

Macroeconomics in One Equation

Lecture 6: Business Cycle Fluctuations

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For His Glory and Mission

Business & Economics
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Basic Concepts and Models

Business Cycles

The combination of expansions (from trough to peak) and recessions (from peak to trough), the ebb and flow of economic activity.

Okun's Law (Authur M. Okun, 1962)

The relation between output growth and the unemployment rate.

Phillips Curve (William Phillips, 1958)

The empirical relation between unemployment rate and inflation rate, showing that employment growth tends to produce more inflation, especially when an economy is near full employment level.

Aggregate Demand-Aggregate Supply Model (AD-AS)

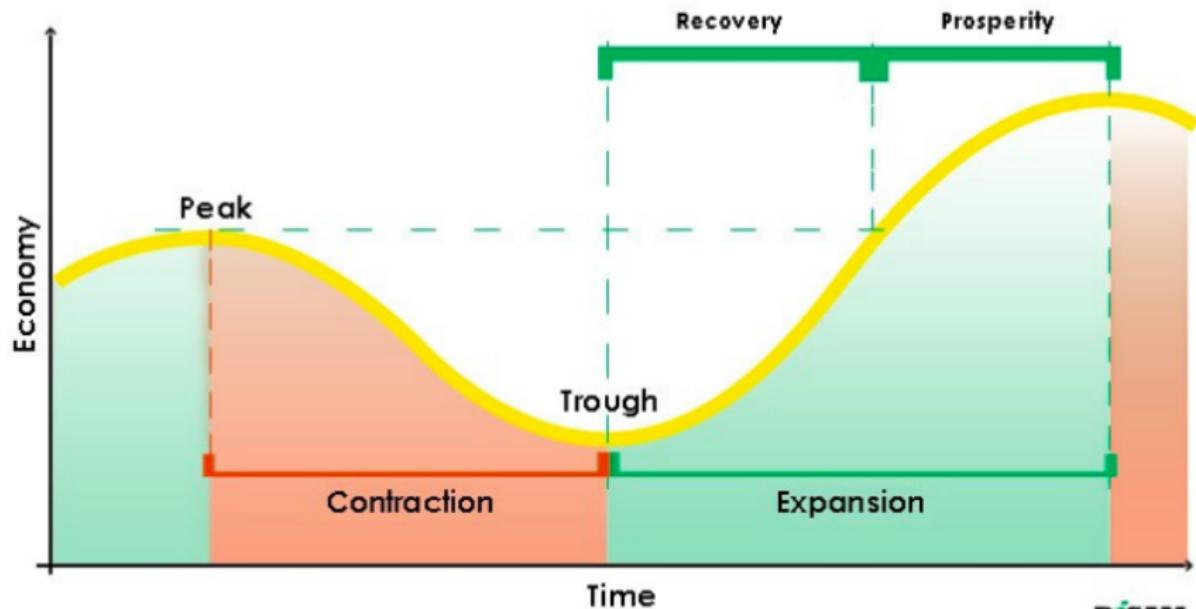
The equilibrium relation between output and price level in an economy.



Introduction

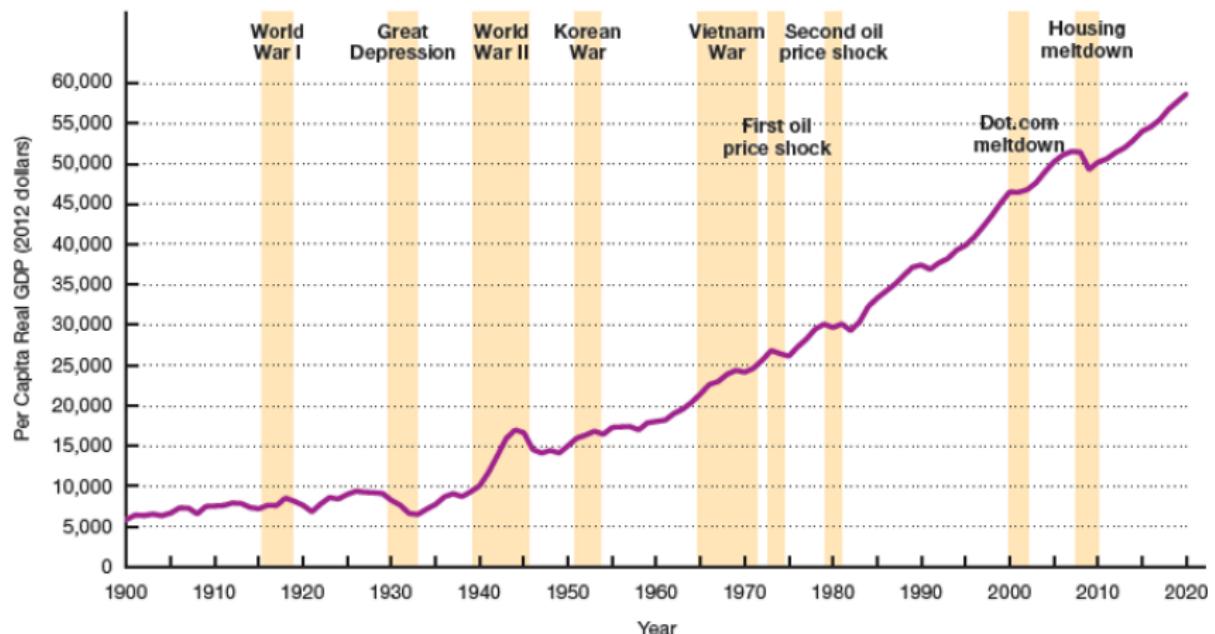
- The quantity theory of money provides a unifying framework for understanding macroeconomics, or the birdview of the forest.
- The first half of macroeconomics introduces the fundamental variables: what are the most essential ones and how are they being measured?
- After studying the theoretical and measurement variables, students will take a step forward and examine their behaviors and patterns over time.
- Next, we must connect the dots and see how the trees form the habitat of the forest. What are the relationship between output and price level? What are the relationship between employment and output? Price level and output? Money and everything else? The answers to these questions are not obvious and can even be confusing sometimes.
- The movements and fluctuations of macroeconomic variables are part of the business cycles studies. To explain and understand their relationships, economists apply the aggregate demand and aggregate supply model.

Business Cycle Stages

**RICAM**

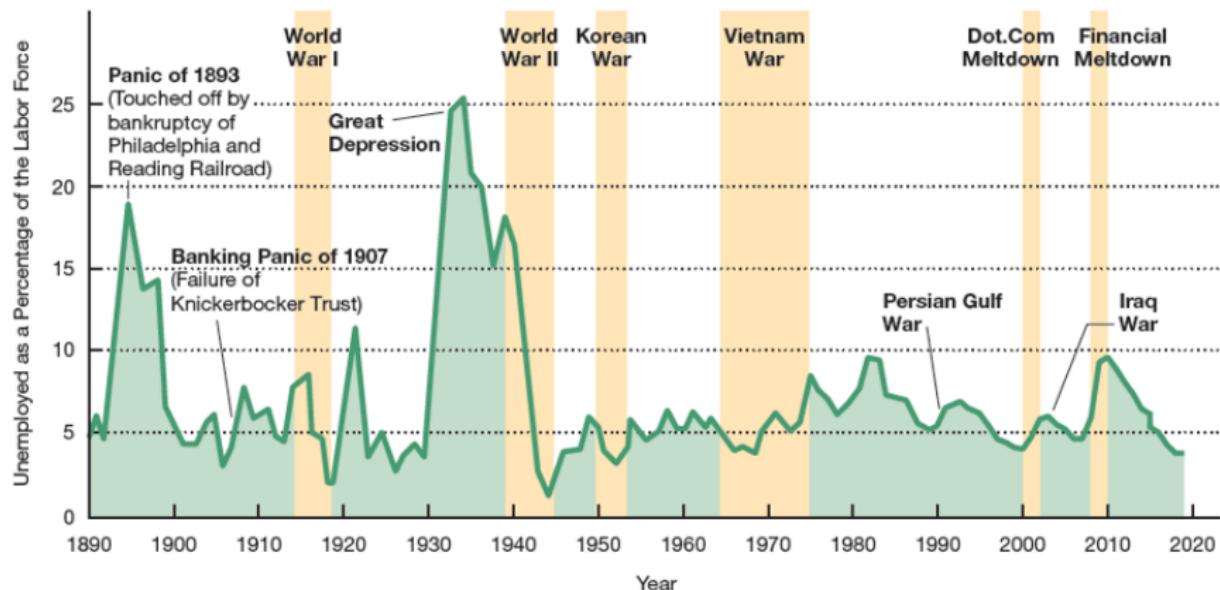
<https://ricamconsultoria.medium.com/how-economic-cycles-work-and-where-brazil-stands-b1b29427a14d>

U.S. Real GDP Per Capita, 1900-2020



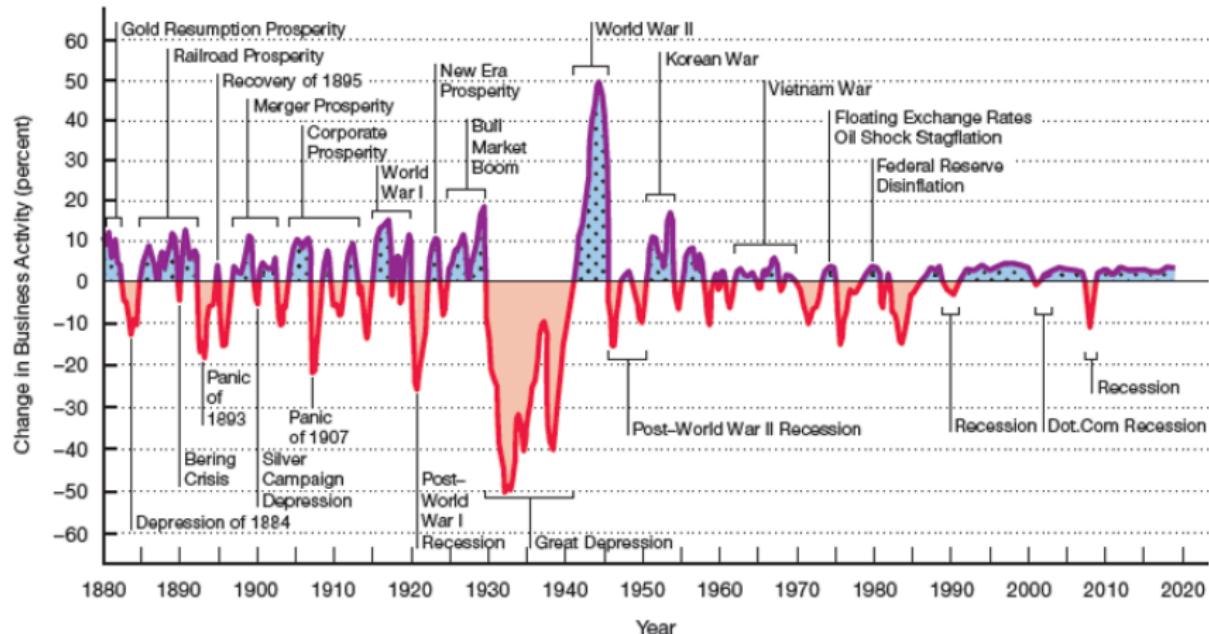
Source: Roger Leroy Miller (2021) Economics Today - Macro View, 20e, Pearson

U.S. Unemployment Rate,



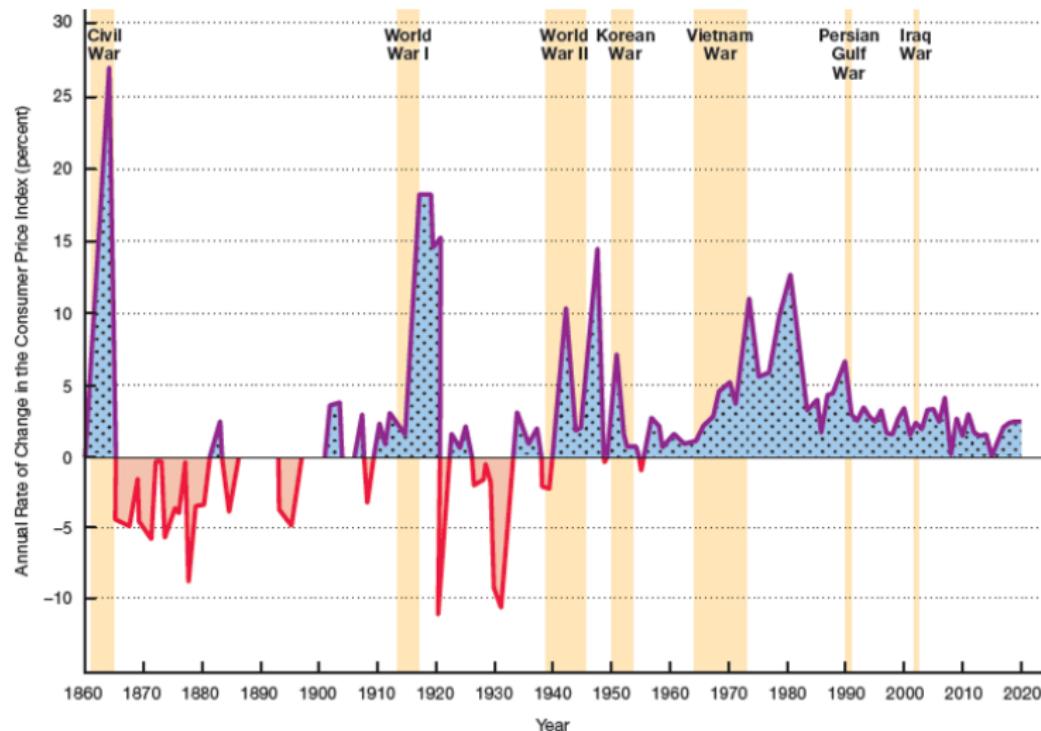
Source: Roger Leroy Miller (2021) Economics Today - Macro View, 20e, Pearson

U.S. Business Activity, 1880-2020



Source: Roger Leroy Miller (2021) Economics Today - Macro View, 20e, Pearson

U.S. Inflation Rate, 1880-2020



Source: Roger Leroy Miller (2021) Economics Today - Macro View, 20e, Pearson



Outline

① Business Cycle Fluctuations

② Inflation & Unemployment

③ Output & Unemployment

④ The AD-AS Model



Business Cycle Dating

- The National Bureau of Economic Research (NBER) Business Cycle Dating Committee maintains a chronology of US business cycles.
- The chronology identifies the dates of peaks and troughs that frame economic recessions and expansions.
- A recession is the period between a peak of economic activity and its subsequent trough, or lowest point. The NBER's definition emphasizes that a recession involves a significant decline in economic activity that is spread across the economy and lasts more than a few months.
- Between trough and peak, the economy is in an expansion.
- Expansion is the normal state of the economy; most recessions are brief. However, the time that it takes for the economy to return to its previous peak level of activity or its previous trend path may be quite extended.
- According to the NBER chronology, the most recent peak occurred in February 2020. The most recent trough occurred in April 2020.

