - 65	3.0	3.9	1.8

Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

Suggested Reading

Kolb and Rodriguez, *Financial Institutions*.

Mishkin, *The Economics of Money, Banking, and Financial Markets*.

Mishkin, "What Should Central Banks Do?"

Questions to Consider

1. How would you characterize the evidence that supports the conclusion that central banks are responsible when excess inflation occurs in an economy? What is the nature of the evidence? Is the evidence strong or weak?

2. Why is it reasonable to describe a central bank as a "banker's bank"?

3. How does the Federal Reserve differ from the U.S. Treasury?

Present Value

Lecture 13

All of us need to move money through time at some point in our lives. We may, for example, need to move money from the future into the present to buy a house. That's what we do when we sign a note and take out a mortgage. Business managers move money through time when they borrow against expected future profits to obtain funds to build and install equipment in a new plant. Deciding on how to move money through time requires us to be able to compare the value of a dollar at two different dates, and in this lecture, you'll learn about the tool that allows us to make that comparison: present value.

The Puzzle of Pat and Jean

- We begin with a puzzle we can solve using the idea of present value: Pat and Jean are twins who just celebrated their 21st birthday. As a birthday gift, their grandmother gave them a U.S. savings bond that will pay $10,000 on their 31st birthday and nothing before then. Put another way, a fair division of the birthday gift will provide Pat and Jean each with $5000 in 10 years.

- Pat has worked for several years, currently has $15,000 in a bank account, and is content to wait to receive his share of the gift. Jean has started a business into which she has poured all of her funds; she would like to have her share of the gift now.

- Jean suggests that Pat give her $5000 now from his bank account in exchange for her share of the gift. She reasons that Pat will get the money back in 10 years when he receives both halves of the gift. But if Pat left the money in his bank account, he would receive interest on the $5000. He thinks it would be fair to pay Jean a lesser amount for her share of the gift.

- The key to solving Pat and Jean's problem is the concept of present value.

The Concept of Present Value

- The concept of present value is central to understanding the relationship between bond prices and interest rates. It is also the key to determining what a share of stock should be worth and, by extension, when stock is overvalued. This concept guides business managers in deciding whether or not to invest and household decision makers as they decide on savings plans to fund future college expenses or retirement.

- With rare exceptions, a dollar that will be received (or paid) in the future (a future dollar) is worth less than a dollar in hand today (dollar today).

- A dollar today provides its owner with a larger set of opportunities than a future dollar provides. One of these opportunities is to hold the dollar until the future arrives. A dollar today is more valuable because the extra opportunities it affords are valuable.

- Usually, you can earn interest on a dollar today and, at a future date, have both the dollar plus the earned interest.

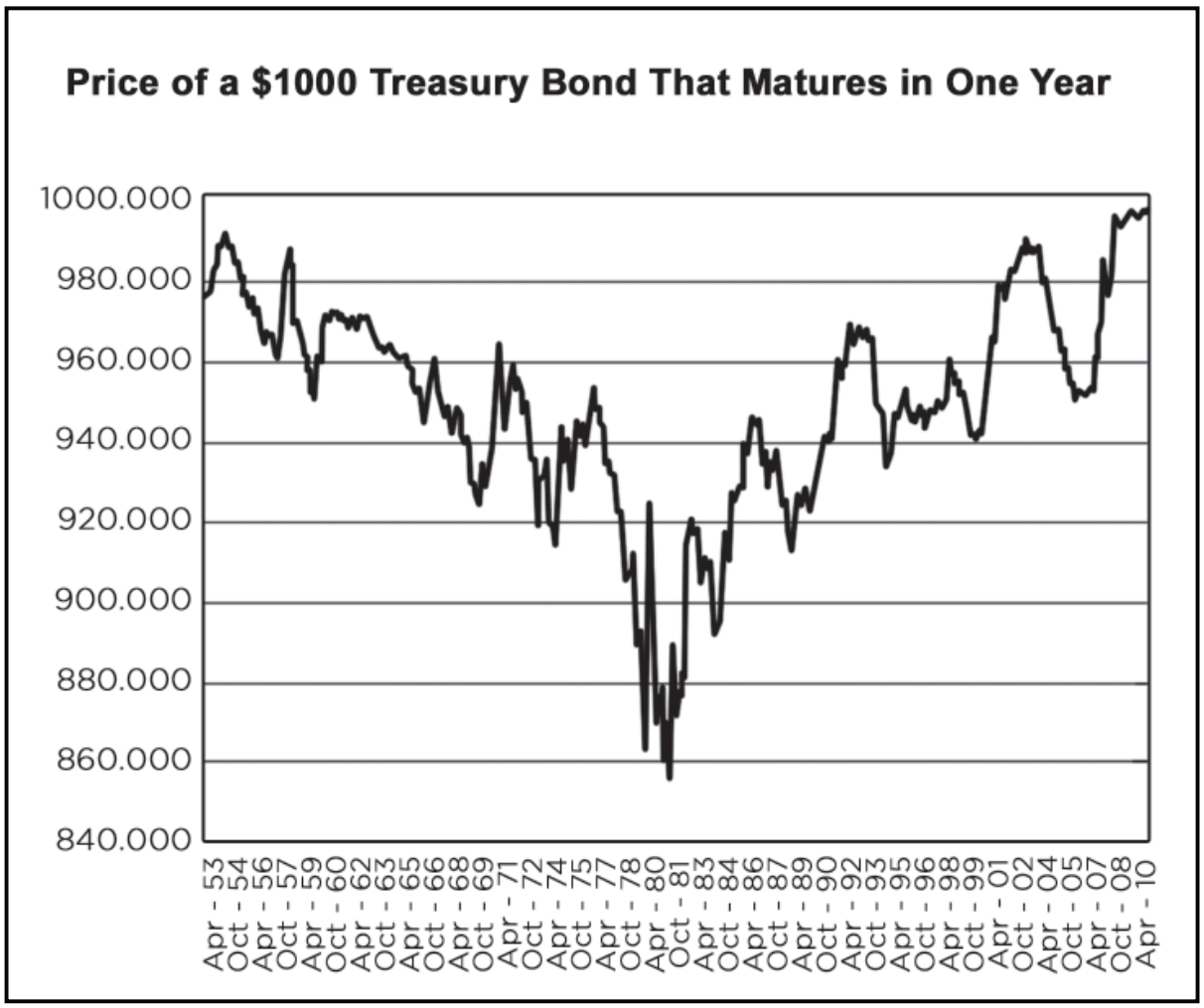
- The Treasury bill market provides an example. A Treasury bill is the U.S. Treasury's promise to pay an amount (say, $1000) at a date in the future. The current market price of a Treasury bill is always less than the face value of the bill; that is, the bill sells at a discount. As the date of payment grows closer, the market price of the bill converges to its face value.

Computing Present Value

- To compute the present value of a future payment is to discount the future payment.

- A **discount rate** is a positive number that defines the rate at which a future payment loses value as the date of the payment moves further into the future. It is expressed as a decimal.

Figure 13.1



Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

- As an example, suppose the time is measured in years and the discount rate is $d = 0.07$ (or 7%). Then, a dollar to be received after one year is worth 7% less than a dollar in hand today.

- To discount a future payment is to divide it by a number greater than 1.0 $(1 + d)$.

Present-Value Formula

- The present value of a payment to be made at a future date is an amount just large enough so that it will grow to the size of the future payment by the future date.

- For example, the present value (PV) of \$1.00 to be received in one year is as follows:

  $PV = \$1.00/(1 + d)$

  $PV = \$1.00/1.07$

  $PV = \$0.935$

- We can rewrite the formula to illustrate that the present value grows into the future value (FV), as follows:

  $FV = \$1.00$

  $FV = (1 + d) \times PV$

  $\$1.00 = (1.07) \times \$0.935$

- The present-value formula shows how to compute the present value of a stream of payments. Suppose, again, that time is measured in years. Let t be the present date, $t + 1$ is a date one year into the future, $t + 2$ is a date two years into the future, and so on. The stream of payments is represented as: S_{t+1} dollars at time $t + 1$, S_{t+2} dollars at $t + 2$, and so forth. The present-value formula is as follows:

  $$PV = S(t + 1) / (1 + d) + S(t + 2) / (1 + d)^2 + ... + S(t + m) / (1 + d)^m$$

- Suppose the stream of payments is \$100 at $t + 1$, \$100 at $t + 2$, and \$1100 at $t + 3$ so that $m = 3$. This is the stream of payments promised by a bond with a face value of \$1,000 and a coupon rate of 10%. The formula would read as follows:

  $$PV = \$100 / (1.07) + \$100 / ((1.07)^2 + \$1,100 / (1.07)^3$$

  $PV = \$93.458 + \$87.344 + \$897.928 = \$1,078.73$

- Thus, $1078.73 is the present value of the stream of payments ($100, $100, $1100) when the discount rate is 7%.

- The present value of a stream of payments is the exact amount that is sufficient to replicate the stream of payments provided that one can borrow and lend at the discount rate used in the present-value calculation.

- If we start with an amount equal to the present value of the stream of payments, deposit that amount in an account paying 7% (the discount rate assumed), and make withdrawals just sufficient to make the payments in the stream, then we will exhaust the available funds on the date of the last payment.

- This example shows the sense in which the present value of a stream of payments is equivalent to the stream and a fair price for purchasing the stream.

Present Value and Savings

- The concept of present value is crucial in figuring out a savings plan to provide sufficient funds for planned future payments.

- Suppose you decide to save for your child's education by depositing an amount each year into a special fund. Your goal is to have $100,000 in the fund on the child's 18th birthday. The key to determining how much you must save each year is to use the present-value formula.

- The present value of the fund is: P Val Fund = $100,000 / $(1 + d)^{18}$.

- The present value of your saving plan is: P Val Plan = $x + x / (1 + d) = x / (1 + d)^2 + \ldots + x / (1 + d)^{18}$.

- In these formulas, d is the discount; it would be appropriate to use the rate of interest you can earn on your saving plan funds for d.

- In the second formula, x is the unknown amount you must save. To calculate the saving plan is to find the value of x such that the present value of the fund equals the present value of the plan.

- If $d = 0.02$—that is, if you can earn 2% on your funds—then $x = \$4378.18$.

What about Pat and Jean?

- Armed with our knowledge of present value, we return to the question of how much Pat should pay Jean today to fairly compensate Pat for giving up the claim to $5,000 to be paid 10 years from today.

- The present-value formula tells us that Pat should pay Jean: Present Value = $\$5000 / (1 + d)^{10}$. Pat can earn 3% in a savings account at his credit union; thus, the twins agree that $d = 0.03$ is fair.

- Pat should pay Jean:

  $\text{P Val} = \$5000 / (1.03)^{10}$

  $\text{P Val} = \$5000 / 1.344$

  $\text{P Val} = \$3720.47$

- In addition to solving Pat and Jean's problem, present value is an important tool used by economists and financial analysts to compute bond yields and fundamental values for stocks.

Important Term

discount rate: A positive number that defines the rate at which a future payment loses value as the date of the payment moves further into the future.

Suggested Reading

Eichberger and Harper, *Financial Economics*.

Federal Reserve Bank of New York Public, "Interest Rates."

Mishkin, *The Economics of Money, Banking, and Financial Markets*.

Questions to Consider

1. Identify some other problems in your home or professional life that could be solved using the concept of present value.

2. Explain why present value and compound interest are closely related concepts.

3. How would you use present value to decide how much to save for your retirement? What discount rate would you use in your calculations? Why?

Probability, Expected Value, and Uncertainty

Lecture 14

This lecture begins an investigation of decision making in the face of uncertainty. You will encounter the concepts of probability and expected value and learn how they can be used to guide decision making. These concepts help us think through many kinds of decisions we face in our lives and better understand the importance of financial markets in our society. These concepts also provide a background for investigating financial institutions, which routinely make decisions in the face of uncertainty when they decide whether to lend funds or underwrite an initial public offering of stock.

A Random-Outcome Generator

- To introduce decision making in the face of uncertain outcomes, we will use a "random-outcome generator"—the roll of one fair die. Begin by considering random events with only 6 outcomes; if the die is fair, the probability of each outcome is 1/6.

- Suppose you have the opportunity to play the game depicted in the following table:

Probabilities and Payouts

Outcome	1	2	3	4	5	6
Probability	1/6	1/6	1/6	1/6	1/6	1/6
Payout	–$5.00	–$1.00	0	0	$1.00	$5.00

- The **expected value** (EV) of the game is the probability weighted average of the game's payouts: EV = (–$5.00)(1/6) + (–$1.00)(1/6) + ($0)(1/3) + ($1.00)(1/6) + ($5.00)(1/6) = $0.00.

- The probability weighted average is different than a simple average. The 0 outcome has a weight of 1/3 because that outcome is twice as likely as the others.

- When the expected payout of a game is 0, the game is said to be "fair." If the expected value were positive, we would call the game "better than fair," or a **player-advantage game**. If the expected value were negative, we would call the game "worse than fair," or a **house-advantage game**.

- The expected value of the game may be interpreted as the average prize you would receive if you played the game many times. Clearly, you should not expect to make a profit by playing this game.

More Complicated Decisions

- The owner of a toy store must decide in July on the kind and quantity of toys to order for the holiday shopping season. This July, the decision is particularly difficult because there is great uncertainty about consumer confidence. When consumers fear that a recession may come and unemployment may rise, they often spend less during the holiday season in order to build up their cash reserves.

- The toy shop owner has two available strategies. In the aggressive strategy, the owner purchases a large quantity of toys, including a good supply of the newest and most expensive ones. In the conservative strategy, the owner purchases a much smaller inventory and sticks with tried-and-true toys rather than new, expensive ones.

- Both strategies entail risks. If consumer confidence is low and the owner pursues the aggressive strategy, he or she will be stuck with inventory that can only be sold at a loss. If consumer confidence is

high and the owner pursues the conservative strategy, he or she will miss out on the opportunity to make many profitable sales.

- The table below shows the owner's assessment of the costs and benefits of each strategy as a function of consumer confidence.

Toy Store Profits (Thousands of Dollars)

Consumer Confidence	High					Low
	6	5	4	3	2	1
Probability	1/6	1/6	1/6	1/6	1/6	1/6
Aggressive	100	75	50	0	–25	–50
Conservative	20	20	20	10	–5	–10

- The conservative strategy loses only in the worst two states, and when it loses, it loses relatively little. But the conservative strategy tops out at a $20,000 profit and does not benefit from the high levels of spending associated with a truly good holiday shopping season.

- The aggressive strategy is profitable in only half of the states, and in the worst two states, losses are high. But in the best three states, profits are large relative to the other strategy.

- The expected profit of the aggressive strategy is $25,000. The expected profit of the conservative strategy is $9,167. What decision should the toy store owner make?

- Some decision makers believe that they should always choose the strategy with the higher expected return. In this case, the aggressive strategy clearly dominates. However, by any reasonable measure, the aggressive strategy is riskier.

Not a Game of Chance

- It's important to note that the toy store decision is not like a game of chance in at least two very important respects. First, it is generally not possible to play the game multiple times.

- To appreciate the importance of this point, consider a modification of the first game, as presented in the following table:

Better-than-Fair Game

Outcome	1	2	3	4	5	6
Probability	1/6	1/6	1/6	1/6	1/6	1/6
Payout	*–$5.00*	*–$1.00*	*0*	*0*	*$1.00*	*$6.00*

- Only one feature of the game has changed: The payout associated with outcome 6 is now $6.00, rather than $5.00. This means that the expected payout of the game is now $0.16. If you can play this game without limit, you should, because your wealth will grow without bound.

- As the game is played multiple times, the law of large numbers tells us that the average return becomes a certain return. This, by the way, is the business model of a casino. Casino games are invariably house games; that is, they are less-than-fair games with negative expected payouts for the player and positive expected payouts for the house.

- Our toy store scenario is not one that an entrepreneur can repeat without limit.

- An entrepreneur who believed that he or she had a strategy with a positive expected profit might try to replicate it in a number of different markets. However, in our example, the law of large numbers would not work to the entrepreneur's advantage

because the source of risk—consumer confidence—would not be determined by independent, random events. Consumer confidence is an economy-wide phenomenon based on the overall prospects for the economy.

- Thus, it is not obvious that one of the two strategies is better. The aggressive strategy has a higher expected profit, but it is also riskier by any reasonable definition of risk.

Sources of Information about Relevant Probabilities

- There is a second important difference between the toy store decision and the decision to play a casino game. That difference centers on the source of information about the relevant probabilities of events.

- For the first game, randomness is generated by a random-number generator (a die) with specific, well-understood properties. No such random-number generator exists for generating different consumer confidence outcomes that define the random states of the world in the toy store scenario.

- In real-world decision scenarios, decision makers must often define the relevant states and estimate the relevant probabilities themselves (or hire experts to do so). Frequently, this is done by analyzing data on similar past events with the assumption that the frequencies of events in the past are good estimates of the probabilities of similar events in the future.

- A new example will help us understand the difference between decision scenarios where probabilities are estimated and decision scenarios where they are known on a priori grounds.

- The following table contains a frequency distribution of annual real returns on all the stocks traded on the New York Stock Exchange (NYSE) between 1945 and 2007.

- **Real returns** are defined as the sum of percentage capital gains and dividends earned on the NYSE market portfolio minus the rate of inflation.

- A positive return means an individual holding the NYSE portfolio experienced a gain in purchasing power. A negative return means that individual experienced a loss in purchasing power.

- For each sextile, the table reports the average of returns with the sextile. The probabilities are the frequencies observed in historical data.

Real-Return Sextiles for the NYSE, 1945–2007

Sextiles	1	2	3	4	5	6
Probability	1/6	1/6	1/6	1/6	1/6	1/6
Payout	–0.18	–0.02	0.07	0.13	0.19	0.28

- The stock market, as characterized by this table, is a better-than-fair game. The average real return between 1945 and 2007 is 0.08. But that does not necessarily mean that an investor should expect an 8% return in the future. In 2008, the real return on the NYSE was –0.44, lower than any other return experience over the historical period.

- Real-world decision making is different from decision making in the casino because we may only be able to estimate the probabilities of various outcomes.

Initial Rules of Thumb

- If a game or an investment opportunity has a positive expected return, a rational agent should play rather than pass.

- If a rational agent has to choose among games or investments, the agent should choose the one with the largest expected return.

Important Terms

expected value (EV): The probability-weighted average of the game's payouts.

house-advantage game: When the expected value is negative.

player-advantage game: When the expected value is positive.

real returns: The sum of percentage capital gains and dividends earned on the NYSE market portfolio minus the rate of inflation.

Suggested Reading

Eichberger and Harper, *Financial Economics*.

Stat Trek, "Statistics Tutorial."

Questions to Consider

1. Is it reasonable to liken a business decision that must be made without knowing all the facts that will determine profitability to a game of chance? Why or why not?

2. Why is it reasonable to characterize the U.S. stock market as a "better-than-fair" game?

3. Should all rational individuals be willing to play a better-than-fair game? Why or why not?

Risk and Risk Aversion

Lecture 15

In this lecture, you return to the question of how economists think about risk and decision making in the face of uncertainty. Such issues are the cornerstones of our understanding of equity markets, insurance, and derivative securities. They help us understand why we decide to insure ourselves against some hazards but not others, and they help us determine when bank regulations are likely to make banks safer and when they may have the unintended consequence of making them riskier.

A Review of Fair Games and Expected Value

- A fair coin toss means that the probability of landing on either heads or tails is 50% and that the outcome is in no way controlled by the person who flips the coin. With that in mind, consider a game in which, if the outcome is heads, you are paid $1.00; if the outcome is tails, you must pay $1.00.

- The game is fair because the expected payout is 0: Exp Pay = –(1/2) × $1.00 + (1/2) × $1.00 = $0.00

- In a better-than-fair version of this game, you would receive $1.10 when the outcome is heads, and you would pay $1.00 when the outcome is tails.

- For a long time, it was believed that rational decision makers would always choose to play a better-than-fair game and, faced with the choice of several games, would always choose the game with the highest expected value. Thus, a rational individual would always be willing to play the second version of the coin-toss game.

The St. Petersburg Paradox

- This traditional thinking changed when scholars confronted a puzzle called the St. Petersburg Paradox.

- In the St. Petersburg game, players flip a fair coin until the first tails appears. If it appears on the first toss, the game pays $1.00; on the second toss, the prize doubles to $2.00; on the third toss, $4.00; and so on.

- What would you pay to play the St. Petersburg game? Of course, everyone will pay at least $1.00 because $1.00 is the minimum payout of the game. In fact, when given the opportunity to purchase a play of the St. Petersburg game, most experimental subjects are willing to pay between $2.00 and $3.00.

- However, the expected payout of the game is infinite, as the following computation confirms: Exp Pay = (1/2) $1.00 + (1/4) $2.00 + (1/8) $4.00 + … = $0.50 + $0.50 + …

- The paradox is as follows: If rational decision making means playing a game any time its expected outcome is greater than 0, then rational decision makers should be willing to pay any amount to play the St. Petersburg game. But clearly, there is a limit to what people are willing to pay to play.

- The resolution of the paradox is that most rational agents are risk averse. They will not play some better-than-fair games because those games are risky, and they are willing to pay to have risk eliminated from their lives.

Definition of "Risk"

- To define "risk," we will use three similar but different coin-toss games. In each game, there will be only one toss of the coin, and you will win if the coin shows heads and lose if the coin shows tails. What makes the games different is the size of the wager.

Game	Heads	Tails	Exp Pay
A	$1.10	–$1.00	$0.05
B	$2.10	–$2.00	$0.05
C	–$3.10	–$3.00	$0.05

- All three games have the same expected payout, $0.05, which means that all three games are better than fair. Clearly, however, game C is riskier than game B, which is riskier than game A.

- The standard measure of risk is a measure of the dispersion of the payouts. A graph of the probability weighted payouts of games A, B, and C shows that the possible payouts of game C (–$3.00, $3.10) are more widely dispersed (separated) than the payouts of game B (–$2.00, $2.10), which are more widely dispersed than the payouts of game A (–$1.00, $1.10).

- Another way to understand why game C is the riskiest is to note that probability weighted loss is greater for game C (.5 × $3.00 = $1.50) than for game B (.5 × $2.00 = $1.00) and for game A (.5 × $1.00 = $0.50).

- For those who are familiar with statistics, a standard measure of dispersion is the standard deviation of payouts.

Resolution of the Paradox

- The resolution of the St. Petersburg Paradox is generally attributed to the mathematician Daniel Bernoulli. It has two essential components.

- The first component is the idea that the value to an individual of additional wealth falls as wealth increases. It follows that the satisfaction derived from gaining an additional dollar is less than the satisfaction lost from losing a dollar.

- Bernoulli's first idea is embodied in the hypothesis that the utility an individual derives from wealth is a concave function of wealth. The concavity of the function implies that the utility gained from the gain of an additional dollar of wealth is smaller than the utility lost from the loss of a dollar of wealth. Put another way, the marginal value of wealth falls as our wealth increases.

- Bernoulli's utility-of-wealth function has a solid intuition behind it. When an individual has little wealth, it is used to acquire the things he or she values most. As wealth increase, an individual can acquire new things that add to his or her utility but add less than the important things acquired when the individual had less wealth.

Images from the History of Medicine (NLM).

Daniel Bernoulli (1700–1782), a mathematician who is attribued with the resolution to the St. Petersburg Paradox.

- The second component of the resolution is the hypothesis that a rational decision maker maximizes expected utility rather than expected value. Expected utility is the probability weighted average of the utility of the wealth that would result from each possible random outcome.

- By way of example, let's ask whether a person who maximizes expected utility and whose preferences are described by the concave utility function would play a fair coin toss game for $10.00.

- The answer is no because by not playing the game, the risk-averse individual can keep his or her utility at 0—the normalized starting point for our utility measure. By playing the game, the individual would have a 50% chance of winning $10.00 and a 50% chance of

losing $10.00. But the gain in utility associated with winning $10.00 is smaller than the loss in utility associated with losing $10.00.

- Why does the expected utility hypothesis resolve the St. Petersburg Paradox? A person with little wealth places a great deal of utility weight on each dollar he or she must spend for a "ticket" to play the St. Petersburg game. The person places less utility weight on each dollar he or she would win if it took many coin tosses for the first heads to appear.

Lessons from Bernoulli

- Most individuals do not make decisions in the face of uncertainty by considering only the expected value associated with the random event.

- Bernoulli's resolution of the St. Petersburg Paradox suggests that individuals are risk averse because they value the dollars they might lose more highly at the margin than they value the dollars they might win.

- The expected utility hypothesis is not the last word on decision making in the face of uncertainty. For example, it's a puzzle for researchers to explain why individuals buy property insurance or lottery tickets. Milton Friedman and Leonard Savage hypothesized that the typical household has a utility-of-wealth function that is concave in the vicinity of "normal wealth" but turns convex at much higher levels.

- In sum, the resolution of the St. Petersburg Paradox tells us that most decision makers are risk averse. They dislike dispersion of payouts and the prospect of losing. Bernoulli's expected utility hypothesis is a simple but powerful idea: We place greater value on a dollar we lose than on a dollar we gain.

Suggested Reading

Eichberger and Harper, *Financial Economics*.

Friedman and Savage, "The Expected-Utility Hypothesis."

Questions to Consider

1. Does the utility-of-wealth diagram presented in this lecture provide a good description of the way your personal utility varies with wealth? Why or why not?

2. Would you describe yourself as "risk averse" in the sense of this lecture?

3. Consider an individual whose utility-of-wealth function was convex rather than concave. How would that person behave when faced with an opportunity to gamble?

An Introduction to Bond Markets

Lecture 16

This lecture introduces the bond market and explains the various types of government and non-government debt obligations. You also look at the connection between debt securities and the federal deficit and revisit the summer of 2011, when the United States faced the possibility of defaulting on bonds for the first time in its history.

U.S. Treasury Bills, Notes, and Bonds

- U.S. Treasury bills are short-term debt instruments. A **T-bill** is the promise of the Treasury to pay the face value of the bill at maturity. The market price of a T-bill is less than its face value; in other words, T-bills always sell at a discount.

- U.S. Treasury notes are medium-term debt instruments. A Treasury note is the promise of the Treasury to pay the face value of the note at maturity and to pay coupon payments every six months. The note is thus defined by its face value, the size of the coupon payments, and the date of its maturity.

- When the Treasury issues new notes, it typically sets the coupon rate (which will be locked for the life of the note) close to the current interest rate. As time passes, the coupon rate may turn out to be greater or less than the prevailing market rate of interest. The market price of a Treasury note can be either larger or smaller than its face value.

- U.S. Treasury bonds are long-term debt instruments. **Bonds** are like Treasury notes in all respects except one: Treasury notes mature in 2–10 years, while bonds offer a maturity of 30 years.

- Government bills, **notes**, and bonds are all considered to be less risky than stocks, primarily because they specify in advance the payments they will make.

STRIPS and TIPS

- The Treasury sells additional securities, including those known as **STRIPS** (Separate Trading of Registered Interest and Principal Securities).

- STRIPS are the result of "stripping" the coupon payments from a Treasury bond or note and using the payments to create another government debt obligation that makes a single payment on its maturity date. Thus, STRIPS are "zero-coupon" securities.

- STRIPS are popular with investors who want to receive a known payment on a specific future date. For example, a financial institution that has a future obligation to pay a known amount of funds might purchase STRIPS with a maturity date equal or close to the date at which its obligation must be paid.

U.S. Treasury Department, Washington D.C.

- STRIPS are not issued or sold directly to investors. They can be purchased and held only through financial institutions and government securities brokers and dealers.

- The U.S. Treasury also sells **TIPS** (Treasury Inflation Protected Securities); the principal of a TIPS increases with inflation and decreases with deflation, as measured by the CPI. When a TIPS bond matures, the owner is paid the adjusted principal or original principal, whichever is greater.

- Since 2004, a non-protected bond had an average yield about 2% greater than the yield on a TIPS bond, indicating that the market values the inflation protection that TIPS provide.

- As of June 2009, TIPS represented 8% of the $6.6 trillion public Treasury debt.

The Federal Deficit and the National Debt

- The U.S. government supplies debt securities to the marketplace when it operates at a **deficit**, which occurs when government revenues are less than expenditures. The deficit is a flow—its units are dollars per year or per quarter.

- The **national debt** is the accumulation of deficits; it is a stock rather than a flow. If the government deficit is likened to the amount of water spilling over a dam, then the debt is the amount of water collected in the pool under the dam. The units of the national debt are dollars.

- When the federal government runs a deficit, the national debt increases. When the government runs a **surplus** (tax revenues greater than expenditures), the national debt decreases.

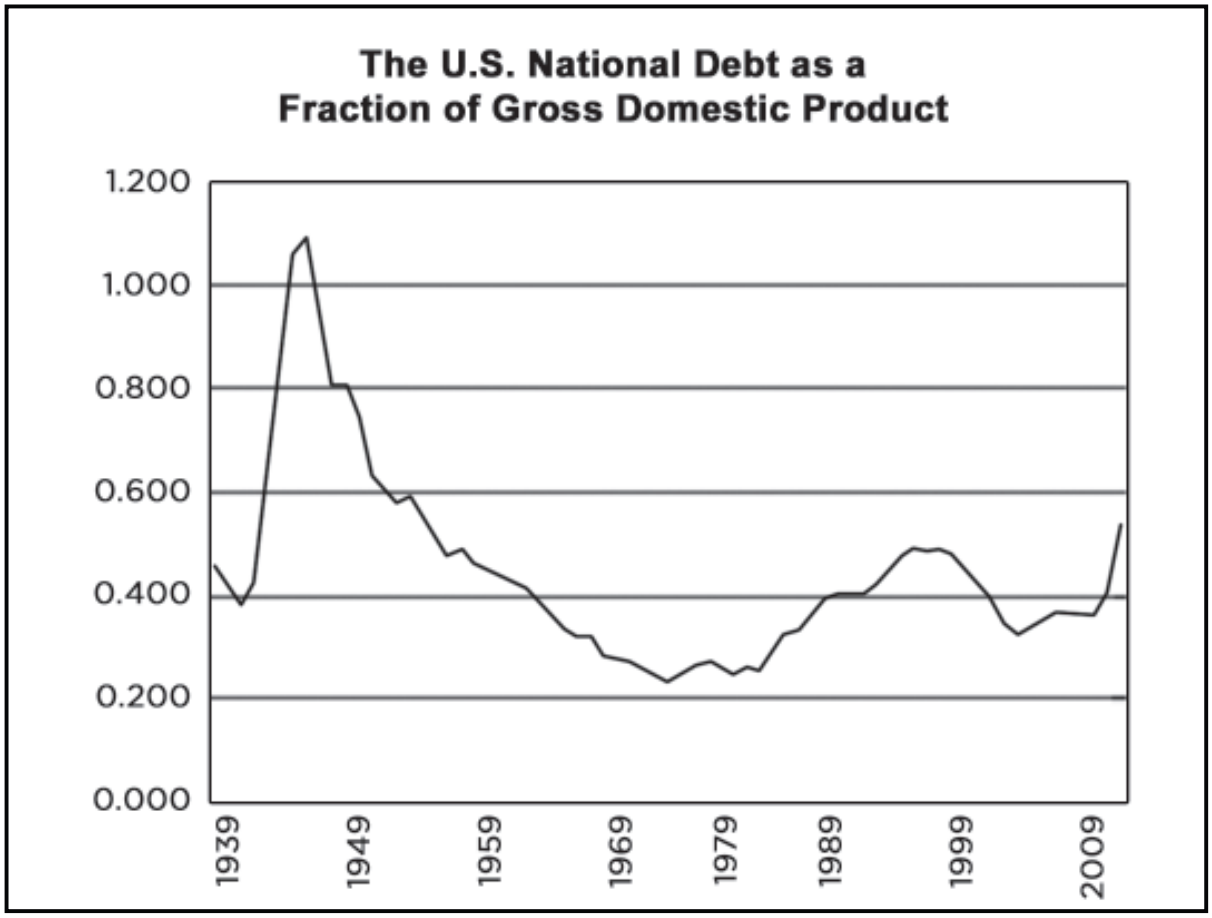
- Every year, the government must pay interest on the national debt; this interest is a current expenditure. In that sense, a higher debt means higher interest expenses, which means a higher deficit (or a lower surplus) if other factors remain unchanged.

- If a government ever had a debt so large that the interest on the debt exceeded its total tax revenues, the government would certainly fail. In fact, many economists believe that governments would fail at lower levels of the debt. Whether the levels of the debt and deficit are too large or not is a question that should be answered in the context of the size of the economy.

- A graph of the federal deficit as a share of GDP shows that the largest fraction of GDP (13%) occurred during World War II. The federal deficit exceeded 8% of GDP during the Great Recession of 2007–2009. Large deficits imply large new Treasury security issues.

- A graph of the national debt as a share of GDP shows that the largest fraction of GDP (110%) was reached at the end of the World War II. The figure hit a low of 25% in 1975, increased to a peak of 50% in 1995, fell to 32% in 2001 (after the Clinton tax increases),

Figure 16.1



Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

and began to increase again with the Bush tax cuts and the large deficits associated with the Great Recession.

- The national debt held by the public is the supply of government securities that must be willingly held by private citizens here and abroad.

Other Bond Markets

- Other important bond markets are those through which corporations and state and local governments borrow funds. An overview of market activity in the corporate bond market shows three categories of bonds: (1) investment-grade bonds (highly rated), (2) high-yield bonds (low ratings; sometimes called "junk bonds"), and (3) convertible bonds (can be converted to stock under certain conditions).

- On November 19, 2010, 5500 different bond issues were traded with a total value of more than $14 billion. On that day, about half the traded issues saw their prices increase, while half saw their prices decrease.

- Typically, the yields of the best investment-grade corporate bonds are higher than the yields of government bonds of the same maturity because market participants believe that there is greater risk that a corporation will not be able to keep its promises than there is that the U.S. government will be able to keep its promises.

- Other government entities also borrow funds in the bond markets. For example, state and local governments and various government entities, such as toll road authorities and government water and sewer systems, issue bonds in order to finance construction of public facilities.