<https://www.nber.org/research/business-cycle-dating>

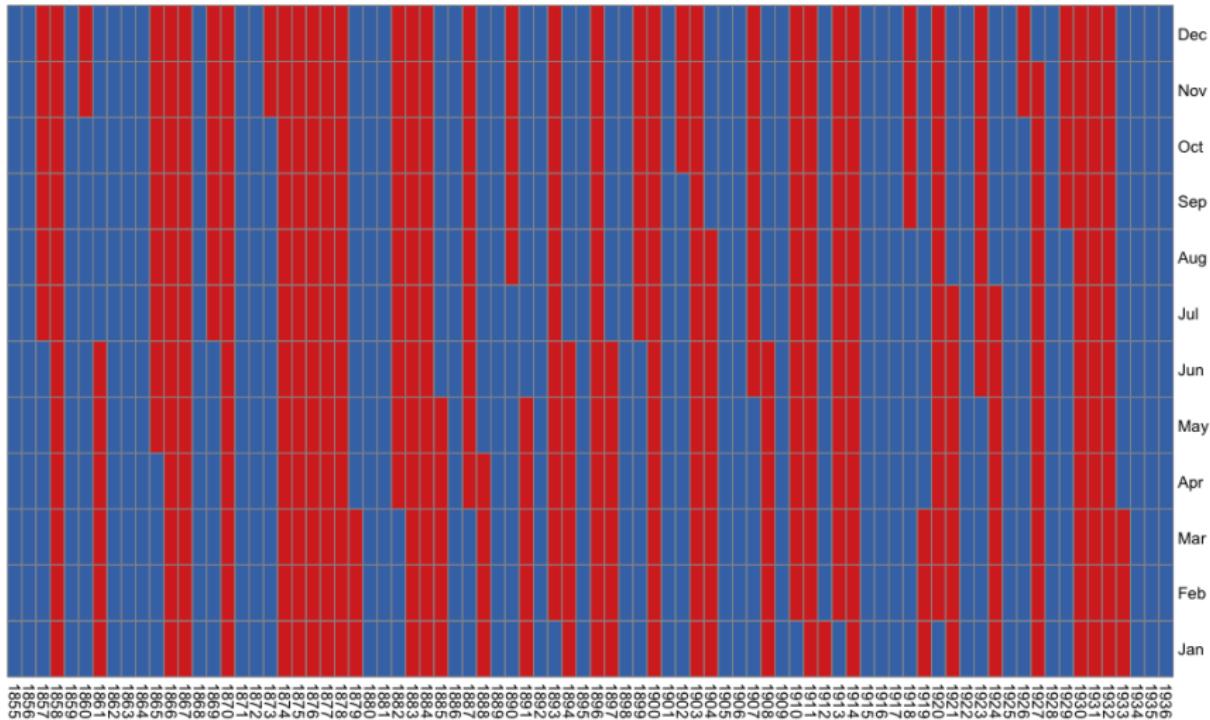
U.S. Business Cycle Turning Months

Starting Month	Ending Month	Duration (months)	Decline in Real GDP from Peak to Trough
August 1929	March 1933	43	26.3%
May 1937	June 1938	13	3.3%
February 1945	October 1945	8	12.7% ¹
November 1948	October 1949	11	1.5%
July 1953	May 1954	10	1.9%
August 1957	April 1958	8	3.0%
April 1960	February 1961	10	0.3%
December 1969	November 1970	11	0.2%
November 1973	March 1975	16	3.1%
January 1980	July 1980	6	2.2%
July 1981	November 1982	16	2.5%
July 1990	March 1991	8	1.3%
March 2001	November 2001	8	0.3%
December 2007	June 2009	18	4.3%
February 2020	April 2020	2	NA

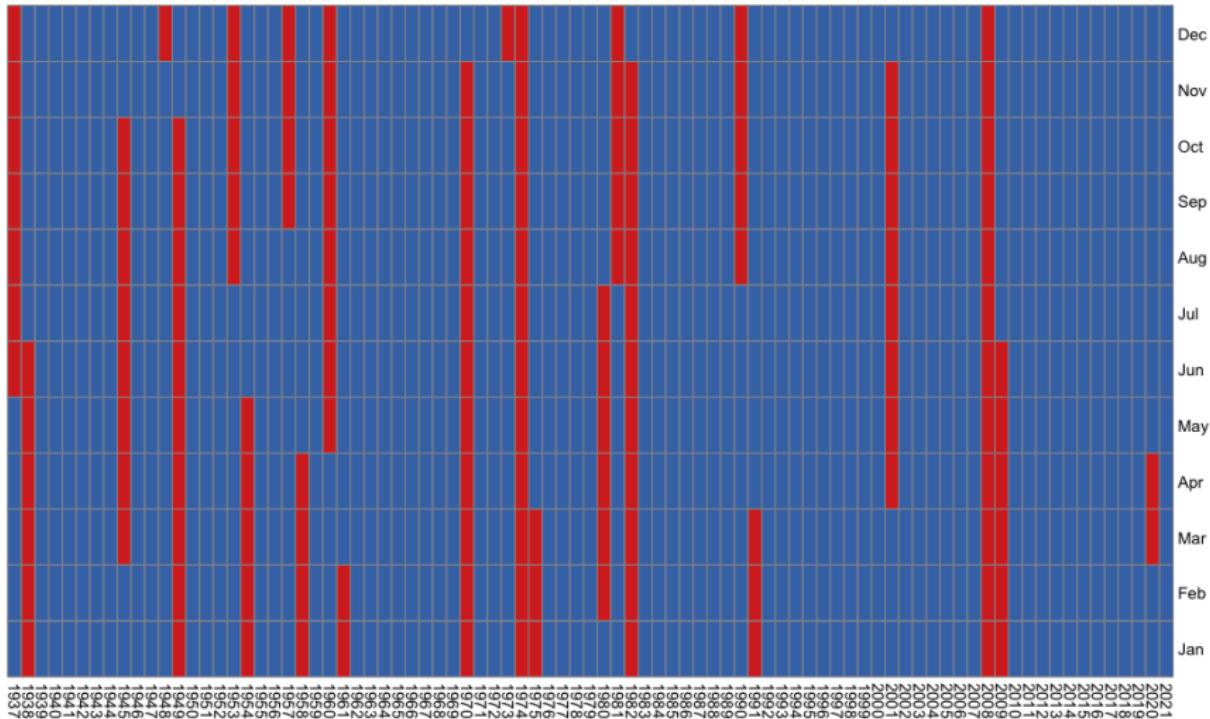
Source: Acemoglu, Laibson, and List (2022) CH12, Macroeconomics, 3e, Pearson.

<https://www.nber.org/research/data/us-business-cycle-expansions-and-contractions>

U.S. NBER Recessions, 1855-1936



Data source: Federal Reserve Bank of St. Louis, NBER based Recessions Indicators (in red) for the United States from the Period following the Peak through the Trough. <https://fred.stlouisfed.org/series/USREC>



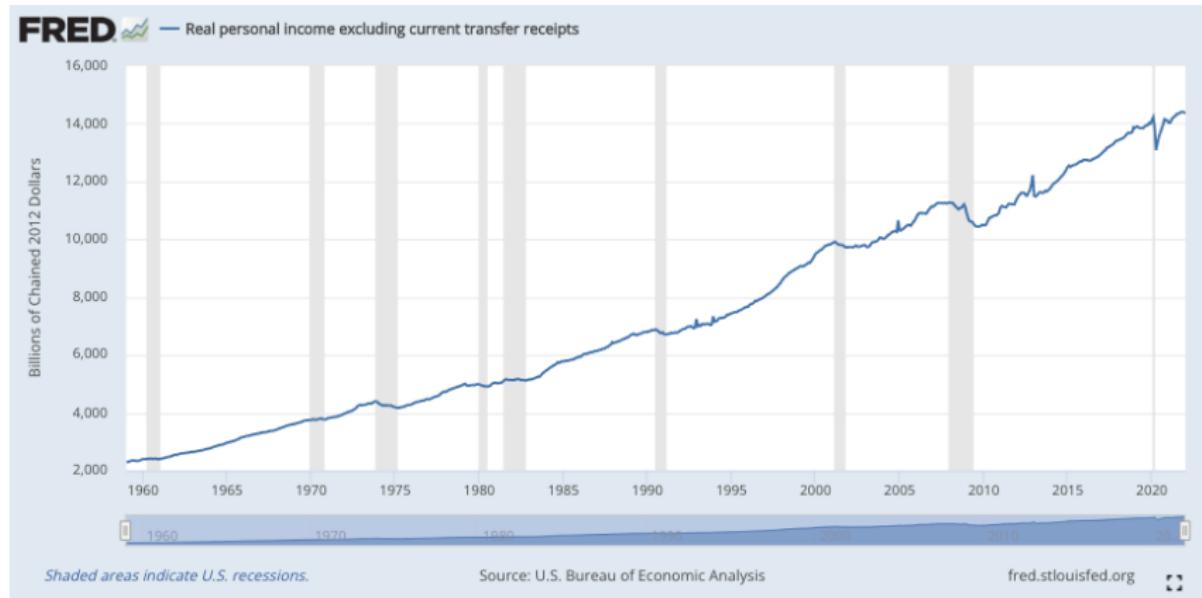
Data source: Federal Reserve Bank of St. Louis, NBER based Recessions Indicators (in red) for the United States from the Period following the Peak through the Trough. <https://fred.stlouisfed.org/series/USREC>

Recessions: Determination and Measures

- Because a recession must influence the economy broadly and not be confined to one sector, the committee emphasizes economy-wide measures of economic activity.
 - The determination of the months of peaks and troughs is based on a range of monthly measures of aggregate real economic activity published by the federal statistical agencies.
 - These include real personal income less transfers, nonfarm payroll employment, employment as measured by the household survey, real personal consumption expenditures, wholesale-retail sales adjusted for price changes, and industrial production.
 - There is no fixed rule about what measures contribute information to the process or how they are weighted in our decisions. In recent decades, the two measures we have put the most weight on are real personal income less transfers and nonfarm payroll employment.

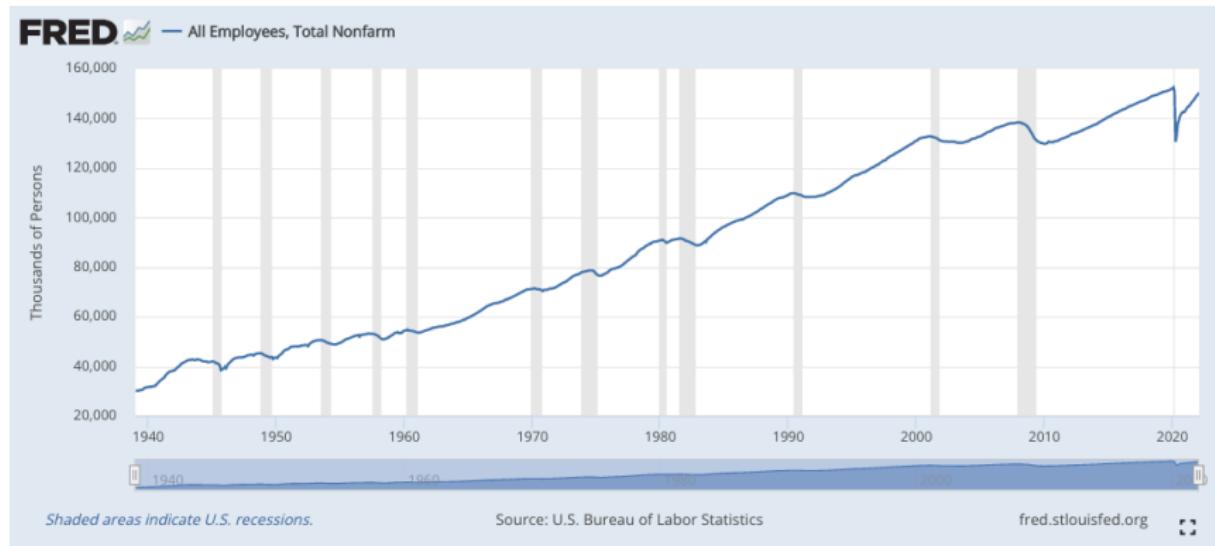
<https://www.nber.org/research/business-cycle-dating>

Real Personal Income Less Transfers



Source: U.S. Bureau of Economic Analysis, Real personal income excluding current transfer receipts.
<https://fred.stlouisfed.org/series/W875RX1>

Total Nonfarm Payroll Employment

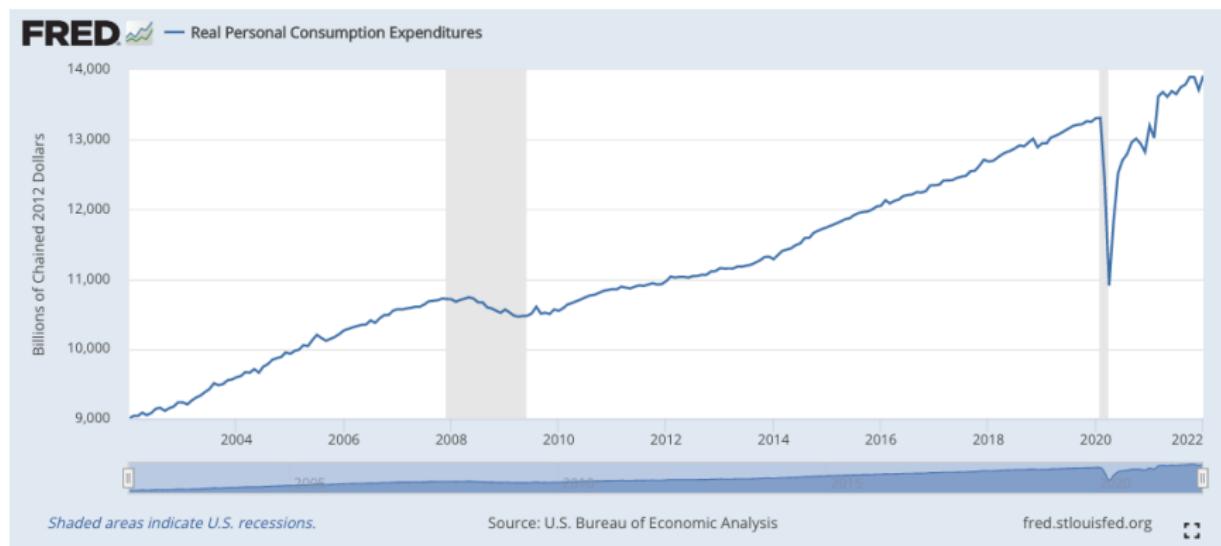


All Employees: Total Nonfarm, commonly known as Total Nonfarm Payroll, is a measure of the number of U.S. workers in the economy that excludes proprietors, private household employees, unpaid volunteers, farm employees, and the unincorporated self-employed. This measure accounts for approximately 80 percent of the workers who contribute to Gross Domestic Product (GDP). The series comes from the BLS Current Employment Statistics (Establishment Survey).

Source: U.S. Bureau of Labor Statistics, retrieved from FRED, Federal Reserve Bank of St. Louis.

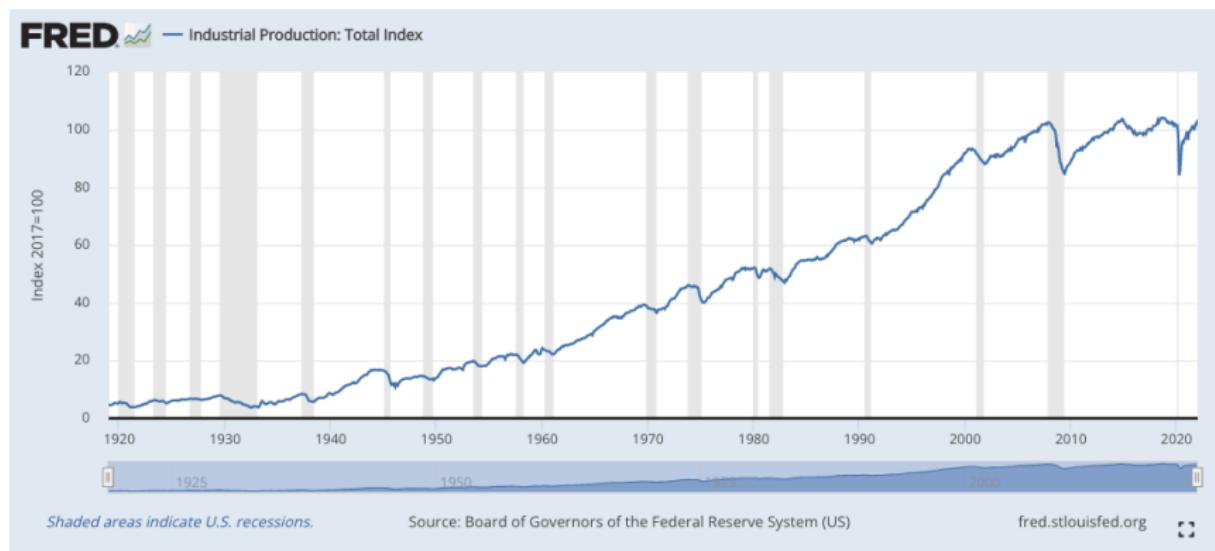
<https://fred.stlouisfed.org/series/PAYEMS>

Real Personal Consumption Expenditure



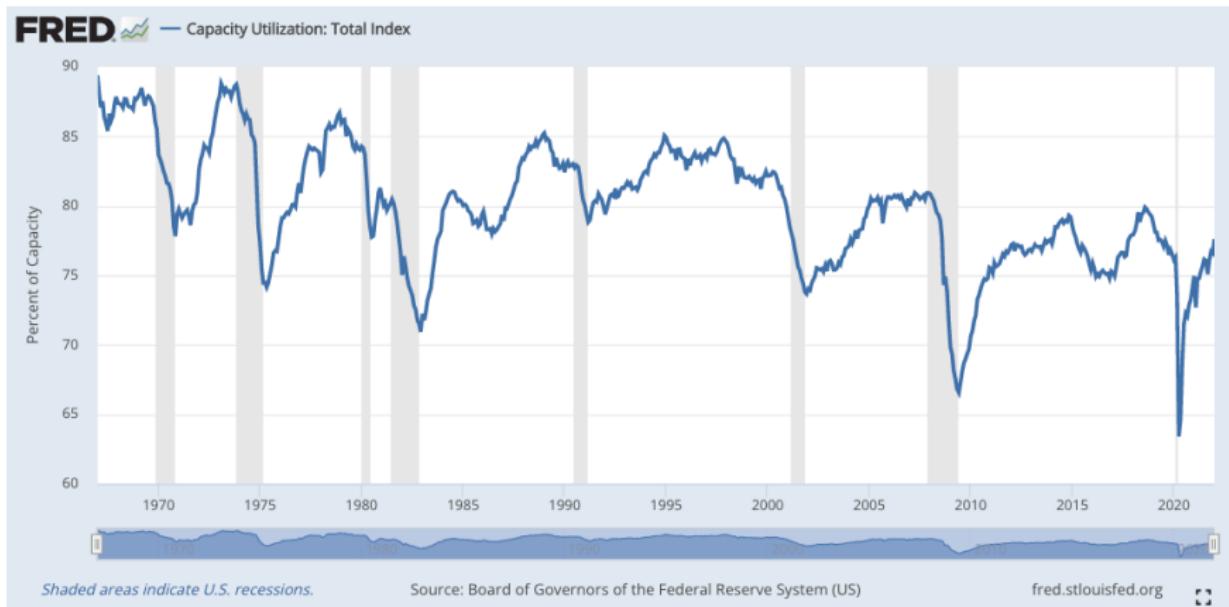
Source: U.S. Bureau of Economic Analysis, Real Personal Consumption Expenditures, retrieved from FRED, Federal Reserve Bank of St. Louis. <https://fred.stlouisfed.org/series/PCEC96>

Industrial Production: Total Index



The Industrial Production Index (INDPRO) is an economic indicator that measures real output for all facilities located in the United States manufacturing, mining, and electric, and gas utilities (excluding those in U.S. territories). The index is compiled on a monthly basis to bring attention to short-term changes in industrial production,. It measures movements in production output and highlights structural developments in the economy. Growth in the production index from month to month is an indicator of growth in the industry.
<https://fred.stlouisfed.org/series/INDPRO>

Capacity Utilization: Total Industry



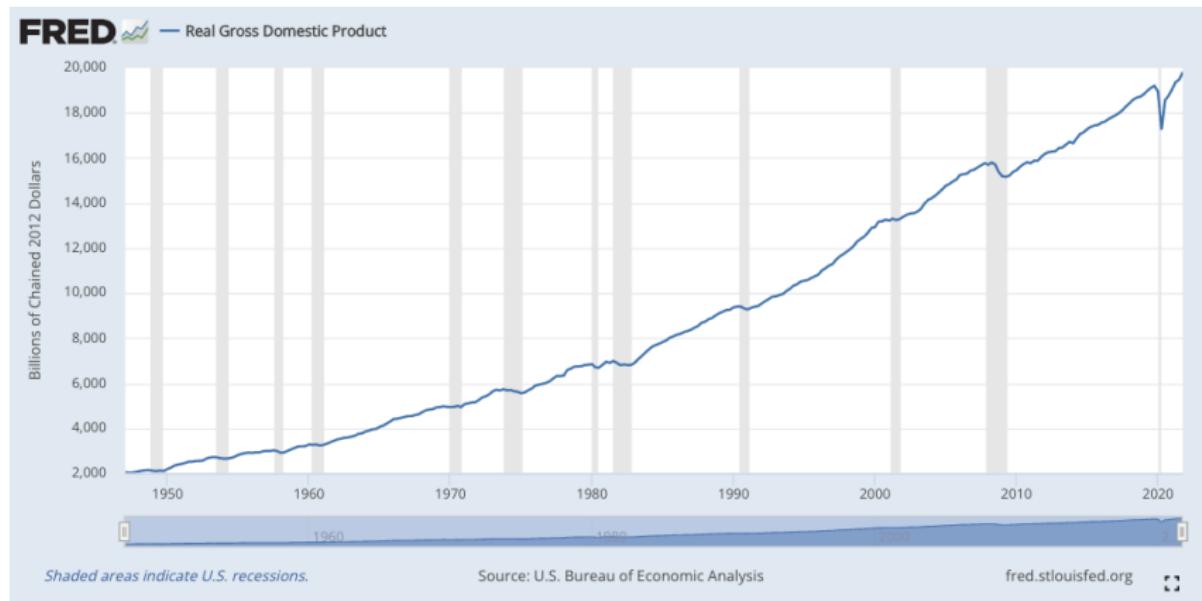
Capacity Utilization: Total Industry (TCU) is the percentage of resources used by corporations and factories to produce goods in manufacturing, mining, and electric and gas utilities for all facilities located in the United States (excluding those in U.S. territories). We can also think of capacity utilization as how much capacity is being used from the total available capacity to produce demanded finished products.
<https://fred.stlouisfed.org/series/TCU>

Peak and Trough: Determination and Measures

- The NBER business cycle dating committee makes a separate determination of the calendar quarter of a peak or trough, based on measures of aggregate economic activity over the relevant quarters.
- Two measures that are important in the determination of quarterly peaks and troughs, but that are not available monthly, are the expenditure-side and income-side estimates of real gross domestic product (GDP and GDI).
- The committee also considers quarterly averages of the monthly indicators described before, particularly payroll employment.
- The committee's approach to determining the dates of turning points is retrospective. In making its peak and trough announcements, it waits until sufficient data are available to avoid the need for major revisions to the business cycle chronology. In determining the date of a peak in activity, it waits until it is confident that a recession has occurred.

<https://www.nber.org/research/business-cycle-dating>

Real Gross Domestic Product



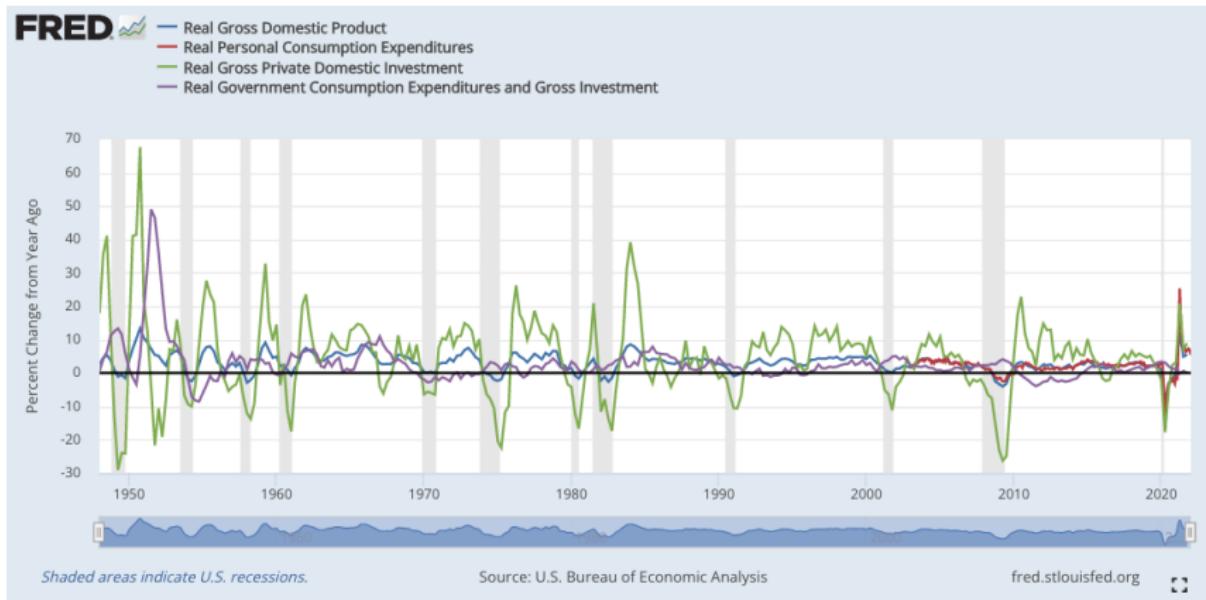
<https://fred.stlouisfed.org/series/GDPC1>

Unemployment Rate



<https://fred.stlouisfed.org/series/UNRATE>

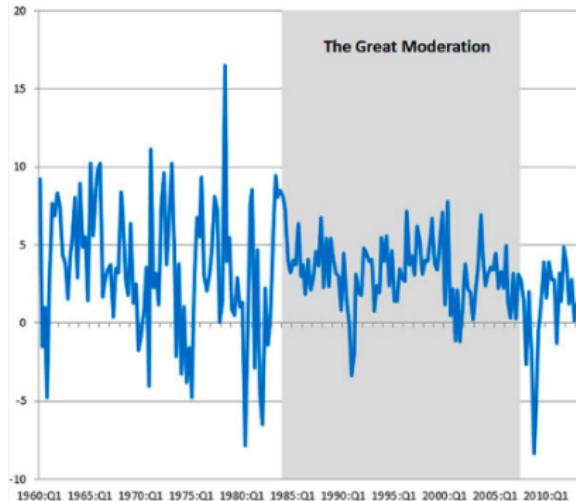
Real GDP Components: Growth Rates



<https://fred.stlouisfed.org/series/GDPC1>

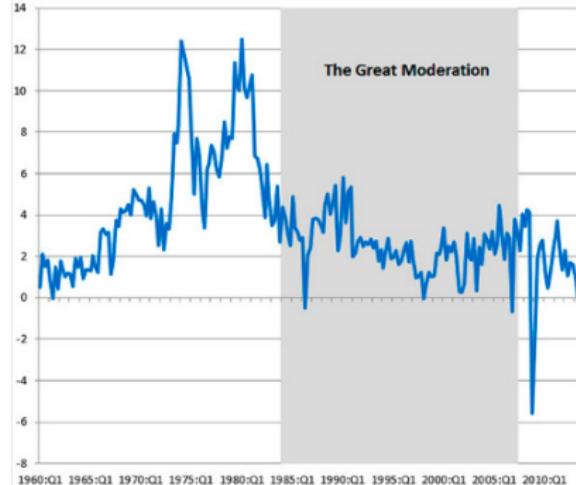
The Great Moderation, 1984-2007

Real GDP growth



Sources: Bureau of Economic Analysis, Haver

PCE Inflation



Sources: Bureau of Economic Analysis, Haver

<https://www.federalreservehistory.org/essays/great-moderation>

U.S. Business Cycle Fluctuations: Summary

Short-run economic fluctuations, or business cycles, display strong patterns:

- ① Co-movement of many aggregate macroeconomic variables. Variables such as real consumption, real investment, and employment move positively (or together) with real GDP. Variables such as unemployment move negatively (or opposite) with real GDP.
- ② Limited predictability of fluctuations. Economists can't predict the length of a recession or when a recession will start or end. The same is true for expansions. Even the most sophisticated statistical tools that economists use today are unable to predict recessions and expansions except to a very limited degree.
- ③ Persistence in the rate of economic growth. Economic growth tend to be persistent. If the economy is in a recession this quarter, then most likely it will be in a recession in the next quarter. The same is true of expansions.
- ④ Great Moderation: The mid-1980s to 2007 was a period of relative macroeconomic stability after the volatility of the Great Inflation.

Source: Acemoglu, Laibson, and List (2022) CH12, Macroeconomics, 3e, Pearson.