- Many savers, especially those with high incomes, prefer to hold municipal bonds because of the preferred tax treatment they receive for the interest payments made by those bonds.

The Importance of Bond Markets

- Bond markets are where corporations, the federal government, state and local governments, and other public entities compete with one another for scarce funds provided by savers.

- Savers lend funds to these borrowers in anticipation of receiving interest payments that come in the form of coupons or capital gains or some combination of the two.

- Bond markets determine several key issues: a nation's interest rates, whether borrowing is expensive or inexpensive, which investment projects are funded and which are not, and how much you will pay to borrow funds to buy a house or car.

The Debt Ceiling

- During the Great Recession and the fragile recovery that followed, both the federal deficit and the national debt increased as a share of GDP. In the summer of 2011, the national debt approached its previously authorized ceiling of $14.294 trillion.

- A national debate raged about whether or not to raise the debt ceiling. Republicans were willing to raise the ceiling only if Congress agreed to large permanent cuts in federal spending. Democrats would agree to spending cuts, but only if they were accompanied by policy changes that would raise new revenues.

- As the date when the national debt would exceed its authorized maximum approached, the nation wondered whether Congress would authorize an increase or whether, for the first time in its history, the United States would default on its promises to pay.

Important Terms

bond: A certificate promising to repay money at a fixed rate of interest at a specified time.

deficit: When government revenues are less than expenditures. The deficit is a flow—its units are dollars per year or per quarter.

national debt: The accumulation of deficits; it is a stock rather than a flow.

notes: Medium-turn debt instruments of the Treasury; the promise of the Treasury to pay the face value of the note at maturity and also to pay coupon payments every six months.

STRIPS (Separate Trading of Registered Interest and Principal Securities): The result of stripping the coupon payments from a Treasury bond or note and using those coupon payments to create another government debt obligation that makes a single payment on its maturity date.

surplus: When tax revenues are greater than expenditures.

T-bill: Short-turn debt instruments of the Treasury; the promise of the Treasury to pay the face value of the bill at maturity.

TIPS (Treasury Inflation Protected Securities): The principal of a TIPS increases with inflation and decreases with deflation, as measured by the CPI. When a TIPS bond matures, the owner is paid the adjusted principal or original principal, whichever is greater.

Suggested Reading

Federal Reserve Bank of New York, "Interest Rates."

Mishkin, *The Economics of Money, Banking, and Financial Markets*.

Questions to Consider

1. Why does it make sense for U.S. Treasury securities to sell at prices that imply lower yields to maturity than are implied by the prices of bonds of reputable U.S. corporations?

2. How would you explain to someone who has not studied financial markets why owning bonds is less risky than owning shares of stock? How would you explain to them why owning bonds is not riskless?

3. What is the implication for bond markets when the U.S. federal deficit grows as a share of GDP?

Bond Prices and Yields

Lecture 17

Bond markets are where interest rates paid by borrowers and earned by lenders are determined. But exactly how does this happen? The short answer is that by setting the price of bonds, bond markets determine the yields to maturity of those bonds, and bond yields are interest rates; thus, bond markets determine interest rates. It's important to understand the relationship between bond prices and yields to maturity for a number of reasons, including the fact that yields to maturity determined in the bond market are market standards to which other interest rates, such as those paid by home buyers, adjust.

Secondary Markets

- Although the U.S. Treasury is the original seller of Treasury securities, such as bills, bonds, and notes, private individuals and businesses buy and sell these securities in the secondary market. The existence of a secondary market means that it is easy to convert a Treasury security into cash on any business day.

- The existence of a secondary market also means that individuals who wish to move money from the present to the future have a larger menu of maturity dates than that offered for new issues by the Treasury.

- Suppose that in 2000, the Treasury issued 30-year bonds with a coupon rate of 4%. The maturity date of those bonds is 2030, but they will continue to trade in secondary markets until they mature. In 2005, those bonds provided an opportunity equivalent to a 25-year bond; in 2010, they provided an opportunity equivalent to a 20-year bond; and so on.

Figure 17.1

Treasury Statistics

		Trade prices: 11/17/2010			Average Daily Volumes: 09/2010		Average Closing Quotes	
Security Name US Treasury	Curr	High	Low	Median	No. of Trades	Volume	Bid	Offer
2.0 30/11/2013 S	USD	103.62	103.62	103.62	<1	57809		
2.375 31/07/2017 S	USD	102.16	102.16	102.16	<1	375428	101.70	101.74
2.5 30/04/2015 S	USD	105.23	105.23	105.23	<1	118095	104.95	104.98
2.625 15/08/2020 S	USD	100.39	97.63	98.64	161	144231971	97.76	97.80
2.625 15/11/2020 S	USD	98.50	97.11	98.06			97.71	97.72
2.625 31/07/2014 S	USD	105.84	105.84	105.84	<1	2857	105.61	105.65
2.75 15/02/2019 S	USD	102.47	102.47	102.47	1	552247	101.88	101.93

Source: Bondmarketprices.com.

- Let's consider a Treasury bond that will mature on February 15, 2019, with a coupon rate of 2.75%. On November 17, 2010, its median trade price was 102.47% of its face value, or $1024.70 for a $1000 bond. The reason the bond sold at a premium was that its coupon rate was higher than market interest rates on November 17, 2010.

- The fact that Treasury securities trade on secondary markets means that their prices and yields change with every change in price.

Yield to Maturity

- The yield to maturity of a Treasury security is the internal rate of return on the stream of payments promised by the security.

- Recall from an earlier lecture the formula for present value, as shown below. According to the formula, the present value of a set of payments to be made on different future dates is the sum of the appropriately discounted value of each of those payments, where d is the discount rate: $PV = S(t + 1)/(1+ d) + S(t + 2)/(1 + d)^2 + \ldots + S(t + m)/(1 + d)^m$.

- Let's look at the stream of payments promised by a 52-week Treasury bill. On November 1, 2010, such a bill with a face value of $1000 had a secondary market price of $997.90.

- The yield to maturity (YTM) of this Treasury bill is the value of the discount rate that sets the present value of the payments the bill will make equal to its market price. The formula for this is:

  Market Price = (Payment in 1 Year) / (1 + YTM)

  $997.90 = $1000 / (1 + YTM)

- The value of YTM in this case is 0.0021.

- Let's now move to November 15, 2010, and compute the yield to maturity of a Treasury note with a coupon rate of 0.5%, a face value of $1000, a maturity date of November 15, 2013, and a market price of $991.50.

Stream of Payments Promised by the Exemplar Treasury Note

Date	May 15, 2011	Nov 15, 2011	May 15, 2012	Nov 15, 2012	May 15, 2013	Nov 15, 2013
Payment	$2.50	$2.50	$2.50	$2.50	$2.50	$1002.50

Source: Michael Salemi.

- The YTM of this Treasury note is the value of x that sets the present value of the stream of payments equal to its price, as shown below:

  $\$991.50 = 2.50/(1 + x) + 2.50/(1 + x)^2 + 2.50/ (1 + x)^3 + 2.50/ (1 + x)^4 + 2.50/(1 + x)^5 + 1002.50/(1 + x)^6$

- The value of x is 0.00285, or a semiannual yield of 0.285%, or an annual yield of 0.57%.

- Why do the prices and yields of Treasury securities move in opposite directions? To answer that question, let's return to the earlier Treasury bill example. Recall the formula we used:

  Market Price = (Payment in 1 Year) / (1 + YTM)

- When the market price rises, YTM must fall. Conversely, when the market price falls, YTM must rise. The same is true for a bond that pays coupons. A decrease in the market price of a bond always implies an increase in its YTM.

Holding Period Yield

- The holding period yield of a Treasury security is not generally the same as the yield to maturity.

- The **yield to maturity** is the ex ante yield that a bill, note, or bond purchaser will earn if the bond is held from the date of purchase to maturity. Put another way, the yield to maturity is the rate at which the purchaser's initial investment will grow between the date of purchase and the date on which the security matures.

- The purchaser may, however, decide to sell the security before it matures. The holding period yield on the bond is the rate of return earned on the initial financial investment between the date the bond is purchased and the date it is sold.

- If the yield to maturity of a bond increases between the time of purchase and the time of sale, then the holding period yield will

be smaller than the yield to maturity calculated when the bond was purchased. The price of the bond will be lower when it is sold than originally expected.

- If the yield to maturity of the bond falls between the time of purchase and the time of sale, then the holding period yield will be higher than the yield to maturity calculated when the bond was purchased. The price of the bond will be higher when it is sold than originally expected.

Capital Loss or Gain?

- Suppose you purchase a 10-year U.S. Treasury bond that you expect to sell after 5 years. What sort of economic news would likely create a capital loss or gain for your bond holdings? The answer to this question depends on what has happened to the yield to maturity in the time between the purchase and sale of the bond.

- If the yield to maturity has risen, you will experience a capital loss because the market price of the bond you sell will be lower in order to make the bond competitive with newer bonds that are promising higher yields to maturity.

- If the yield to maturity has fallen, you can expect a capital gain because the market price of the bond you sell will be higher given that it offers a higher yield to maturity than newer bonds.

- What sort of economic events would make yields to maturity rise or fall? If economic growth increases beyond the expectations that were in place when you bought the bond, then yields to maturity will rise and you will sell your bond at a lower price than you expected.

- Harkening back to our discussion of the debt ceiling, if anything happens to make it more likely that the U.S. government will default on its bonds, then the yield to maturity on newly issued bonds will rise as market participants demand higher yields as compensation for the higher risks they face in lending to the government. Again,

you will realize a capital loss because a lower price for the bond you are selling is required to make it attractive to prospective buyers.

Takeaway Points

- The present-value equation provides the crucial link between bond prices and yields to maturity.

- The yield to maturity for a discount security (a Treasury bill or STRIPS) is the rate at which the current market price for the security must grow so that the security is worth its face value on the day of maturity.

- A bond or note that has coupons provides two sources of payment: the coupon payment and the capital gain (or loss) associated with paying the market price and receiving the face value at maturity.

- The yield to maturity is computed using the present-value formula to account for the amount and timing of all payments. In fact, the yield to maturity is the discount rate that makes the present value of the payments offered by the bond equal to its market price.

- Someone who purchases a bond and sells it prior to maturity can receive a holding period yield different from the yield to maturity computed at the time of purchase.

Important Term

yield to maturity: The ex ante yield that a bill, note, or bond purchaser will earn if the bond is held from the date of purchase to maturity.

Suggested Reading

Eichberger and Harper, *Financial Economics*.

Federal Reserve Bank of New York, "Interest Rates: An Introduction."

Mishkin, *The Economics of Money, Banking, and Financial Markets*.

Questions to Consider

1. What is the difference between the yield to maturity of a bond and the holding period yield of a bond? When will those two yields be different? Will they ever be the same?

2. Suppose you have purchased 10-year U.S. Treasury bonds that you expect to hold for 5 years and then sell. What sort of economic news would likely create a capital loss for your bond holdings? What sort of news would likely create a capital gain?

How Economic Forces Affect Interest Rates

Lecture 18

In this lecture, you'll learn to think of interest rates in a new way: as market-determined "prices" that are set by the forces of demand and supply. What "good" is being priced when markets determine the interest rate? The answer is "early use of funds." In this conception, demanders are those who want to use funds earlier than their incomes justify, and suppliers are those who provide early use of funds to those who will pay sufficient interest. Equilibrium occurs at the interest rate that makes the plans of fund demanders and suppliers compatible. This lecture explains this idea of an interest rate as a market price in this lecture and learn how different long-run and short-run economic forces work on the rate of interest.

Interest Rates as Market Prices

- Let's begin by supposing that Jane wishes to purchase a new car for $20,000. We will assume that there is no inflation and that Jane pays the same interest rate to borrow that she receives when she saves.

- Jane has at least two options: (1) She can borrow $20,000 to purchase a car and repay the loan in equal monthly installments over 36 months, or (2) she can put an equal amount in her savings account every month for 36 months until the balance of the account is $20,000.

- The difference in cost of the two options depends on the rate of interest. Clearly, an increase in the rate of interest makes the borrowing option more expensive and the saving option less expensive when Jane's monthly payments are used as the measuring stick.

Figure 18.1

How Changes in the Interest Rate Affect the Cash Flow of Borrowers and Lenders When the Object Is to Purchase a $20,000 Automobile

Interest Rate	Monthly Payment Required to Purchase Auto	Monthly Saving Required to Purchase Auto in 36 Month
2	$572.85	$538.62
6	$608.44	$505.91
10	$645.34	$474.72
14	$683.55	$445.03

Source: Michael Salemi.

- Economists take the view that relative prices matter for economic decision making and that relative prices adjust to clear markets. If a pound of apples costs $2.00 and a pound of pears costs $3.00, then the relative price of a pound of pears is 1.5 pounds of apples. This means that when a consumer chooses a pound of pears, he or she refuses 1.5 pounds of apples.

- If pears are scarce relative to apples, the relative price of pears should increase (say, to 2 pounds of apples per pound of pears). If pears become abundant relative to apples, then the relative price of pears should fall.

- The inflation-adjusted (or real) rate of interest measures the cost of goods today relative to goods in the future. If the real rate is higher, someone who buys goods now gives up more goods in the future. If the real rate is lower, someone who buys goods now gives up fewer goods in the future.

The Long-Run World

- In the long run, the real rate of interest is determined by the patience of the population and the productivity of the nation's capital. This important point was made by one of the great 20th-century economists, Irving Fisher.

- In Fisher's long-run world, the economy remains at full employment, government budgets are balanced, and the economy's current account is balanced. That means, approximately, that the value of goods and services imported in a year equals the value of goods and services exported. Clearly, the long-run world is one that we rarely see, but it is a world toward which economic forces propel us.

- When markets determine the rate of interest, the economic "good" that is being priced is "early use of funds." The interest rate is the price of that good.

Demanders and Suppliers

- Let's think of "demanders" as those who have some compelling desire to use funds in excess of their income. Examples include households that wish to buy a home or pay for a child's education, as well as business owners who wish to implement highly productive technologies or plans. The more productive, the higher the interest rate the demanders are willing to pay.

- For demanders, higher interest rates are a disincentive to borrow. Suppose you have an idea for a better mousetrap, but to buy equipment and obtain space for manufacturing and distribution, you must obtain startup funds. The interest you pay on these funds is a cost of realizing your business plan. The higher that interest rate, the greater the cost.

- There is another way to explain the role of interest rates in an investment decision: To invest is to spend money today and to receive in return a stream of future profits. An investment is economically rational only if the present value of the profit stream

exceeds the current investment outlay. Higher interest rates imply higher discount rates for future profits and smaller values for present value.

- In this conception, it does not matter whether you must borrow the funds or you have them in hand. If you have them in hand, the interest rate measures your opportunity cost of using them to finance your mousetrap factory because you could lend them and earn the interest rate.

- Your investment plans must be sufficiently productive to justify all costs of implementation, including interest costs. As the interest rate rises, the plans of some entrepreneurs become unprofitable. The higher the interest rate, the greater the number of investment plans that are not profitable and will not be undertaken.

- "Suppliers" are patient in the sense that they are willing to lend from their current income. That is, they are willing to allow others to borrow a part of the income they have earned in exchange for interest payments. For demanders, higher interest rates are an incentive to lend.

- Patient people are more likely to lend than impatient people. Patience is likely to be higher when a household's income is more than sufficient to provide for food, clothing, and shelter. Patience is also likely to be higher when a household desires to make an expensive purchase in the future, such as a house.

- A higher interest rate is an incentive to supply funds because a higher interest rate implies a greater reward to saving. That is, a higher interest rate implies that one's savings will buy more in the future.

- In the long run, interest rates tend to the values that balance the plans of borrowers and lenders. If there is more credit demanded than can be supplied, those with the most productive projects will offer to pay a higher interest rate and will crowd out less productive

projects. If there is less credit demanded than can be willingly supplied, the most patient savers will offer to accept a smaller interest rate.

The Departure of Interest Rates from Long-Run Values

- In the short run, interest rates depart from long-run values for several important reasons.

- For example, governments sometimes spend more than they earn in tax revenue; that is, they run deficits. When the government sector runs a deficit, it must borrow funds to balance its accounts. In doing so, government competes with private borrowers for scarce funds. If the government deficit increases (other factors unchanged), the demand for funds increases and interest rates rise. The rise in interest rates crowds out some investment projects.

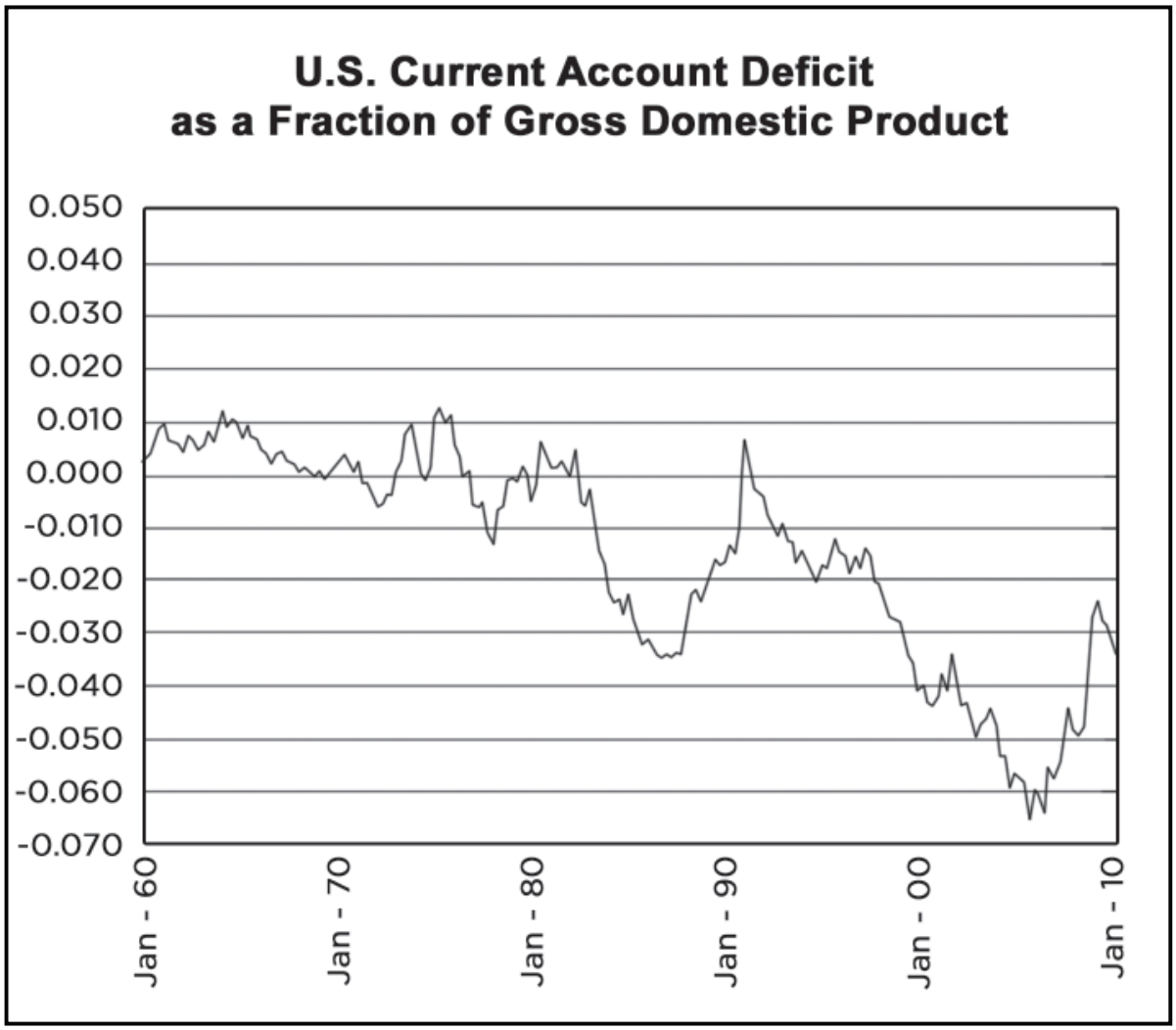
- Interest rates may also depart from long-run values when a nation runs a current account deficit, which is the difference between the values of a nation's imports and exports (with some adjustments). When a nation runs a current account deficit, the value of its imports is higher than would be justified by its exports (and income flows).

- When the United States runs a current account deficit, the rest of the world "lends" it purchasing power. That is, our trading partners prefer to use some of the dollars they receive by selling us goods to buy financial assets issued by U.S. firms and the government. In effect, the trading partners are lending us funds.

- When the current account is in deficit, the supply of credit to the United States is higher than from domestic sources alone, which means that interest rates are lower, other factors unchanged.

- Finally, interest rates may depart from long-run values when the economy is in recession. In this situation, demand for credit is low in part because firms doubt that households will buy their products. Because demand for credit is low, interest rates are also low.

Figure 18.2



Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

Takeaways on Interest Rates

- Interest rates are important economic prices that are determined in the market for credit.

- In the long run, the saving and investment plans of the members of an economy jointly determine interest rates. In the short run, other forces are important, as well.

- Government deficits tend to raise interest rates because the government competes with private borrowers for scarce funds. Current account deficits tend to lower interest rates because the supply of credit is greater than it would be from domestic sources alone.

- When the economy is in a recession and resources are unemployed, interest rates tend to be lower both because demand for credit is low and because the Federal Reserve often lowers rates in an attempt to stimulate spending.

Suggested Reading

Federal Reserve Bank of New York, "Interest Rates: An Introduction."

Fisher, *The Theory of Interest*.

Kennedy, "Eight Reasons."

Mishkin, *The Economics of Money, Banking, and Financial Markets*.

Questions to Consider

1. What did Irving Fisher mean when he famously said that the (real) rate of interest was determined by the interaction between the patience of the nation's population and the productivity of its capital?

2. In what sort of nation would you expect the average real rate of interest computed over a century to be high? To be low?

3. Why do real rates of interest depart from their long-run values?

Why Interest Rates Move Together

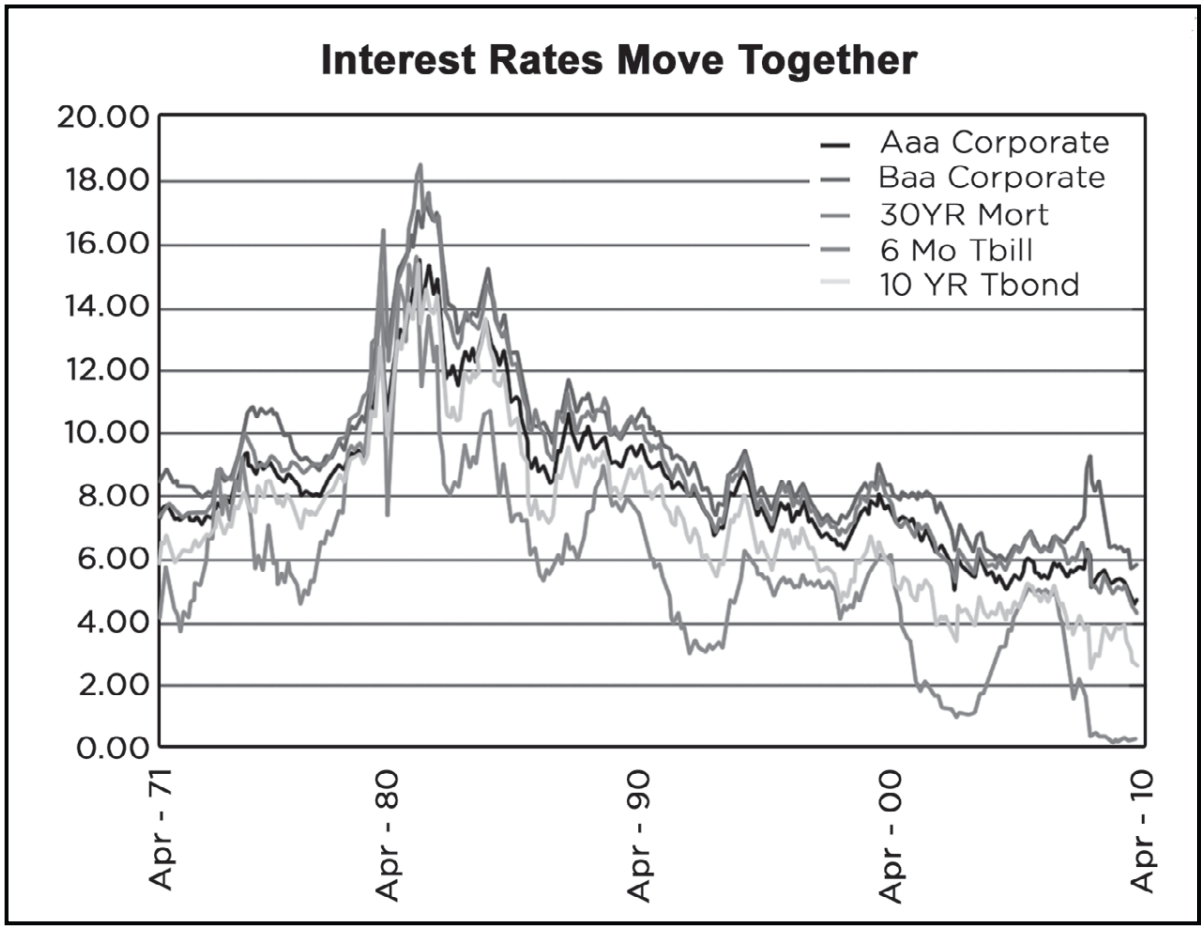
Lecture 19

Economists frequently use the term "rate of interest," as if there were but a single interest rate that described credit conditions in the U.S. economy—nothing could be further from the truth. This lecture explores the most important factors that account for differences in interest rates, including inflation and risk.

Interest Rates in Sync

- A graph of the movement of several interest rates between 1971 and 2010 shows that the rates move together. But the different yields do not have the same values at each date.

Figure 19.1



Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

- Interest rates move together because they all adjust to offset changes in the inflation rate.

- As we learned in an earlier lecture, markets care about the inflation-adjusted interest rate, which economists call the **real rate of interest.**

- The real rate of interest is the correct way to measure the reward for saving and lending and the cost of borrowing. It is also the price of credit.

- The real rate of interest is the nominal rate minus the rate of inflation expected to occur over the life of the credit transaction. If you buy a one-year Treasury bond that has a yield to maturity of 7% and you expect the rate of inflation to be 2% in the coming year, you can predict that the real rate of interest will be 7 – 2 = 5%.

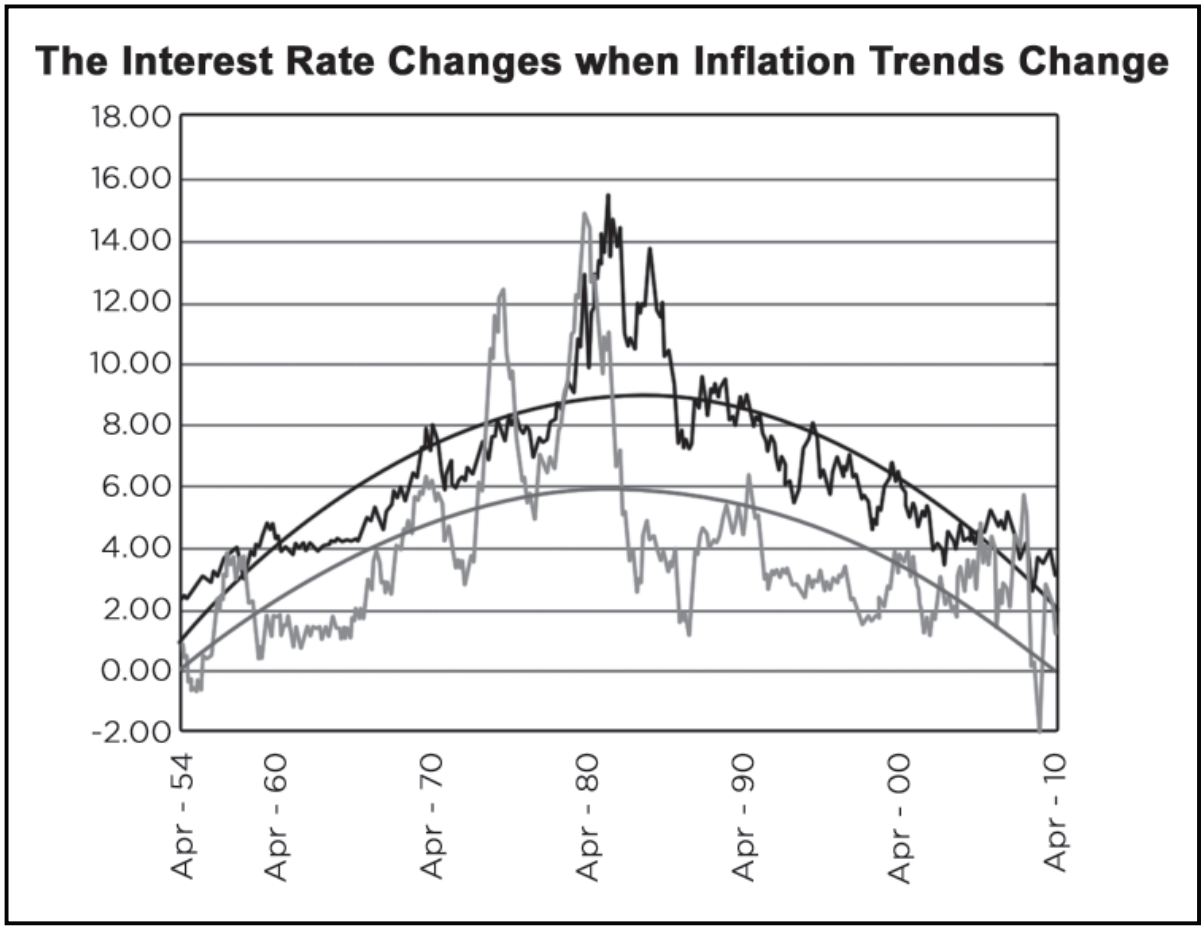
Irving Fisher's Hypothesis

- Irving Fisher hypothesized that interest rates adjust point for point with any expected change in the rate of inflation.

- The intuition for this hypothesis is straightforward: If lenders somehow knew for sure that the rate of inflation would increase by, say, 1%, they would require a 1-percent increase in the nominal interest rate in order to be willing to lend what they were previously willing to lend. Likewise, borrowers would be willing to pay an additional 1% in the nominal interest rate and still be willing to borrow the same amount that they were previously willing to borrow.

- Of course, Fisher's hypothesis cannot be literally true because there are never events that lead all decision makers to agree on their predictions about the future course of inflation. But some events lead to widespread agreement about inflation, and when such events occur, all interest rates should move together.

Figure 19.2



Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

- A graph that plots the 10-year Treasury bond rate and the CPI inflation rate between 1954 and 2010 suggests that Fisher is correct. The trend lines provide crude estimates of the expected path of each series and are nearly parallel. The idea is that borrowers and lenders might not always have foreseen the "wiggles" in the inflation path, but it is reasonable to believe that they foresaw the trend.

Further Proof of the Hypothesis

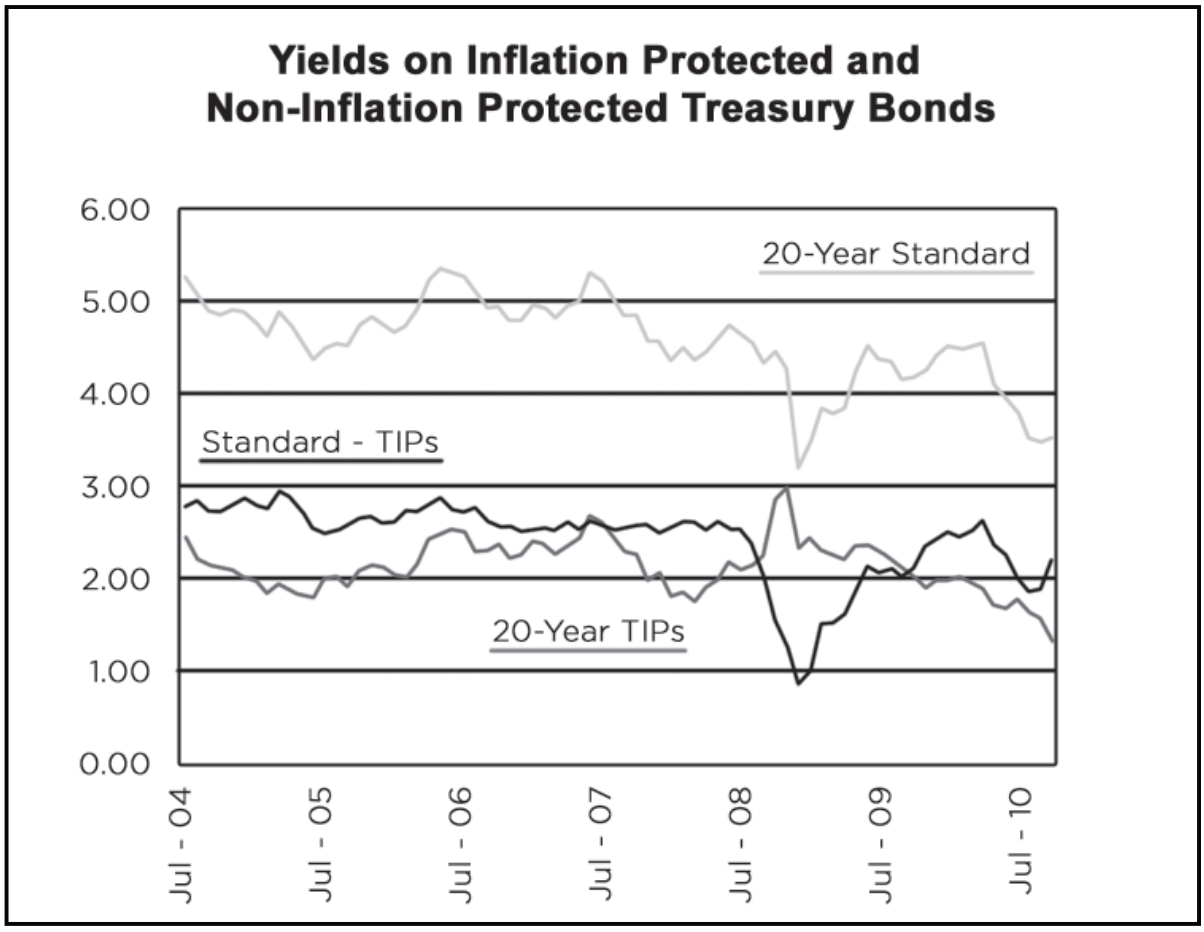
- Another way to check the validity of Fisher's hypothesis is to compare the yields on inflation-protected bonds to the yields on similar bonds that do not have inflation protection.

- As we discussed in Lecture 16, TIPS are inflation-protected Treasury bonds. The principal of a TIPS increases with inflation and decreases with deflation, as measured by the CPI. When a TIPS

bond matures, the owner is paid the adjusted principal or original principal, whichever is greater.

- A chart of the yields on 20-year constant-maturity Treasury bonds with and without inflation protection shows that, on average, a non-protected bond pays about 2.5% more than a TIPS bond. This indicates that the market values the inflation protection provided by TIPS.

Figure 19.3



Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

- The onset of the financial crisis in 2008 had an interesting impact on bond prices. It raised the price and lowered the yield on standard bonds and lowered the price and raised the yield on TIPS. The result was an unusual fall in the premium paid by non-TIPS bonds relative to TIPS bonds.

- Some analysts attribute this decrease to Lehman Brothers' attempts to sell large quantities of TIPS just before the firm failed as a result of the financial crisis. Others suggest that it was brought on by fears of deflation in the latter months of 2008.

- If deflation occurs, TIPS bonds should have the same yield as non-TIPS bonds of the same maturity because the TIPS contract does not specify a reduction of principal in the case of deflation. One way to look at the data is that concern about deflation caused the rates on TIPS and non-TIPS bonds to converge for a short period of time.

Risk Premiums

- Another reason that interest rates move together is that the premium the market provides to those who lend to riskier borrowers is approximately constant over time.

- A risk premium is an addition to the rate of interest agreed to by borrowers and lenders that compensates the lender for the increased riskiness of a lending contract.

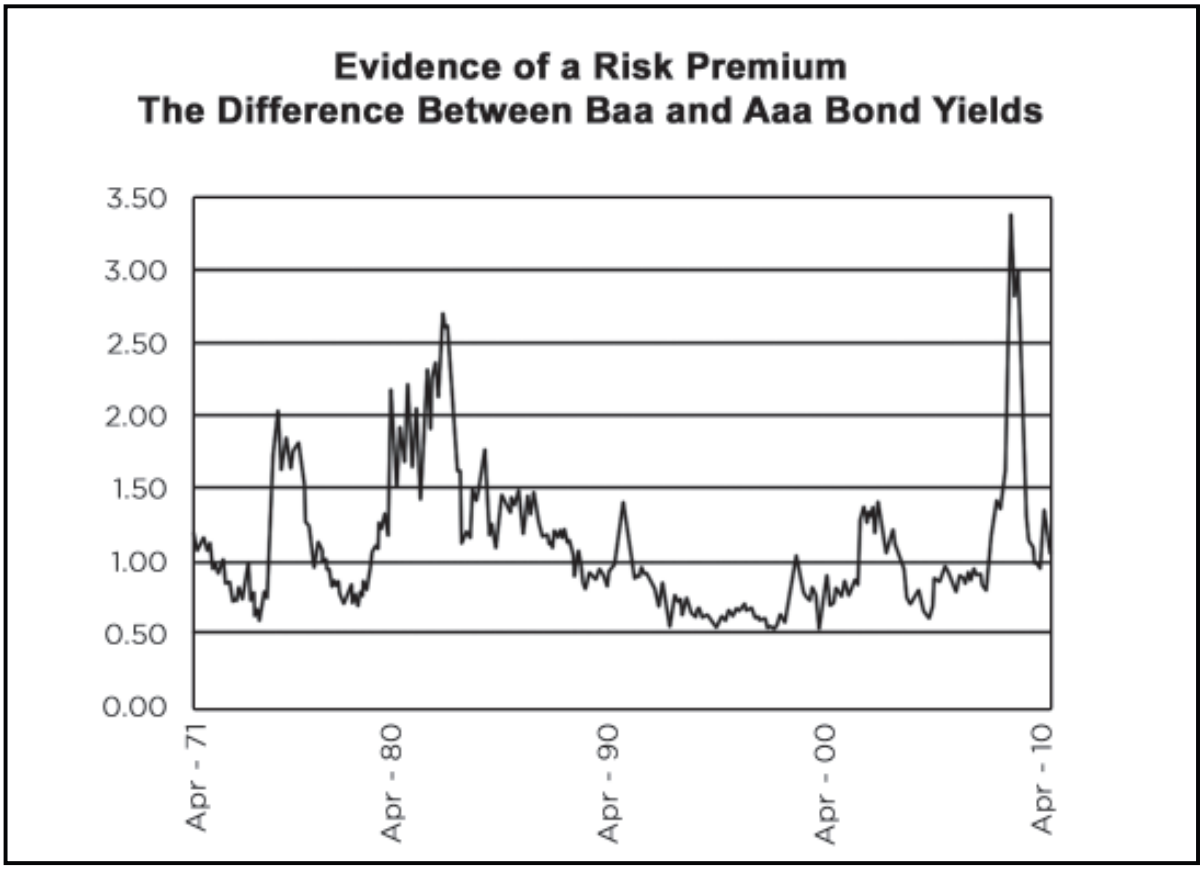
- One lending contract may be riskier than another for a number of reasons. In particular, borrower B may be less likely to repay than borrower A, or one lending contract may defer repayment for a longer period of time than another.

- Consider the situation in which borrower B is less likely to repay a loan in accordance with the terms of the loan agreement or bond. An easy way to check for the existence of a risk premium is to compare the yields on Moody-rated Baa bonds with those on Moody-rated Aaa bonds.

- What about the case of two lending contracts that are alike in all respects except that one has a longer maturity? Recall that the present-value formula defines the price of a $1,000 zero-coupon bond that matures in *m* years to be: Bond Price = $1000 / $(1 + R)^m$, where *R* is the yield to maturity of the bond. We infer the yield of a bond by observing face value, time to maturity, and market price and applying the formula.

- What risk does a Treasury bond holder face? It is not the risk that the borrower will fail to repay because the borrower is the U.S. Treasury. Instead, Treasury bond owners face the risk that interest rates will increase. If they do, the market value of the bonds will fall, implying that owners experience a capital loss on their investment. The longer the maturity, the greater the fall in bond price.

Figure 19.4



Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

- A table of the change in market price of a $1,000 bond with an initial interest rate of 5% shows that an increase of 1% in the interest rate leads to capital losses that increase with bond maturity.

- The intuition here is straightforward: When interest rates increase, both old bonds that were created earlier and new bonds must offer the new competitive rate. The only way for an old bond to offer a higher rate is for its market price to fall. The size of that fall in percentage terms is an increasing function of the bond's time to maturity.

Recap of Interest Rate Movement

- Interest rates move together because they are driven by a common component of all market rates—the price of credit at the time a bond is priced.

- Because bonds are not identical, their yields are not identical. However, the data suggest that the part of bond yields that can be interpreted as a risk premium or an inflation premium varies less than the part of the yield that is associated with the price of credit.

- Understanding that the price of credit varies with market conditions and that such variation explains most of the variation over time in thousands of interest rates makes bond markets and credit markets easier to understand.

- There is substantial intuition for the working of bond markets and the behavior of bond yields. Savers rationally view different bonds as substitutes—buying any bond allows a saver to move funds from the present into the future. Savers look for bonds that offer the best combination of high yield and low risk. Because savers are always on the lookout for a better opportunity to "store their savings," it is not surprising that bond yields move together.

- Bond yields move together for the same reason that prices of different kinds of apples move together. If the price of Golden Delicious apples begins to increase, many consumers will purchase Red Delicious apples instead, with the result that the prices of those two types of apples rise and fall together.

Suggested Reading

Federal Reserve Bank of San Francisco, "What Makes the Yield Curve Move?"

Russell, "Understanding the Term Structure of Interest Rates."

Questions to Consider

1. In your view, what is the most important reason that interest rates move through time together?

2. Economists often speak about the "rate of interest" as if there were only one. For what kind of considerations is this economic simplification warranted? For what kind of considerations is this simplification unwarranted?

3. How would you explain to someone who has not studied financial markets why holding long-maturity bonds is riskier than holding short-maturity bonds?

The Term Structure of Interest Rates

Lecture 20

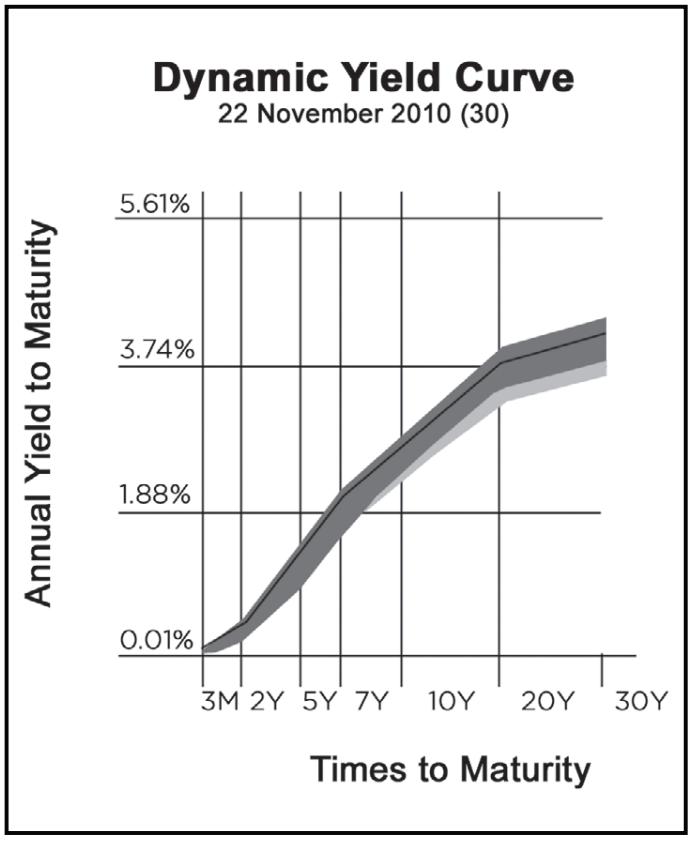
Wouldn't it be great if we had a crystal ball into which we could gaze to obtain at least a partial understanding of the future of our economy? As it turns out, we do have this ability to some extent. As we have seen in our lectures on the bond market, government bills, notes, and bonds trade every business day in secondary markets. That means that every business day, borrowers and lenders and all market traders interact to produce prices on Treasury securities with one, two, three, and more years to maturity. The focus of this lecture is on the fact that traders simultaneously determine prices for Treasury securities of different maturities. We can use this price information, combined with what's known as the expectations hypothesis, to predict interest rates in the future.

The Yield Curve

- Our ability to forecast the future course of credit conditions relies on our ability to interpret the term structure of interest rates and its graphical representation, the yield curve.

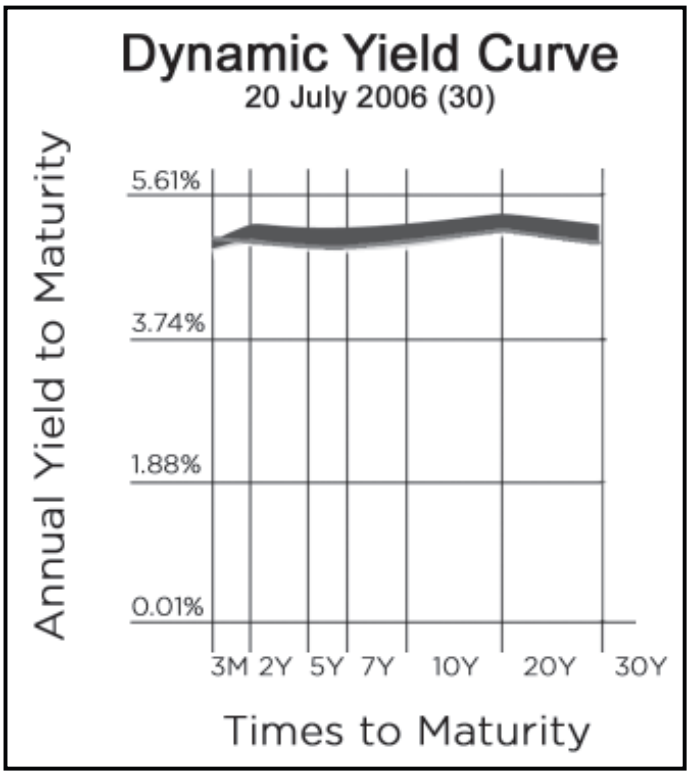
- We see a depiction of the upward-sloping Treasury yield curve on November 22, 2010. Along the horizontal axis are times to maturity

Figure 20.1



ranging from 3 months to 30 years. Along the vertical axis are annual yields to maturity measured in percentage points.

Figure 20.2



- The shorter-maturity yields are those on Treasury bills; the intermediate-maturity yields are those on Treasury notes; and the longer-maturity yields are those on Treasury bonds. The upward slope means that as maturity increases, yield increases.

- The yield curve for a different date, July 20, 2006, is flat. This means that longer-maturity yields were approximately equal to shorter-maturity yields in July 2006.

The Expectations Hypothesis

- The expectations hypothesis of the term structure of interest rates is the idea that long-maturity interest rates are averages of current short-maturity rates and expected future short-maturity rates between the present and the maturity date.

- The intuition behind this hypothesis is the claim that all bond-holding strategies that move money between the same two points in time should provide the bond holder with the same yield to maturity.

- Suppose that Jane wants to move money between the present and a date three years in the future, perhaps to retire or to pay off her

mortgage. One strategy available to Jane is to buy a three-year Treasury bond that matures in three years. A second strategy is to buy a one-year note, allow it to mature in one year, use the funds from the maturing note to buy a second one-year note, allow it to mature, and then buy a third one-year note. This strategy is to "roll over" one-year notes between the present and the target date in three years.

- According to the expectations hypothesis, the yield to maturity of the two strategies should be the same; if it were not, Jane and every other person who buys government bonds with the same horizon would choose the strategy that provided the higher yield.

- To make the statement of the expectations hypothesis more precise requires some new notation. Let $R(n,t)$ equal the yield to maturity (R) of an n-year Treasury security at time t. For example, if n = 3 and t = November 22, 2010, $R(n,t)$ is the yield to maturity on a three-year note on November 22, 2010.

- The second new symbol we need is $Rhat(1,t + m)$. *Rhat* is the best possible forecast of the future yield of the one-year Treasury note that market forces will determine m years from now at time $t + m$. For example, $Rhat(1, t + 1)$ is the current (time-t) forecast of next year's yield on a one-year note. $Rhat(1,t + 2)$ is the time-t forecast of the yield on a one-year note two years from now.

- This new notation provides a hint of what the expectations hypothesis will reveal: forecasts of future credit market yields.

Formalizing the Hypothesis

- According to the expectations hypothesis, current long-maturity yields are averages of current and forecasted future short-term yields. The following equation presents this hypothesis in a formal way:

$$R(n,t) = (R(1,t) + Rhat(1,t + 1) + \ldots + R(1,t + n - 1)) / n$$

- Although the equation looks formidable, its meaning is intuitive: The yield to maturity on an *n*-year bond at time *t* must equal the average of *n* different yields—the current one-year yield, the one-year yield expected to be determined by credit markets one year from now, the one-year yield expected to be determined two years from now, and so on, up to the yield that will be in place during the last year of the *n*-year bond's life.

- Let's assume that Jane is making her decision about Treasury bonds on November 22, 2010. The version of the expectations hypothesis that is relevant is:

$$R(3,t) = [\ R(1,t) + Rhat(1,t+1) + Rhat(1,t+2)\ ] / 3$$

- In Jane's case, the expectations hypothesis says that the 2010 yield on a three-year note is equal to the average of the 2010 one-year yield, the 2011 one-year yield, and the 2012 one-year yield (with the understanding that it is the current expectation of those future yields that belong in the equation).

Forecasting Future Credit Market Conditions

- The expectations hypothesis implies that the Treasury yield curve provides a forecast of future credit market conditions. To see this clearly, let's again consider Jane's situation.

- On November 22, 2010, Jane knows the yield to maturity of one-, two-, and three-year Treasury securities. She knows $R(1,t)$, $R(2,t)$, and $R(3,t)$. By using the expectations hypothesis, she can learn $Rhat(1,t+1)$ and $Rhat(1,t+2)$.

- We first write the equation as:

$$R(2,2020) = [\ R(1,2010) + Rhat(1,2011)\ ] / 2$$

- This equation can be rewritten as:

$$Rhat(1,2011) = 2R(2,2010) - R(1,2010)$$

- This means that Jane can forecast the one-year bond rate to be determined in 2011 by using information embedded in the two-year and one-year bond rates in 2010.

- The expectations hypothesis also tells us:

$$R(3,2010) = [\ R(1,2010) + Rhat(1,2011) + Rhat(1,2012)\ ] / 3$$

$$R(3,2010) = [\ 2R(2,2010) + Rhat(1,2012)\ ]/ 3$$

- This second implementation of the hypothesis allows us to solve for *Rhat*(1,2012):

$$Rhat(1,2012) = 3R(3,2010) - 2R(2,2010)$$

- We can combine the information embedded in the three-year and two-year yields observed in 2010 to produce a forecast of the one-year yield that will be set by the market in 2012.

- Let's look at a numerical example. On November 19, 2010, the one-, two-, and three-year yields on Treasury notes were 0.27, 0.52, and 0.78%.

- Using the information in the yield curve in 2010 allows us to predict that the one-year bond rate in 2011 would increase to 0.77%, as shown below:

$$Rhat(1,2011) = 2R(2,2010) - R(1,2010) = 2(0.52) - 0.27 = 0.77$$

- Using the same information also allows us to predict that the one-year bond rate in 2012 would increase to 1.30%, as shown below:

$$Rhat(1,2012) = 3R(3,2010) - 2R(2,2010) = 3(0.78) - 2(0.52) = 1.30$$

- The expectations hypothesis thus implies that Jane's two possible strategies will leave her with the same amount of money after three years.

The Shape of the Treasury Yield Curve

- Based on the expectations hypothesis, we now have an explanation of the shape of the Treasury yield curve.

- The curve slopes upward when future short-term yields are expected to increase, is horizontal when future short-term yields are expected to equal current short-term yields, and slopes downward when future short-term yields are expected to be lower than current short-term yields.

- It's important to note that some of the upward slope in the yield curve may be attributable to the fact that long-maturity bonds are riskier than short-maturity bonds. A modification of the expectations hypothesis that allows for risk premiums requires us to modify our interpretation of movements in the yield curve—but only slightly, because economists believe that risk premiums change more slowly than interest rates.

Predictions of Our Crystal Ball

- How can people who are worried about locking in a mortgage interest rate or a loan rate for a business benefit from the forecasting power of the Treasury yield curve?

- When the yield curve steepens, it's a good bet that market participants believe interest rates will increase in the future. Those who wish to borrow funds should be forewarned that if they delay, the interest is likely to increase.

- When the yield curve remains flat, it's a good sign that market participants believe interest rates will remain constant.

- When the yield curve changes from a positive slope to a negative slope, it's a good sign that market participants believe interest rates will fall in the future.

Suggested Reading

Federal Reserve Bank of San Francisco, "What Makes the Yield Curve Move?"

Russell, "Understanding the Term Structure of Interest Rates."

Questions to Consider

1. In your own professional life, how might you benefit from an accurate estimate of future interest rates?

2. Why does it make sense that the normal shape of the yield curve is upward sloping?

3. Some analysts believe that a downward-sloping yield curve is an indicator of a coming recession. Would the expectations hypothesis of the term structure support this belief? Why or why not?

Introduction to the Stock Market

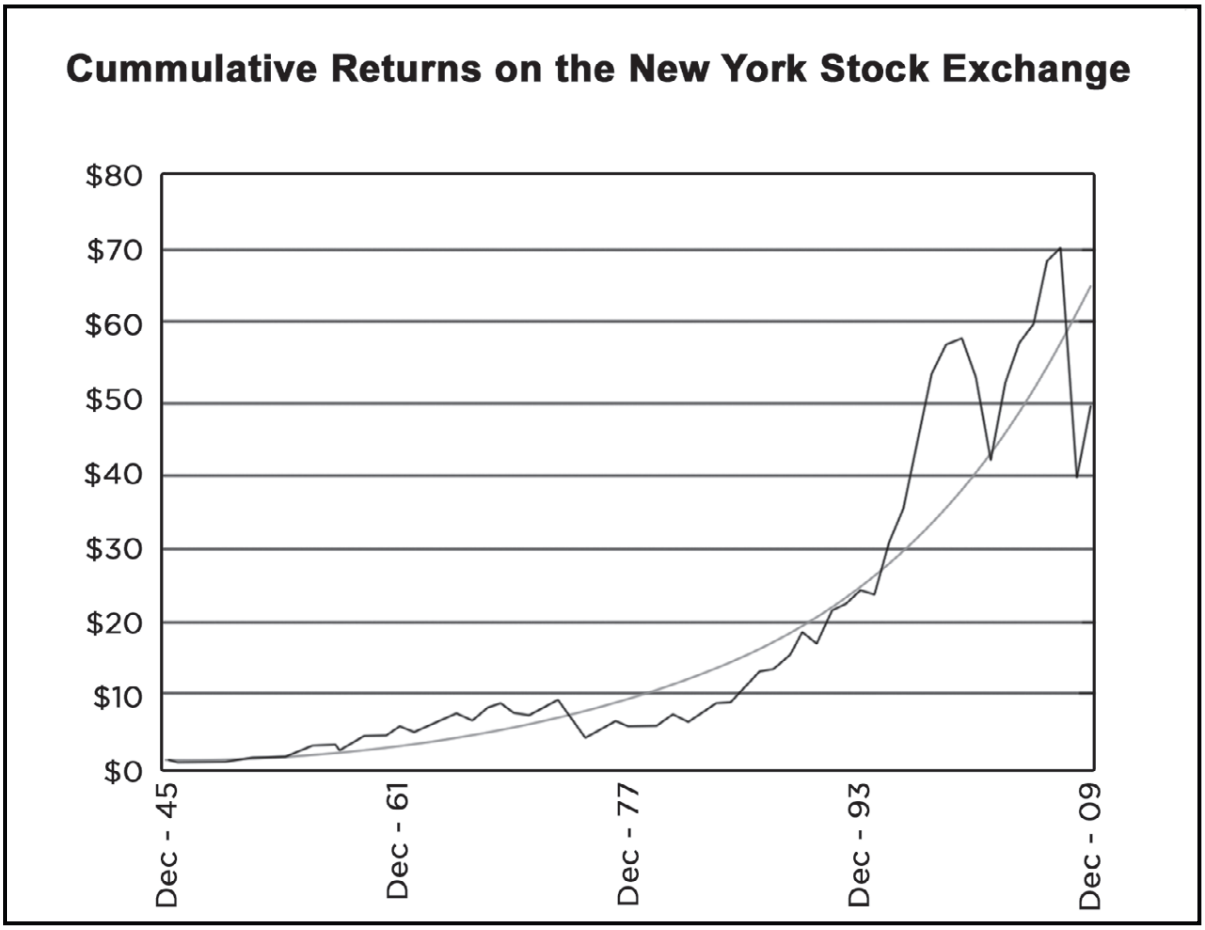
Lecture 21

In our grandfathers' time, only a small fraction of the population owned shares of stock, but with the advent of mutual funds and increasing coverage of workers by defined contribution pension plans, stock ownership has become more common. This lecture provides an introduction to stock markets and stock prices.

The Case for Owning Stocks

- The case for owning stocks as part of a strategy to save for retirement and other long-horizon objectives is strong, as we can see in a graph of cumulative stock market returns net of inflation for the period 1945 to 2009.

Figure 21.1

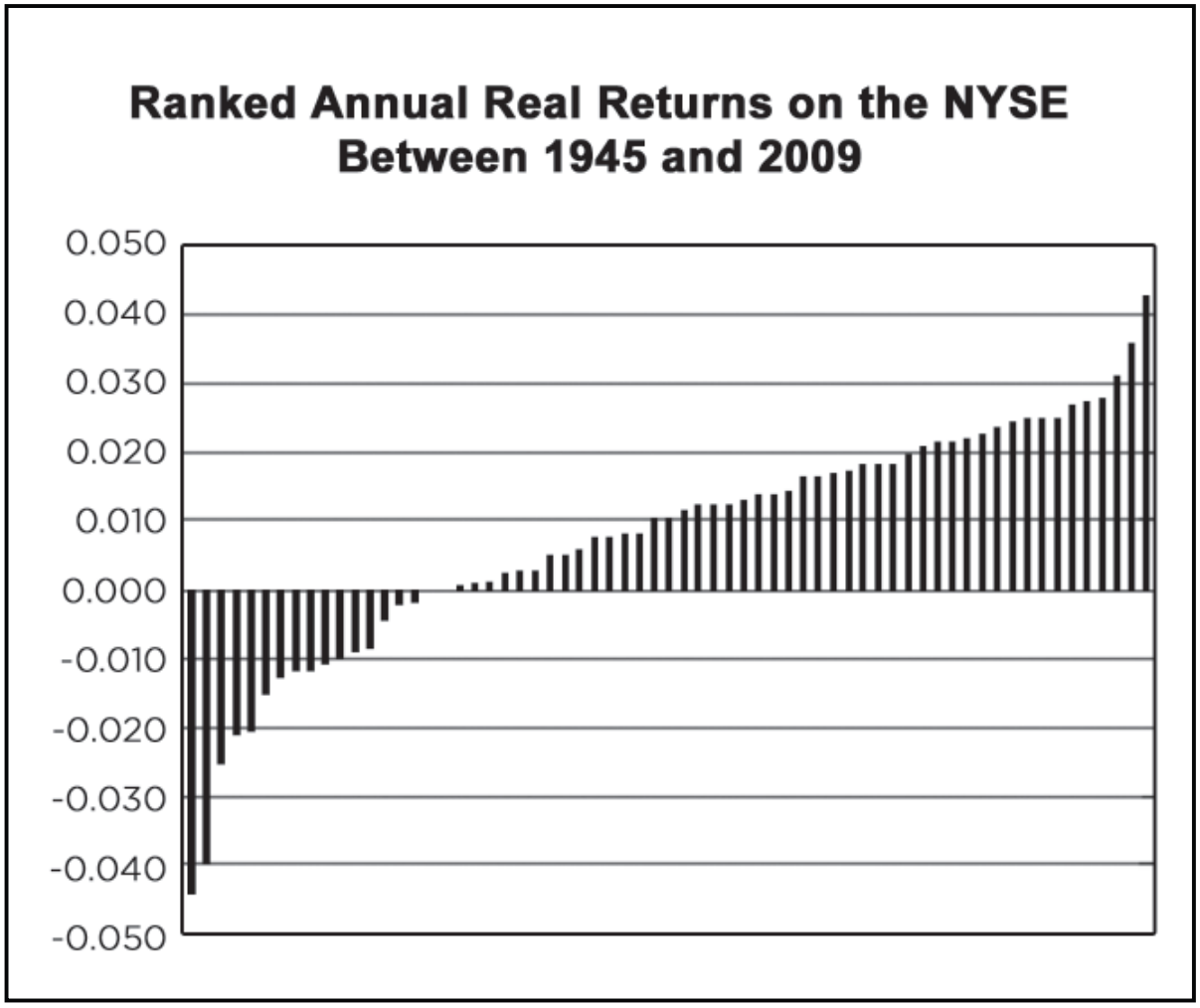


Source: Michael Salemi.

- Over that period, the average real return (the return on a portfolio of all stocks traded on the New York Stock Exchange [NYSE] minus the rate of inflation) was 7.7%. In other words, an individual who purchased and held stock over this period experienced 7.7% annual growth in the purchasing power of his or her initial financial investment.

- There is no denying, however, that purchasing stocks during this period was risky. Real returns were negative in 19 of the 65 years, and the average negative return was –14%.

Figure 21.2



Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

Common Stock

- A share of **common stock** is an ownership interest in a corporation. The management of a corporation is charged with advancing the interests of the owners, that is, the holders of common stock shares.

- In the United States, ownership of a share of common stock confers limited liability to its owners, meaning that owners can never lose more than the value of the shares. For example, the owners of the common shares of BP stock could not be held personally responsible for the 2010 Gulf of Mexico oil spill.

- Owners of shares of common stock are residual claimants. The corporation must pay workers, raw material suppliers, bond holders, and preferred shareholders before they pay any funds to owners of common stock shares.

- Owners of shares of common stock have the right to receive dividends and to vote on major matters pertaining to the operation of the firm.

The Origins and Development of Stock Markets

- The London Stock Exchange is one of the world's oldest stock exchanges and can trace its history back more than 300 years. It began in the coffeehouses of 17th-century London.

- In January 1698, John Castaing began to publish from an office in Jonathan's Coffee House a list of foreign exchange rates, gold and silver prices, and the prices of shares of bank stocks, the East India Company, and the Hudson Bay Company.

- In 1923, the London Stock Exchange received its own coat of arms that includes the motto of the exchange: *Dictum meum pactum*, or "My word is my bond."

- The NYSE traces its origins to early attempts by Alexander Hamilton to provide for the commercial development of the United States.

- In 1792, 24 merchant-brokers made a pact called the Buttonwood Agreement that formalized the trading of securities, including $80 million in bonds that the U.S. Treasury under Hamilton had issued in 1790. The buttonwood tree under which the agreement was signed stood at what is now 68 Wall Street.

- On December 9, 1865, the NYSE moved to its first permanent home on Broad Street. In 1867, Dr. S. S. Laws modified a telegraph that could impress electrical impulses on a moving tape. The tickertape was born.

- On September 9, 1901, the cornerstone for the new NYSE building was laid on the site of the previous building. Until the new building was completed, the NYSE operated at a temporary location.

- On February 18, 1971, the NYSE was incorporated as a not-for-profit company.

- On April 17, 1978, the Inter-market Trading System (ITS), which provides an electronic link between the NYSE and other stock exchanges in the United States, began operation. The ITS allows brokers to easily locate the best price for a security.

The Organization of Financial Markets

- The functions of a stock market are as follows: (1) price discovery (markets should enable participants to find prices at which they can buy and sell shares), (2) mechanism for trading (markets should bring buyers and sellers together to make agreements to buy and sell shares), and (3) execution of agreements (markets should ensure that the terms of each agreement are honored). In particular, the market should include mechanisms to confirm that a trade was made, to ensure that ownership of the traded asset changed hands, and to ensure that payment for the traded asset was made.

- Among the role players in stock markets are public investors, such as private citizens, pension fund and mutual fund managers, and trusts. These players buy and sell stocks as part of a strategy to grow and protect their wealth.

- Brokers in stock markets act as agents for public investors and receive fees and commissions in return.

- Dealers buy from and sell shares to public investors but, unlike them, benefit primarily from trading rather than from holding assets. Brokers do not hold inventories of stocks, but dealers do.

- Specialists are agents who are obliged by market rules to buy and sell shares. They are market makers whose existence guarantees that it is always possible to buy and sell. In general, specialists may trade on their own behalf, meaning that they have an incentive to buy low and sell high.

- Some markets, such as the NYSE, are order driven in the sense that public investors place buy and sell orders with brokers. The market then matches buyers and sellers and consummates trades. In the NYSE, there are specialists who guarantee that there is always a price at which buyers can buy and sellers can sell.

- Some markets, such as the National Association of Securities Dealers Automated Quotations (NASDAQ) system, are quote driven in the sense that dealers quote bid and ask prices at which they are prepared to buy and sell. Buyers decide whether the ask price is acceptable, and sellers decide whether the bid price is acceptable. Bid and ask prices change depending on buying and selling by public investors, but competition among dealers keeps the bid-ask spread from growing too large.

- Some markets, such as the grain pits and bond pits at the Chicago Board of Trade, operate on a system of open outcry, where floor traders shout buy and sell orders aloud on the trading floor. The

traders wear costumes that identify who they are and signal their trading desires with hand gestures.

Stock Markets, Stock Market Indexes, and Mutual Funds

- Several closely watched indexes provide a summary of stock price movements.

- The Dow Jones Industrial Average is perhaps the most closely watched measure of U.S. stock prices; it is an index of 30 large, publicly traded stocks.

- The S&P 500 is an index of the share prices of 500 large, publicly traded companies that is owned and maintained by Standard & Poor's, a company that also provides risk assessments of corporate and government-issued bonds.

- The Nasdaq is an index of shares traded over the counter through the NASDAQ system.

- Other indexes include the FTSE 100 (British shares), DAX (German shares), CAC 40 (French shares), Nikkei (Japanese shares), Hang Seng (Hong Kong shares), and Shanghai (Chinese shares).

- A mutual fund is a financial intermediary that sells shares and uses the proceeds to purchase a portfolio of financial assets in accordance with the fund's investment objectives.

- A mutual fund allows small financial investors to diversify their holdings. They obtain the return and risk properties of a portfolio that includes many more stocks than they could purchase if they purchased individual shares. It is possible to buy mutual funds that mimic the main market indexes, such as the NYSE, the S&P 500, and so forth.

The Benefits of Stock Markets

- Stock markets provide a highly organized way for individuals to acquire ownership rights in corporations. While it is true that many businesses are privately held, it is also true that many of the largest corporations have shares that are publicly traded on various stock markets.

- Stock markets provide those who are willing to bear the risks an opportunity to share in the profits of corporations around the world.

Important Term

common stock: An ownership interest in a corporation.

Suggested Reading

Blume, Crockett, and Friend, "Stock Ownership."

Hennessy, *Coffee House to Cyber Market*.

Kolb and Rodriguez, *Financial Institutions*.

Questions to Consider

1. Why do the two graphs presented at the beginning of the lecture provide evidence that ownership of stocks is risky?

2. In what way does the existence of a well-functioning stock market enhance investment activity in an economy (keeping in mind that to an economist, "investment" means growth in the stock of productive capital)?