Sources of Fluctuations: Economic Theories

- ① Real business cycle theory emphasizes changes in productivity and technology. Technological advances and other productivity-enhancing innovation cause expansions. An increase in input prices like oil causes recessions.
- ② Keynesian theory focuses on sentiments and multiplier effects. According to Keynes, when the sentiments (expectations, uncertainty, and animal spirits) of consumers or businesses change, they alter their expectations and, as a result, change their consumption and investment. The idea behind multipliers is simple: The impact of an initial change in business or household spending is amplified by successive changes in spending in the economy.
- ③ Financial and monetary theory looks at changes in prices and interest rates. Downward wage rigidities, monetary contractions (causing higher real interest rates), credit crunch are all contributing factors to recessions.

Source: Acemoglu, Laibson, and List (2022) CH12, Macroeconomics, 3e, Pearson.

The Conference Board Leading Economic Index

The Conference Board is the member-driven think tank that delivers trusted insights for what's ahead. Founded in 1916, the Conference Board is a non-partisan, not-for-profit entity in the U.S.

- The composite economic indexes are the key elements in an analytic system designed to signal peaks and troughs in the business cycle.
- The leading, coincident, and lagging economic indexes are essentially composite averages of several individual leading, coincident, or lagging indicators.
- They are constructed to summarize and reveal common turning point patterns in economic data in a clearer and more convincing manner than any individual component—primarily because they smooth out some of the volatility of individual components.

<http://www.conference-board.org>

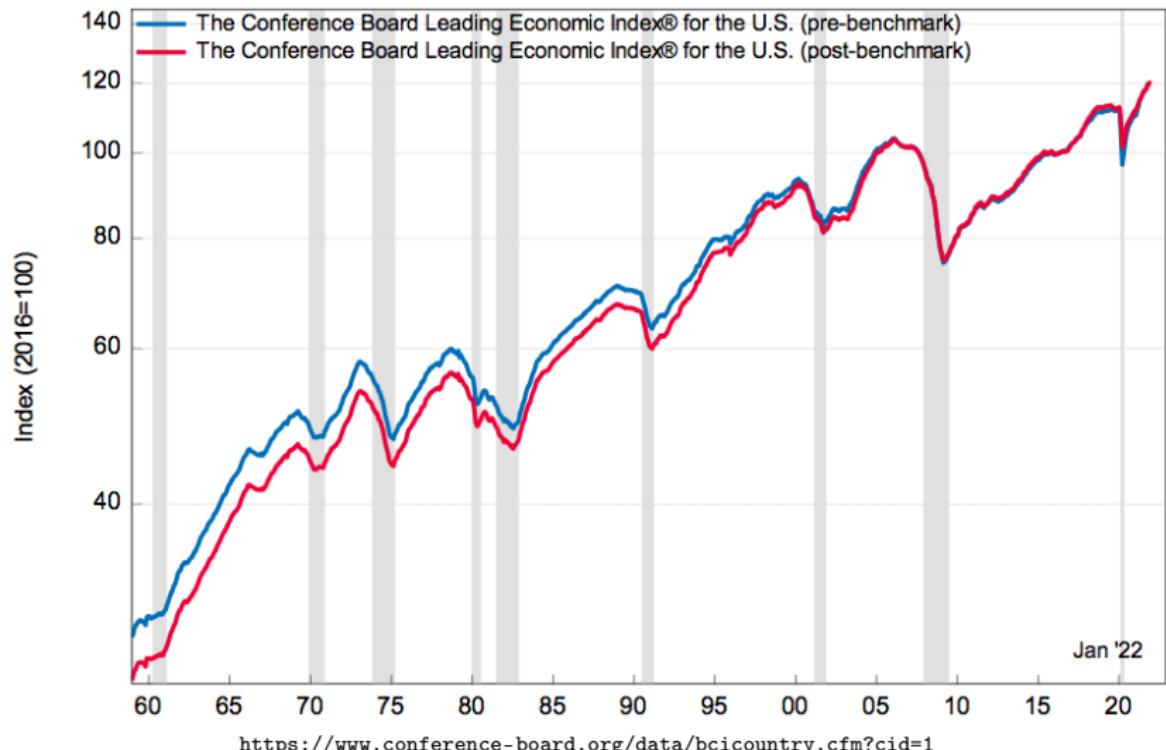
The Conference Board LEI Components

- ① Average weekly hours, manufacturing
- ② Average weekly initial claims for unemployment insurance
- ③ Manufacturers' new orders, consumer goods and materials
- ④ ISM Index of new orders
- ⑤ Manufacturers' new orders, nondefense capital goods ex. aircraft orders
- ⑥ Building permits, new private housing units
- ⑦ Stock prices, 500 common stocks
- ⑧ Leading Credit Index
- ⑨ Interest rate spread, 10-year Treasury bonds less federal funds
- ⑩ Average consumer expectations for business conditions

Press release and technical notes: <http://www.conference-board.org/data/bcicountry.cfm?cid=1>

**The Conference Board Leading Economic Index® (LEI) for United States before and after benchmark revisions**

Peak: 60:4 69:12 73:11 80:181:7 90:7 01:3 07:12 20:2
Trough: 61:2 70:11 75:3 80:782:11 91:3 01:11 09:6 20:4



The Coincident and Lagging Indexes Components

Coincident Economic Index

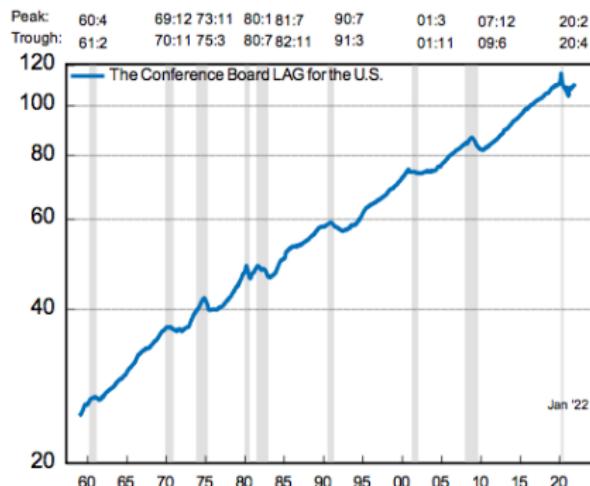
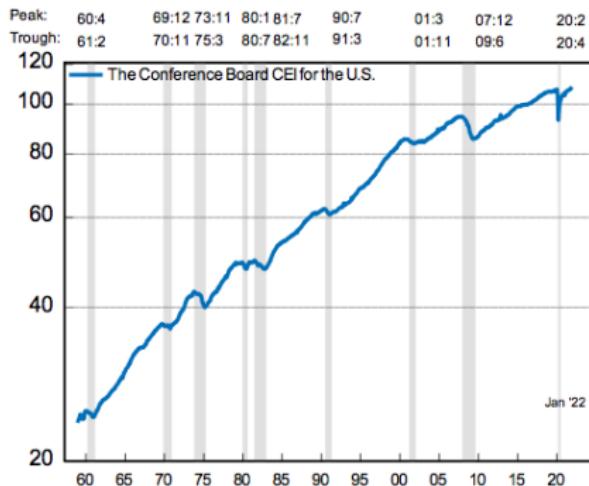
1	Employees on nonagricultural payrolls	0.3230
2	Personal income less transfer payments	0.3146
3	Industrial production	0.1923
4	Manufacturing and trade sales	0.1701

Lagging Economic Index

1	Inventories to sales ratio, manufacturing and trade	0.1168
2	Average duration of unemployment	0.0270
3	Consumer installment credit outstanding to personal income ratio	0.1595
4	Commercial and industrial loans	0.0861
5	Average prime rate	0.3318
6	Labor cost per unit of output, manufacturing	0.0499
7	Consumer price index for services	0.2289

<https://www.conference-board.org/data/bcicountry.cfm?cid=1>

The Coincident and Lagging Indexes



<https://www.conference-board.org/data/bcicountry.cfm?cid=1>



Outline

1 Business Cycle Fluctuations

2 Inflation & Unemployment

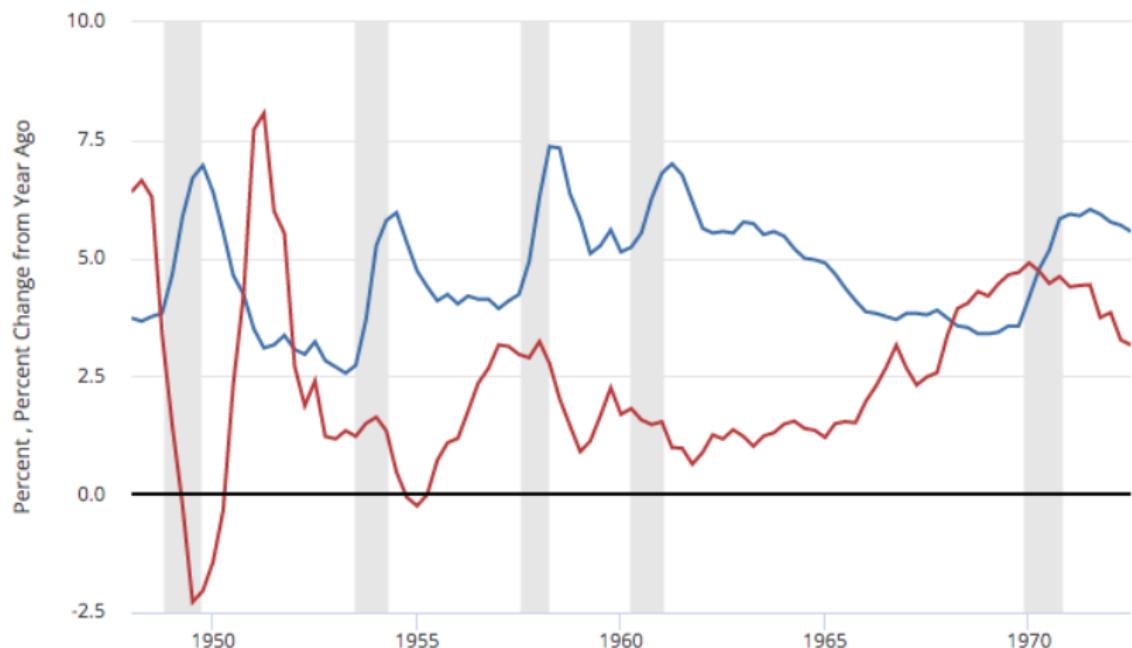
3 Output & Unemployment

4 The AD-AS Model

Inflation Rate and Unemployment Rate, 1948-1971

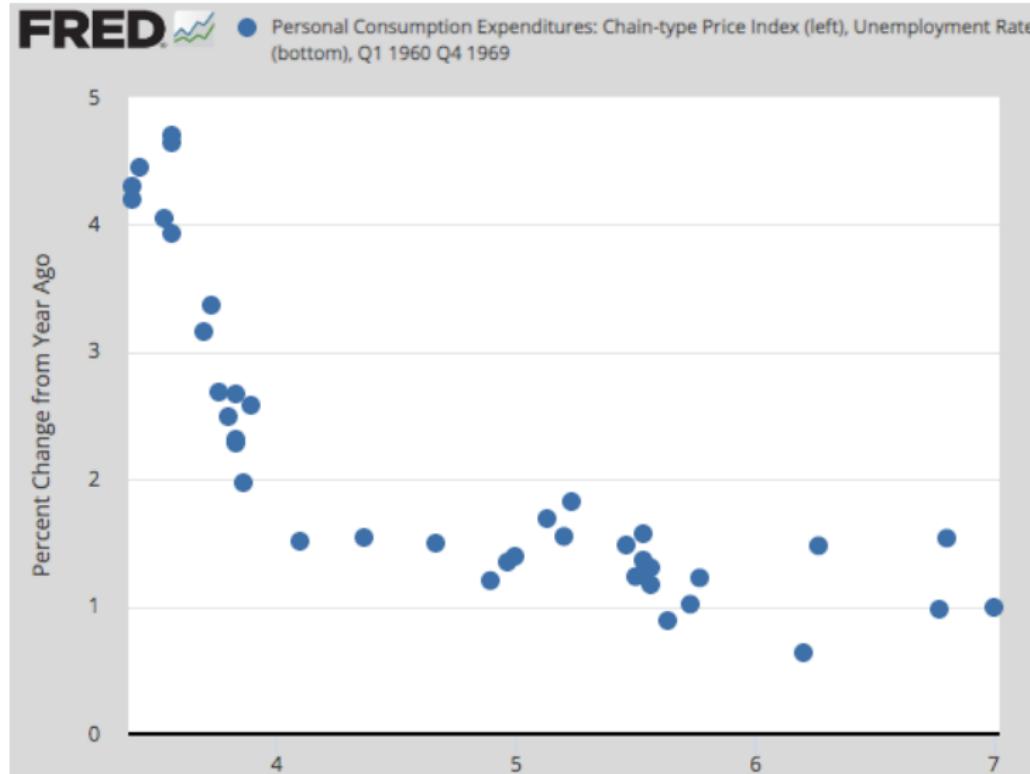
FRED 

— Unemployment Rate
— Personal Consumption Expenditures: Chain-type Price Index



<https://www.stlouisfed.org/open-vault/2020/january/what-is-phillips-curve-why-flattened>

Inflation Rate and Unemployment Rate in the 1960s

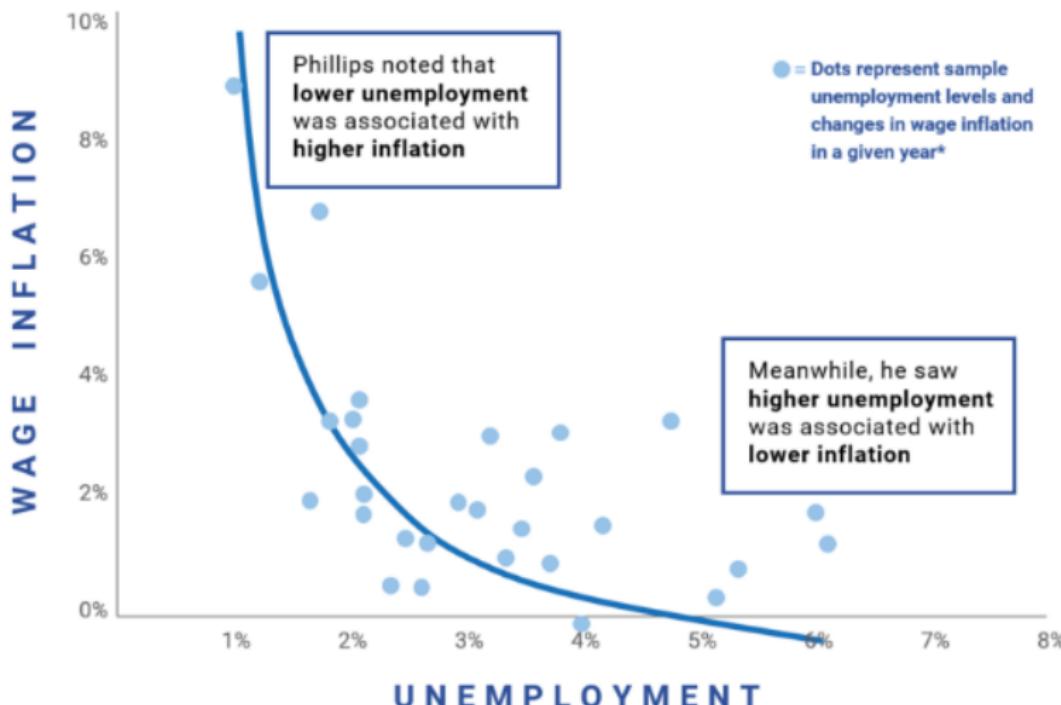


Phillips Curve: An Introduction

- The Phillips curve represents the relationship between the rate of inflation and the unemployment rate. Although he had precursors, (the New Zealand economist) A. W. H. Phillips's study of wage inflation and unemployment in the United Kingdom from 1861 to 1957 is a milestone in the development of macroeconomics.
- Phillips found a consistent inverse relationship: when unemployment was high, wages increased slowly; when unemployment was low, wages rose rapidly. He conjectured that the lower the unemployment rate, the tighter the labor market and, therefore, the faster firms must raise wages to attract scarce labor. At higher unemployment rates, the pressure abated.
- Phillips's "curve" represented the average relationship between unemployment and wage behavior over the business cycle. It showed the rate of wage inflation that would result if a particular level of unemployment persisted for some time.