3. Given the way you invest financially, does it make more sense for you to pay attention to the Dow Jones Industrial Average or to some other stock market index? Why?

Stock Price Fundamentals

Lecture 22

Are stock prices really determined by those who know the value of nothing? Is the stock market a place where people act on the basis of misinformation and whim? In this lecture, you will look at what economists call the fundamental theory of stock prices and the capital asset pricing model. In place of whim, these models are used by academics and professionals to study how stock prices should be connected to economic events.

The Market Fundamental Model

- The mainstream model of stock share prices is the market fundamental model, according to which shares have value because and only because they are claims on future dividends.

- The fundamental model is a hypothesis about how stock prices are determined. It begins with the present-value equation and can be written in the following form: $P(z,t) = D(z,t + 1)/(1 + RR) + D(z,t + 2)/(1 + RR)^2 + (z,t + 3)/(1 + RR)^3 + ...$

- $P(z,t)$ is the price of a share of company z stock as predicted by the fundamental model. According to the model, the share price equals the discounted sum of future dividends that the shareholder expects to receive.

- $D(z,t + k)$ is the per-share dividend that company z will pay to shareholders in period $t + k$. Although many companies pay dividends quarterly, we will assume that dividends are paid annually. At the time of purchase, the purchaser must estimate future dividends.

- *RR* is the required rate of return. This rate is used to discount future dividends, and it is the rate that stock market participants must expect to receive on the dollars they "invest" in order to be willing to give up other investment opportunities. Because stocks are riskier than bonds, *RR* will be greater than the yield to maturity on a long-term corporate bond issued by company z.

- The displayed formula gives the first three terms in the summation, but the sum includes further-into-the-future terms. Of course, those further-future terms are discounted more highly and make smaller contributions per dividend dollar to the fundamental stock price.

- There are several differences between the future payments offered by bonds and stocks. For instance, the coupon and final payments associated with a bond are known with perfect certainty in the case of a Treasury bond and with a high degree of certainty in the case of a corporate bond. In contrast, firms decide each period whether or not to pay dividends and how large those dividends should be. That is why the expectation appears in the fundamental value formula and not in the bond price formula.

- Further, the maturity date of a bond is fixed, but there is no maturity date for a share of common stock. Share owners are entitled to receive dividends as long as the company exists and the owner continues to own the share. Thus, the sum in the stock price equation has an infinite number of terms.

- It's logical to ask whether the sum should run from the present until the future day when the purchaser plans to sell the share. The answer is yes, but on the sale day, the sale price should be equal to the present value of dividends going forward. Thus, the stock price equation is the same no matter whether or when you plan to sell.

- *RR* should be larger than the yield to maturity on a long-maturity corporate bond because stocks are riskier; companies must pay promised debt (bond) obligations before they pay dividends to owners.

- The detailed fundamental model combines three equations: one that describes how the firm earns profits (in proportion to its capital), a second that describes how the company grows over time, and a third that describes the firm's dividend policy.

- Combining these three equations enables us to obtain an expression for dividends as a function of capital and the parameters, insert the expression for dividends into the present-value equation, and obtain an equation for the price of a share of the company.

What Does the Equation Teach Us about Fundamental Values?

- The value of a share is proportional to the capital to which the share is title. If a firm has more capital per share, then, other factors equal, the theory predicts that its shares will have a higher market price.

- The higher the required rate of return, the lower the share price. This makes sense for the simple reason that a higher value of *RR* implies that future dividends are discounted more deeply in the present-value equation.

- A higher value of ρ (the rate at which the firm earns profits) implies a higher value of the price of a share. Both a direct and an indirect channel are responsible for this occurrence. First, a higher ρ means more profits and, thus, more dividends. Second, a higher ρ means higher retained earnings and, thus, more rapid growth of the firm's capital and higher profits and dividends in the future.

- Let's assume values for the remaining parameters and see what our formula says about stock price. If δ (profits)= 0.25, ρ = 0.12, and *RR* = 0.10, the formula predicts that $P(z,t)$ (the price of a share of company z stock) = 3.27 $K(t)$ (the firm's capital stock per share of common stock at time t). The share price of the firm should be 3.27 times the book value of the firm. Given that per-share earnings are 0.12 $K(t)$ and the share price is 3.27 $K(t)$, the value for the price earnings of the firm is 27.3.

The Capital Asset Pricing Model

- The fundamental value model determines the price of a share of stock as a function of its dividends and the required rate of return that the stock purchaser uses to discount expected future dividends. The capital asset pricing model (CAPM) provides insights about the required rate of return.

- CAPM begins with at least two important assumptions: First, stock purchasers are risk averse, and second, they construct their portfolios with knowledge not only of expected future dividends but of how those dividends will co-vary as the economy moves through the business cycle. This correlation of returns is a crucial component of CAPM.

- CAPM provides a prediction about the required rate of return of a share of company z stock. The formula for this is:

  $$RR(z,t) = R(t) + \beta(z)\,(\,R(M,t) - R(t)\,)$$

- $RR(z,t)$ is the required rate of return on company z shares; the market uses this rate when discounting expected future dividends of company z.

- $R(t)$ is the risk-free rate, approximately the rate on a long-maturity Treasury bond.

- $R(M,t)$ is the market return. It is the required rate of return on the "market portfolio," that is, the portfolio made up of all shares of common stock. Put another way, it is the rate of return that stock market purchasers require in order to be willing to hold a diversified portfolio of common stock shares.

- $\beta(z)$ measures the correlation between the return on company z shares and the market return.

CAPM

SHARE	BETA (z)	R (z,t)
highly correlated	positive	> risk free rate
uncorrelated	∅	= risk free rate
negatively correlated	negative	< risk free rate

Interpretation of the CAPM Equation

- According to CAPM, the required rate of return on a share of stock equals the risk-free rate plus a risk adjustment. The risk adjustment is the product of two factors—the market risk adjustment ($R(M,t) - R(t)$) and $\beta(z)$.

- If a share is highly correlated with the market, $\beta(z)$ is positive and $R(z,t)$ is greater than the risk-free rate.

- If a share is uncorrelated with the market, $\beta(z)$ is 0 and $R(z,t)$ equals the risk-free rate.

- If a share is negatively correlated with the market, $\beta(z)$ is negative and $R(z,t)$ is less than the risk-free rate.

A Rational Picture

- Both the fundamental value theory and CAPM paint a picture of a rational and orderly stock market.

- According to the fundamental value theory, the price of a share of stock is the present value of the expected dividends that the share will pay.

- According to CAPM, there is a market rate of return that investors require to hold a well-diversified portfolio of shares.

- Individual shares have rates of return that relate in a rational way to the market return. When the return on a share is strongly positively correlated with the market, it is not possible to diversify the risk inherent in holding the share, and the required rate of return increases. When the share is weakly correlated with the market, its required rate of return is lower because the share provides an opportunity to diversify risk.

Suggested Reading

Malkiel, *A Random Walk Down Wall Street*.

Mishkin, *The Economics of Money, Banking, and Financial Markets*.

Sharpe, *Investments*.

Questions to Consider

1. Why might a proponent of the fundamental theory of stock prices shy away from stocks that have high price-earnings ratios?

2. How would you explain to someone who has not studied financial markets the most important differences between the fundamental theory of stock prices and CAPM?

3. According to CAPM, does it matter to the value of a stock how returns on that stock co-vary with returns on other stocks?

Stock Market Bubbles and Irrational Exuberance

Lecture 23

No one seems to know for sure how the bull and bear images came to be associated with the stock market, but the bull, as leader of the herd, may be an appropriate representation for the herd mentality that partially explains the inflation and popping of stock market bubbles. This lecture looks at a theory of stock price determination that has less to do with the rational calculation and discounting of dividends that we saw in the last lecture and more to do with group psychology. Like all extreme events, stock bubbles provide important insights about the workings of markets. Economists often cite stock markets as examples of markets that function well. The existence of bubbles calls that belief into question and raises the deeper issue of why bubbles occur.

Stock Market Bubbles

- A **bubble** is an event in which the price of a financial asset grows more rapidly than justified by fundamentals for a substantial period of time.

- Robert Shiller, author of a study entitled *Irrational Exuberance*, defines a speculative bubble as "a situation in which temporarily high prices are sustained largely by investors' enthusiasm rather than by consistent estimation of real values."

- Shiller argues that speculative bubbles begin to inflate when market participants treat share price increases as news that justifies increased optimism about future share prices. As the bubble inflates, participants stop asking whether the price increases are justified by fundamentals and increasingly believe that the price increases must somehow be warranted by "new economic rules."

- Why do we use the term "bubble" to describe periods of irrational exuberance? Because a bubble is something that pops.

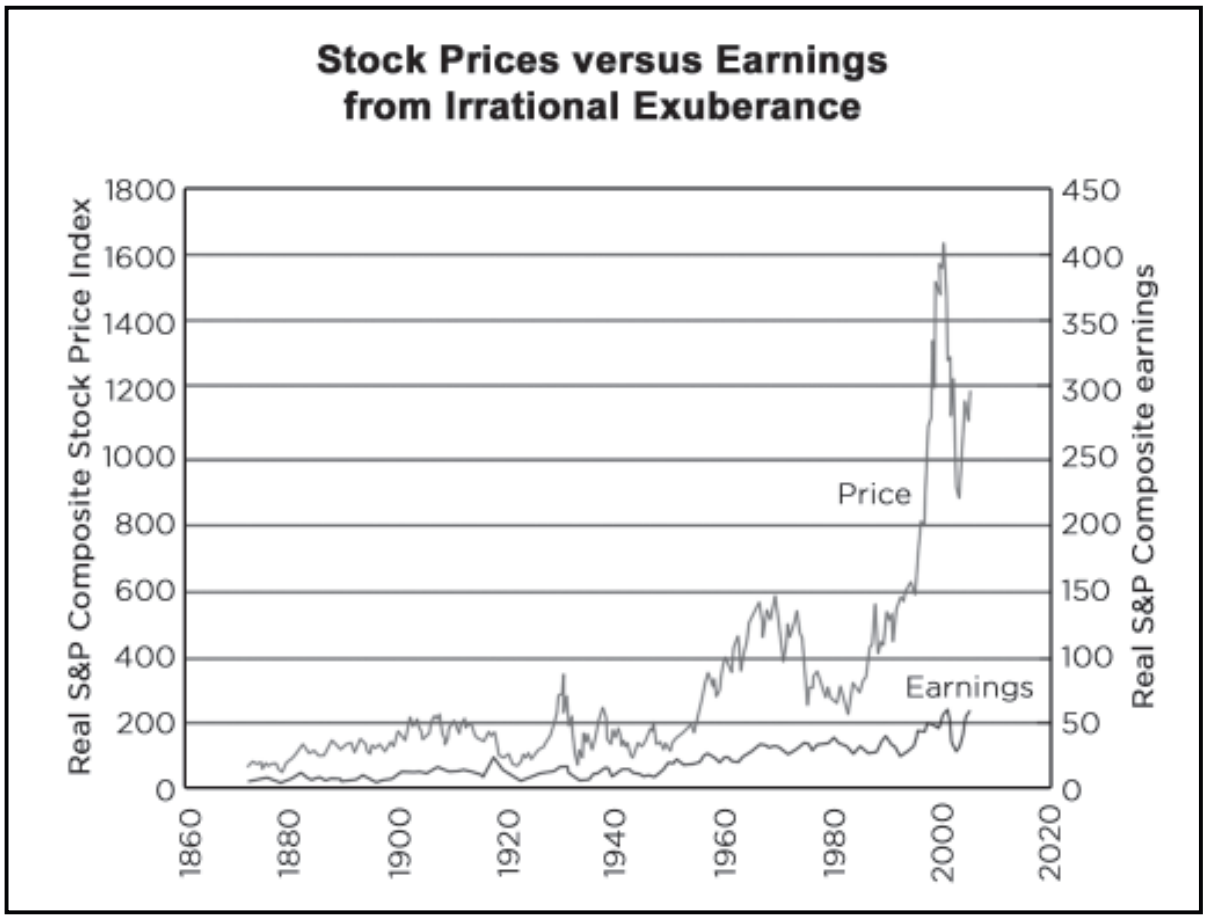
A Recent Stock Price Bubble

- The most famous recent stock price bubble occurred between 1995 and 2000.

- A graph of the inflation-adjusted S&P 500 stock price index and inflation-adjusted earnings for companies included in the index from 1870 to 2005 shows the extraordinary rise and fall in stock prices that began in the mid-1980s, accelerated after 1990, and ended abruptly in 2000.

- Clearly, the shape of the path of stock prices was very different than the shape of the path of corporate earnings between 1980 and 2000.

Figure 23.1

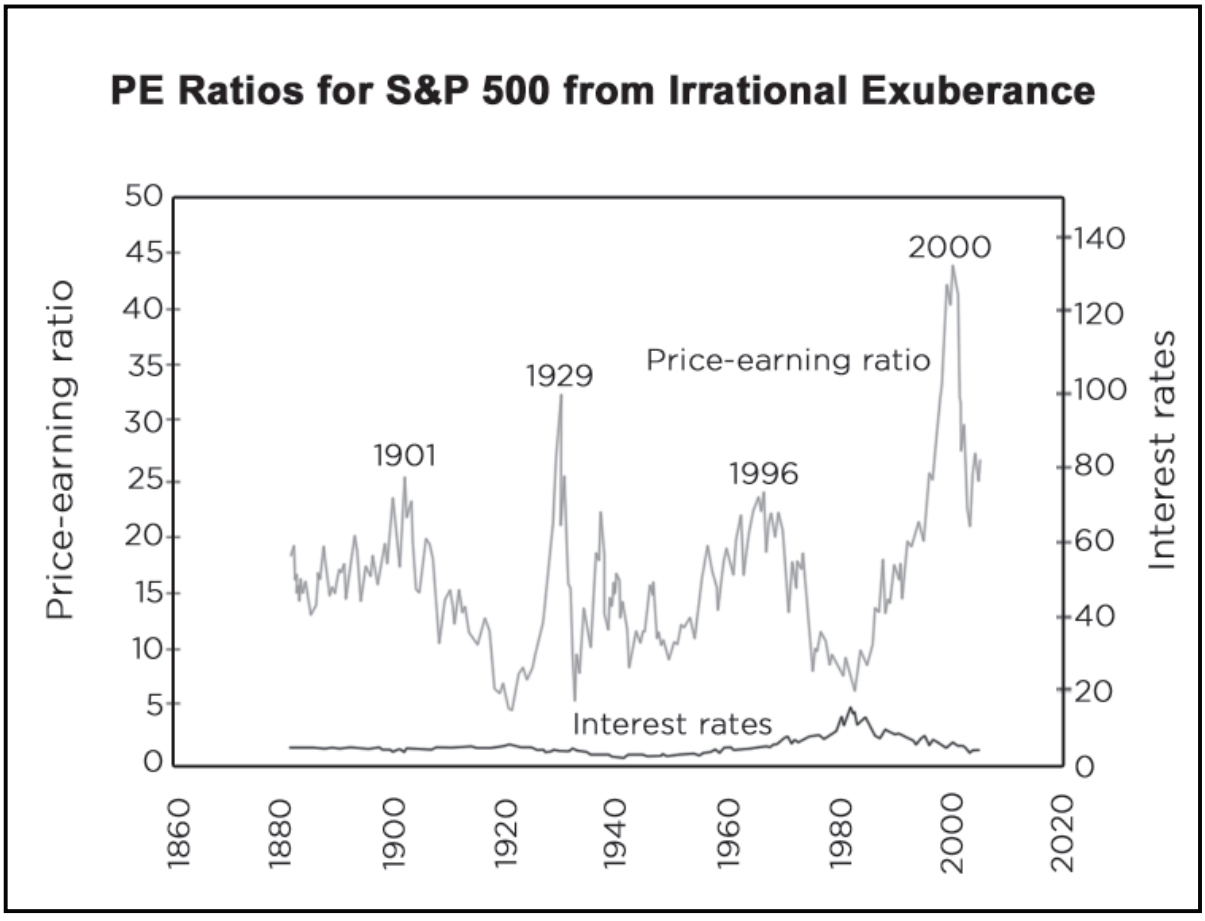


- Between the end of August 1994 and the end of August 2000, the S&P 500 index more than tripled, and the annual rate of increase was 21.6%, about three times greater than the average return over the postwar period.

- By the end of August 2001, the index had experienced a stunning drop of 25.5%, and between the summer of 2000 and 2002, its average decline was 22.4%.

- Another way to see just how extreme price growth was during the bubble period is to look at changes in the price-earnings (PE) ratio. A graph of S&P 500 PE ratios shows that at the peak of the millennium bubble, the price of the index was 47.2 (March 24, 2000). In contrast, the average PE ratio for the entire period was between 15 and 20.

Figure 23.2



- What does the PE ratio tell us? In normal times, those who buy stocks are willing to pay somewhere between $15.00 and $20.00 for the right to hold a share of stock that represents annual earnings of $1.00. However, at the peak of the millennium bubble, people were paying $47.00 for that same share.

- The millennium bubble had the classic features of a speculative bubble. Growth in the price of an asset (300+%) unjustified by fundamentals, followed by a relatively rapid decline in prices once the bubble pops.

How Does a Bubble Inflate?

- To understand how a speculative bubble inflates, we can use the fundamental theory to show how the current price of a share of stock depends on the expected future price of a share of stock.

- As we saw in the previous lecture, the fundamental theory says that the price of a share of stock should equal the present value of dividends that the stock will pay in the future. We can rewrite the present-value equation so that the current share price depends on the expected future price of the share, as follows:

$$P(z,t) = D(z,t + 1) / (1 + RR) + P(z,t + 1) / (1 + RR)$$

- There is substantial intuition for writing the share price in this way. Over one period (say, a year), a share of stock entitles its owner to receive two payments—the dividend paid next year and the sale price that can be obtained at the end of the year. The fundamental theory says that the price today should equal the present value of those two payments.

- This equation is the source of the famous "random walk" theory of stock prices.

- Measuring time in days rather than years induces two changes to the formula. First, for most daily increments, a dividend will not be expected, so that the first term of the equation will be 0. Second,

the required rate of return over a day will be much smaller than the required rate over a year, so that the denominator will be only slightly larger than 1.

- With time measured in days, the formula becomes: $P(z,t) = P(z,t + 1)$. This is the famous random walk expression for stock prices. Keep in mind that the term on the right should be thought of as our best forecast of the stock price of company z one period from now. According to the equation, the price of a share today should equal whatever market traders believe the price of that share will be tomorrow.

- If the equation did not hold, individuals will expect that buying or selling shares will be profitable. If market traders thought that the price of company z shares would rise over the near term, they would buy those shares in anticipation of a profit. And they would continue to buy company z shares until the equation held and no short-term profits were expected.

- The point at which a "rational exuberance" theory of stock prices departs from the fundamental value theory is the source of justification for an expected increase in share prices. On the fundamental theory, only an increase in expected future dividends or a decrease in the required rate of return can justify an increase in share prices. An "irrational exuberance" theory of stock prices drops fundamentals as the source of the belief that share prices will rise.

The "Greater Fool" Theory

- The underlying cause of a speculative bubble is psychological. On the irrational exuberance theory, expected capital gains need not be justified by current and expected company profitability. Any information that makes one think that share prices will increase is justification for buying the share, driving its price up now, and contributing to a self-fulfilling prophecy that share prices will grow at rates higher than the required rate of return.

- The psychological process that drives ever-higher share prices is sometimes called the "greater fool" theory. According to this, you may believe that you are paying too much for a share of stock but buy it anyway because you think that soon someone will pay even more to buy it from you. In this scenario, buyers are focused on short-term capital gains, not on holding the stock for the long term in order to participate in company profits.

- If other buyers are behaving irrationally by paying unjustifiably large amounts for a share of stock, it becomes rational to do the same thing. During a bubble period, traders pay attention only to stock prices and their increases and ignore other data.

- In his book *Irrational Exuberance,* Shiller describes many factors that contributed to the buy-buy-buy mentality prevalent during the millennium bubble, including increased media attention to financial news and the explosion of the Internet and the huge fortunes made by Bill Gates and others.

- In the end, the psychology that underlies bubbles may be similar to the psychology that leads gamblers to describe dice as sometimes being "hot" even though rational thought tells them that the probability of a 7 is 1/6 on each and every roll.

Important Term

bubble: An event in which the price of a financial asset grows more rapidly than justified by fundamentals for a substantial period of time.

Suggested Reading

Akerlof and Shiller**,** *Animal Spirits*.

Shiller, *Irrational Exuberance*.

Questions to Consider

1. How do you think bubbles begin to inflate?

2. What do you think Keynes meant when he said that investors were possessed of animal spirits?

3. At what level of the PE ratio for, say, the S&P 500, would you believe that a stock price bubble had inflated?

Derivative Securities

Lecture 24

Derivative securities made up of subprime mortgages were routinely described as "toxic assets" during the financial market crisis that began in 2008. But in principle, derivative securities are important tools that allow a wide range of decision makers to lower the risk of their business operations. Further, most derivative securities and associated trades improve social welfare and are, in no sense, evil. This lecture offers an overview of the various types of derivative securities that are routinely bought and sold in financial markets and looks in detail at the contribution of collateralized-debt obligations to the financial crisis of 2008.

Derivative Securities: Definition and Types

- A **derivative** security is an agreement between two parties, the value of which depends on an underlying price or transaction. For example, a **commodities futures contract** is an agreement to buy a well-defined quantity and quality of a commodity at a specified future date. The underlying product for such a contract is the commodity itself. Many derivative securities involve delayed delivery of the underlying product.

- Although popular accounts of derivatives and derivative markets often focus on speculative activity, it's important to understand that derivatives provide opportunities to lower risk associated with business activities.

- Many types of derivatives and hundreds of different derivative contracts are traded regularly on financial markets. Among the major types are options to buy or sell shares of stock (call options and put options); futures contracts on a wide variety of underlying commodities and financial products; forward contracts, especially on foreign currency; and swaps, contracts in which two parties agree to exchange payment streams.

Structured Products

- A structured product combines assets into a new financial product that provides risk and return features not otherwise available in the marketplace or not available except at high transaction costs.

- One example of a structured product is a share in a mutual fund. The mutual fund company agrees to create a portfolio of stocks and other financial assets that best meet a set of objectives. There are mutual funds, for example, with the stated objective of matching the risk and return features of stock indexes, such as the NYSE, S&P 500, Russell 4000, and so forth.

- A mutual fund provides diversification at low transaction costs. It would be impossible for a small investor to construct a portfolio from individual stocks that would provide the same diversification of risk as provided by, say, a mutual fund designed to mimic the S&P 500.

- Treasury STRIPS are also structured products. Consider a $20,000, 20-year bond issued by the Treasury with a 5% coupon rate. The bond promises 41 payments: 40 payments of $500 that will be made every six months between the date of issuance and the date of maturity and one payment of $20,000 on the maturity date.

- A clever financial firm could cut that single 20-year bond into 41 different zero-coupon bonds, but that is not a winning strategy. Instead, the firm will buy many government bonds and offer a menu of zero-coupon bonds tailored to the needs of the firm's customers.

Commodity Price Futures

- Commodity price futures are derivative contracts that can be used to hedge risk.

- A commodity futures contract is an agreement to supply a fixed quantity of a well-defined quality of a commodity at a well-defined place and at a specific future time. For example, a wheat contract

might specify 5,000 bushels of No. 2 Soft Red Winter Wheat to be delivered to an approved warehouse on a specific date. Contracts are available that specify expiration dates in July, September, December, March, and May of each year.

- A typical posting of wheat futures in the *Wall Street Journal* (December 10, 2010) shows prices per bushel of $7.45 for December wheat, $7.83 for March wheat, $8.10 for May wheat, and so forth.

- How does a wheat farmer use the wheat futures market to hedge risk? The farmer must spend money to plant a crop months before he knows what the wheat is worth in the spot market. When he commits funds for field preparation, seed, fertilizer, and so on, the farmer does not know whether the revenues from the expected crop will exceed the costs of producing that crop.

Figure 23.1

Wheat Futures

Month	Last	Change	High	Low
Dec 2010	745'0 b	-3'2	745'0	745'0
Mar 2011	783'0	-5'4	790'0	778'0
May 2011	810'4 b	-3'4	810'4	810'4
Jul 2011	810'4 b	0'0	814'0	803'0
Sep 2011	824'2	-3'0	824'2	824'2
Dec 2011	835'0	+1'0	836'4	835'0

Source: CME Group.

- The farmer can hedge risk by selling wheat contracts in the futures market. If the farmer were making decisions about a crop in December 2010, he would know that he could sell wheat in the futures market for $8.24 next September. The hedging strategy would be to sell the number of wheat contracts just equivalent to his expected crop size (in units of 500 bushels).

- The hedge works because if the price of wheat in the spot market falls, the value of the futures contract rises and offsets the loss associated with supplying wheat at the spot price. Of course, if the spot price increases, the value of the futures contract falls, but that fall is offset by the gain associated with selling wheat at the higher spot price.

- The farmer will never let the futures contract expire. Instead, he will take an offsetting position in the futures market prior to the expiration date and, thereby, zero out his futures positions.

- Farmers may sell wheat in the futures market to large users, such as commercial bakeries, or to speculators. To make profits, speculators buy wheat futures when they think the eventual spot price will be higher than the futures contract price and sell wheat futures when they think the eventual spot price will be lower than the futures contract price.

- In effect, the existence of the futures market in wheat allows farmers to transfer the risk associated with variation in wheat prices to another party, one that is more willing to bear the risk.

- In equilibrium, speculators will earn an expected profit just high enough to compensate them for the risk they bear.

- In equilibrium, the farmer's expectation of future wheat prices will be different than the futures price, with the difference being the source of profit for the speculator. For example, the farmer may believe that the price of wheat next September will be $8.40. But the farmer might prefer to lock in a price of $8.24 per bushel rather

than assuming the risk that the price might be lower, perhaps low enough that the spot value of his wheat will not cover his costs of planting and raising the crop.

Collateralized Debt Obligations (CDOs)

- A collateralized debt obligation is a structured product. The CDOs that were the focus of attention during the financial market crisis of 2008 were mortgage-backed securities. Some of the mortgages were claims against borrowers with substandard credit and came to be called subprime mortgages, hence the name subprime mortgage crisis.

- Under certain assumptions, CDOs are much less risky than the underlying mortgages. Suppose we hold two $1,000 IOUs, with two possible payment outcomes: full payment and complete default. The probability of full payment is 90% for each IOU, and payments are independent events.

- From the underlying IOUs, we construct two new securities. The first is a senior security that pays $1,000 unless both IOUs default. The default probability of the senior security is 1%, given the independence assumption. The second is a junior security that pays nothing if either IOU defaults. The default probability of the junior security is 19%, given the independence assumption. The result here is one safe and one less safe derivative security from the underlying IOUs.

- Actual mortgage-backed securities are more complicated but work in essentially the same way as the example. The initial pool has many mortgages rather than two, and there are more than two groups (called "tranches" in the trade). The securitization process is sometimes repeated by pooling and tranching the CDOs to create a second-order derivative called a CDO^2. A form of insurance (credit default swap) may be bundled with the lower tranches of the CDOs to lower their risk.

Reduction of Risk

- Derivatives play a crucial role in allowing business decision makers to reduce risk.

- The farmer reduces risk by selling a crop in the futures market. An airline executive reduces risk by buying jet fuel in a different futures market. An exporter who is at the point of selling machine tools to a Japanese buyer can reduce risk by selling yen forward and, thereby, locking in the dollar value of the sale.

- Financial firms that issue mortgages can more easily raise funds to finance a portfolio of mortgages by using them as the underlying product for a CDO.

Important Terms

commodities futures contract: An agreement to buy a well-defined quantity and quality of a commodity at a specified future date.

derivative: An agreement between two parties, the value of which depends on an underlying price or transaction.

Suggested Reading

Kolb, *Financial Derivatives*.

Norris, *The Pit: A Story of Chicago*.

Questions to Consider

1. In what sense is it true that the market for derivative securities is a "place" where speculators and risk-averse individuals make mutually advantageous trades?

2. In what sense is it true that derivative securities have been "born of necessity"?

3. You are planning a trip to Europe for your family to celebrate your 65th birthday. You will be covering all expenses for 10 family members. How might you use financial derivatives to hedge the risk of rising trip expenses?

Asymmetric Information

Lecture 25

This lecture defines the problem of asymmetrical information and how it relates to the fact that few firms actually use stock and bond markets to raise funds for investment. Most firms borrow funds through banks and other financial intermediaries, and you will see how these institutions compensate for the problem of asymmetric information.

Symmetric and Asymmetric Information

- The condition of **asymmetric information** occurs when one party in a transaction has substantially more relevant knowledge than another. Often, the relevant knowledge is about the quality of the product being bought and sold.

- For many products and markets, it makes sense to assume that buyers and sellers have symmetric information. For example, if the product is a pound of flour, it is easy for the buyer to know everything about the product that is considered relevant.

- For many other products and services, however, it is clear that one party to the transaction has knowledge that the other does not. The seller of a used car, for example, knows more about how well the car was maintained than the buyer does. The buyer of health insurance knows his or her health better than the seller of insurance.

"The Lemons Problem"

- Nobel laureate George Akerlof is credited with first studying the impact of asymmetric information on economic markets and outcomes. According to Akerlof, asymmetric information leads to adverse selection in the marketplace, a situation that Akerlof described as "the lemons problem."

- The seller of a used car has more complete knowledge about the quality and maintenance of the car than the buyer. The buyer rightly assumes that purchasing a used car is risky; the car could be a lemon rather than a cherry. The buyer will only buy at a price low enough to provide compensation for the risk of getting a lemon.

- Potential sellers who have well-maintained and well-running used cars (cherries) will be less willing to sell them in the used-car market because the price they will receive is less than the price for a cherry.

- Because of asymmetric information, lemons will be overrepresented and cherries will be underrepresented in the used-car market. The market adversely selects lemons, and the belief that it offers lemons becomes a self-fulfilling prophecy.

- Akerlof pointed out that the lemons problem creates a market failure. There are owners of cherries who would like to sell and buyers who would be willing to pay a fair price for a cherry, but given asymmetric information, the welfare-enhancing trades between members of these two groups never occur.

- Akerlof argued that the lemons problem affects job markets, insurance markets, and many other markets. In financial markets, potential borrowers have more complete knowledge than lenders do about how funds will be used.

- A loan applicant has an incentive to paint the rosiest possible picture of the investment that the borrowed funds will finance. The lender is at a disadvantage because it costs something to gain even partial information about the project.

- After the fact, the borrower may have an incentive to understate the profitability of the project. That will be true whenever an understatement lowers what the borrower must pay. Of course, the lender understands that it possesses less information and structures contracts accordingly.

Adverse Selection and Moral Hazard

- Financial firms that lend face two types of asymmetric information problems: adverse selection before the lending transaction occurs and moral hazard after the transaction.

- As the term adverse selection suggests, the existence of asymmetric information can select participants into the loan market in a perverse way. Suppose, for example, economic data suggest that a recession of unknown depth and duration may occur within the next few quarters. How will a lender behave toward its prospective borrowers?

- The lender might raise its borrowing rates to compensate for the higher risk entailed in lending in a higher-risk economic environment. However, it may be unwise for the lender to raise its rates when it believes that investment projects have become riskier. Raising borrowing rates may select higher-risk borrowers into the applicant pool and exclude lower-risk borrowers.

- The issue of moral hazard arises when the existence of asymmetric information provides one party with an incentive to behave differently after the transaction than he or she promised to behave when the transaction was negotiated.

- For example, to maximize the likelihood that a loan will be approved, a company may tell a lender that borrowed funds will be invested in a safe project. Once the loan is approved, the company may have an incentive to use the funds to undertake a riskier project.

The Standard Debt Contract

- As mentioned earlier, stocks and bonds are not the most important sources of external financing for businesses. Why do so few firms use these markets to raise funds for investment?

- Prospective buyers of stocks and bonds realize that they can never know very much about the operations of a firm, especially a smaller firm. They also realize that it is easy for small companies

to understate their profits and that company managers have an incentive to "convert" funds into bonuses and hidden compensation.

- Asymmetric information implies that adverse selection is likely to occur. The PE ratios of small company shares will be low to compensate share buyers for the risk of owning a lemon. Lemon companies will be overrepresented in the stock market, and good companies will be underrepresented.

- Banks have designed a particular kind of debt contract—the standard debt contract—that provides some relief against the problems of asymmetric information.

- In the standard debt contract, the bank does not share profits with the borrower because the bank realizes that it is easy for the borrower to understate true profits and hard for the bank to detect the understatement.

- Instead, the optimal debt contract allows the borrower to declare only two states: "able to repay" or "unable to repay."

- In the first state, the "able" borrower repays a fixed interest rate plus principal. The lender receives the same interest payment no matter how successful the project is and does not monitor the success of the project.

- In the second state, with the "unable" borrower, the lender pays an audit cost to discover how much the project earned. Even if it earned too little for the borrower to repay interest and principal, the project probably earned something. The lender will take the entire return from the project in partial compensation for the loan.

- The standard debt contract has two important properties: First, it optimizes truth telling on the part of the borrower when the truth matters. That is, the borrower either repays or declares that it is unable to repay; in the latter case, the bank audits the project and takes all the available proceeds. Second, the standard debt contract

makes the borrower and the firm better off whenever the borrower's project is sufficiently profitable to justify a loan.

Rigid Loan Practices

- Banks demand collateral and place restrictions on borrowers' behavior because the standard debt contract is not a complete remedy to the problem of asymmetric information. The issue of moral hazard remains.

- Even under a standard debt contract, a borrower has an incentive to promise the bank it will run a safe project and, then, once the loan is granted, decide to run a riskier project. If the project succeeds, the firm earns higher profits. If it does not succeed, the firm is no worse off than it would have been if it had run the safe project.

- The requirement that a borrower provide collateral is an additional remedy for asymmetric information problems. The bank may be able to more accurately assess the value of collateral than it can assess the value of a project that has failed. Further, by posting collateral, the borrower gives the bank tangible assurance that it will use the funds as promised. To the extent that the collateral has a value greater than the borrowed amount, the lender no longer suffers from an information disadvantage.

Bank Loans and Used Cars

- Both bank loans and used-car transactions suffer from the problem of asymmetric information, and this problem also explains why few firms can obtain funds from stock and bond markets. Profit sharing is risky for the parties who know less about the firm's operations than the managers do.

- Most companies must borrow from banks and other professional lending institutions, which are partially protected from the problem of asymmetric information by the standard debt contract.

Suggested Reading

Akerlof, "The Market for 'Lemons.'"

Coval, Jurek, and Stafford, "The Economics of Structured Finance."

Stiglitz and Weiss, "Credit Rationing in Markets with Imperfect Information."

Questions to Consider

1. In what sense can asymmetric information cause a market failure?

2. Why don't commercial banks take a share of the profits of firms to which they lend money?

3. In what sense does the existence of asymmetric information provide a fundamental argument for the existence of commercial banks?

Regulation of Financial Firms

Lecture 26

In the early 1980s, Continental Illinois National Bank, the seventh largest bank in the United States, was in trouble. It had lent large amounts to Penn Square Bank of Oklahoma, which had, in turn, used those loans to finance oil projects in the late 1970s and early 1980s. When oil prices fell, Penn Square failed and Continental Illinois found itself in serious trouble. The bank tried to raise enough funds to restore creditor and depositor confidence but failed to do so. The Federal Reserve stepped in, guaranteeing that it would meet all liquidity needs of the bank, and the Federal Deposit Insurance Corporation guaranteed all deposits and creditor claims. The bailout gave birth to the phrase "too big to fail." In this lecture, you learn when and why it is in the public interest to bail out a failing bank or financial institution, explore the connection between bailouts and bank regulation, and see how the concept of asymmetric information helps us understand why and how banks are regulated.

The Case for Bailouts

- Depository institutions, such as banks, thrifts, and credit unions, perform an essential economic function by channeling funds from savers to investors. You also learned that all depository institutions are fragile in the sense that they do not keep enough cash on hand to weather a run on deposits.

- Deposits at banks and other depository institutions are part of the nation's money supply. When the financial system is functioning normally, depositors regard their deposits as available "on demand." If depositors were suddenly to lose immediate access to their deposits, the economy would suffer a devastating shock because depositors would stop paying their bills and stop buying goods.

- It is in the public interest to provide support for a failing bank or financial firm when failure to do so would threaten public confidence in the financial system.

- In a world where individuals have the option to lower transactions costs by depositing currency and using deposits for transactions, there are two possible equilibrium situations: everyone deposits and no one deposits.

- When a large bank fails for any reason, the failure raises the prospect that other financial institutions will fail. The other institutions may have been owed funds by the failed bank or may be thought of as suffering from some of the same problems as the failed bank.

- If the public loses confidence in the safety of deposits, it becomes optimal for all institutions to stop making required payments. The system grinds to a halt.

- Those who suggest that "too big to fail" indicates a government preference for helping Wall Street instead of Main Street miss an important point: If the financial system fails, Main Street fails, too.

- However, when the government bails out a bank to preserve the payments system, it creates some perverse incentives. Bank managers have an incentive to approve riskier loans if, when they go bad, the government steps in to cover the losses.

The Case for Regulation

- Recall that banks and other lenders face the problems of asymmetric information, that is, adverse selection and moral hazard. If the government bails out a failing financial institution, it faces the same problems.

- A lender, such as a commercial bank, knows much more about how it vets borrowers and the true value of the loans it lists among its assets than the government knows.

- When the government implicitly or explicitly guarantees that a bank will not be allowed to fail, it creates an incentive for the bank to acquire assets that have higher expected returns but entail more

risk. If those assets pay off, the bank earns higher profits. If those assets fail, the government caps the downside risk for the bank.

- The goal of regulation is to counter the effects of asymmetric information on the financial services industry.

Types of Regulation

- Banks and financial firms are subject to several types of government regulation under current law, including requirements to maintain deposit insurance, restrictions on assets that commercial banks are permitted to hold, capital requirements, the requirement to obtain a charter, adherence to standard accounting procedures, and disclosure of certain information.

- Deposit insurance keeps depositors from running a bank when they hear news that the bank is "in trouble." Currently, deposit accounts are insured up to $100,000.

- From the perspective of depositors, deposit insurance solves an asymmetric information problem by making the superior information about fund use possessed by banks irrelevant. Deposit insurance also makes it unnecessary for depositors to monitor the lending practices of their banks. Deposit insurance shifts the asymmetric information problem from depositors to bank guarantors.

- Restrictions on the assets that commercial banks are permitted to hold were enacted by the Glass-Steagall Act of 1933. This legislation separated commercial and investment banking in the United States and made it illegal for commercial banks to hold equity and corporate bonds to prohibit banks from taking certain risks with deposited funds.

- Some economists argued that Glass-Steagall had an unintended consequence: Its prohibitions actually made banks riskier by keeping them from holding a more diversified portfolio of assets. The Gramm-Leach-Bliley Act of 1999 repealed many elements of the Glass-Steagall Act.

- The idea behind capital requirements is to ensure that the bank itself has more to lose from a failure. When a bank has little capital, the guarantor faces moral hazard problems because the bank has an incentive to promise to lend conservatively but, in fact, to take great risks. If the risks are successful, the bank wins. If not, the bank is no worse off because its capital value was low in the first place.

- Banks must obtain a charter from the Comptroller of the Currency (for national banks) or from the state banking authority. Limiting entry lowers competition among banks but raises costs to bank customers.

- Finally, regulators require that banks adhere to certain standard accounting principles and disclose information that helps the market assess the quality of the bank's asset portfolio and enables stockholders, creditors, and depositors to monitor bank behavior.

The Federal Reserve System

- Since the development of the Federal Reserve System in 1914, the regulation of financial firms has been a work in progress. Congress has tightened and loosened regulations on many occasions, often in response to crises.

- There is no general agreement about how much to regulate banks and financial firms, although extreme positions are not attractive. Minimal regulation would require depositors to monitor their depository institutions and to face the risks associated with uninsured deposit accounts. Maximal regulation would reduce the market competition that makes bank operations efficient, provides a wider selection of financial market services, and keeps prices closer to cost than they would be with a monopolized banking sector.

- Changes in regulation by the Federal Reserve typically occur in response to crises, such as the Great Depression, high inflation in the 1960s and 1970s, and the failure of thrift institutions and Continental Illinois National Bank in the 1980s. In many cases,

however, the regulatory response to one crisis sows the seeds for a subsequent crisis.

- The U.S. government rightly seeks to maintain confidence in the financial system, understanding that if confidence failed, the economy would follow. But to maintain this confidence, the government has sometimes bailed out financial institutions—especially ones that it deemed too big to fail. In so doing, government has created an asymmetric information problem for itself: The banks it vows to protect know much more about their lending and other risk-taking activities than the government does.

- It is an understatement to say that financial market regulators walk a tightrope between competing goals. Too much support for banks and the banks tend to take greater risks, knowing that they will be bailed out if things go badly. Too little support for banks and economics crises can convert themselves to financial panics. Too much regulation and the competitive forces of the marketplace do not engender efficiency. Too little regulation and banks will be more successful in finding ways to take risks with other people's money.

Suggested Reading

Kolb and Rodriguez, *Financial Institutions*.

Mishkin, *The Economics of Money, Banking, and Financial Markets*.

Questions to Consider

1. Which is more important: payment system stability or the elimination of the moral hazard associated with the belief that the Fed will bail out large banks before they fail?

2. Does the United States have too much regulation of banks? If yes, which regulations would you like to eliminate and why?

3. What do you believe is the remedy to the "too big to fail" problem in the U.S. financial system?

Subprime Mortgage Crisis and Reregulation

Lecture 27

On September 15, 2008, after 12 months of economic turbulence and as a result of the failure of the financial firm Lehman Brothers, the stock market suffered its largest loss since 9/11. The Dow Jones dropped 504 points, or 4.4%, and the market recorded a sales volume of more than 8 billion shares. But the market fall was less about the failure of Lehman Brothers and more about fear of what lay ahead. Insurance giant AIG had written many insurance contracts on mortgage-backed derivative securities, and market participants feared that a failure of AIG would make these contracts worthless, instigating the failure of the entire financial system. In this lecture, we will treat the subprime crisis as a case study. We will consider the causes of the crisis, learn how mortgage-backed securities contributed to the crisis, and look at how the regulatory reform that followed is likely to change the financial landscape.

Backdrop to the Crisis

- A subprime mortgage is a mortgage by a borrower who has a credit score below 620, a limited credit history, or some other credit impairment.

- As we learned earlier, a collateralized debt obligation (CDO) is a derivative security that is issued against a portfolio of underlying securities. In the case of the subprime crisis, the underlying securities were mortgages.

- A sample balance sheet illustrates the idea behind a CDO. The issuer of mortgage-backed securities buys, say, 1000 mortgages, each with a face value of $200,000, from a mortgage lending specialist.

- To acquire the funds to buy these mortgages, the issuer sells several different but related mortgage-backed securities. The third tranche (or grouping) of mortgages is the riskiest security.

It absorbs all the losses from all the mortgages on the asset side of the balance sheet until those losses are so large that the third tranche security has zero value.

- The second tranche is the next riskiest security. It absorbs losses in excess of those that drive the value of the third tranche to zero.

- The first tranche is the safest security. It absorbs losses only when losses from the underlying mortgages are so great that they have reduced the value of all other tranches to zero.

- Traditionally, mortgages are fairly safe debt obligations, but they are not riskless. In a pool of 1000 mortgages, one never knows in advance which mortgages will lose value because of default and which will not.

- The CDO arrangement creates a sorting of mortgages into risk categories. The highest-quality tranche is offered to buyers who wish to hold very safe securities and receive a lower return. The lower-quality tranches are offered to buyers who are willing to take on additional risk in exchange for a higher return.

A Classic Case of Asymmetric Information

- The owners of mortgage-backed securities have little or no knowledge about the ultimate borrowers—those individuals who signed the mortgages. Perhaps more importantly, the mortgage issuers know more about the quality of the mortgages they wrote than the financial institutions that bought them as inputs to the securitization process. And the financial institutions know more about the mortgages than the buyers of the CDOs.

- As one remedy for the asymmetric information problem, mortgage issuers use the services of rating agencies, such as Moody's, Standard and Poor's, and Fitch.

- Before the crisis, the rating agencies typically gave all but the lowest CDO tranches their highest ratings, at least partially because rating agencies are paid by those seeking ratings. A decision to downgrade a CDO issue typically led the seeker to use a different rating agency.

The Onset of the Subprime Crisis

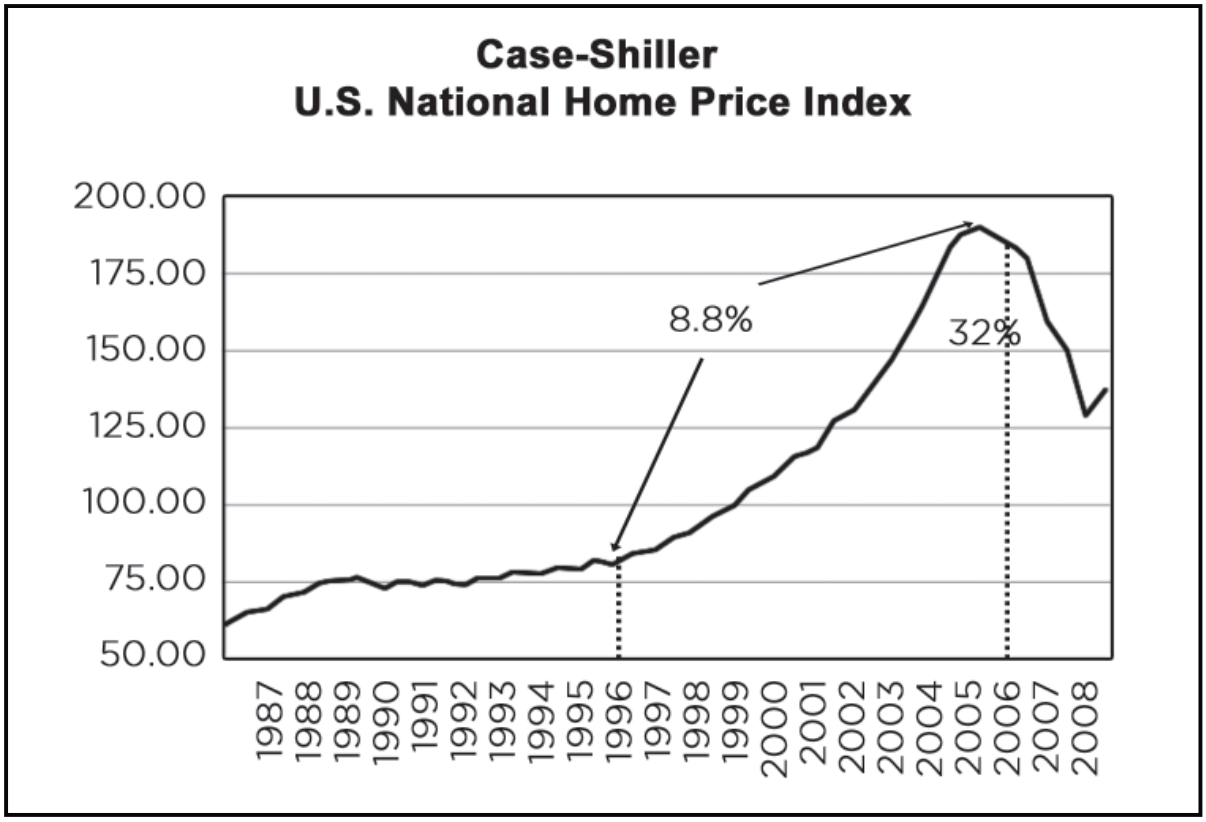
- The performance of CDOs and the idea that higher tranches are virtually riskless rests critically on the assumption that the default of any one mortgage is independent of the default of any other mortgage.

- When mortgage defaults are independent events, the probability that both mortgages will default equals the product of the probabilities that each mortgage will default. In normal economic times, it is reasonable to assume that a default is an independent event because it is likely to be the result of an idiosyncratic occurrence, such as the sickness or death of the borrower. But when overall economic events affect many mortgages simultaneously, many are likely to fail.

- The proximate cause of the subprime crisis was the bursting of the housing bubble in the U.S. real estate market. Research begun after the onset of the crisis indicates that rating agencies had assumed that housing prices could not fall when they gave their highest credit ratings to CDOs. But the Case-Shiller house price index shows a dramatic drop between 2006 and 2009.

- The drop in house prices worked like a "coordinating event" that made many mortgages fail at the same time. Many subprime mortgagees had borrowed on the presumption that they would experience capital gains quickly as house prices continued to increase, and such gains would offset the fact that they had inadequate income to make mortgage payments at higher interest rates. At the same time, many subprime mortgages offered borrowers low initial payments.

Figure 27.1



Source: Standard & Poor's and FiServ.

- In numerous cases, it became economically rational for owners of properties purchased with subprime mortgages to default on their mortgages and surrender their properties.

- Holders of CDOs found themselves in possession of assets that clearly had fallen in value. It was difficult to know what the various tranches of CDO securities were worth because of both the complexity of the derivatives and uncertainty about actual default rates for the underlying mortgages.

- The problem was compounded by the increased likelihood that AIG would not have sufficient funds to pay off on "insurance contracts" that it had written and owners of CDOs used to hedge the risk associated with their positions in mortgage-backed derivatives.

- As the financial crisis deepened, it accelerated the economic downturn that had begun in the last quarter of 2007.

Ultimate Causes of the Subprime Crisis

- Research on the ultimate causes and consequences of the subprime crisis is in the early stages, but two interesting theories have come to light.

- Some researchers believe that the crisis was caused by a long period of low interest rates in the United States. The Federal Reserve had lowered interest rates significantly after 9/11 to promote confidence in the U.S. financial system.

- But critics of this approach believe that low rates on Treasury securities led savers to seek higher-return alternative assets, such as mortgage-backed securities. Critics also assert that low rates reduced the incentives for commercial banks and other financial firms to spend scarce resources to assess the risks associated with lending.

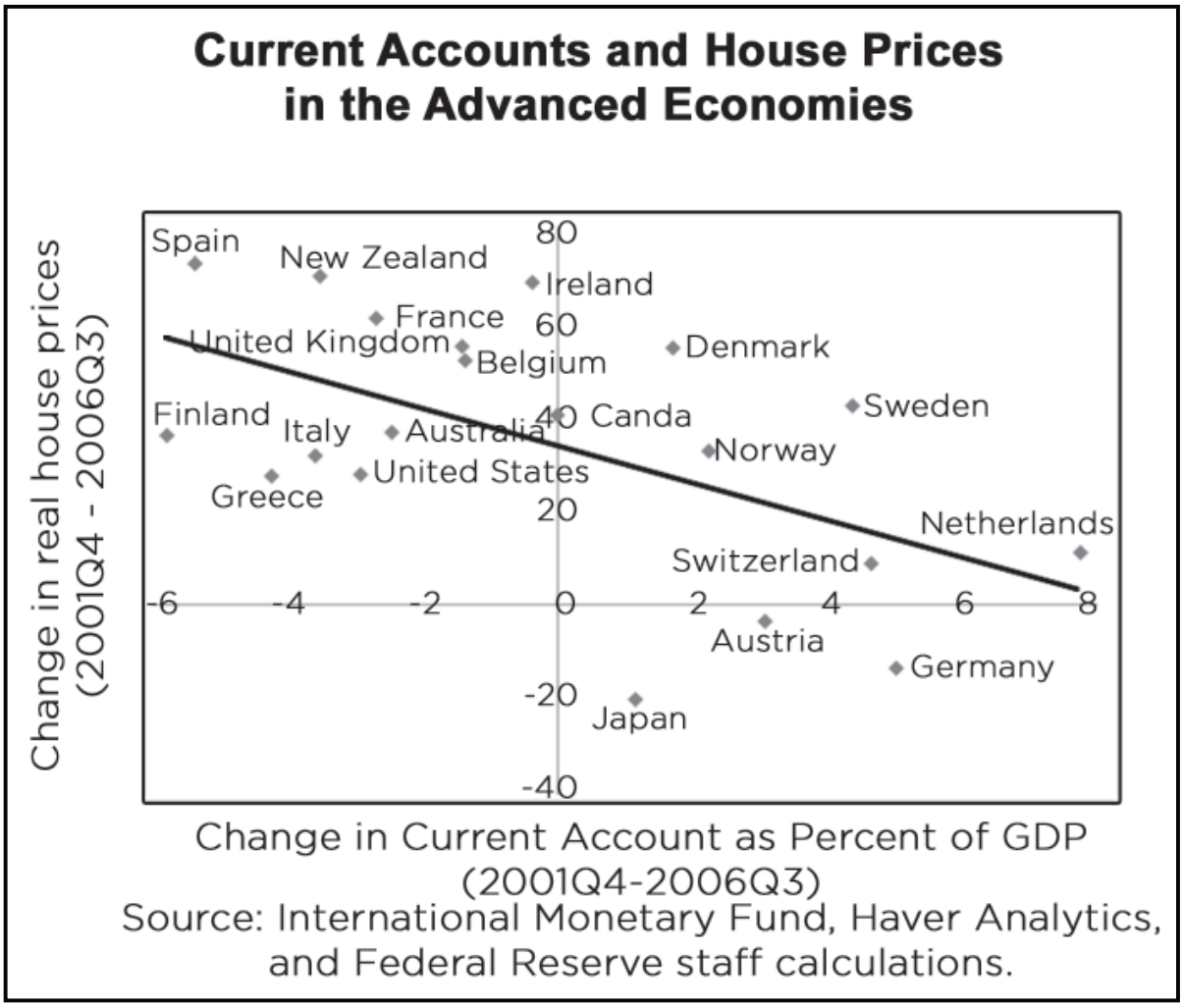
- Other analysts believe that the crisis was caused by a glut of global saving. The United States and many other nations experienced large current account deficits in the period leading up to the subprime crisis. Such a deficit results when a nation imports more than it exports (with adjustments for other income flows).

- When the United States experiences a current account deficit, other nations have a surplus of U.S. dollars that they use to purchase our nation's financial assets, such as bonds, stocks, and mortgage securities. Before the subprime crisis, "hot" dollars streamed into the United States, creating a demand for assets that were judged safe but still paid an attractive rate of return. Because interest rates on government bonds were low during the period, many of those hot dollars were used to purchase mortgage-backed securities.

Regulatory Reform

- The process of re-regulation after a crisis is often dominated by highly charged politics. Unfortunately, the desire to assess blame and "punish the guilty" can lead to changes in financial market regulation that make matters worse rather than better.

Figure 27.2



Source: Federal Reserve.

- The stated aim of the Dodd-Frank Act of 2010 is: "To promote the financial stability of the United States by improving accountability and transparency in the financial system, to end 'to big to fail', to protect the American taxpayer by ending bailouts, to protect consumers from abusive financial services practices, and for other purposes."

- It is too soon to say whether Dodd-Frank will solve the problems that were revealed by the subprime mortgage crisis, although experts have said that it does not end "too big to fail." Financial firms still have an incentive to grow to the point where their failure would be contradicted by the nation's desire for system stability.

- The subprime crisis and the Dodd-Frank Act are the latest installment in the back-and-forth cycle of crisis and regulatory reform. This back-and-forth is the result of a fundamental tension between the need for accountability on the part of financial firms and the need for a stable financial system.

Suggested Reading

Bernanke, "Monetary Policy and the Housing Bubble."

Cassidy, "Anatomy of a Meltdown."

Chomsisengphet and Pennington-Cross, "The Evolution of the Subprime Mortgage Market."

Federal Reserve Bank of San Francisco, "The Economy, Crisis and Response."

Questions to Consider

1. Would you favor making it illegal to bundle mortgages into CDOs? Why or why not?

2. Do you believe that the Fed was responsible for the subprime crisis and the Great Recession? Why or why not?

3. How would you advise handling the "too big to fail" problem?

Interest Rate Policy at the Fed and ECB

Lecture 28

In December, 2010, the Federal Open Market Committee (FOMC) met to discuss the state of the U.S. economy and make decisions about monetary policy. In its official statement, dated December 14, 2010, the FOMC announced that it would keep target values for the federal funds rate extremely low and that it intended to purchase $600 billion in longer-term Treasury securities. Such an extraordinary acquisition program is not normally part of Federal Reserve policy but was undertaken in an attempt to accelerate economic recovery in the United States. In this lecture, you look at the actions the Federal Reserve takes to pursue its policy objectives and compare Fed policy with that of the European Central Bank. As we will see, both institutions can de-stimulate the economy by raising short-term interest rates, but the decision to stimulate the economy by lowering short-term rates may not be successful if banks are unwilling to lend, even though their cost of funds has fallen. The unwillingness of banks to lend explains why FOMC policy in 2010 included both low federal funds rates and direct asset purchases.

The Federal Funds Rate

- By U.S. law, depository institutions, such as banks, thrifts, and credit unions, must hold reserves. The required level of reserves is 10% of demand deposits—those deposits that are available to customers on demand—but not time deposits—those that depositors agree to leave with banks for specified periods of time.

- Federal funds qualify as reserves. Federal funds are either cash in the vault of depository institutions or deposits in favor of the institution at the Federal Reserve. (Recall that depository institutions have accounts at the Fed.)

- When the Fed wants to lower the federal funds rate, it buys U.S. Treasury securities on the open market from private dealers of those securities and pays for those funds with a "check." When the bond

dealer deposits the check at its bank and the bank presents the check to the Fed for payment, the Fed honors the check by adding to the bank's deposit account at the Fed. In this way, the Fed has created new federal funds, and those new funds allow commercial banks to loan 10 new dollars for every 1 new dollar in federal funds.

- In the federal funds market, banks with excess reserves lend those reserves to other banks to meet reserve requirements. The federal funds rate is the market-determined rate for loans of federal funds. The funds are lent for very short periods because the borrowing banks need them just long enough to bring their reserve totals up to the required level on the last day of each two-week reserve maintenance period.

- When the Fed buys bonds, it increases the supply of federal funds and, thereby, lowers the market rate at which those funds are borrowed and lent.

- When the Fed wants to raise the federal funds rate, it sells U.S. Treasury securities on the open market to private securities dealers. A dealer pays for those bonds with a check that the Fed collects by lowering the deposit balance of the dealer's bank. Thus, selling bonds destroys federals funds. The decrease in the supply of federal funds raises the market rate at which the funds are borrowed and lent.

Differences in the European System

- The European Central Bank (ECB) is the central bank for 17 European Union nations that use the euro as their common currency. The central banks of the individual euro nations, such as the Deutsche Bundesbank and the Banque de France, now function more like branches of the ECB than as freestanding central banks.

- The ECB pursues its policy objectives by conducting open-market operations, maintaining "standing facilities" for participating credit institutions, and as in the United States, requiring credit institutions to hold minimum reserves with the Eurosystem.

- The ECB requires credit institutions (called counterparties) to hold minimum reserves on accounts with the national central banks as specified by the Eurosystem. The list of liabilities against which counterparties must hold reserves is broader in the Eurosystem than in the Federal Reserve System, and the reserve requirements are different for different classes of liabilities.

- The ECB uses end-of-month balance sheet data to compute required reserves that institutions must hold during a one-month period that begins one month later.

- Counterparties may use one of two standing facilities: (1) the Marginal Lending Facility, intended to satisfy counterparties' temporary liquidity needs and functioning like the federal funds market, and (2) the Deposit Facility, which allows counterparties to make overnight deposits with national central banks and to receive interest income on the reserves they hold.

- The ECB conducts open-market operations in a manner similar to the Fed. It may buy and sell debt certificates issued by the ECB and issued by the national central banks of the Eurosystem prior to the date of adoption of the euro. All traded debt certificates must meet high-credit standards and must be issued or guaranteed by central banks, public-sector entities, private-sector entities, or international or supranational institutions.

- The ECB's open-market operations are intended to keep the Euro Overnight Index Average (EONIA) close to a published target rate. When the ECB wishes to stimulate the European economy, it lowers its target for EONIA and buys debt certificates, thereby raising the amount of reserves and lowering the cost of borrowing them. When the ECB wants to de-stimulate the European economy, it raises its target for EONIA and sells debt certificates, thereby lowering the amount of reserves and raising the cost of borrowing them.

- The rates the ECB charges to borrow reserves in its Marginal Lending Facility and the rates it pays for reserves on deposit in its Deposit Facility provide an upper and lower bound (a corridor) for EONIA.

Monetary Policy and the Business Cycle

- The objectives of the Fed and the ECB are not the same. The ECB's priority mandate is to conduct monetary policy in a manner that is conducive to price stability; full employment is subordinated to maintaining price stability. The Fed has a dual mandate: to maintain price stability and to promote full employment of resources in the economy.

- A timeline shows how the Fed adjusted the federal funds rate over two business cycles, maintaining a "station-keeping" level in the late 1990s, raising the rate in 1999 to offset inflationary forces, dropping the rate in 2000 to offset recessionary forces, and so on up to 2009–2011, when the rate has been kept just slightly above 0.

- A comparison of ECB settings for EONIA with Fed settings for the federal funds rate shows that the ECB responded in much the same way as the Fed during the same period.

What's Next?

- At the beginning of 2011, the ECB and the Fed had lowered EONIA and the federal funds rate to values only slightly higher than 0. But what can a central bank do when it has lowered rates to 0 and the economy remains in recession?

- As we will see in a later lecture, the Fed did not respond to the financial market crisis and the Great Recession simply by keeping the funds rate low; it took other extraordinary and controversial policy measures, as well.

Suggested Reading

European Central Bank, "The Implementation of Monetary Policy in the Euro Area."

——— *The Monetary Policy of the ECB*.

Federal Reserve Bank of San Francisco, "U.S. Monetary Policy."

Meulendyke, *U. S. Monetary Policy and Financial Markets*.

Questions to Consider

1. In your view, would the Federal Reserve be better off if it had a policy mandate more like that of the ECB, where low and stable inflation is explicitly stated to be the primary objective of policy?

2. Most analysts believe that a central bank should conduct policy in a transparent way and that the communications made to the public by the central banks should clearly indicate the likely future course of policy. Would you say that the December 14, 2010, policy statement by the Fed quoted at the beginning of the lecture is transparent?

The Objectives of Monetary Policy

Lecture 29

It is impossible to imagine a course on money and banking that does not honor the contributions that Milton Friedman made to economics in general and to our understanding of monetary policy in particular. In an address to the American Economic Association in 1968, Friedman cautioned that monetary policy "cannot peg interest rates for more than very limited periods" and "cannot peg the rate of unemployment for more than very limited periods." Friedman highlighted these two limitations because he thought that politicians, economists, and people generally believe that monetary policy has far greater power that it actually does to affect economic outcomes. According to Friedman, what monetary policy can do is "prevent money itself from being a major source of economic disturbance" and "provide a stable background for the economy." In this first of two lectures on monetary policy, we will explore what the objective or objectives of monetary policy should be; in the next lecture, we'll ask whether central banks should follow rules or whether they should routinely use discretion in the conduct of monetary policy.

A "Helicopter Drop" of Money

- A simple example explains the essence of the argument that changes in the money supply and, therefore, monetary policy cannot affect employment of resources in the long run.

- Consider an economy in equilibrium, with resources fully employed. Among other things, this means that wage rates are at levels so that qualified workers who want jobs either have them or could find them in a short time. It also means that managers of factories are operating at levels that they believe can be sustained indefinitely.

- Now suppose that the central bank doubles the money supply; it accomplishes this goal by trading two "new" dollars for one "old" dollar. Friedman sometimes described this thought experiment as a "helicopter drop" of money into the economy.

- If everyone understands what the central bank has done (a big if), then a new equilibrium is in existence, in which production and employment (and consumption and investment) are exactly the same as before, but the prices for goods and services are twice as much.

- In the short run, an increase in the money supply will lead to real effects. Providers of goods and services, including labor services, will not raise their prices immediately. The central bank will increase the money supply by increasing federal funds to banks, with the result that interest rates will fall. Those whose spending decisions are interest rate–sensitive will spend more, and employment of resources will increase. This may occur even if the economy is already operating at or near full employment because workers and firms may choose to work overtime for a period of time.

- Suppose now that the central bank raised the rate at which it expanded the supply of money. That is, it increased the money supply not once but month after month. Friedman argued that after the short-run effects of increased growth in the money supply wore off, the economy would be left only with higher inflation.

- Inflation would begin in markets where resources are scarce but would gradually spread to all markets. As economic decision makers observed the increased rate of inflation, they would build it into their forecasts for the future. The final outcome would be higher inflation and a return to the economy's normal levels of output and production.

- For economists, this thought experiment demonstrates the "neutrality" of money. In other words, increasing the money supply is not like stepping on the gas or the brake; it's like leaving the car in neutral.

Central Bank Mandates

- Guided by the understanding that money is neutral in the long run and by Friedman's warning that monetary policy can be

destabilizing, some nations commit their central banks to one and only one target: low and steady inflation.

- Other central banks adhere to a dual mandate in which they are required not only to keep inflation low and stable over the long run but also to undertake counter-cyclical policy designed to soften the effects of recessions on production and employment.

- The ECB has a dual mandate (although price stability is explicitly stated to be the primary objective), as does the Federal Reserve. The Fed's enabling legislation states that its objective is "to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates." The third goal here is generally thought to be implied by the other two. That is, an economy where employment is full and prices are stable will be an economy with moderate long-term interest rates.

- The fact that Congress has provided a dual mandate for monetary policy itself creates many opportunities for criticism of the Federal Reserve. In particular, various stakeholders in the U.S. economy argue that the Fed should broaden its objectives.

Mandate Pressure on the Fed

- A good example of mandate pressure is the debate that centers on the question of whether or not the Fed should act to deflate speculative bubbles. In an op-ed piece for the *New York Times* on June 15, 2008, Alan Blinder of Princeton addressed the question of what the Fed should do about an asset price bubble, such as the United States experienced between 2004 and 2007.

- Recall that an asset price bubble is an unsustainable increase in asset prices that occurs over a sustained period of time—months rather than days. In this context, "unsustainable" means that the increase in prices during the bubble is unjustified by changes in underlying fundamental forces. For example, most analysts agree that repeated increases in stock prices are evidence of a bubble unless they are accompanied by credible evidence that corporate profits will rise.

- Blinder explained the schools of thought on the Fed's two possible courses of action: deliberately bursting the bubble or allowing it to burst on its own.

- At least partially because it is difficult to identify a bubble in its early stages, some economists, including Alan Greenspan and Ben Bernanke, hold that "deliberate bubble-bursting" should be avoided.

- Others believe that letting the housing bubble burst on its own led to the subprime mortgage crisis, that mopping up after a bubble sows the seeds for the next bubble (because the Fed keeps interest rates abnormally low), and that allowing bubbles to inflate and burst leads to more rapid growth in the general level of prices. CPI inflation is the result of the Fed allowing the economy to heat up while the bubble inflates, then trying to keep it from fully cooling after the bubble bursts.

- Friedman would likely agree that it is difficult to identify a bubble before it bursts, especially when it first begins to inflate, because analysts rarely agree on the future course of fundamentals. He would likewise warn that by the time the Fed could be reasonably sure that observed increases in asset prices constituted a bubble, a decision to cool the economy and deflate the bubble would not begin to affect spending decisions until the bubble burst of its own accord. In that case, the Fed would end up perversely reinforcing the recessionary effects of the burst.

- Blinder's own view is that the "mop-up" strategy is a good one, provided that the bubble is not based on excessive bank lending. Even when bank lending gets out of hand, Blinder believes that the Fed should not address the problem with the blunt instrument of interest rate increases because it has more scalpel-like tools at its disposal.

- Blinder's op-ed piece reminds us that there is no consensus about what central banks should make the target of monetary policy. Under its mandate, the Fed has the freedom to deflate a bubble if it

believes that doing so would ultimately make the general price level more stable or make the economy less likely to slip into a recession. But the Fed is also mandated to promote maximum employment. If it began cooling the economy in the early stages of a run-up in stock prices, there would likely be outrage on Capitol Hill.