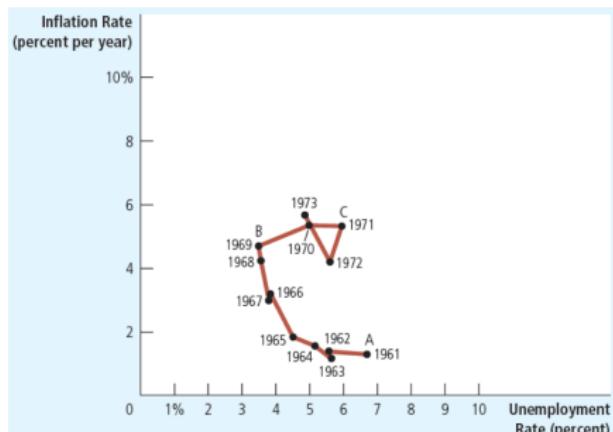
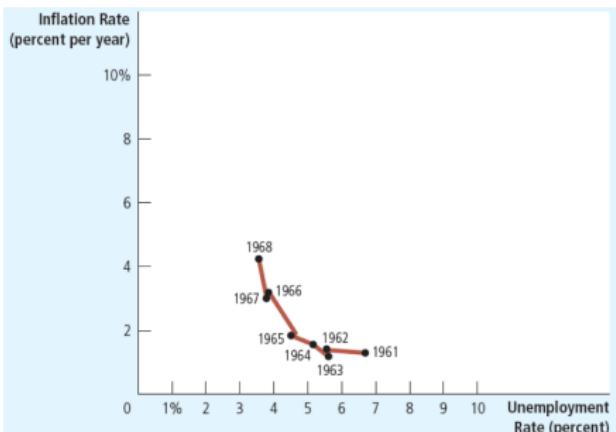
<https://www.econlib.org/library/Enc/PhillipsCurve.html>

The Phillips Curve Tradeoff



<https://www.stlouisfed.org/open-vault/2020/january/what-is-phillips-curve-why-flattened>

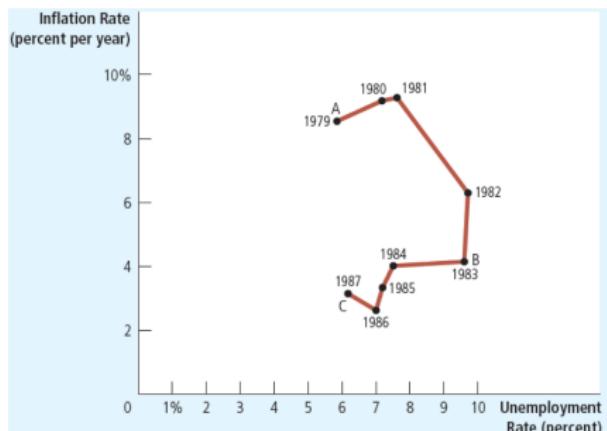
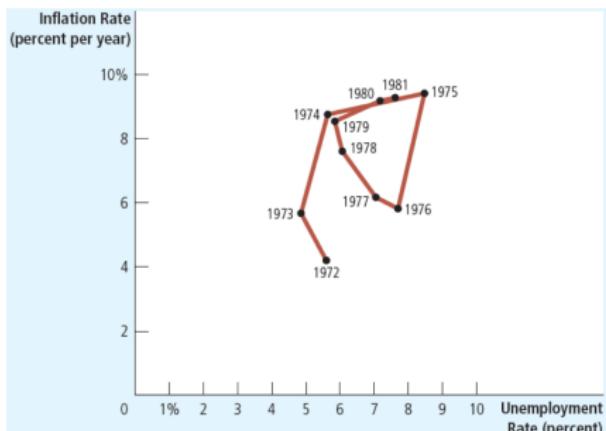
The Phillips Curve in 1960s



The left figure uses annual data from 1961 to 1968 on the unemployment rate and on the inflation rate (as measured by the GDP deflator) to show the negative relationship between inflation and unemployment. The right figure updates data to 1973. The Phillips curve of the 1960s breaks down in the early 1970s, just as Friedman and Phelps had predicted.

Source: N. G. Mankiw (2021) CH35, Principles of Economics, 9e, Cengage.

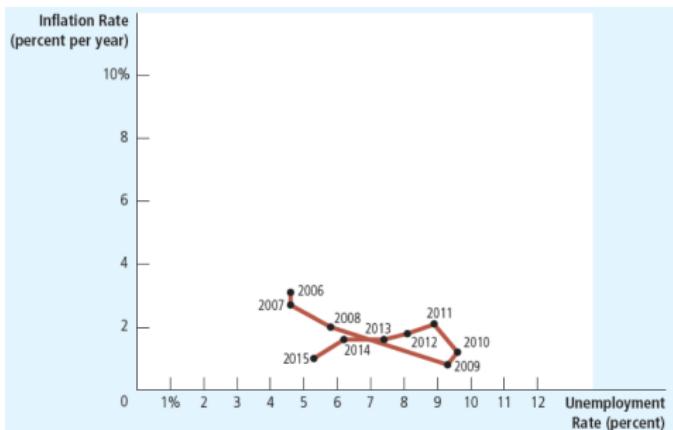
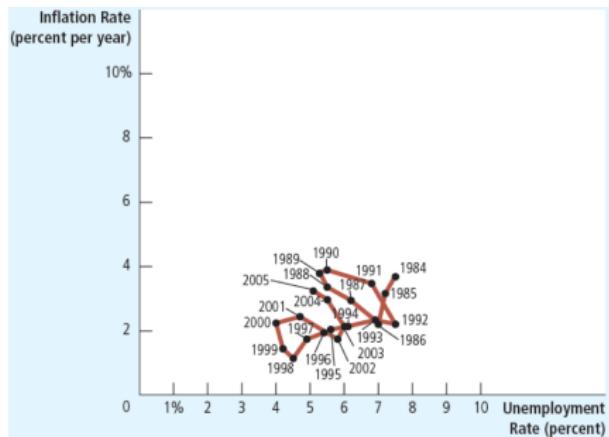
The Phillips Curve in 1970s and 1980s



The left figure shows annual data from 1972 to 1981 on the unemployment rate and on the inflation rate (as measured by the GDP deflator). In the periods 1973?1975 and 1978?1981, increases in world oil prices led to higher inflation and higher unemployment. The right figure shows annual data from 1979 to 1987. The reduction in inflation during this period came at the cost of very high unemployment in 1982 and 1983.

Source: N. G. Mankiw (2021) CH35, Principles of Economics, 9e, Cengage.

The Phillips Curve in 1990s and 2000s



The left figure shows annual data from 1984 to 2005 on the unemployment rate and on the inflation rate (as measured by the GDP deflator). During most of this period, Alan Greenspan was chairman of the Federal Reserve. Fluctuations in inflation and unemployment were relatively small. The right figure shows annual data from 2006 to 2015. A financial crisis caused aggregate demand to plummet, leading to much higher unemployment and pushing inflation down to a very low level.

Source: N. G. Mankiw (2021) CH35, Principles of Economics, 9e, Cengage.

The Phillips Curve Model

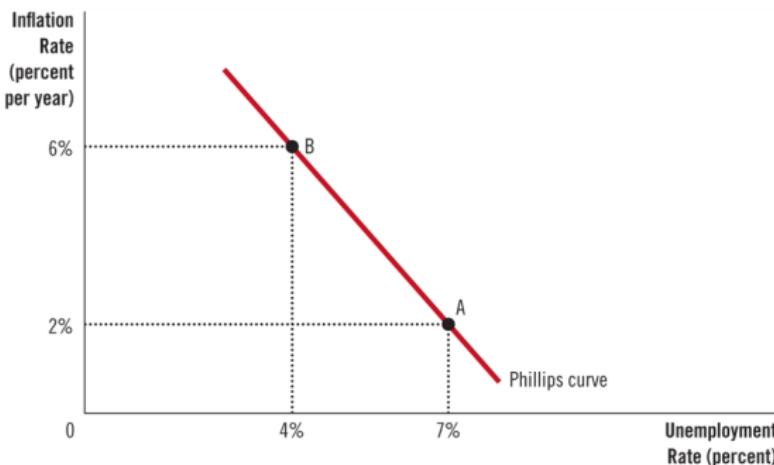


FIGURE 1

The Phillips Curve

The Phillips curve illustrates a negative association between the inflation rate and the unemployment rate. At point A, inflation is low and unemployment is high. At point B, inflation is high and unemployment is low.

Source: N. G. Mankiw (2021) CH35, Principles of Economics, 9e, Cengage.

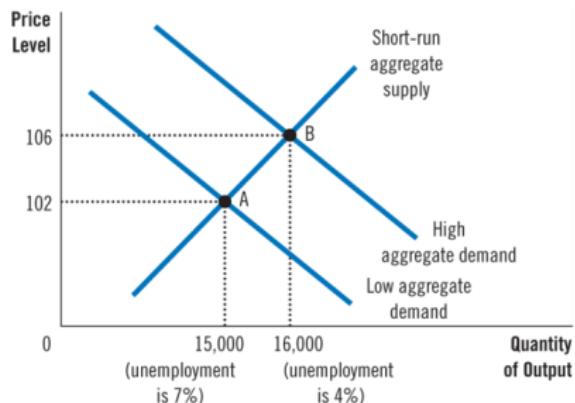
In 1958, A.W. Phillips published a paper in which he showed, using British data, that years of high unemployment rates tended to coincide with steady or falling wages and years of low unemployment rates were also years of rising wages. Because wage and price inflation move together, Phillips' finding can be extended to the relationship between price inflation and the unemployment rate. The annual U.S. data for the 1960s actually shows that relationship rather clearly. Many economists believe that the Phillips curve is a very useful relationship because both inflation and unemployment are key measures of economic performance. Monetary policymakers tend to use the Phillips curve framework. Source: FRBSF (2008) Dr. Econ: What is the relevance of the Phillips curve to modern economies? (w)

FIGURE 2

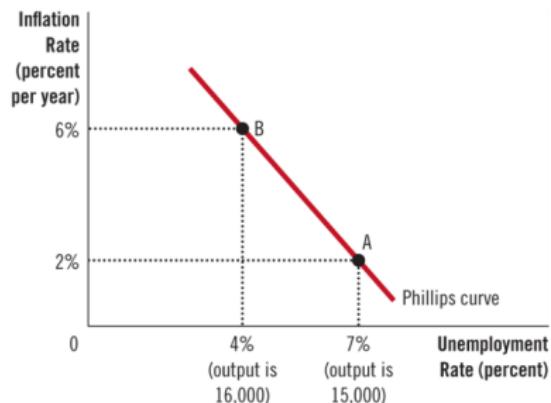
How the Phillips Curve Is Related to the Model of Aggregate Demand and Aggregate Supply

This figure assumes a price level of 100 for the year 2020 and charts possible outcomes for the year 2021. Panel (a) shows the model of aggregate demand and aggregate supply. If aggregate demand is low, the economy is at point A; output is low (15,000), and the price level is low (102). If aggregate demand is high, the economy is at point B; output is high (16,000), and the price level is high (106). Panel (b) shows the implications for the Phillips curve. Point A, which arises when aggregate demand is low, has high unemployment (7 percent) and low inflation (2 percent). Point B, which arises when aggregate demand is high, has low unemployment (4 percent) and high inflation (6 percent).

(a) The Model of Aggregate Demand and Aggregate Supply



(b) The Phillips Curve



Source: N. G. Mankiw (2021) CH35, Principles of Economics, 9e, Cengage.



Phillips Curve: Short-Run vs Long-Run

- The close fit between the estimated curve and the data encouraged many economists, following the lead of Paul Samuelson and Robert Solow, to treat the Phillips curve as a sort of menu of policy tradeoff options.
- At the height of the Phillips curve's popularity as a guide to policy, Edmund Phelps and Milton Friedman independently challenged its theoretical underpinnings. They argued that well-informed, rational employers and workers would pay attention only to real wages—the inflation-adjusted purchasing power of money wages.
- In their view, real wages would adjust to make the supply of labor equal to the demand for labor, and the unemployment rate would then stand at a level uniquely associated with that real wage—the "natural rate" of unemployment. Both Friedman and Phelps argued that the government could not permanently trade higher inflation for lower unemployment.
- The long-run Phillips curve is a vertical line above the natural rate.

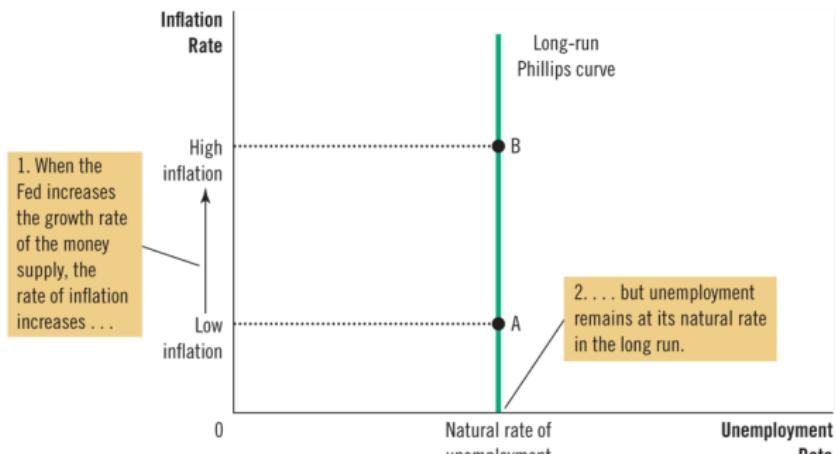
<https://www.econlib.org/library/Enc/PhillipsCurve.html>

The Long-Run Phillips Curve

FIGURE 3

The Long-Run Phillips Curve

According to Friedman and Phelps, there is no trade-off between inflation and unemployment in the long run. Growth in the money supply determines the inflation rate. Regardless of the inflation rate, the unemployment rate gravitates toward its natural rate. As a result, the long-run Phillips curve is vertical.