Suggested Reading

Federal Reserve Bank of San Francisco, "U.S. Monetary Policy."

Friedman, "The Role of Monetary Policy."

Judd and Rudebusch, "The Goals of U.S. Monetary Policy."

Mishkin, "What Should Central Banks Do?"

Questions to Consider

1. Should the United States have a single policy mandate like that given to the Reserve Bank of New Zealand? Why or why not?

2. Given what you know now, do you believe that the Fed should try to deflate the next asset price bubble it detects, or do you believe the Fed should let the bubble run its course?

3. Do you believe that money is neutral in the long run? Why or why not?

Should Central Banks Follow a Policy Rule?

Lecture 30

In a speech on October 14, 2005, William Poole, then president of the Federal Reserve Bank of St. Louis, asked whether the Federal Reserve followed a policy rule and whether it should. At first blush, these questions seem like the sort of thing that might concern an academic economist but would be of little interest to the rest of us. But whether or not to follow a rule is a question that most of us face on a regular basis as we decide how to organize our lives or to parent our children. The dilemmas we face in such situations are similar to what policymakers confront in the big stakes game of monetary policy. In this lecture, we make the case for both following a policy rule and using policy discretion, then ask which course the Fed seems to have taken.

Policy Rule and Policy Discretion

- A **policy rule** is a formula for determining policy. It specifies what the policy instrument is and how settings of the instrument should respond to observable changes in the state of the economy. The policy instrument is generally meant to be the federal funds rate.

- **Policy discretion** is the conduct of policy that is not bound by a policy rule. The use of policy discretion means that the policymaker is free to regard each situation as a unique event that requires a unique policy prescription.

- William Poole reminds us that policies made by rules are predictable, while policies made via discretion are not.

The Case for Following a Policy Rule

- The case for following a policy rule is, in many respects, a case against using policy discretion. To understand the problems of discretion, let's consider a public policy problem: The government wants to establish a policy governing the assistance it will provide to coastal property owners who suffer damage from a hurricane.

- The government believes that coastal property owners should use special building materials and procedures to hurricane-proof their buildings. It also believes, however, that it is in the public interest to assist those who suffer hurricane damage.

- In an attempt to balance these two objectives, the government announces that it will provide post-storm assistance only to building owners whose buildings were constructed appropriately. This is a policy rule.

- Now suppose that Hurricane Zelda hits North Carolina with devastating effect. In an outpouring of sympathy, the government suspends its rule and offers assistance to everyone who suffered property damage. It decides to use discretion rather than the rule and treat Zelda as a special case.

- Nobel laureates Edward Prescott and Fynn Kydland point out that the use of discretion in this case creates an unintended consequence. Coastal builders and potential property owners learn from the government's decision that if a storm is "really bad" the government will help everyone and conclude that it is better to avoid the added cost of storm-proofing their structures.

- The positive case for following a policy rule is that doing so makes policy predictable and leads private citizens to undertake desirable actions. If, after Hurricane Zelda, the government provides assistance only to owners whose buildings have been properly constructed, then other builders and owners will realize that they can expect help only if they storm-proof their structures.

- By the same token, if the Federal Reserve follows a policy rule, then everyone will be able to forecast when, approximately, the Fed will raise interest rates and when it will lower them. Decision makers will respond not only to what the Fed does but also to what they expect the Fed to do, which will make monetary policy more effective.

The Case for Policy Discretion

- The case for discretion and against adherence to a policy rule is based on several considerations.

- First, the real world is so complicated that it is impossible to construct a rule that will allow for all important contingencies.

- Even if it were possible to do so, that rule would be so complicated that private decision makers would not be able to use it to predict future monetary policy.

- It's also true that committing to a policy rule is easier said than done. A credible commitment requires what policy analysts call a "commitment mechanism."

The K-Percent Rule and the Taylor Rule

- The "k-percent rule" was the frequent recommendation of Milton Friedman. He wrote that two requirements were necessary for monetary policy to make the contributions to stability of the economy that it was capable of making: (1) The Fed should base its policy rule on a magnitude it can control (the growth rate of the money supply), and (2) the rule should ensure that the Fed would avoid "sharp swings in policy."

- Friedman believed that the Fed should choose a money supply growth rate somewhere between 3–5% per year, then focus its efforts on making the money supply grow at the chosen rate.

- William Poole argued that the Federal Reserve follows, at least approximately, what has come to be called the "Taylor rule," which defines normal values for the federal funds rate as a function of two statistics that describe the state of the U.S. economy.

- According to the Taylor rule, the Fed should anchor the federal funds rate at the nominal rate of interest implied by the long-run equilibrium rate of interest and the inflation target. This means that the Taylor rule requires the Fed to set the long-run value for the

federal funds rate at a level consistent with long-run equilibrium market forces.

- Further, the Taylor rule requires the Fed to raise the federal funds rate whenever the inflation rate is above its target level. The Fed should respond to increases in inflation by raising the federal funds rate by more than the increase in inflation.

- According to the Taylor rule, the Fed should raise the federal funds rate when the output gap is positive and lower it when the output gap is negative. Taylor defines the output gap to be the percentage deviation between real GDP and potential real GDP.

- A positive output gap means the economy is operating above its potential, a situation that is likely to produce increases in the inflation rate as producers compete for scarce resources. A negative output gap means the economy is operating below its potential, a situation that creates unemployment of labor and underutilization of capital.

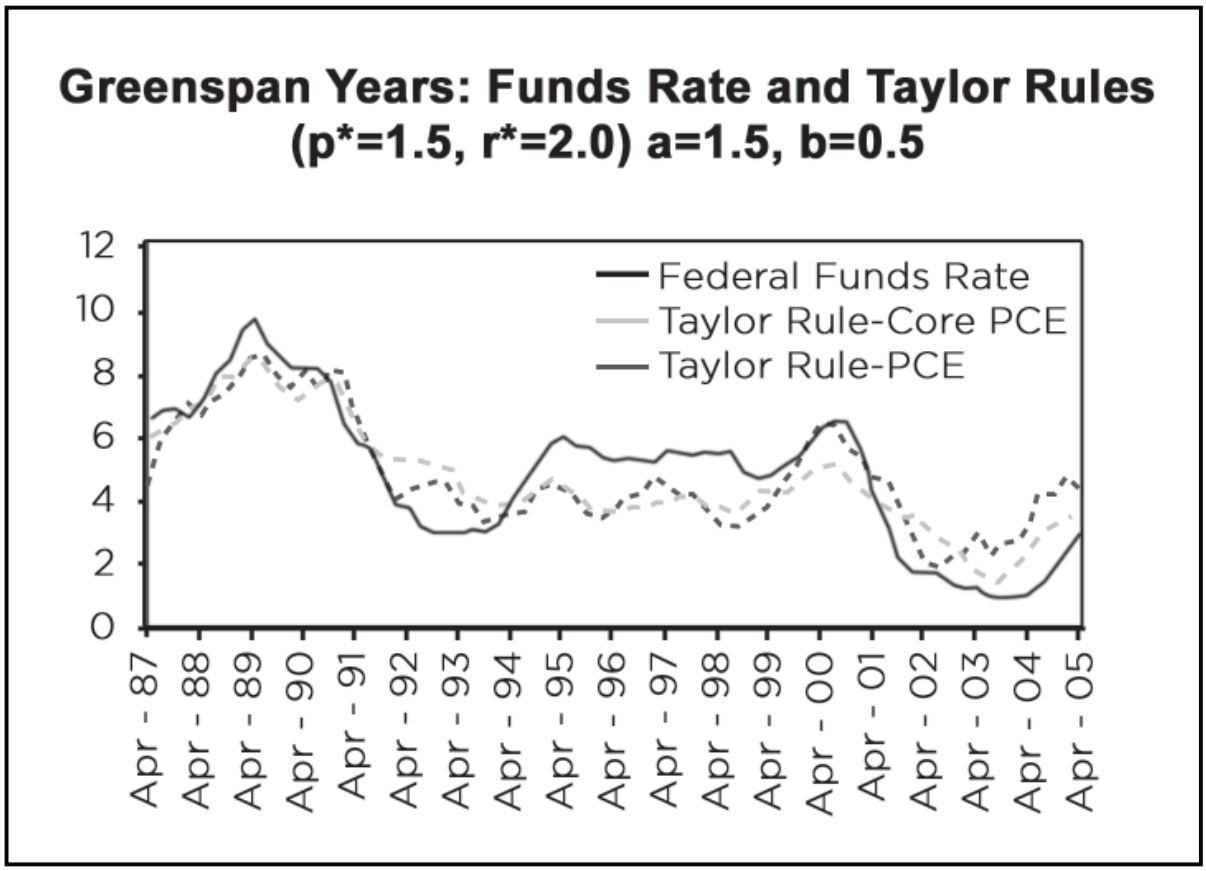
The Fed and the Taylor Rule

- Poole asserts that during the Alan Greenspan years at the Fed, monetary policy followed the Taylor rule, and a comparison of the actual and the Taylor-rule federal funds rates shows that the Taylor rule provides a good approximation of the actual rate.

- The Taylor rule does not, however, account for all of the variation in the federal funds rate. Departures from the rule seem to indicate that the Fed uses its own internal analyses at times to adjust the rate away from the Taylor-rule prescription; in other words, the Fed uses policy discretion.

- The Taylor rule specifies that the federal funds rate should depend only on recent observations for the inflation rate and the output gap. Committing to the rule would require the Fed to ignore other data that bear on the state of the economy, such as the recent behavior of stock market and housing prices.

Figure 30.1



Poole, William, "The Fed's Monetary Policy Rule." Federal Reserve Bank of St. Louis *Review*, January/February 2006, 88(1), pp. 1–11. Copyright 2006, Federal Reserve Bank of St. Louis.

- It is generally acknowledged that the Fed forecasts future economic outcomes by using sophisticated models and data that it believes provide a better characterization of economic conditions than can be provided by inflation and output gap data alone.

- Even if the Fed were prepared to choose a target for the federal funds rate based only on inflation and output gap information, one can still imagine many exceptional cases arising.

- A proponent of discretion would also point out that the Greenspan era did not include a financial crisis as experienced during the Bernanke era. Poole himself says, "The above rules are suspended when necessary to respond to a financial crisis." But if a rule can be suspended, is it a rule?

A Combination of Policy and Discretion

- Economists generally agree that the Federal Reserve exercises discretion but has managed in recent years to follow a policy that is sufficiently credible and predictable that private-sector agents believe the Fed when it announces a future course of policy.

- At the beginning of 2011, however, the Fed faced a credibility challenge that has yet to be resolved. Although the Great Recession had officially ended and GDP had begun to grow, unemployment remained high. The Fed, in response, continued to stimulate the economy with both standard and nonstandard policy.

- Some economists believe that the Fed's actions may rekindle inflation, although Bernanke has stated that the Fed could reverse course quickly enough to avoid that result.

Important Terms

policy discretion: The conduct of policy that is not bound by a policy rule.

policy rule: A formula for determining policy. It specifies what the policy instrument is and how settings of the instrument should respond to observable changes in the state of the economy.

Suggested Reading

Kydland and Prescott, "Rules Rather than Discretion."

Poole, "The Fed's Monetary Policy Rule."

Taylor, "Discretion versus Policy Rules in Practice."

——— "A Historical Analysis of Monetary Policy Rules."

Questions to Consider

1. Do you believe that Federal Reserve should bind itself to a policy rule? If so, would you prefer the k-percent growth rule, the Taylor rule, or something else?

2. What is the significance of Poole's finding that during the Greenspan years, the Fed changed the federal funds rate in a manner very similar to the prescriptions of the Taylor rule?

Extraordinary Tools for Extraordinary Times

Lecture 31

During the period beginning with the failure of Lehman Brothers in 2008, the Federal Reserve and the Federal Open Market Committee entered uncharted waters by expanding the kinds of policy initiatives they undertook and the degree of commitment they made to soften the blow of the Great Recession and its evil twin, the subprime mortgage financial market crisis. These initiatives led some to criticize Ben Bernanke, the chair of the Federal Reserve Board of Governors. Some of Bernanke's critics worried that the unprecedented attempts by the Fed to expand credit would ultimately lead to increased inflation in the United States. In this lecture, we will look at what constitutes "normal" policy for the Federal Reserve, then turn to the extraordinary measures it undertook during the recent crisis years to aid the economy.

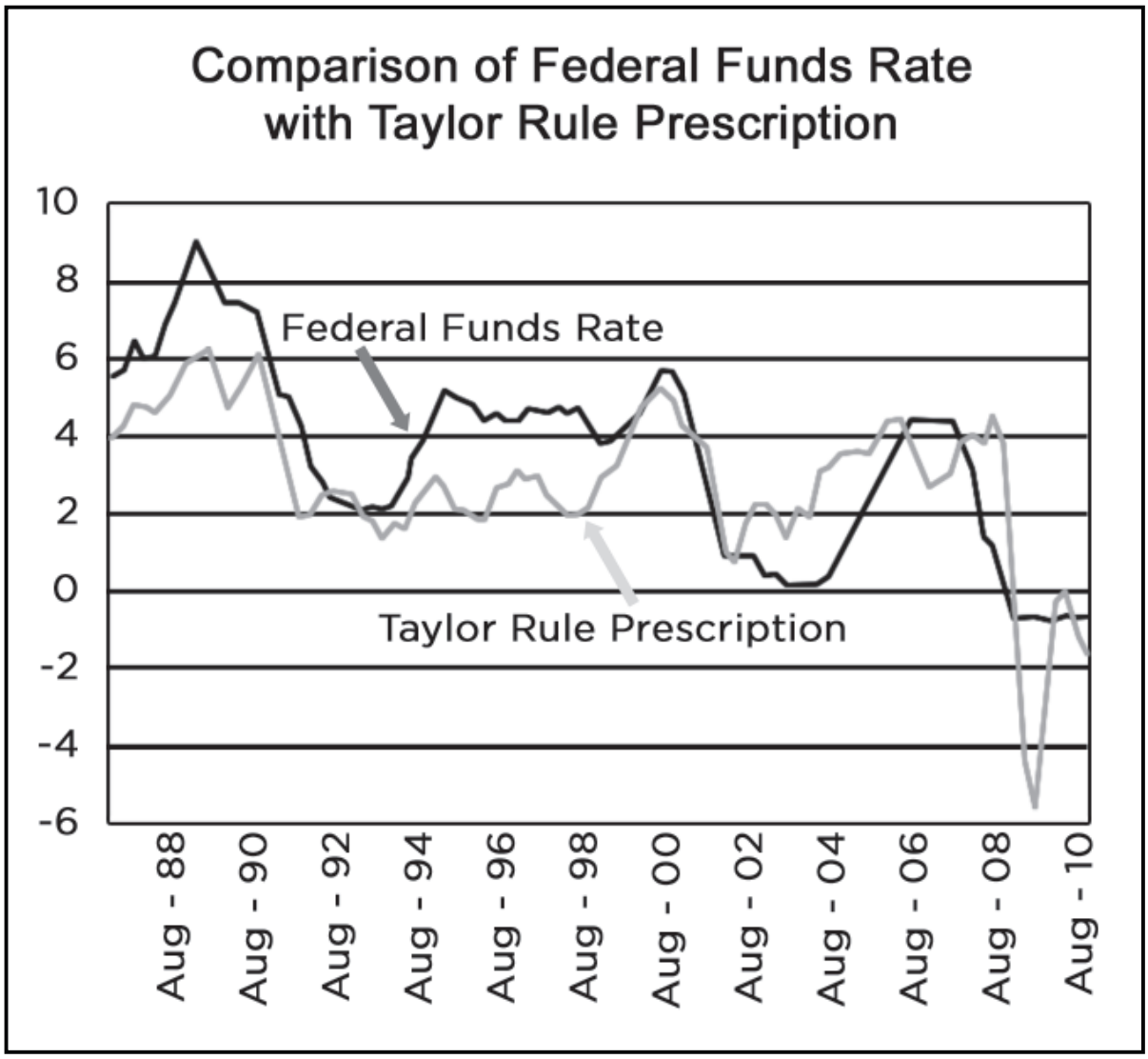
"Normal" Federal Reserve Policy

- Recall from the last lecture that the Taylor rule specifies that the federal funds rate should be anchored at the nominal rate of interest implied by the long-run equilibrium rate of interest and the inflation target. This means that the Taylor rule requires the Fed to set the long-run value for the federal funds rate at a level consistent with long-run equilibrium market forces.

- Again, as we noted in the last lecture, the Taylor-rule prescription tracked the actual federal funds rate fairly well between 1987 and 2011, suggesting that the Taylor rule provides a good approximation of what the Fed actually does.

- In 2008, the output gap became a large negative number as real GDP fell as much as 8% below potential. The inflation rate fell below the target value of 1.5%. The Fed lowered the federal funds rate to very near 0, but the Taylor rule prescribed a negative federal funds rate, which is impossible.

Figure 31.1



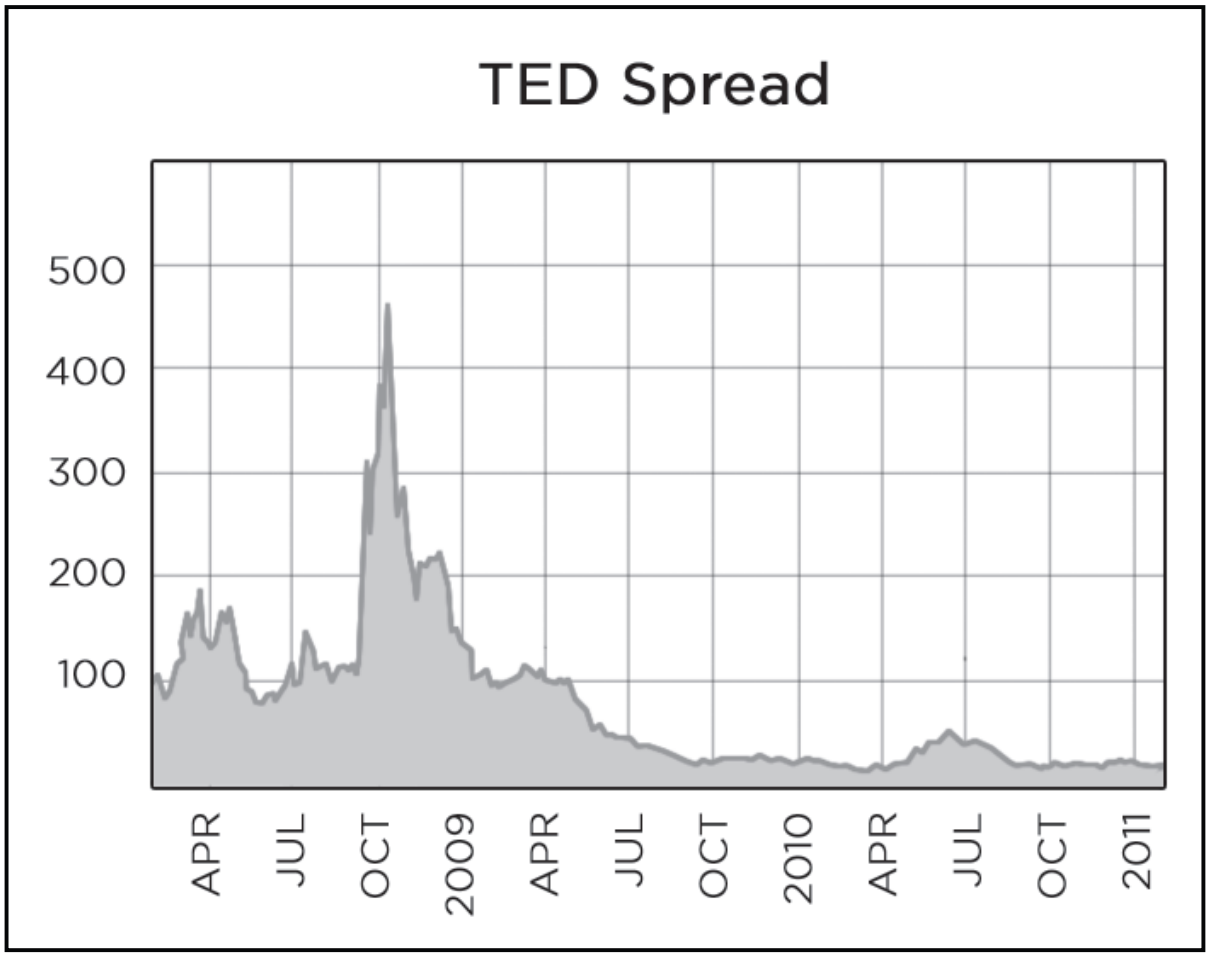
Source: Michael Salemi.

- The Taylor-rule prescription is an indication of how bad the economy was performing. The Fed responded to these extraordinarily bad conditions with extraordinary policy initiatives, essentially addressing three different kinds of problems: those that resulted from the financial crisis itself, problems faced by banks, and the need to stimulate the economy.

Problems Resulting from the Financial Crisis

- During the financial crisis, short-term credit markets ceased functioning because lenders believed that if the financial system failed, no creditors would be able to repay their debt obligations.

Figure 31.2



Source: Bloomberg.

- Evidence of how serious the matter was can be found by looking at data for the TED spread, the difference between the three-month London interbank rate and the three-month U.S. Treasury bill rate.

- Normally, the TED spread is very small because loans in London and Treasury bills are very close substitutes. In 2008, however, the TED spread spiked.

- The Fed normally provides loans only to depository institutions, such as banks, and does so through its "discount window." But in March 2008, the Fed created two programs to provide short-term secured loans to securities dealers, similar to discount-window loans.

- Short-term credit markets improved dramatically in 2009, and the TED spread returned to normal.

- In the fall of 2008, the Fed also intervened to improve credit conditions in two markets that were breaking down: money market mutual funds and the commercial paper market. Money market mutual funds are considered relatively safe; they pool funds from savers and use them to make short-term loans to businesses. The commercial paper market is a source of short-term loans that businesses rely on.

- After the Lehman bankruptcy, savers feared that commercial paper could become worthless; they ceased lending and started withdrawing funds from money market mutual funds. As a remedy, the Fed provided secured loans to institutions offering commercial paper and money market mutual funds. The markets returned to normalcy early in 2009.

- Finally, the Fed intervened to save financial institutions when it deemed that failure of those institutions would undermine the functioning of the financial system. For example, it provided loans to J.P. Morgan to assist it in acquiring Bear Sterns and to AIG because the insurance giant was determined to be "too connected to fail."

Problems Faced by Banks

- The Fed also launched extraordinary policy initiatives to address problems faced by banks.

- When banks became reluctant to loan funds to one another, as evidenced by the spike in the TED spread in 2008, the Fed increased the availability of loans to banks. In particular, it increased the availability of one- to three-month discount loans to banks, increased the availability of dollar-denominated loans to banks in other countries, and created a temporary liquidity guarantee program that provided guarantees on newly issued bank debt and expanded coverage of deposit insurance.

- The Fed also conducted "stress tests" of major banks to ensure that they could weather future bad economic times. The purpose of the tests was not only to force stressed banks to raise new capital but also to restore confidence in the stability of the banking system.

- The Fed provided loans to "systemically important" banks, such as Citigroup and Bank of America. As a result, bank share prices, which had fallen over 2007 and 2008, stabilized at the beginning of 2009.

The Need for Stimulus

- At the same time that it addressed problems brought on by the financial crisis and problems faced by banks, the Fed also provided extraordinary stimulus to the economy.

Federal Reserve Bank.

- Although it normally buys and sells only short-maturity Treasury securities, the Fed bought longer-term Treasury securities and mortgage-backed securities beginning in 2008.

- The Fed also supported securitization of consumer and business loans. As we've seen, securitization refers to the practice of creating derivatives that allow the marketing of bundles of securities, such as mortgages. Loan securitization creates an important source of funds through which mortgages, student loans, and other credit is made more affordable.

- In response to the decline of securitization during the subprime crisis, the Fed created the Term Asset-Backed Securities Loan Facility, which provides credit to institutions that securitize loans. Issuance of asset-backed securities returned to normal levels in 2009.

Extraordinary Measures: Necessary or Not?

- Many believe that the Fed provided too much stimulus during the Great Recession and, thereby, sowed the seeds of future inflation.

- One way to appreciate why the Fed took the measures it did is to look at bank balance sheets during the Great Recession. At the time, banks greatly increased their holdings of excess reserves.

- In normal times, banks would have responded to these increases with increased lending. But during the Great Recession, banks preferred to hold huge quantities of reserves rather than assume the risks of lending.

- During the financial crisis and the Great Recession, the Fed's normal policy response—lowering the federal funds rate—proved inadequate. It acted boldly to provide credit and to stabilize the payments system. In short, it acted because banks would not.

Figure 31.3

Aggregate Reserves of Depository Institutions
Billions of Dollars

	October 2007	October 2009
Total Reserves	42.5	1,056.4
Required Reserves	41.0	61.7
Excess Reserves	1.4	994.7

Source: Federal Reserve.

- Whether the Fed went too far has yet to be determined. And the question now is whether the Fed can reverse course quickly enough once the economy begins to grow robustly. If it does, the Fed will be credited with having successfully piloted the economy through its most dangerous period since the bank's inception in 1914. If it does not, the Fed will be blamed for once again allowing inflation to be woven into the fabric of American prices.

Suggested Reading

Bernanke, "Monetary Policy and the Housing Bubble."

Cassidy, "Anatomy of a Meltdown."

Federal Reserve Bank of San Francisco, "The Economy, Crisis and Response."

Federal Reserve Bank of St. Louis, "Crisis Timeline."

Questions to Consider

1. Do you believe that the extraordinary policy initiatives undertaken by the Fed during the subprime mortgage crisis and Great Recession were wise?

2. Why were commercial banks unwilling to lend during the crisis?

3. Are you convinced by the evidence presented in the lecture that the extraordinary measures were successful? Why or why not?

Central Bank Independence

Lecture 32

In this lecture, you will set out the case for central bank independence, then drill down and ask more precisely what scholars mean by the "independence" of a central bank. We will also look at a statistical analysis that quantifies central bank independence around the world, ask whether greater independence is associated with desirable economic outcomes, and explore the recent emphasis on central bank transparency.

The Traditional Argument for Independence

- The traditional argument for central bank independence is that independence is necessary if a central bank is to keep inflation low and steady. Without independence, central banks are more likely to succumb to pressure to provide more stimulus to the economy than is consistent with low and steady inflation.

- One part of the argument for central bank independence is based on the model of Robert Barro and David Gordon.

- The model has two equations. The first explains the connection between unemployment and inflation. This equation is a version of the "Phillips curve," which quantifies the observation that increases in inflation are associated with decreases in unemployment.

- Many economists have sought to explain this inverse relationship in their own models. The reason for the relationship is that differences between actual and expected inflation) are associated with increased stimulus from monetary policy that increases total economic demand and leads to higher employment of all resources, including labor, and therefore, lower labor unemployment rates.

- According to the second equation in Barro and Gordon's model, there are two sources of "loss"—unemployment and inflation.

- Barro and Gordon evaluate or grade monetary policies using this loss (L) function. They would say that a policy that achieves a lower value of L is a better policy.

- The relative distaste for inflation is captured by a positive parameter in this equation (b); if the Fed opposes inflation much more than unemployment, b will be a very large positive number. If the Fed opposes inflation less than it opposes unemployment, b will be positive but less than 1.

- The strength of political pressure is measured by another parameter (k). If $k = 1$, the Fed is under no political pressure and counts unemployment as a bad relative to the natural rate of unemployment. If $k < 1$, than the Fed is under pressure to stabilize unemployment around a rate lower than the economy is capable of generating in the long run. The smaller the value of k, the stronger the political pressure.

- The results of the model show the Fed's best policy under the assumptions that the Fed exercises discretion, treats every single economic situation as unique, and uses as its policy instrument the rate of inflation.

Further Analysis

- Private decision makers have an incentive to forecast the inflation rate accurately. Barro and Gordon ask what happens over time as private expectations adjust to what the Fed is doing.

- The result when decision makers forecast the inflation rate correctly is called the "inflation bias" result. When private expectations are correct, the unemployment rate equals its natural level—the level compatible with market clearing.

- But the inflation rate is positive as long as $k < 1$; that is, as long as political pressure induces the Fed to try consider its unemployment target to be less than the natural rate of unemployment. Notice that the bias persists no matter how much the Fed opposes inflation (i.e.,

no matter how large is the value of b). An independent central bank is one for which $k = 1$, so there is no inflation bias.

Confirmation of the Bank Independence/Inflation Connection

- In 1993, Alberto Alesina and Lawrence Summers defined what it means for a central bank to be independent, constructed a statistical index of central bank independence, and provided evidence confirming the connection between central bank independence and inflation.

- Two diagrams summarize the findings of these researchers. Figure 32.1 shows a clear inverse relationship between central bank independence and the average rate of inflation over the period 1955–1988. Figure 32.2 shows a clear inverse relationship between central bank independence and inflation variability.

- The United States fares well in the two diagrams. The Fed is judged to be among the most independent of the central banks and to have low inflation and low inflation variance over the period relative to the outcomes of other developed economies.

What Makes a Central Bank Independent?

- Central bank independence is greater under four conditions: (1) the management is insulated from political pressure by secure tenure and independent appointments, (2) the government cannot participate in or overturn bank policy decisions, (3) the bank's legal mandate specifies a clearly defined objective for monetary policy, and (4) financial independence of the bank relies on restrictions that limit lending to the government.

- Researchers Christopher Crowe and Ellen Meade studied how central bank independence has changed since the 1980s across 72 countries. The results of their work show a dramatic movement toward central bank independence among both advanced and non-advanced countries.

- In the 1980s, the Fed was more independent than the average central bank; now, it is less independent than average. The Fed scores below

average in policy objective because of its dual mandate. It is also less independent because the members of the Board of Governors are chosen by the president rather than by the bank and because the Fed plays no statutory role in the government budget process.

Figure 32.1

Frequency Distribution of Central Bank Independence

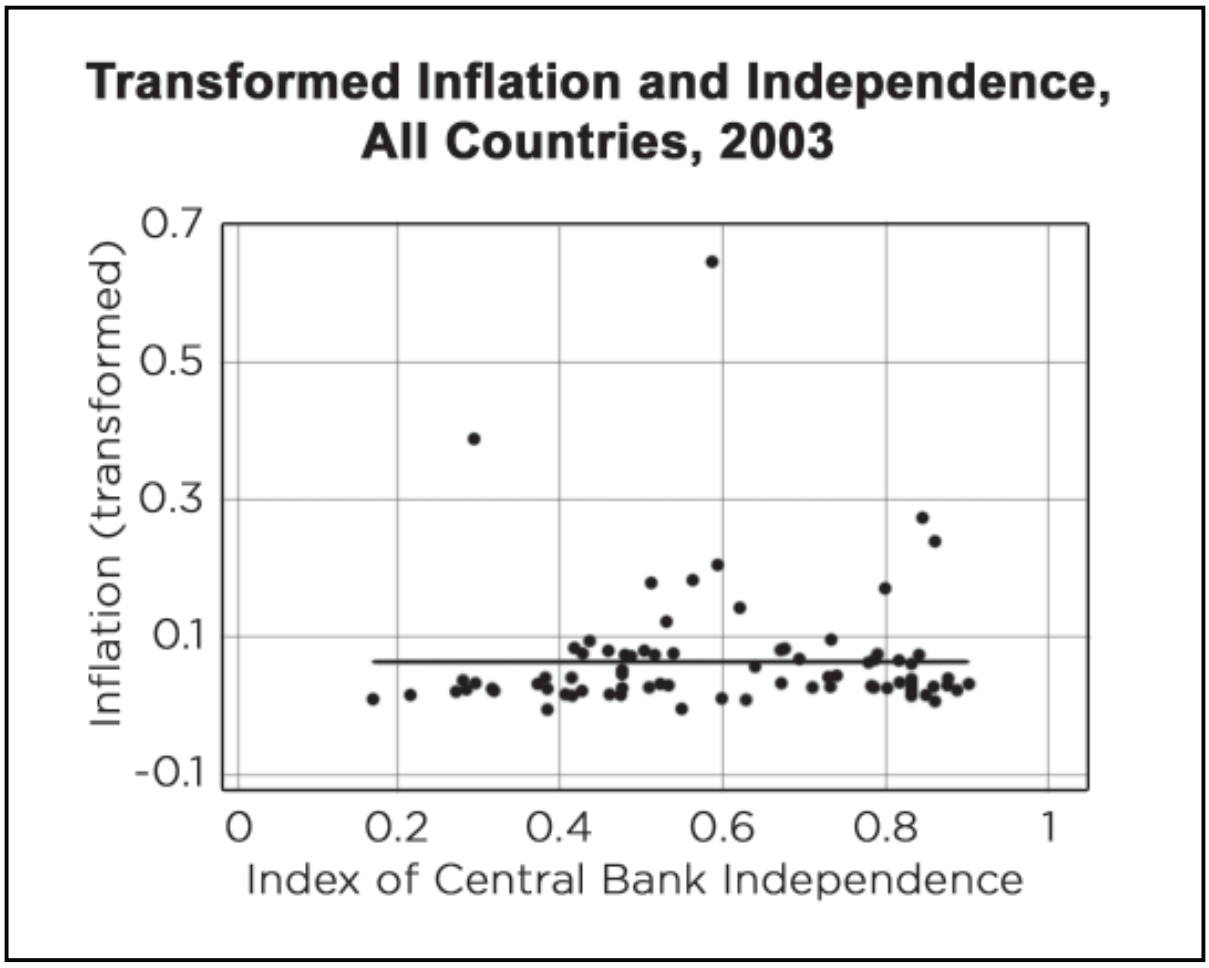
	All countries		Advanced Countries		Emerging market and developing countries	
	1980-89	2003	1980-89	2003	1980-89	2003
x<0.2	6	1	2	1	4	0
0.2<x<0.4	39	13	11	7	28	6
0.4<x<0.6	24	34	5	3	19	31
0.6<x<0.8	3	20	3	2	0	18
x>0.8	0	28	0	13	0	15
Total	72	96	21	26	51	70

Crowe, Christopher and Ellen E. Meade, "The Evolution of Central Bank Governance around the World, Journal of Economic Perspectives, 21, 4, 2007, 69-90. Figure 1 and Table 2. Used with permission.

- Crowe and Meade show that the movement toward greater central bank independence and the onset of the Great Moderation in inflation that began in the late 1980s have removed the negative correlation between independence and inflation reported by Alesina and Summers.

- These results seem to imply that the nations of the world have largely exploited the opportunities suggested by Alesina and Summers's work to lower inflation by increasing central bank independence. It will be interesting to learn whether the negative correlation between inflation and independence reemerges as economies begin growing after the Great Recession.

Figure 32.2



Crowe, Christopher and Ellen E. Meade, "The Evolution of Central Bank Governance around the World, Journal of Economic Perspectives, 21, 4, 2007, 69-90. Figure 1 and Table 2. Used with permission.

Central Bank Transparency and Inflation

- A central bank is more "transparent" when it does a better job of communicating its intentions to the public and, thereby, reduces public uncertainty about what the central bank is trying to achieve.

- Crowe and Meade constructed a statistical measure of central bank transparency using data that would allow them to measure transparency for a large number of central banks and to compare changes in transparency between the 1980s and the present.

- Interestingly, Crowe and Meade found that inflation-targeting central banks were more transparent than banks with other mandates, including the Fed. The ECB has below-average transparency because it discloses much less information than is disclosed by central banks that have committed to inflation targeting.

- Crowe and Meade also found that increased transparency leads, on average, to a small decline in average inflation, but the effect is not as precisely estimated as the relationship found between inflation and independence by Alesina and Summers.

The Independence of the Fed

- The Fed is now less independent than most central banks. Should we take steps to alter this situation?

- Events during the subprime mortgage crisis and the Great Contraction gave conflicting signals on central bank independence. On the one hand, the Fed frequently came under strong political pressure to explain its policy actions. On the other hand, unlike Alan Greenspan, Ben Bernanke spoke out on questions of fiscal policy—a sign of greater independence.

Suggested Reading

Alesina and Summers, "Central Bank Independence."

Crowe and Meade, "The Evolution of Central Bank Governance around the World."

Greider, *Secrets of the Temple*.

Sargent and Wallace, "Some Unpleasant Monetarist Arithmetic."

Questions to Consider

1. Does the Federal Reserve have too little or too much independence from the Congress and executive branches of the U.S. government? Explain your view.

2. Do you believe that a reduction in central bank independence makes inflation more likely? Through what mechanism does this occur?

The Foreign Exchange Value of the Dollar

Lecture 33

This lecture is the first in a group of three that looks at international monetary and financial relationships. We will begin by learning about exchange rates and what determines the exchange value of two currencies. We will also see that while most developed nations allow the value of their currencies to float freely and change in response to the forces of demand and supply, China pegs the value of its currency (the renminbi) to the dollar. We will discuss how China does this and what the implications of this policy are for the U.S. economy. In subsequent lectures, we will look at the roles that financial institutions play in international trade and finance and explore the case for coordinated monetary policy among the nations of the developed world.

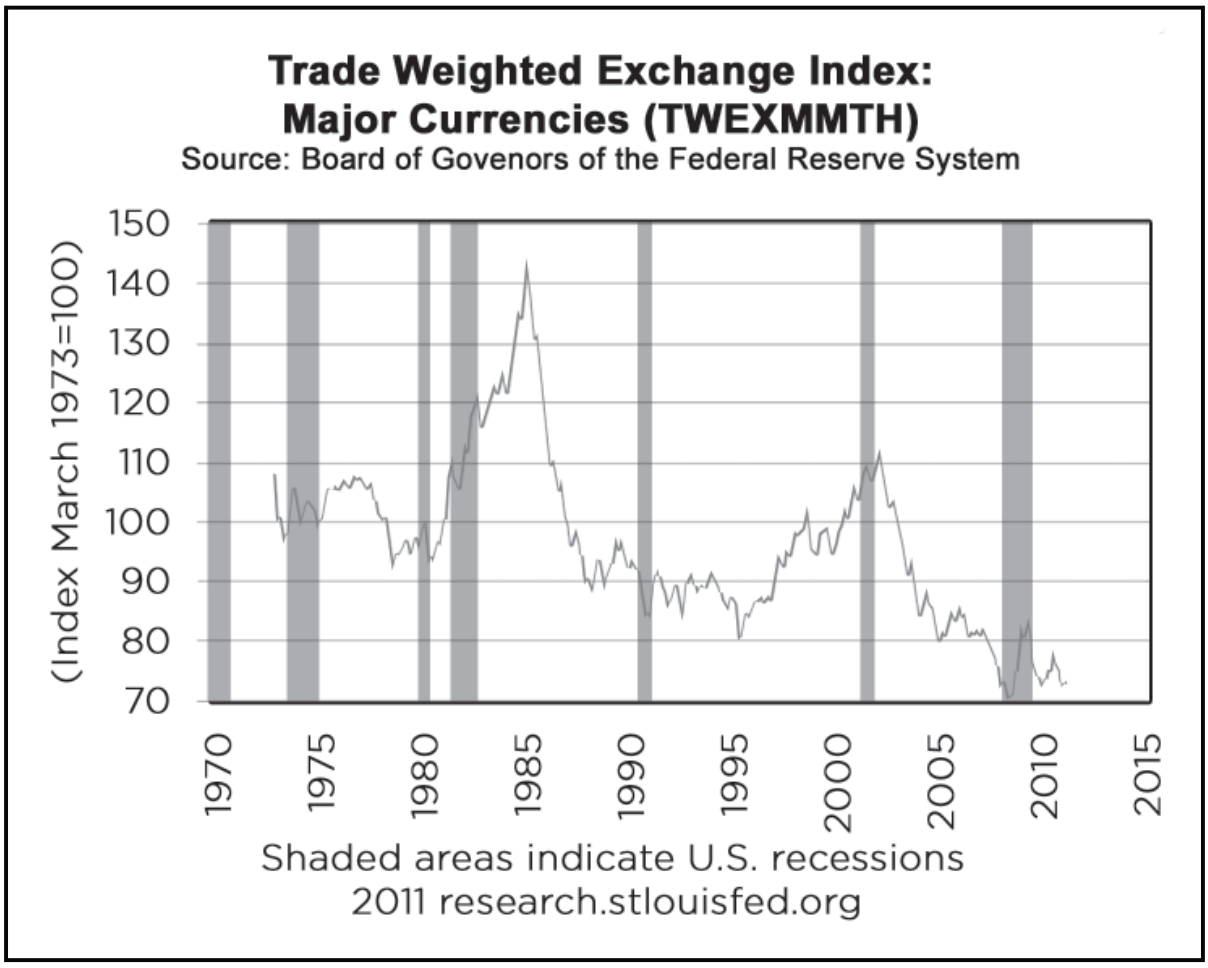
The System of Floating Exchange Rates

- In a floating exchange-rate system, the foreign exchange value of the dollar is determined by the forces of demand and supply.

- An **exchange rate** is the market price of one currency in terms of another, a trading ratio between two currencies. It can be expressed in two ways: the number of dollars required to buy, for example, a yen or the number of yen required to buy a dollar. To an order of approximation, the dollar price of the yen is the reciprocal of the yen price of the dollar.

- Anyone who has traveled knows that at the end of a trip, one typically sells foreign currency for less than one paid to buy it. The difference between the buying price and the selling price is revenue for the financial institutions that provide currency-exchange services.

Figure 33.1

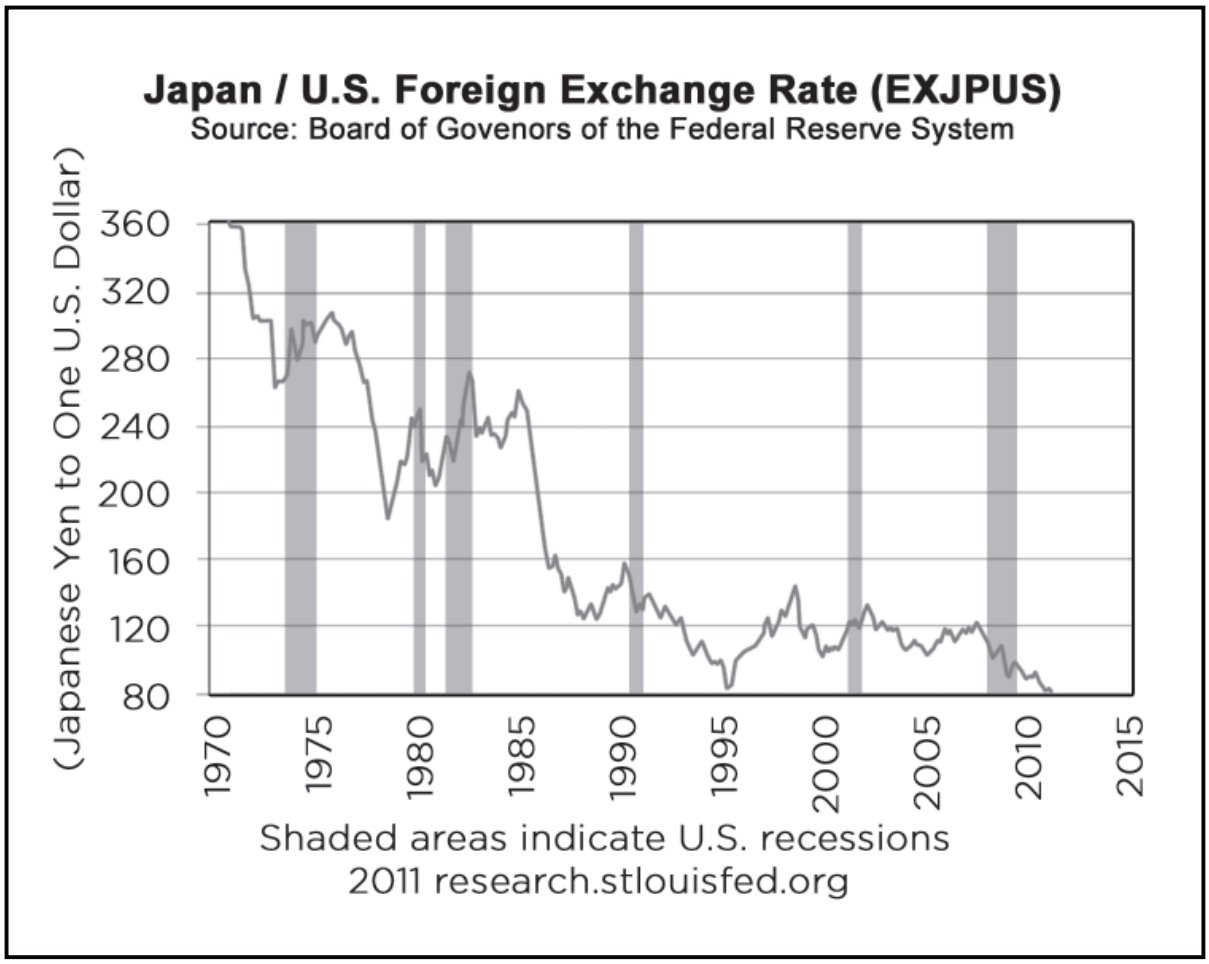


Source: Federal Reserve.

- A graph of the value of the dollar vis-à-vis a market basket of the currencies of the trading partners of the United States since 1970 shows that the dollar was most valuable between 1980 and 1985. Relatively high U.S. interest rates at the time caused an increase in the demand for the dollar on the part of foreign investors, who bought dollars in order to buy high-yield U.S. assets.

- Since 2001, the value of the dollar has declined by about 40%. Our nation has consistently experienced trade and current account deficits during this period. Such deficits are equivalent to increases in the world supply of dollars, which amounts to lowering the value of the dollar.

Figure 33.2



Source: Federal Reserve.

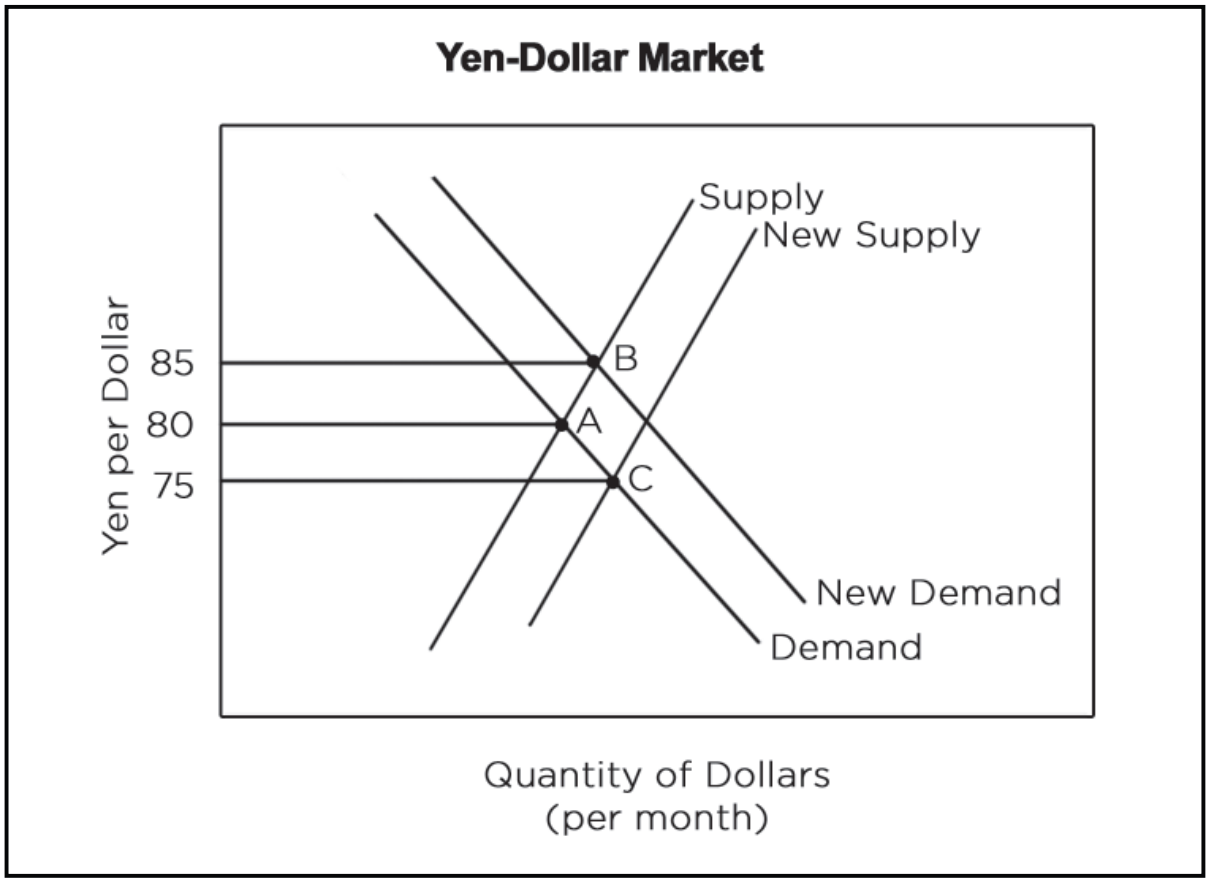
The Dollar-Yen Exchange Rate

- A graph of the dollar-yen exchange rate tells a similar story, but not an identical one. The value of the dollar in terms of the yen began to fall after 1985, reached its low point in the mid-1990s, and has remained relatively constant since then.

- A demand-and-supply graph can illustrate how economic forces translate into changes in the value of the dollar in terms of other currencies.

- Consider, for example, the yen price of the dollar (graphed along the vertical axis). When the yen price of the dollar increases, we say that the dollar appreciates and the yen depreciates. When the yen price of the dollar falls, we say that the yen appreciates and the dollar depreciates.

Figure 33.3



Source: Michael Salemi.

- The number of dollars exchanged for yen is graphed along the horizontal axis. A larger volume of exchange is a movement to the right.

- The demand for yen is graphed as a downward-sloping schedule. The demand schedule summarizes the behavior of people who use yen to buy dollars, including Japanese who import U.S. goods, Japanese who wish to buy securities for which payment in dollars is required, and governments that buy dollars with yen to influence the yen-dollar exchange rate.

- The negative slope of the schedule (showing an inverse relationship between the yen price of the dollar and the quantity of dollars demanded) reflects the fact that as the yen price of the dollar increases, U.S. goods and securities become more expensive, and demand for them falls.

- Changes in other factors that affect trade and securities purchases are represented as shifts in the demand schedule. For example, an increase in the dollar price of oil would shift the demand schedule toward higher quantities because Japan imports all the oil it uses and because oil exporters require payment in dollars.

- The supply of yen is graphed as an upward-sloping schedule. The supply schedule summarizes the behavior of people who use dollars to buy yen, including Americans who import Japanese goods, Americans who wish to buy Japanese securities, and governments that supply dollars to influence the yen-dollar exchange rate.

- The positive slope of the schedule reflects the fact that as the yen price of the dollar increases, Japanese goods and securities become less expensive, so Americans supply more dollars to buy more of them.

- Changes in other factors are represented by shifts in the supply schedule. For example, an increase in U.S. interest rates would shift the supply schedule toward lower quantities because financial investors would use fewer dollars to purchase Japanese securities, given that U.S. securities would offer a relatively higher return.

- When governments allow their exchange rates to float, the rate is determined by the forces of supply and demand. The exchange rate varies with shifts in the demand and supply schedule.

- For example, suppose that the U.S. trade deficit with Japan increases. The result is an increase in the supply of dollars in the yen-dollar market and a depreciation of the dollar.

- Suppose instead that interest rates in the United States increase relative to those in Japan. The result is an increase in the demand for dollars in the yen-dollar market and an appreciation of the dollar.

- Most of the depreciation of the dollar relative to the yen in the past 30 years has been due to the persistent deficits the United States has

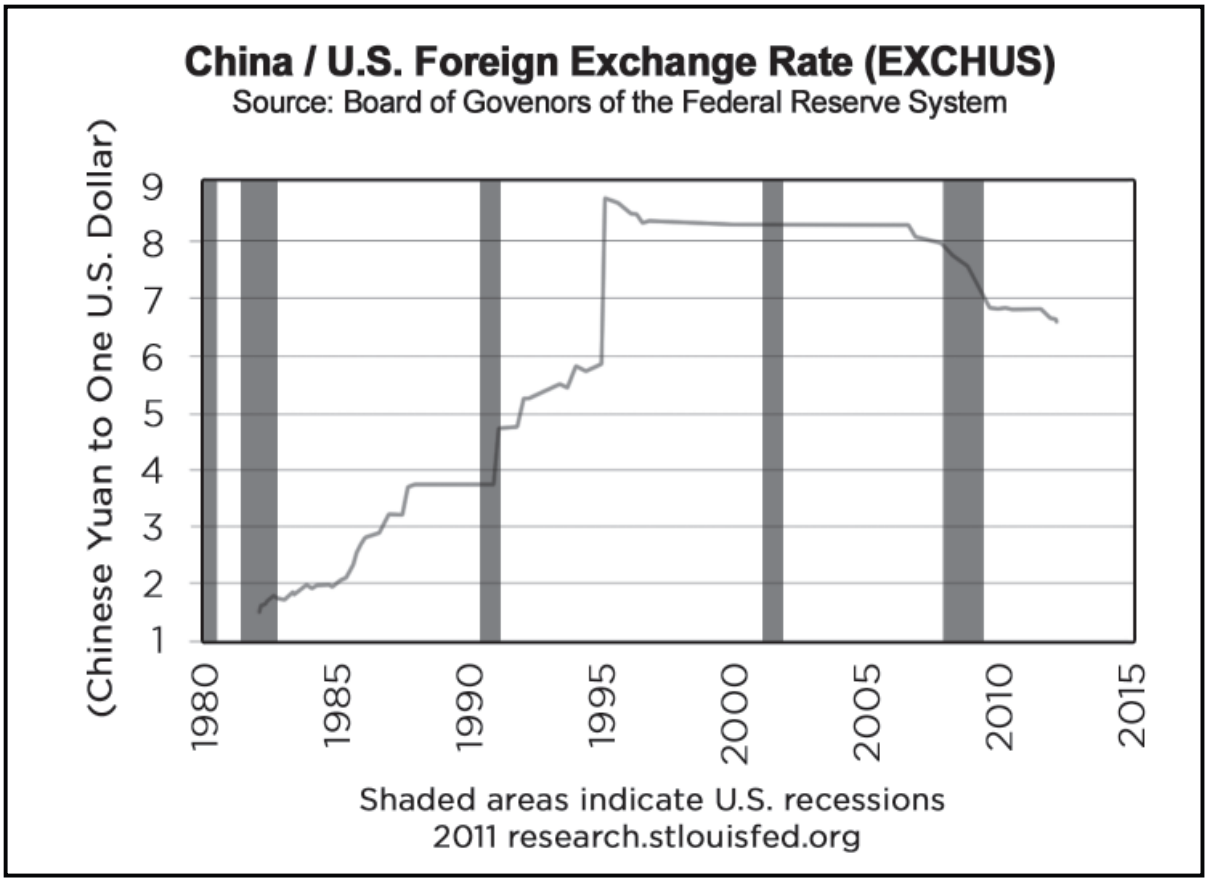
recorded in its bilateral trade relationship with Japan. Toward the end of this period, relatively low interest rates in the United States accounted for further declines in the yen price of the dollar.

The Dollar-Renminbi Exchange Rate

- In China, the currency is the renminbi, and it is measured in units called yuan. A graph of the yuan price of the U.S. dollar between 1980 and 2011 shows that the yuan-dollar exchange rate increased from about 1.5 to 8 yuan between 1980 and 1985 and remained there for 12 years.

- Between 1990 and 2010, the renminbi price of the dollar rose from 3.75 to 7. That is, the dollar doubled in value over the period. During the same time, the U.S. trade deficit with China increased from 10.4 billion to 273.1 billion. The increased trade deficit should have resulted in a depreciation of the dollar.

Figure 33.4

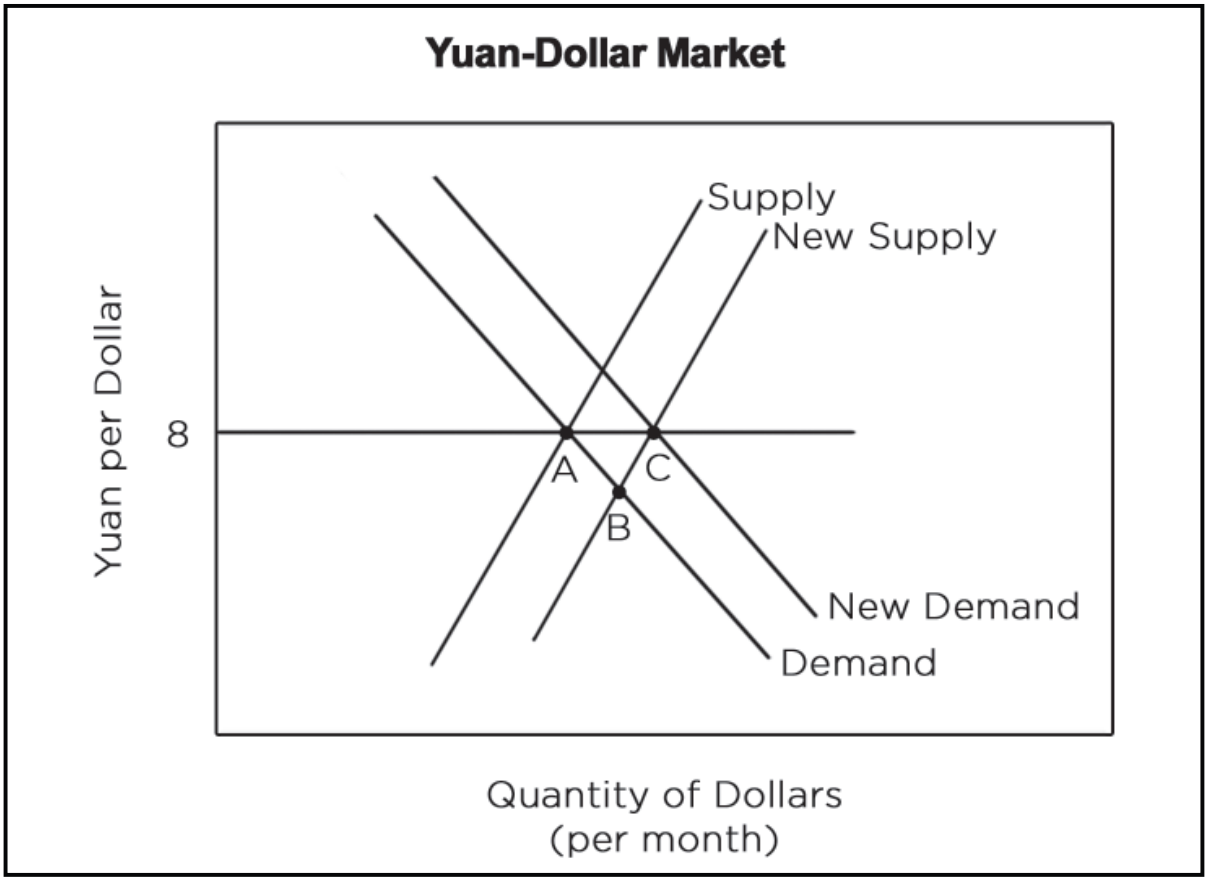


Source: Federal Reserve.

- The resolution of this puzzle lies in the fact that China requires its People's Bank to follow a fixed exchange-rate regime. Thus, the values of the yuan-dollar exchange rate should be thought of as those chosen by China rather than determined by supply and demand.

- An adaptation of the demand-and-supply diagram shows how the fixed exchange-rate regime works. The axes and the demand and supply schedules are like those shown earlier for the yen-dollar market. In particular, the supply schedule shows the dollars that the United States supplies to China as a function of the yuan-dollar rate. The rising trade deficits with China shift the supply schedule toward higher dollar quantities.

Figure 33.5



Source: Michael Salemi.

- If the People's Bank behaved passively, an increase in supply would lead to an appreciation of the renminbi and a depreciation of the dollar. However, the People's Bank itself increases the demand

for dollars by creating renminbi and using them to buy dollars from Chinese exporters to keep the renminbi price of the dollar from falling.

- There is a cost to China of pegging its currency to the dollar. If China pegs the renminbi to the dollar, the People's Bank is no longer free to pursue other stabilization objectives. Indeed, the increased supply of renminbi required to keep the value of the yuan low can translate into inflation.

- Princeton economist Paul Krugman argues that China's currency policy "is feeding an artificially large trade surplus" and "… hurts the rest of the world, increasing unemployment in many other countries, America included." This weak currency policy has also resulted in rising inflation rates in China.

Currency Values, 1990 to 2011

- By running large trade deficits over the last 20 years or so, the United States has increased the supply of dollars to the rest of the world. For those nations that allow their exchange rates to float, the result has been appreciation of their currencies (yen, pound, and euro) and depreciation of the dollar.

- China, however, has committed its monetary policy to one objective—keeping the value of the renminbi lower than it would be if the forces of demand and supply were allowed to operate. Presumably, it follows this policy to keep world demand for its exports high by keeping the prices of those goods (in dollars) low.

Important Term

exchange rate: The market price of one currency in terms of another, a trading ratio between two currencies.

Suggested Reading

Krugman and Obstfeld, *International Economics*.

Schlossberg, "Common Questions about Currency Trading."

Questions to Consider

1. Has China been wise in its decision to peg the value of the renminbi to the dollar? Would China have been better off if it allowed its currency to float?

2. From your point of view, has it been a good thing or a bad thing that the dollar has depreciated in value relative to other currencies since the mid-1980s? Why?

3. Do you agree that U.S. trade deficits are keeping the value of the dollar low? Why or why not?

Exchange Rates and International Banking

Lecture 34

To fully understand how monetary policy works and to appreciate the tradeoffs involved with a particular monetary policy strategy requires an understanding of why exchange rates are important and how they are affected by various economic forces, including those associated with monetary policy. In the first part of this lecture, we will return to the topic of exchange rates and look at the forces that tend to account for short-run and long-run movements in exchange rates. It is also important to understand the costs and benefits of opening a nation's financial markets to financial firms from around the globe. In the second part of the lecture, we will look at international banking and the ever-increasing role of international banks in finance.

Short-Run Movements in Exchange Rates

- In the short run, exchange rates are sensitive to movements in interest rates.

- Most of the trades in the foreign exchange market are trades of bank deposits denominated in one currency for bank deposits denominated in another.

- Banks hold deposits in different currencies for customers who demand foreign currencies because they wish to purchase goods for import and for customers who supply foreign currencies because they export to different countries.

- Banks regard deposits in different currencies to be close substitutes because an active foreign exchange market allows them to quickly convert a deposit in one currency into a deposit in another.

- Banks often earn interest by using their deposits to purchase short-maturity government and corporate debt. For example, when interest rates in the United Kingdom increase relative to interest

rates in the United States, banks convert their dollar deposits into pounds so they can buy the higher-yield securities.

The Interest Parity Condition

- The interest parity condition defines equilibrium among domestic interest rates, foreign interest rates, and the relevant exchange rate. That equilibrium is the condition in which banks expect to earn the same interest (denominated in their own currency) from dollar and pound (and yen and euro) deposits.

- To understand this concept, note that a bank can: (1) hold dollar deposits and earn RUS (the U.S. Treasury bill rate), or (2) buy pounds with dollars, earn RUK (a comparable rate on short-term British Treasury debt), and sell the pounds for dollars one period later.

- What specific asset the bank chooses to hold is less important if it keeps its funds in the United States. It is important, however, that we compare U.S. and UK rates of return on comparable UK and U.S. securities—that is, securities with similar maturities and riskiness.

- A bank is assumed to be indifferent between the two strategies when they yield the same number of dollars in period $t + 1$.

- At the time that a bank decides where to hold its deposits, it does not know the value of the exchange rate one period later. Thus, the interest parity condition substitutes the forecasted value of the exchange rate for its actual value.

- In equilibrium, the UK interest rate will equal the U.S. interest rate plus the percentage appreciation in the dollar expected over the period t to $t + 1$.

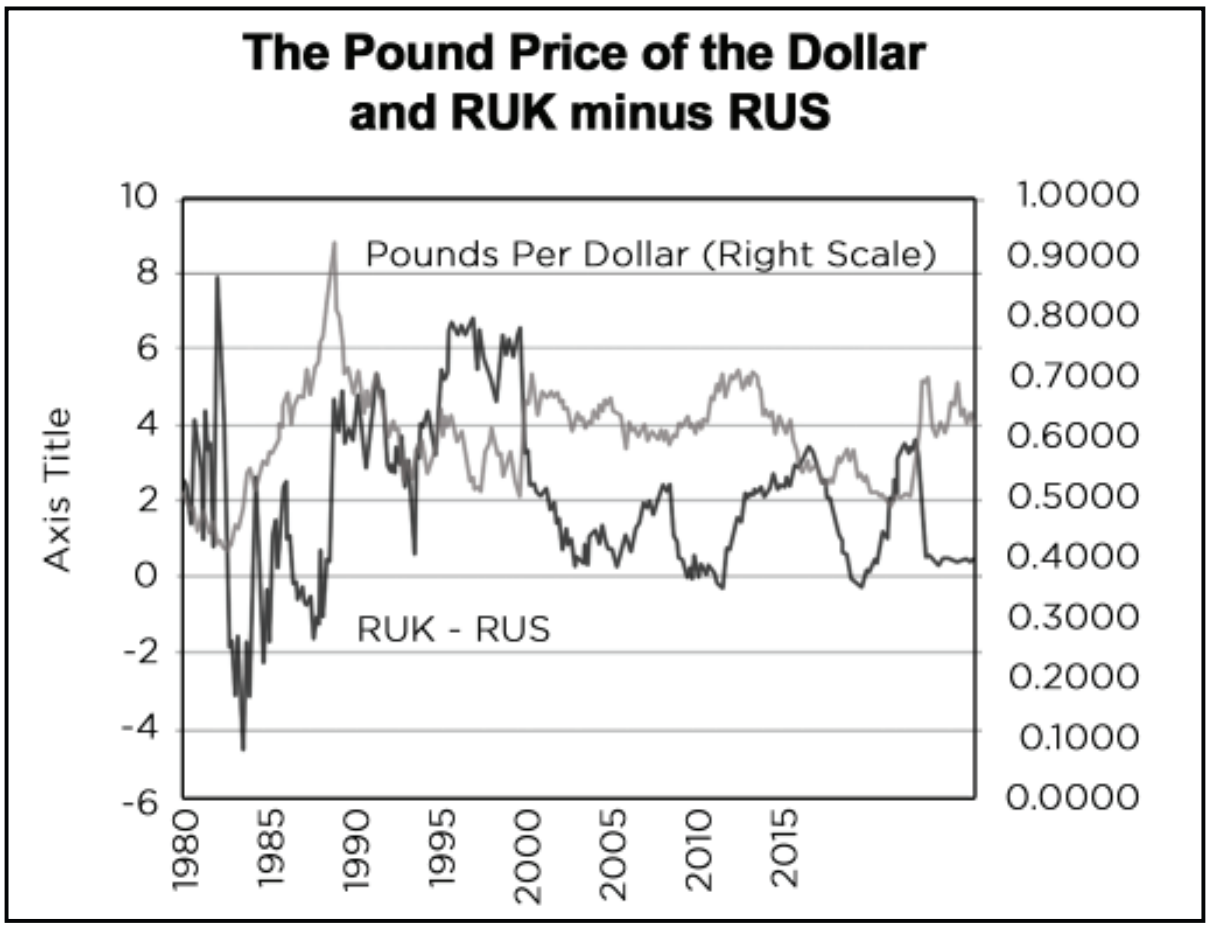
- Suppose interest rates increase in Britain but not in the United States. This situation will lead deposits to flow from the United States to Britain, increasing the supply of dollars in the dollar-

pound exchange market. This, in turn, will cause the number of pounds required to buy a dollar to fall to the point where expected appreciation in the dollar just offsets the difference between U.K. and U.S. interest rates.

- The bank may decide to hedge the foreign exchange risk associated with moving deposits into a foreign currency. If so, it would simultaneously buy pounds now and sell them one period forward. The corresponding equilibrium condition is called covered interest parity.