Source: N. G. Mankiw (2021) CH35, Principles of Economics, 9e, Cengage.

Friedman's and Phelps' analyses provide a distinction between the "short-run" and long-run" Phillips curves. So long as the average rate of inflation remains fairly constant, as it did in the 1960s, inflation and unemployment will be inversely related. But if the average rate of inflation changes, as it will when policymakers persistently try to push unemployment below the natural rate, after a period of adjustment, unemployment will return to the natural rate. That is, once workers' expectations of price inflation have had time to adjust, the natural rate of unemployment is compatible with any rate of inflation.

The 1970s provided striking confirmation of Friedman's and Phelps's fundamental point. Contrary to the original Phillips curve, when the average inflation rate rose from about 2.5 percent in the 1960s to about 7 percent in the 1970s, the unemployment rate not only did not fall, it actually rose from about 4 percent to above 6 percent.

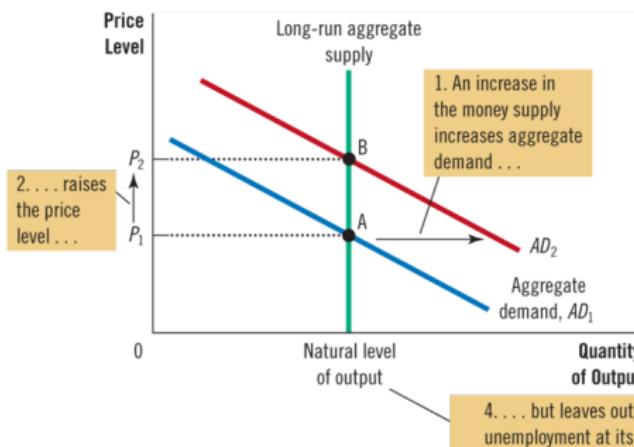
<https://www.econlib.org/library/Enc/PhillipsCurve.html>

Panel (a) shows the model of aggregate demand and aggregate supply with a vertical aggregate-supply curve. When expansionary monetary policy shifts the aggregate-demand curve to the right from AD_1 to AD_2 , the equilibrium moves from point A to point B. The price level rises from P_1 to P_2 , while output remains the same. Panel (b) shows the long-run Phillips curve, which is vertical at the natural rate of unemployment. In the long run, expansionary monetary policy moves the economy from lower inflation (point A) to higher inflation (point B) without changing the rate of unemployment.

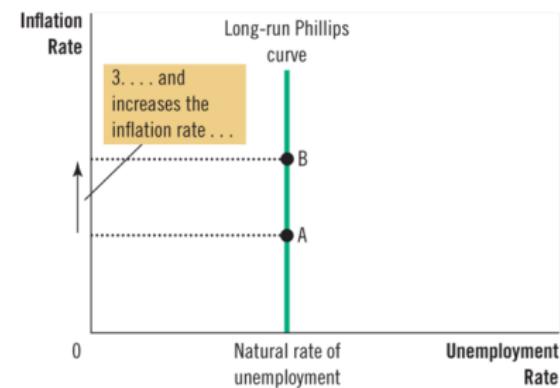
FIGURE 4

How the Long-Run Phillips Curve Is Related to the Model of Aggregate Demand and Aggregate Supply

(a) The Model of Aggregate Demand and Aggregate Supply



(b) The Phillips Curve



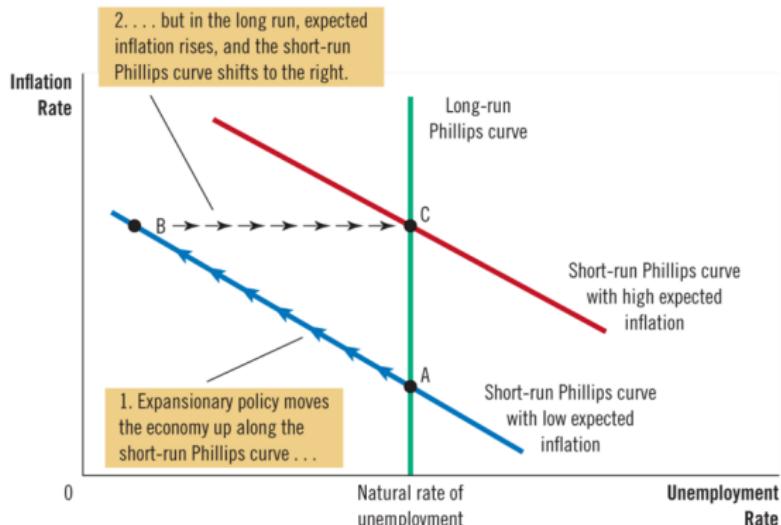
Source: N. G. Mankiw (2021) CH35, Principles of Economics, 9e, Cengage.

Expectation-Augmented Phillips Curve

FIGURE 5

How Expected Inflation Shifts the Short-Run Phillips Curve

The higher the expected rate of inflation, the higher the curve representing the short-run trade-off between inflation and unemployment. At point A, expected inflation and actual inflation are equal at a low rate and unemployment is at its natural rate. If the Fed pursues an expansionary monetary policy, the economy moves from point A to point B in the short run. At point B, expected inflation is still low, but actual inflation is high. Unemployment is below its natural rate. In the long run, expected inflation rises, and the economy moves to point C. At point C, expected inflation and actual inflation are both high, and unemployment is back to its natural rate.



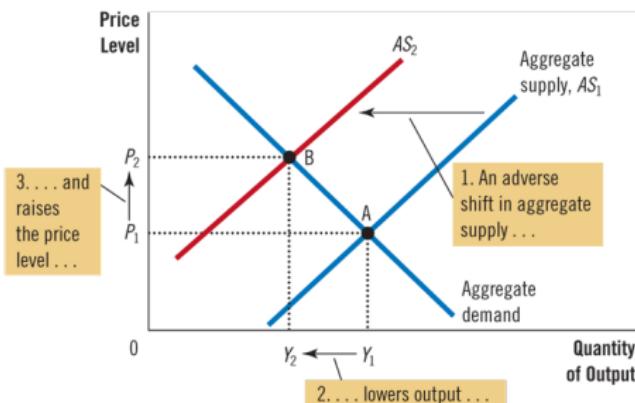
Source: N. G. Mankiw (2021) CH35, Principles of Economics, 9e, Cengage.

Panel (a) shows the model of aggregate demand and aggregate supply. When the aggregate-supply curve shifts to the left from AS_1 to AS_2 , the equilibrium moves from point A to point B. Output falls from Y_1 to Y_2 , and the price level rises from P_1 to P_2 . Panel (b) shows the short-run trade-off between inflation and unemployment. The adverse shift in aggregate supply moves the economy from a point with lower unemployment and lower inflation (point A) to a point with higher unemployment and higher inflation (point B). The short-run Phillips curve shifts to the right from PC_1 to PC_2 . Policymakers now face a worse set of options for inflation and unemployment.

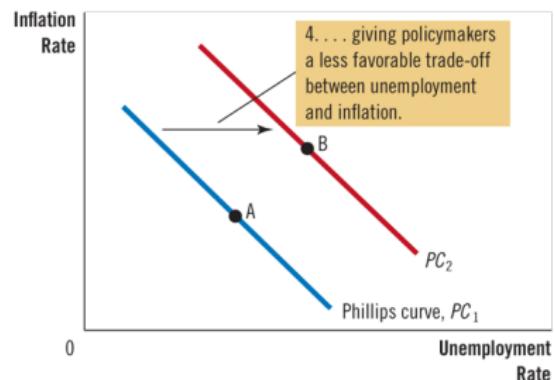
FIGURE 8

An Adverse Shock to Aggregate Supply

(a) The Model of Aggregate Demand and Aggregate Supply



(b) The Phillips Curve



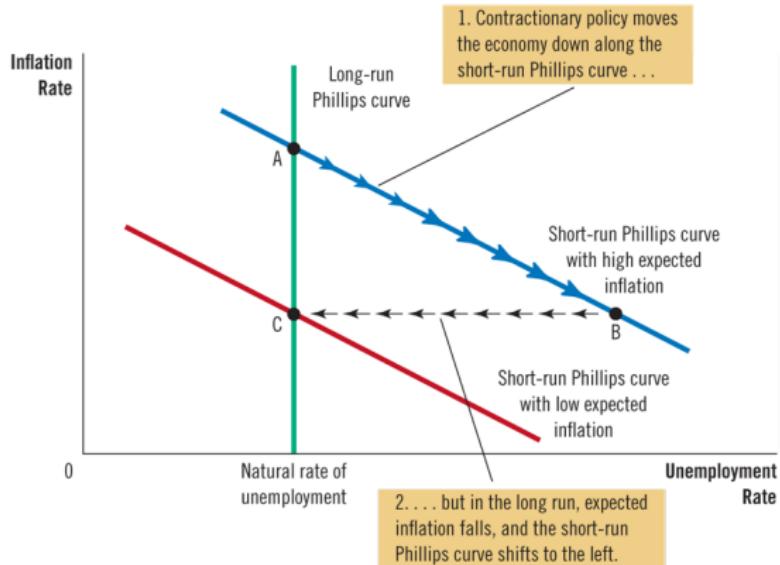
Source: N. G. Mankiw (2021) CH35, Principles of Economics, 9e, Cengage.

Disinflationary Monetary Policy Effect on the Phillips Curve

FIGURE 10

Disinflationary Monetary Policy in the Short Run and Long Run

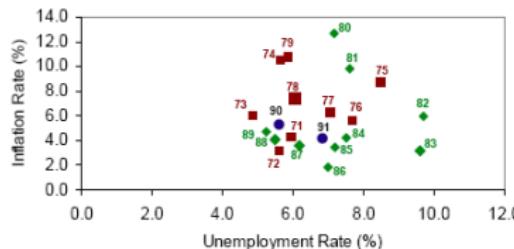
When the Fed pursues contractionary monetary policy to reduce inflation, the economy moves along a short-run Phillips curve from point A to point B. Over time, expected inflation falls, and the short-run Phillips curve shifts downward. When the economy reaches point C, unemployment is back at its natural rate.



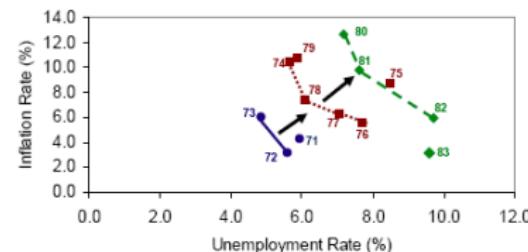
Source: N. G. Mankiw (2021) CH35, Principles of Economics, 9e, Cengage.

To summarize, the modern Phillips curve tells us that inflation is guided by three forces: expected inflation, the deviation of unemployment from its natural rate (sometimes referred to as the unemployment gap), and supply shocks. All other things being equal, an increase in expected inflation is expected to exert upward pressures on inflation. The same goes for unemployment falling below its natural rate and positive supply shocks, such as reductions in the relative prices of energy, food, or imports. Source: FRBSF (2008) Dr. Econ: What is the relevance of the Phillips curve to modern economies? (w)

U.S. CPI Inflation and Unemployment Rates in 1971-1991



Phillips Curve Shifts During the 1970s and Early 1980s



Data Source: U.S. Bureau of Labor Statistics

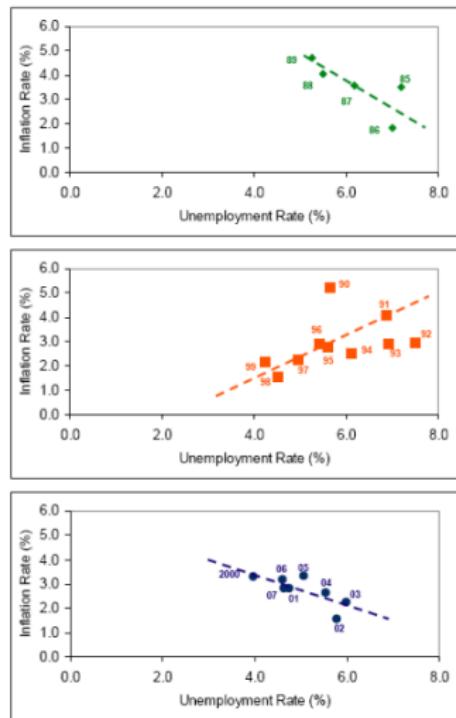
Data Source: U.S. Bureau of Labor Statistics

The Phillips curve appears to have moved to the right during the period. One possible explanation for this could be an upward shift in inflation expectations from the early '70s to the early '90s. In addition, you might recall that another development took place in the 1970s: large supply shocks, one in 1973 and another in 1979. These two shocks coincide very well with the two shifts in the Phillips curve shown in the right graph. It appears that the shifts were caused by both upward revisions to inflation expectations and negative supply shocks. Thus, by the early '90s, the concept of the short-run Phillips curve included not only expected inflation, but also supply shocks.

Source: FRBSF (2008) Dr. Econ: What is the relevance of the Phillips curve to modern economies? (w)



U.S. CPI Inflation and Unemployment Rates in 1985-2007



The figure might be interpreted as suggesting a downward relationship between inflation and unemployment in the 1980s and 2000s (steeper in the 1980s and shallower in the 2000s), but an upward relationship in the 1990s. However, an upward relationship contradicts the Phillips curve theory of a tradeoff between unemployment and inflation. There are several explanations for why the 1990s were characterized by both lower inflation and falling unemployment rates.

One has to do with increased competition in many U.S. industries, which kept producers from increasing prices as much as they would have in the absence of tight competition. Other possible explanations include a more successful monetary policy regime that reduced people's expectations of future inflation, demographic shifts in the labor force, and changes in worker productivity.

Source: FRBSF (2008) Dr. Econ. (w)

Data Source: U.S. Bureau of Labor Statistics



Phillip's Curve: Why it Matters?

- The original Phillips Curve formulation posited a simple relationship between wage growth and unemployment. Since then, macroeconomists have formulated more sophisticated versions that account for the role of inflation expectations and changes in the long-run equilibrium rate of unemployment. The latter is often referred to as the non-accelerating inflation rate of unemployment (NAIRU), defined as the lowest level to which unemployment can fall without generating increases in inflation.
- The Phillips Curve is one key factor in the Federal Reserve's decision-making on interest rates. The Fed's mandate is to aim for maximum sustainable employment—basically the level of employment at the NAIRU—and stable prices—which it defines to be 2 percent inflation.
- Because monetary policy acts with a lag, the Fed wants to know what inflation will be in the future, not just at any given moment. The Phillips Curve is a tool the Fed uses to forecast what will happen to inflation when the unemployment rate falls, as it has in recent years.