- A graph of the pound price of the dollar versus interest-rate differences between the three-month Treasury bill rate in Britain and the United States shows that when U.K. rates increase relative to U.S. rates, the dollar tends to depreciate. When U.S. rates increase relative to U.K. rates, the dollar tends to appreciate.

Figure 34.1



Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

Long-Run Movements in Exchange Rates

- In the long run, exchange rates tend to move with price indexes in the countries in question.

- The law of one price says that identical goods or goods that are close substitutes should sell for the same price in every country.

- Consider a ton of high-quality steel with a U.S. price of P-US. Suppose the same quality steel is also produced in the United Kingdom and has a price in pounds sterling of P-UK. The law of one price says that P-US = P-UK/E.

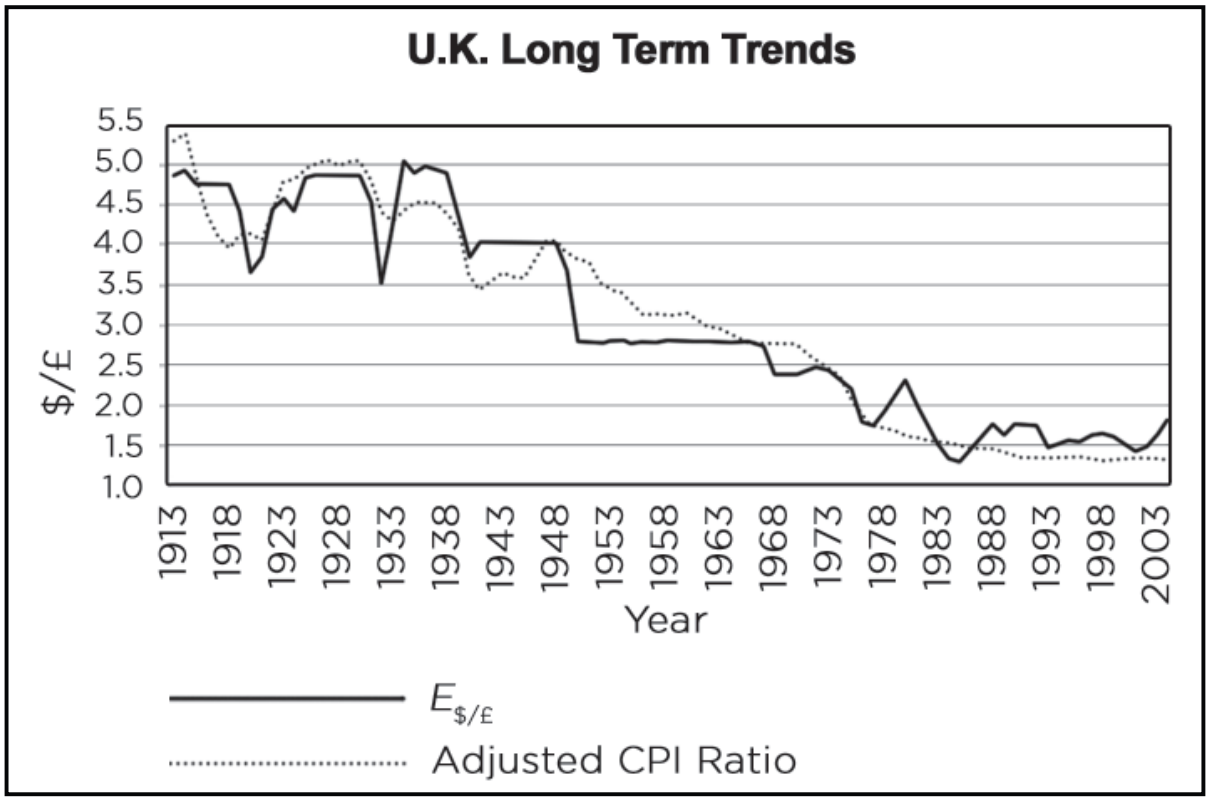
- The economic force at work behind the law of one price is self-interest. Self-interested decision makers will buy high-quality steel wherever it is cheapest. If producers want to sell high-quality steel, they will have to meet the best price available in the world; otherwise, they will be driven out of business.

- The skeptic will argue that transportation costs, tariffs, and other impediments will keep self-interested decision makers from importing cheaper steel. The proponent of the law of one price will argue that the law is supposed to hold in the long run and that in the long run, forces will be at work to get around tariffs, transportation costs, and other impediments.

- Note that the law of one price provides a theory of exchange rates: If we assume that the law holds for a large number of the goods that are consumed and produced throughout the world, then the theory tells us that E = P-UK/P-US, where P-UK and P-US now stand for price indexes of goods in the United Kingdom and the United States.

- A graph of the exchange rate (dollars per pound sterling) between 1913 and 2004, together with an adjusted ratio of the countries' CPIs during the same period, provides evidence in favor of the law of one price theory of long-run exchange-rate movements.

Figure 34.2



- The law of one price is also behind the Big Mac Index constructed annually by the *Economist* magazine. The *Economist* prices Big Macs in many different economies, then uses exchange rates to convert the Big Mac prices to dollars. The index can be used to estimate countries with overvalued and undervalued currencies.

International Banking

- International banking is a crucial feature of the increased globalization of modern economies and has grown at a rapid rate in the past 50 years.

- Frederic Mishkin reckons that this growth has been driven by three forces: (1) growth in international trade, (2) the profitability for U.S. banks of the investment banking business in foreign countries, and (3) the desire of U.S. banks to access the Eurodollar market.

- A Eurodollar is a deposit outside the United States that is denominated in dollars. Many foreign corporations want to hold dollars in foreign banks to facilitate transactions associated with

export, import, and securities operations. The minimum transaction in the Eurodollar market is about $1 million.

- Foreign banks operate in the United States in three ways: (1) as agency offices, which lend and transfer funds in the United States but cannot accept deposits; (2) as a foreign subsidiary of a U.S. bank, which has the rights and obligations of U.S. banks; and (3) as a foreign branch. This is typically a full-service bank formed as an Edge Act facility under U.S. law or as an international banking facility under regulations approved by the Fed.

- The United States has only recently developed a truly national banking system because for most of the 20th century, banks were subject to regional legal requirements that made it difficult for them to operate across state lines.

- Banks in the United States are not large relative to the largest banks in the world. JPMorgan Chase is the only U.S. bank to make the list of the top nine banks in the world by assets (as of December 31, 2010).

Two Closing Thoughts

- Economic forces do not respect national boundaries. The interest parity condition tells us that the value of a dollar depends on interest rates elsewhere in the world. The purchasing power parity condition tells us that in the long run, the value of the dollar depends on how we price important resources relative to their prices elsewhere in the world. And the exchange rate is an important price that affects the desirability of our exports and the cost of our imports.

- Finally, there may be no more obvious sign that we live in a shrinking world than the fact that banks are truly multinational corporations.

Suggested Reading

European Central Bank, *The Monetary Policy of the ECB*.

Meulendyke, *U.S. Monetary Policy and Financial Markets*.

Mishkin, "Global Financial Instability."

Questions to Consider

1. Without making reference to the equations presented in the lecture, explain the intuition for interest rate parity. That is, explain why the dollar should depreciate relative to the euro if the Fed lowers interest rates relative to those in Europe.

2. Do you believe it is good policy to allow foreign banks to operate in the United States? Why or why not?

Monetary Policy Coordination

Lecture 35

On October 14, 2008, the *New York Times* reported some rare good economic news. For the first time that month, the Dow Jones Industrial Average had closed higher than it had opened. Michael Grynbaum of the *Times* attributed this good news to a coordinated campaign on the part of governments and central banks around the world to unlock the global flow of credit. In this lecture, we will look at two types of monetary policy coordination: agreements among central banks to simultaneously change interest rates in the same direction and the coordination implicit in the creation and operation of the International Monetary Fund. As we will see, no economy, including that of the United States, is large enough, important enough, or respected enough to go it alone in a world where funds move at the speed of light across international borders; cooperation among economies is essential.

Superior Outcomes

- When central banks coordinate their monetary policies, they produce outcomes that are superior to those that could be achieved if they worked in isolation.

- News stories in October of 2008 pointed to a decision by the Federal Reserve and the central banks of Canada, England, Sweden, Switzerland, and the euro area to simultaneously announce reductions in interest rates as it became clear that a serious recession had begun.

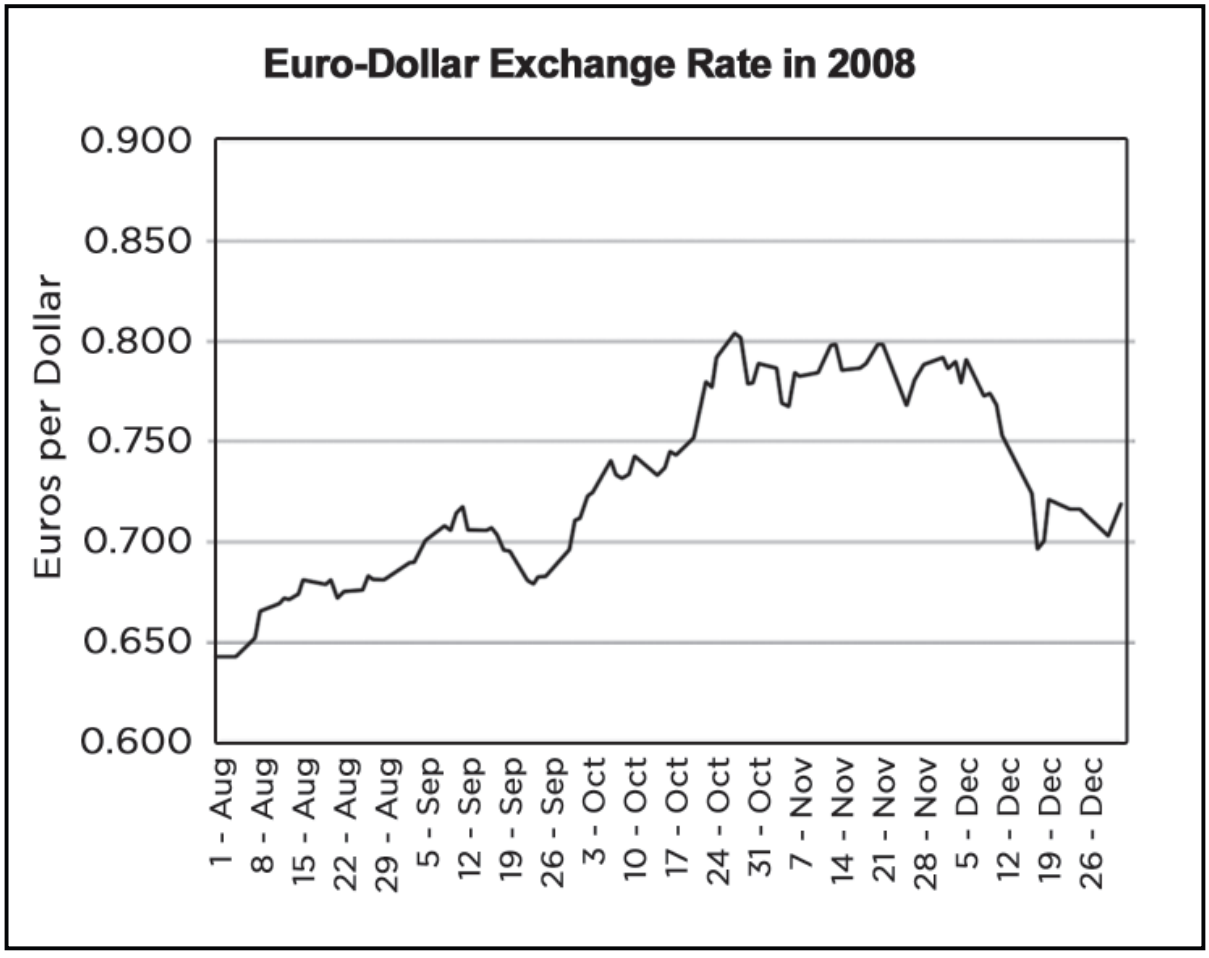
- By coordinating their actions, the central banks were attempting to avoid changes in international exchange rates. If, for example, the Federal Reserve had unilaterally lowered short-term interest rates, bank deposits would leave the United States, seeking higher rates in other countries. Our demand-and-supply model of foreign exchange would represent this as an increase in the supply of dollars to the

dollar-euro market and would predict a decrease in the euro price of the dollar. The dollar would depreciate.

- Suppose, in contrast, that central banks cooperate and lower interest rates at the same time and by similar amounts. Bank deposits do not leave the United States or any other country in search of higher rates because there are no higher rates. There is no increase in the supply of dollars in the dollar-euro market and no depreciation in the dollar.

- Data show that the dollar did not depreciate in October 2008 as the Fed lowered interest rates and switched to a stance where recession was a greater concern than inflation.

Figure 35.1



Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

- Central banks were concerned with avoiding depreciation of the dollar because they, along with other foreign financial institutions, hold large dollar deposits, and a decrease in the value of the dollar would weaken their balance sheets.

- A fall in the value of the dollar would have made U.S. exports cheaper and would have started a competitive game in which nations tried to mitigate the effect of the coming recession by raising exports at the expense of other nations.

- By coordinating their actions, the central banks were attempting to assure financial markets that they understood the severity of the financial crisis and stood ready as a group to provide liquidity to financial institutions around the world.

A Prisoner's Dilemma Game

- In situations where inflation is high, such as the developed world faced in 1980, policy coordination is essential to reducing inflation at the lowest possible cost.

- The Federal Reserve, under the chairmanship of Paul Volcker, took the initiative of implementing very restrictive monetary policy. The result was a decline in U.S. inflation over the coming years but at the cost of a severe recession.

- Paul Krugman and Maurice Obstfeld have argued that global inflation could have been reduced with milder recession if central banks had coordinated their policies. These researchers liken the policy problem to a prisoner's dilemma game.

- Suppose there are two players of the game: Home and Foreign. Both are opposed to unemployment and inflation, but both are willing to suffer some increase in unemployment (as little as possible) to reduce inflation. Both Home and Foreign can choose either a somewhat restrictive policy (with a smaller increase in interest rates) or a very restrictive policy (with a larger increase in interest rates).

- In the non-cooperative game, both Home and Foreign choose the highly restrictive policy. If Home "moves first" and chooses the somewhat restrictive policy, then Foreign will choose the highly restrictive policy and be better off at the expense of Home; Foreign's currency will appreciate and Home's will depreciate. The appreciation of Foreign's currency will lessen its inflation, while the depreciation of Home's currency will increase Home's inflation.

- If Home chooses the very restrictive policy, then Foreign cannot transfer some of its inflation to Home because it cannot appreciate its currency relative to Home. The analysis is symmetric for Foreign if it moves first; thus, both players choose the highly restrictive policy.

- In the cooperative game, where Home and Foreign coordinate their monetary policies, both find it optimal to choose the somewhat restrictive policy. Inflation is lowered in both countries, but the recession in each is milder. The exchange rate between the two countries does not change.

- In this scenario, coordination of policy produces a clearly better remedy—a better way to lower inflation—than any remedies that individual nations could obtain by going it alone. The key to coordination is to simultaneously implement policy to avoid changes in exchange rates.

The International Monetary Fund (IMF)

- The IMF provides for a coordinated approach to financial crises, especially those involving rapid depreciation of exchange rates. It has three overall responsibilities: overseeing the world financial system and the financial and economic policies of its members, providing technical assistance to help countries manage their economies, and serving as an international lender.

- The IMF faces the same difficult tradeoffs in fulfilling its role as international lender that the Federal Reserve faces in fulfilling its role as guarantor of the financial system and regulator of financial firms.

- On the one hand, loans from the IMF can save a nation's financial system when it is under stress. Suppose, for example, that Korea experiences a recession, quickly followed by a decrease in private lending to Korean banks and firms. Several Korean banks fail because they are unable to raise new funds sufficient to pay short-term debts. As the crisis develops, deposits will flee Korea in search of a safe haven, leading to depreciation of Korean currency and deepening the crisis.

- A loan from the IMF, however, can make it possible for banks and other financial firms to pay their debts. With backing from the IMF, depositors will have less reason to remove their funds and exchange-rate stability will be restored. Korean currency will probably not return to its pre-crisis value, but the dollar price of the currency will stop falling.

- On the other hand, loans from the IMF can cause moral hazard problems. If banks and other lenders understand that the IMF will step in during a crisis and rescue them, they have less incentive to engage in prudent lending practices, and central banks have less incentive to oversee other banks diligently.

- To mitigate the moral hazard problem, the IMF makes adoption of "austerity measures" a requirement for emergency lending. Such measures are often unpopular and the cause of political unrest.

- The IMF plays an essential role in maintaining worldwide financial stability. Without it, minor financial crises might frequently turn into major ones. Speculators would have an incentive to sell currencies short in the hope of making a profit when the crisis deepened and the crisis country exchange rate fell. With the IMF, speculators have

lower incentives to attack a currency because they typically have fewer resources for offense than the IMF has for defense.

- The IMF exists because of cooperation among the developed nations of the world. Its resources come mainly from the money that countries pay as their capital subscriptions when they become members.

Threats to Policy Coordination

- Monetary policy coordination among nations is constantly under threat. For example, the coordination of policies between the ECB and the Fed that began in 2008 came under threat in 2011 when oil prices began to rise as a result of political upheaval in the Mideast.

- The ECB, worried about the inflationary effects of oil price increases, leaned in the direction of tighter policy. The Fed, worried about the recessionary effects of oil price increases, leaned in the direction of continued monetary ease.

- As oil prices began to increase and put upward pressure on prices in Europe and the United States, a real possibility existed that the ECB would raise interest rates while the Fed would continue to keep them low. If that occurred, we would predict that the euro price of the dollar would fall, providing additional stimulus to the U.S. economy at the cost to our country of additional upward pressure on prices.

Suggested Reading

Bernanke, "Policy Coordination among Central Banks."

Krugman and Obstfeld, *International Economics*.

Meulendyke, *U. S. Monetary Policy and Financial Markets*.

Questions to Consider

1. Was the Federal Reserve wise to have coordinated its policy changes during the subprime mortgage crisis with the ECB and other central banks? Why or why not?

2. Explain why the news story about oil prices presented at the end of the lecture might herald the end of policy coordination between the Fed and the ECB.

3. Do you believe that the IMF performs a necessary function in the modern world? Why or why not?

Challenges for the Future

Lecture 36

This lecture series concludes by outlining three questions and related challenges that the world's economies, particularly its financial systems, will address in the coming years. These questions are as follows: (1) Will the United States solve its long-run deficit problem and, thereby, free the Federal Reserve to pursue its primary policy objective of keeping the inflation rate low and stable? (2) Will the euro survive? (3) Will financial regulators find a solution to the "too big to fail" problem? The resolution of these questions will greatly affect future growth, inflation, and financial arrangements.

The Long-Run U.S. Deficit

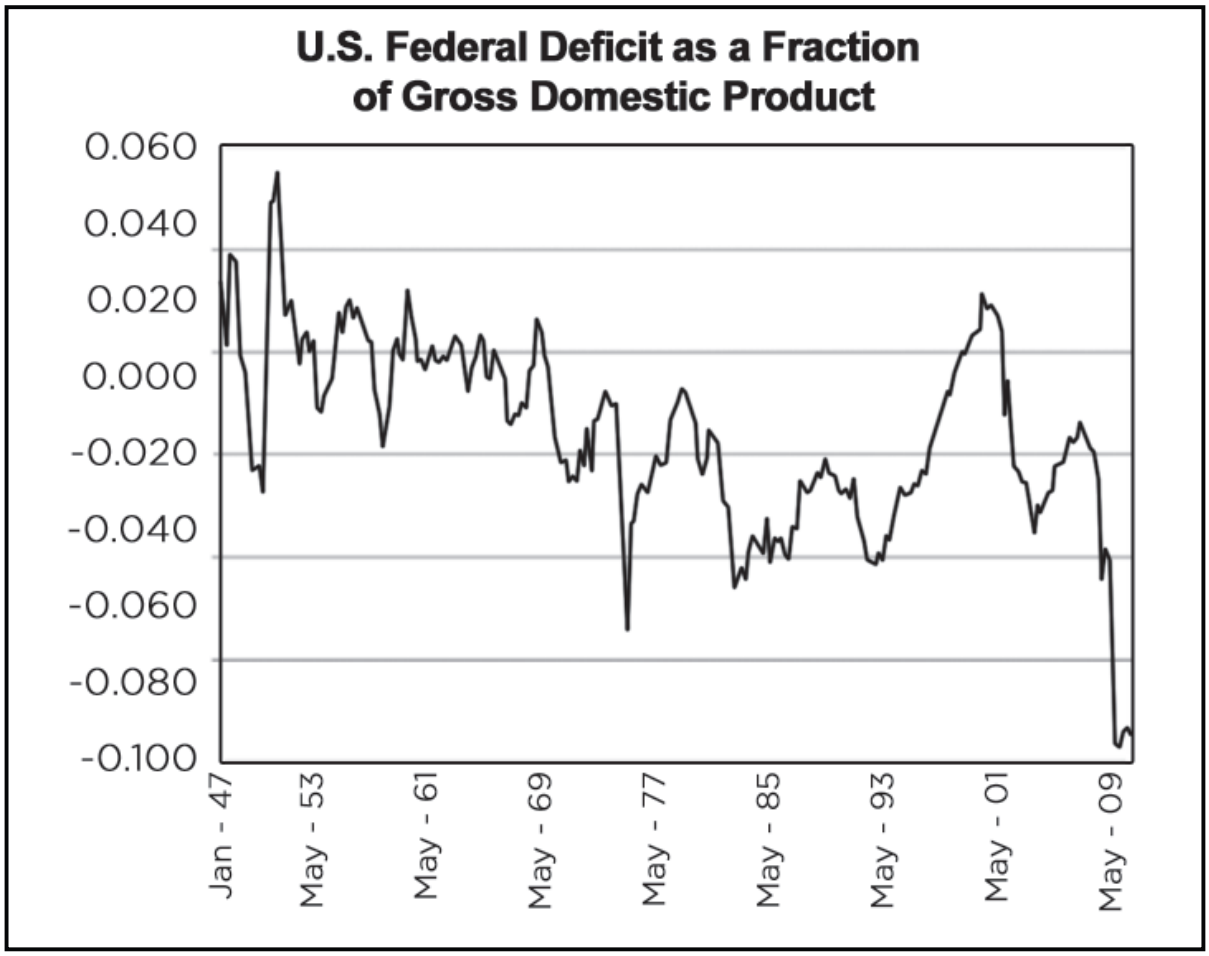
- With the exception of the period immediately after the Clinton tax increases in the late 1990s, the federal budget has been chronically in deficit, and the deficits have grown dramatically as a fraction of GDP since about 2005.

- Currently, increased deficits are the result of the Great Recession, the wars in Iraq and Afghanistan, and tax cuts implemented during the Bush administration.

- Large deficits threaten the ability of the Federal Reserve to perform its most important function—keeping inflation low and stable.

- The federal government must finance its fiscal deficits in some way—either by issuing new Treasury debt or by expanding the money supply. Recall from earlier lectures that inflation results when the Fed allows sustained growth in the money supply at rates higher than the rate at which the economy can grow. Inflation provides seigniorage to the government. It is a tax on money balances—a tax that no member of Congress must vote for.

Figure 36.1



Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

- In writing about this problem, economists Thomas Sargent and Neil Wallace envision two regimes: one in which the Federal Reserve is dominant and one in which Congress and the executive branch are dominant.

- In the first regime, the Federal Reserve sets monetary policy to meet its dual mandate. Congress and the executive branch are forced to adopt tax and spending policies that do not place too much pressure on the willingness of private individuals to purchase government bonds. They can run bond-financed deficits sometimes, but they cannot run large deficits forever. Current deficits must ultimately be offset by surpluses.

- In the second regime, Congress and the executive branch allow large fiscal deficits to continue. Under this regime, there will come a

time when the Treasury will have difficulty selling new government bonds at reasonable rates of interest. At that point, the Fed will come under tremendous pressure to finance the deficit by "printing money." Inflation will result and become systemic.

- It is not enough for a central bank to promise to stop allowing rapid growth in the money supply. It is also necessary to remove the pressure on the central bank caused by the combination of high spending and low taxes.

- The United States is living on borrowed time. Since the 1980s, the rest of the world has been willing to buy U.S. Treasury bonds and help our country finance its fiscal deficits. But at some point, foreign investors will reckon that their holdings of U.S. Treasury securities are too high and the party will end. When that occurs, U.S. interest rates will skyrocket and our growth will drop dramatically.

The Survival of the Euro

- The euro was introduced as an accounting currency on January 1, 1999, and began circulating within the countries of the euro area on January 1, 2002. The 1992 Maastricht Treaty obliges most EU member states to adopt the euro upon meeting monetary and budgetary restrictions, such as lowering fiscal deficits and domestic inflation rates to prescribed standards.

- The benefits of the euro are substantial. This common currency facilitates trade among the euro nations, has allowed those nations a stronger voice in world economic forums and enabled a credible commitment to a low-inflation monetary policy, and fostered progress toward the goal of some member nations of a united Europe.

- The costs of adopting the euro are also substantial. Since the introduction of the euro, nations in the euro area no longer have the ability to conduct individual monetary policies. A euro member nation that experiences a recessionary shock not experienced

by the other members will find that it must do without counter-recessionary monetary policy.

- In a famous article, Robert Mundell, winner of the 1999 Nobel Prize in Economics, asked: When would it be optimal for a group of nations to adopt a mutually fixed exchange-rate system rather than to allow their currencies to float?

- His answer was that a necessary condition for a group of nations to form a successful currency area is for productive resources to flow freely among the nations. In practical terms, free flow of resources means that labor from state A can move at lost cost to state B if unemployment in state A rises and unemployment in state B remains low. Technically, citizens in any EU country may work legally in any other EU country, but there are still greater barriers to labor mobility than in the United States.

- The Greek debt crisis in 2010 raised the question of whether the euro can survive. The EU, ECB, and IMF put together a rescue package for Greece, but that package was very large relative to the EU's annual budget. Among the conditions attached to the package was one that required Greece to cut its budget deficit from 14% of GDP to 3% in 3 years.

- Germany's share of the rescue package was 123 billion euros; German citizens were angry because they saw themselves as rescuing irresponsible Greeks.

- For a time, there was a risk that panic would spread to other euro nations with weaker fiscal records, such as Portugal, Spain, and Ireland.

- The Greek crisis raised the possibility that some euro nations, including Greece and Germany, might try to opt out of the euro.

"Too Big to Fail" (TBTF)

- As we've said, the Federal Reserve rightly fears that allowing a big bank to fail will create financial panic as depositors and bank creditors fear that banks will not pay them. When a bank fears that it will not be paid, the rational thing to do is to not pay itself and to hoard the cash it has. When hoarding becomes widespread, the nation's payment system breaks down.

- The Fed took extraordinary steps during the subprime crisis to ensure that this situation did not take hold.

- If big banks know that the Fed will not let them fail, they have an incentive to make riskier loans. In this situation, big banks systematically take bigger risks, and small banks try to get bigger so that they, too, can become TBTF.

- There is disagreement about whether the Dodd-Frank Act adequately deals with the TBTF problem. Some have argued that the act empowers regulators to identify both bank and non-bank institutions that may represent systemic risk. Combined with a credible resolution process, the act should enable regulators to proactively prevent future crises. Others believe that systemic risk is inherent in the modern financial machine.

- Ben Bernanke favors a three-part plan for ensuring the end of TBTF: (1) Bank supervisors must develop and implement tougher rules to curtail bank risk taking; (2) the nation must become more resilient, in part by developing mechanisms to allow banks to price and liquidate assets when they are in trouble; and (3) the nation must develop a new legal framework to wind down a failing critical financial firm without creating panic or doing damage to the broader financial system.

Course Connections

- As we reach the end of the course, it is interesting to see how many threads have come together.

- Moral hazard affects not only individual banks and the stability of the banking system but also the stability of a currency arrangement, such as the euro. It is reasonable to think of the threat that Greece poses to the euro as a moral hazard problem. The ECB has apparently decided that Greece is too big to fail.

- The fact that inflation is not only costly to individuals but a source of revenue for governments is a second theme that we have visited several times in these lectures. We revisit it in this lecture when we realize that failing to get the U.S. federal deficit under control may make it impossible for the Fed to continue keeping inflation under control.

- Finally, we end as we began, with an understanding that the euro is no more than a recent attempt to provide a group of European individuals with money in a way that better promotes trade and further lowers the costs of trading. It is just the latest incarnation of one of mankind's greatest inventions—money.

Suggested Reading

Beetsma and Giuliodori, "The Macroeconomic Costs and Benefits of the EMU."

Morgan and Stiroh, "Too Big to Fail after All These Years."

Mundell, "A Theory of Optimum Currency Areas."

Stern and Feldman, *Too Big To Fail*.

Questions to Consider

1. Do you think the euro will be Europe's currency in 2050? Why or why not?

2. When the next financial crisis comes, do you think U.S. bank regulators will allow a big bank to fail?

3. What is more important: market discipline or stability of the payment system? Why?

4. How would you explain the connection between U.S. fiscal deficits and potential inflation to someone who had not followed these lectures?

Glossary

asymmetric information: The condition when one party in a transaction has substantially more relevant knowledge than another. Often, the relevant knowledge is about the quality of the product being bought and sold.

balance sheet: A list of the assets, liabilities, and net worth of a firm or individual and that "net worth" is defined to be the value of the firm's assets minus the value of its liabilities.

bank runs: Situations in which depositors all try to withdraw deposited funds at the same time.

barter: Exchange without money.

bond: A certificate promising to repay money at a fixed rate of interest at a specified time.

bubble: An event in which the price of a financial asset grows more rapidly than justified by fundamentals for a substantial period of time.

capital stock: The cumulative measure of all past investment activity.

commodities futures contract: An agreement to buy a well-defined quantity and quality of a commodity at a specified future date.

commodity money: A particular commodity that is agreed upon in the society to be acceptable for exchange.

common stock: An ownership interest in a corporation.

Consumer Price Index (CPI): An index of prices of goods and services (a bushel basket of goods) purchased by the typical household in the United States.

deficit: When government revenues are less than expenditures. The deficit is a flow—its units are dollars per year or per quarter.

derivative: An agreement between two parties, the value of which depends on an underlying price or transaction.

discount rate: A positive number that defines the rate at which a future payment loses value as the date of the payment moves further into the future.

excess reserves: Reserves that were calculated to be beyond the amount required by law or prudence.

exchange rate: The market price of one currency in terms of another, a trading ratio between two currencies.

expected value (EV): The probability-weighted average of the game's payouts.

fiat money: Money that is valuable in exchange because a government has declared it to be.

financial intermediaries: Firms, such as banks, that channel funds from savers to investors and other decision makers who have decided to spend more than their current income permits.

financial investment: Stocks, bonds, and other financial products that individuals purchase as part of a financial plan.

gold standard: An agreement among participating countries to fix the price of each country's currency in terms of an ounce of gold. England adopted the standard in 1819, and the United States adopted it in 1834.

greenbacks: Paper currency issued in 1862; it was used as legal tender after the U.S. government suspended payment in gold in 1861.

house-advantage game: When the expected value is negative.

hyperinflation: Episodes during which the monthly inflation rate exceeds 50%.

inflation: Persistent increase in the general level of prices.

inflation rate: The rate at which the price index increases over time.

investment: The value of increases to a nation's capital stock, such as its factories, equipment, software, and other durable goods used as part of the production process, as well as human capital.

liquidity: A financial asset is said to be "liquid" if it can be rapidly converted to cash with no loss of value.

money: An asset that its owners rightly believe they can, quickly and without loss of value, convert to purchasing power; something that can be used as a medium of exchange.

national debt: The accumulation of deficits; it is a stock rather than a flow.

net worth: Is the value of assets minus the value of liabilities.

nominal rate of interest: Specifies number of dollars borrower must pay to borrow funds.

non-transactions deposits: Deposits in savings accounts, from which funds can be withdrawn at any time.

notes: Medium-turn debt instruments of the Treasury; the promise of the Treasury to pay the face value of the note at maturity and also to pay coupon payments every six months.

player-advantage game: When the expected value is positive.

policy discretion: The conduct of policy that is not bound by a policy rule.

policy rule: A formula for determining policy. It specifies what the policy instrument is and how settings of the instrument should respond to observable changes in the state of the economy. The policy instrument is generally meant to be the federal funds rate.

real rate of interest: The nominal rate minus the rate of inflation expected to occur.

real returns: The sum of percentage capital gains and dividends earned on the NYSE market portfolio minus the rate of inflation.

saving: The difference between a decision maker's income and consumption.

seigniorage: The revenue that a government obtains by deflating the value of its money.

STRIPS (Separate Trading of Registered Interest and Principal Securities): The result of stripping the coupon payments from a Treasury bond or note and using those coupon payments to create another government debt obligation that makes a single payment on its maturity date.

surplus: When tax revenues are greater than expenditures.

T-account: A graphical representation of the balance sheet of an economic entity. The T-account lists assets on the left side and liabilities and the asset's net worth on the right.

T-bill: Short-turn debt instruments of the Treasury; the promise of the Treasury to pay the face value of the bill at maturity.

time deposits: Deposits which have fixed maturity dates.

TIPS (Treasury Inflation Protected Securities): The principal of a TIPS increases with inflation and decreases with deflation, as measured by the CPI. When a TIPS bond matures, the owner is paid the adjusted principal or original principal, whichever is greater.

transactions deposits: Deposits against which checks can be written.

Troubled Asset Relief Program (TARP): Enacted by the Emergency Economic Stabilization Act of 2008, it provided funds for the bailout of troubled financial firms after the subprime mortgage crisis during the Great Recession. The Federal Reserve and the Treasury used TARP funds aggressively to keep banks and non-bank financial firms from failing.

volatile inflation: Inflation that oscillates between low and high rates.

yield to maturity: The ex ante yield that a bill, note, or bond purchaser will earn if the bond is held from the date of purchase to maturity.

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Notes

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