<https://www.brookings.edu/blog/up-front/2018/08/21/the-hutchins-center-explains-the-phillips-curve/>

Phillip's Curve: Recent Development

- The conceptual foundations of this relationship have been a subject of active debate, but for many decades, the relationship seemed well-supported by U.S. data. In the last two decades, however, the U.S. inflation rate has not been particularly high, even during periods of low unemployment. The recent data have led many to wonder whether the Phillips curve has weakened or disappeared.
- The researchers study both inflation in consumer prices and inflation in wages. They test for a "price" Phillips curve using data on annual costs of goods and services, and for a "wage" Phillips curve using hourly earnings data.
- When examining data only from 1988 to 2018, the researchers see less evidence for a robust price Phillips curve. The linear and non-linear slopes are both close to zero, consistent with the common view that the Phillips curve is flattening. However, the wage Phillips curve is much more resilient and is still quite evident in this time period.

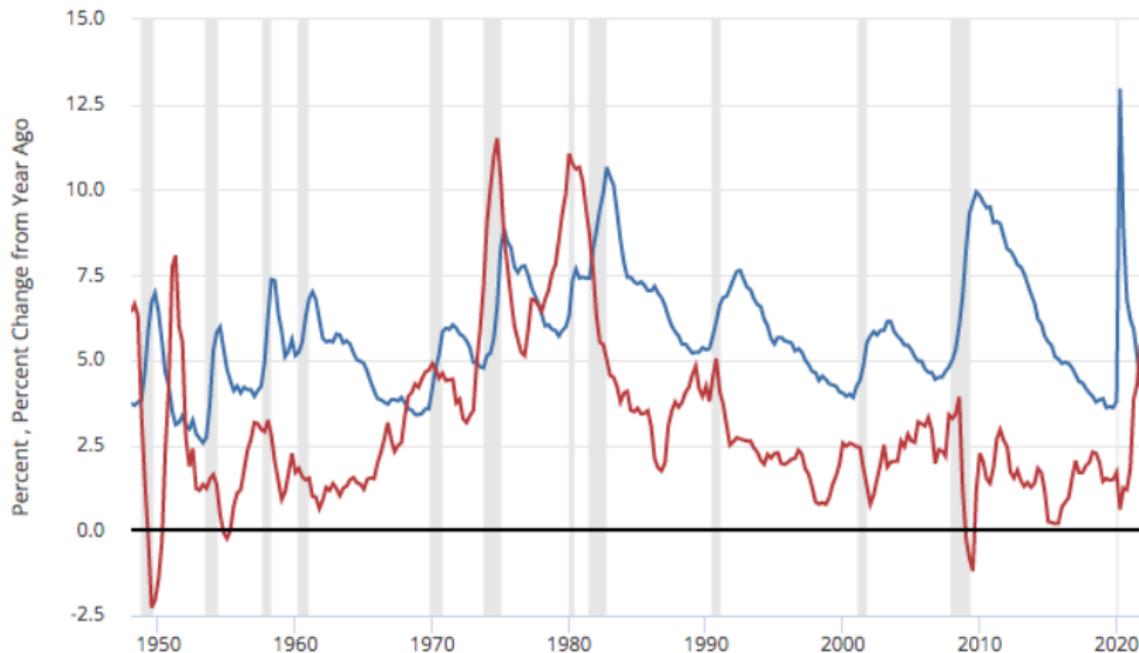
<https://www.nber.org/digest/sep19/phillips-curve-still-useful-guide-policymakers>

Inflation Rate and Unemployment Rate, 1948-2020

FRED

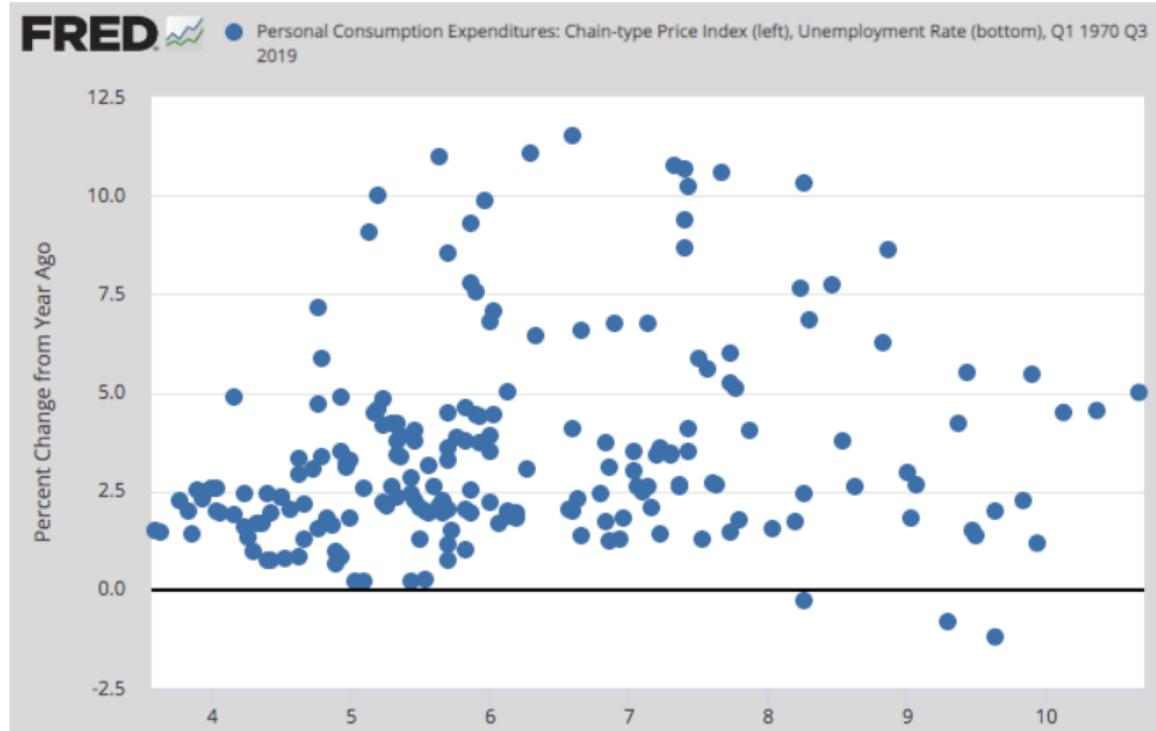
Unemployment Rate

Personal Consumption Expenditures: Chain-type Price Index



<https://www.stlouisfed.org/open-vault/2020/january/what-is-phillips-curve-why-flattened>

Inflation Rate and Unemployment Rate, 1970-2019



<https://www.stlouisfed.org/open-vault/2020/january/what-is-phillips-curve-why-flattened>

Phillips Curve Estimation, 1981-2017

Wage Inflation and Unemployment Rates: State-Level Data, 1981–2017

Nominal wage-inflation rate

10%

5

0

-5

-10

-4%

-3

-2

-1

0

1

2

3

4

5

6

7

Unemployment rate

Slope = -0.41

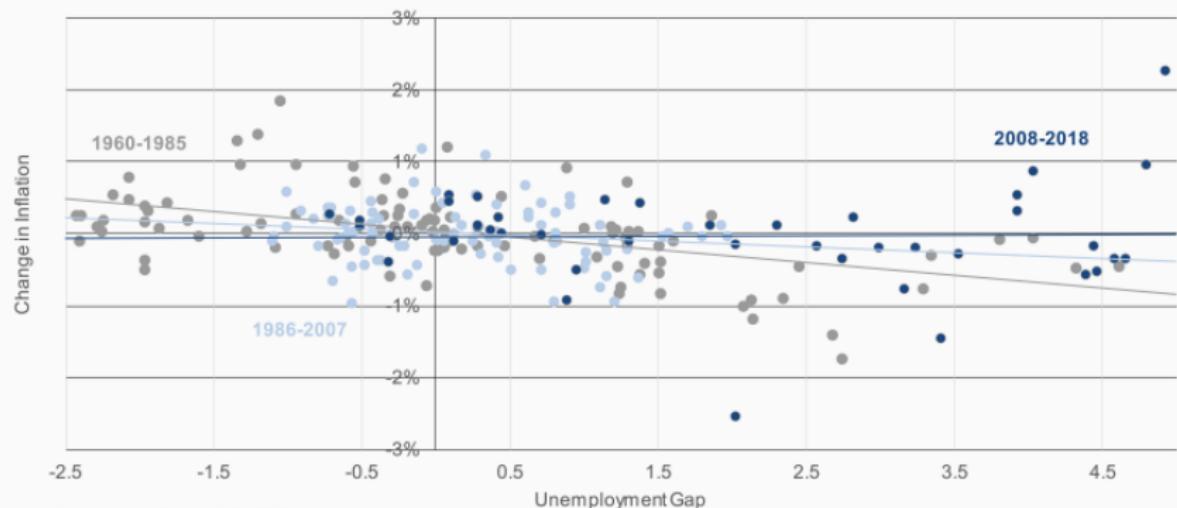
State and year fixed effects have been removed from the unemployment and wage inflation data
Source: Researchers' calculations using data from the Bureau of Labor Statistics

<https://www.nber.org/digest/sep19/phillips-curve-still-useful-guide-policymakers>



The Flattened Phillips Curve

The Phillips Curve slope has gradually flattened over time.



Source: Haver Analytics, CBO, BEA.

Note: Change in inflation is the quarterly difference in year-over-year PCE Inflation.

Unemployment Gap is the difference between unemployment and the CBO's estimate of the long-run NAIRU.

BROOKINGS 

Since 2000, the correlation between unemployment and changes in inflation is nearly zero. On average, inflation has barely moved as unemployment rose and fell. This is puzzling, to say the least. The Fed needs to know whether the Phillips curve has died or has just taken an extended vacation (Alan Blinder, 2018).

<https://www.brookings.edu/blog/up-front/2018/08/21/the-hutchins-center-explains-the-phillips-curve/>

Outline

1 Business Cycle Fluctuations

2 Inflation & Unemployment

3 Output & Unemployment

4 The AD-AS Model

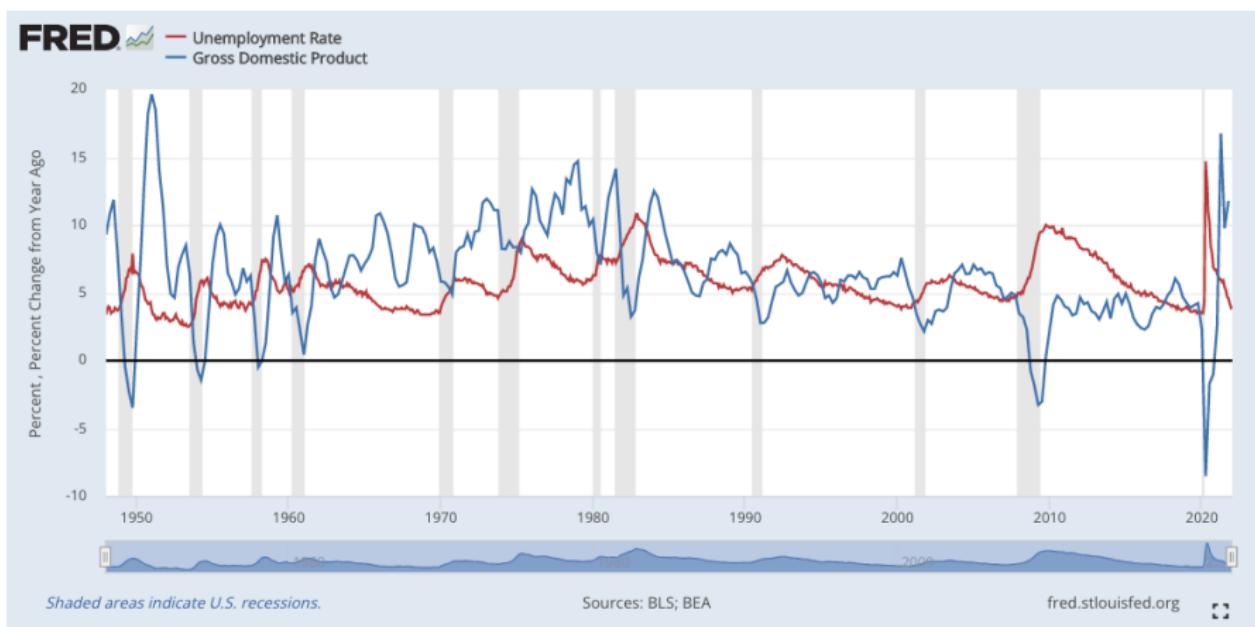


Unemployment Rate and Inflation Rate



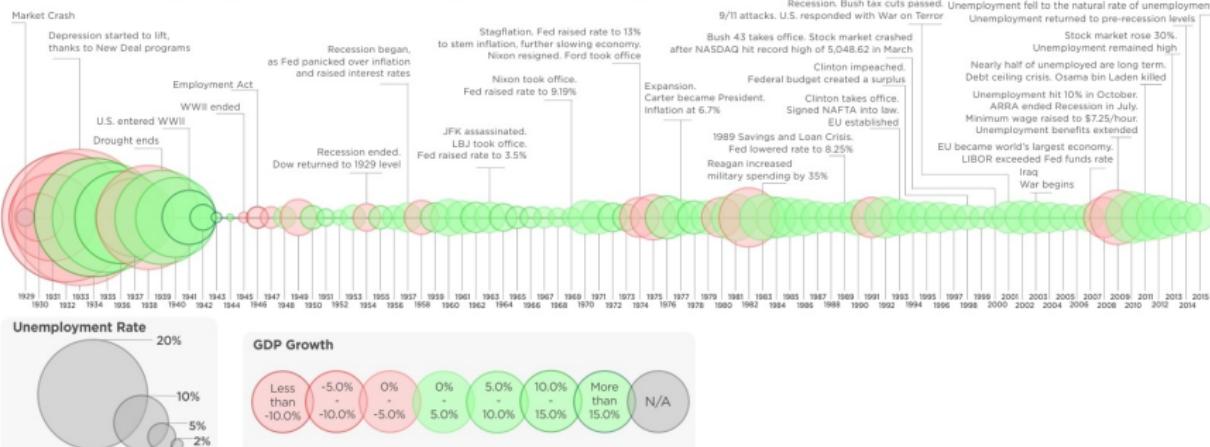


Unemployment Rate and GDP Growth Rate





U.S. Unemployment Rate by Year Compared to Growth and Major Events



Sources & Article:

<https://howmuch.net/articles/unemployment-compared-to-gdp-since-1929>

BLS, Unemployment Rate by Year

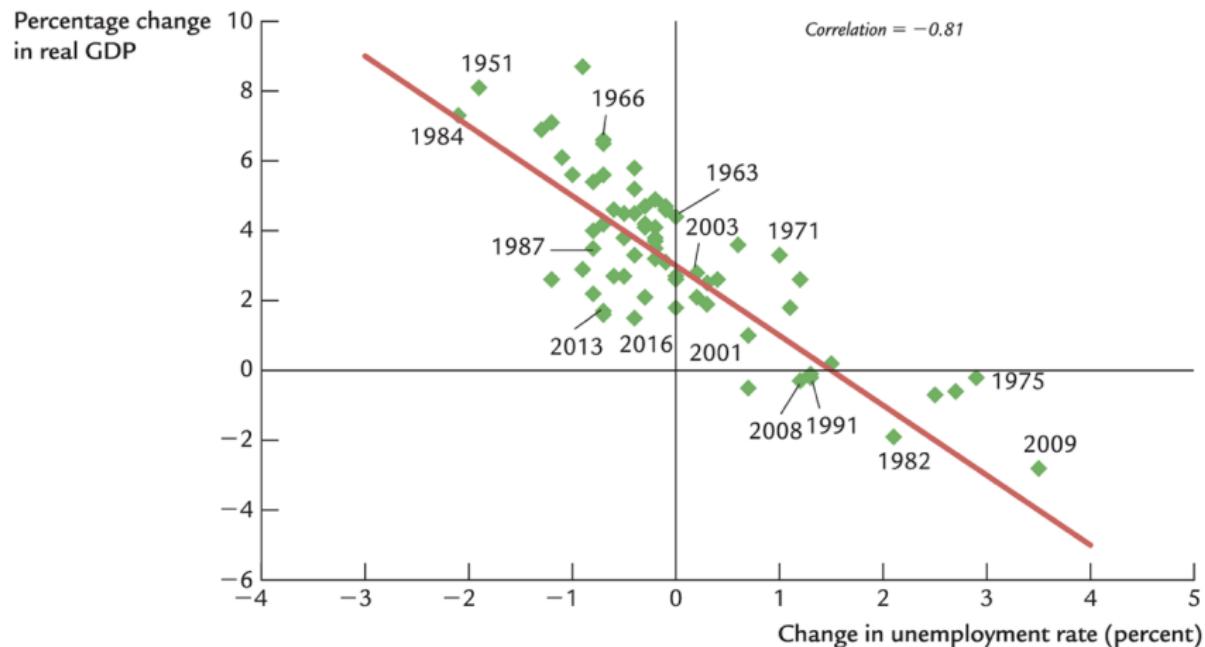
BEA, National Income and Product Accounts Tables

howmuch net

Like an economic stroboscope, the graph pulsates and changes color to indicate the state of the nation. Larger circles indicate higher levels of unemployment, and vice versa. Green means GDP growth, more so if darker green. Red indicates crisis moments, when the Gross Domestic Product contracts—by more, as the shade of red darkens.

<https://howmuch.net/articles/unemployment-compared-to-gdp-since-1929>

Unemployment Rate and GDP Growth Rate



Mankiw, *Macroeconomics*, 10e, © 2019 Worth Publishers



An Introduction to Okun's Law

- Arthur Okun (1962) described the consistent relationship between changes in output and changes in unemployment that has become a standard tool for monetary policymakers and forecasters.
- The statistical relationship he uncovered has come to be known as Okun's law. A simple form of this popular rule of thumb says that a 2% drop in inflation-adjusted GDP growth relative to trend is associated with about a 1% increase in the unemployment rate.
- Because of the historical stability of Okun's law in the United States, economists often use the unemployment rate to calibrate their economic forecasts. In particular, they project that GDP growth and changes in the unemployment rate will move together at this two-to-one ratio in the future as they have on average in the past.
- While this is a sensible approach, it appeared to break down during the Great Recession and ensuing recovery.

Source: Wen and Chen (2012). (w)



Okun's Law: Logic and Intuition

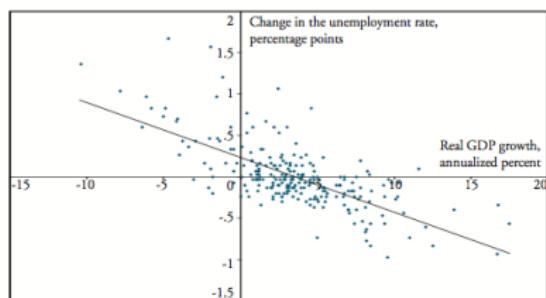
- The second version of the Okun's law applies to the empirical relationship between changes in aggregate output relative to its potential trend and changes in the unemployment rate relative to its natural rate.
- In other words, this law is intended to tell us how much of a country's gross domestic product may be lost when the unemployment rate is above its natural rate.
- The logic behind Okun's law is simple. Output depends on the amount of labor used in the production process, so there is a positive relationship between output and employment. Total employment equals the labor force minus the unemployed, so there is a negative relationship between output and unemployment (conditional on the labor force).
- Hence, Okun's law can also be measured as a positive relationship between changes in output and changes in employment.

Source: Daly et. al. (2014) Interpreting Deviations from Okun's Law. FRBSF Economic Letters. (w)

Okun's Law Estimation, 1948-2007

Chart 1

THE DIFFERENCE VERSION OF OKUN'S LAW,
QUARTERLY DATA



Note: Data are from the Bureau of Economic Analysis and Bureau of Labor Statistics, from the second quarter of 1948 through the second quarter of 2007.

Chart 1 is a scatter plot of the quarterly data for the period between the second quarter of 1948 and the second quarter of 2007. Real output growth on the horizontal axis is measured as the quarterly percentage change in real GDP. Changes in the unemployment rate are the difference between average rates for the three months in each quarter. The black regression line shows the estimated difference version of Okun's law:

$$(UR_t - UR_{t-1}) = -0.07 \times (RGDP_t - RGDP_{t-1})/RGDP_{t-1} + 0.23$$

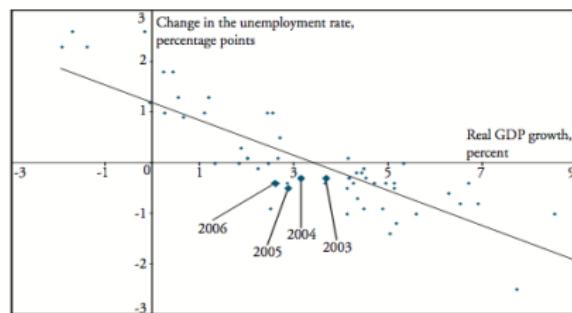
Chart 2 shows a scatter plot of the annual data for real output growth and the change in unemployment from 1949 to 2006.12. The black line in the figure is the estimated regression equation with annual data:

$$(UR_t - UR_{t-1}) = -0.35 \times (RGDP_t - RGDP_{t-1})/RGDP_{t-1} + 1.2$$

Source: Edward S. Knotek (2007) How Useful is Okun's Law? Federal Reserve Bank of Kansas City.

Chart 2

THE DIFFERENCE VERSION OF OKUN'S LAW,
ANNUAL DATA



Note: Data are from the Bureau of Economic Analysis and Bureau of Labor Statistics, from 1949 through 2006.



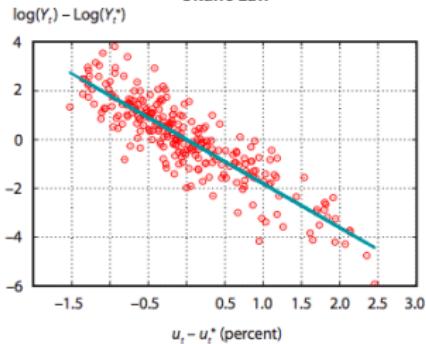
Okun's Law: Estimation and Stability

- If Okun's law is to be useful as an indicator of the status of the economy for policy purposes, it needs to be stable and statistically significant. Achieving this requires us to adopt a time-varying trend for the variables involved in estimating Okun's law.
- When a time-varying trend is used as the long-run trend (as in the top-left panel), Okun's law appears to be very stable and significant over time, even if the estimation is based only on more recent samples including the financial crisis period.
- Suppose we define the long-run natural rate of unemployment as the average of the actual rate of employment. The lower-right panel in the chart shows the alternative Okun's law based on this definition. The slope is now much less steep (-0.57) and much less significant since the dots no longer form a clear pattern with high concentrations. In fact, Okun's law almost disappears.

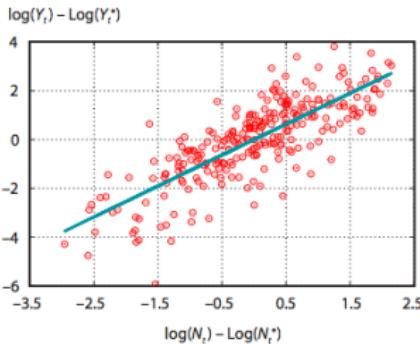
Source: Wen and Chen (2012). (w)

Okun's Law: Estimation and Stability

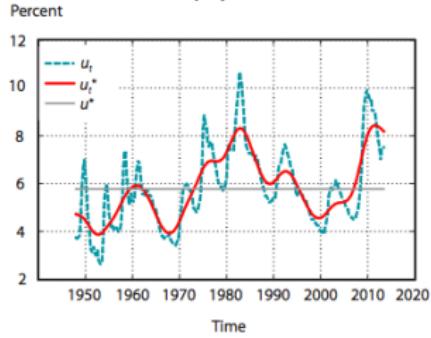
Okun's Law



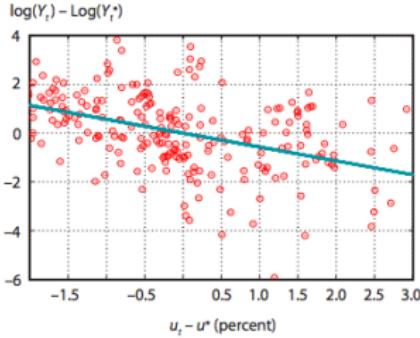
Production Function



Unemployment Rate



Okun's Law (alternative)



NOTE: u_t , Actual unemployment rate; u_t^* , HP trend; u^* , the mean of u_t ; N_t , actual employment level; N_t^* , employment HP trend.



Actual Output and Potential Output

- Gross Domestic Product is a measure of the value of all of the goods and services produced in the economy in a given period. It is calculated by the federal government's Bureau of Economic Analysis each quarter.
- Potential GDP is a theoretical construct, an estimate of the value of the output that the economy would have produced if labor and capital had been employed at their maximum sustainable rates—that is, rates that are consistent with steady growth and stable inflation.
- In general, the economy operates close to potential, but deep recessions are notable exceptions to the trend. In these episodes, GDP can lag behind potential, sometimes persistently.
- Recessions such as the Great Recession of 2007-2009 and the COVID-19 recession feature GDP well below potential.

Source: Powell et. al. (2021) What is potential GDP, and why is it so controversial right now? Brookings. (w)



Potential Output and Output Gap

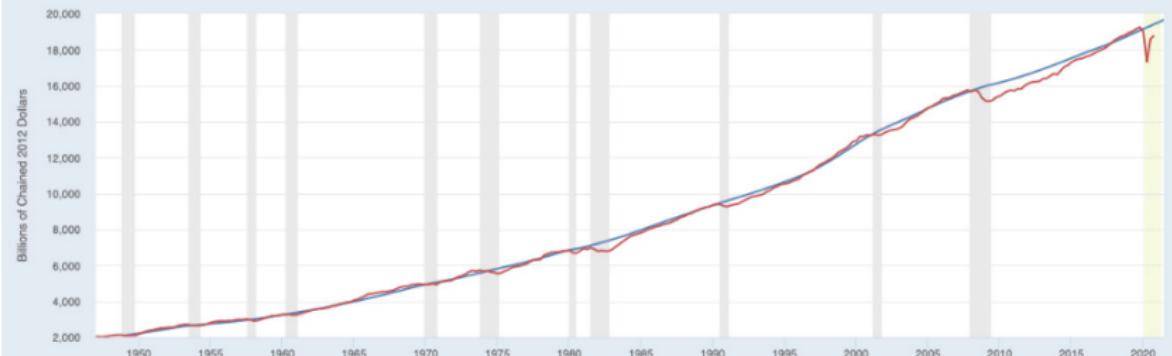
- Potential output is an estimate of what an economy could feasibly produce when it fully employs its available economic resources. The Congressional Budget Office (CBO) estimates potential output by estimating potential GDP, which it describes as "the economy's maximum sustainable output."
- Potential output (estimated as real potential GDP) serves as an important benchmark level against which actual output (measured as real GDP) can be compared with at any given time.
- In short, economists use potential output to represent a benchmark level of output against which actual output can be compared.
- The difference between actual output and potential output is called the output gap, which is expressed as a percentage of potential output.
- The short-run fluctuations of actual output around potential output determine the business cycle stages.

Source: Scott Wolla (2021) "Minding the Output Gap: What Is Potential GDP and Why Does It Matter?"
Page One Economics. Federal Reserve Bank of St. Louis. (w)



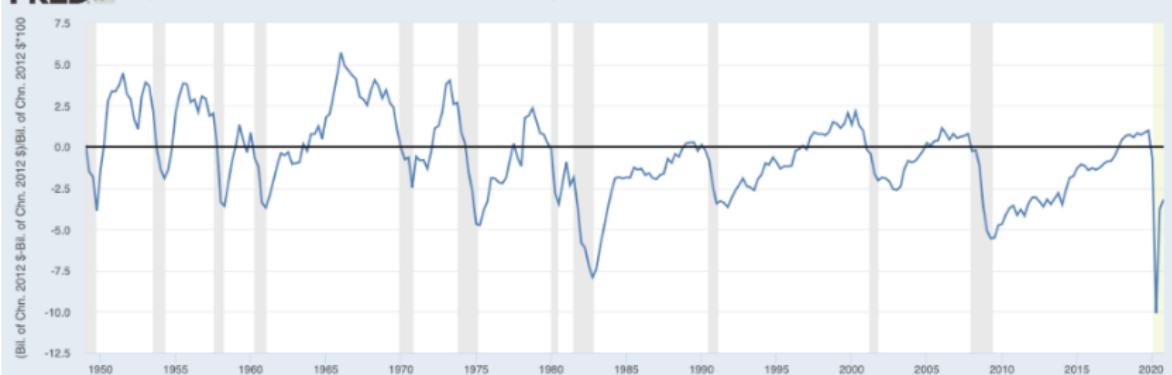
FRED

Real Potential Gross Domestic Product
Real Gross Domestic Product



FRED

(Real Gross Domestic Product-Real Potential Gross Domestic Product)/Real Potential Gross Domestic Product*100



Sources: BEA; CBO

fred.stlouisfed.org



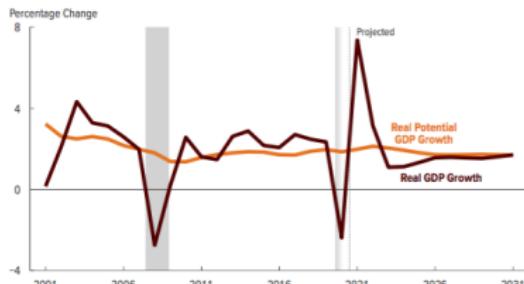
Potential Output: Determinants

- Potential GDP depends on the size of the labor force and the pace of productivity growth (output per hour of work), which itself is dependent on the amount of capital investment.
- That is, potential GDP growth can accelerate if more people enter the labor force, more capital is injected into the economy, or the existing labor force and capital stock become more productive.
- The underlying components of potential GDP are not directly measurable. This makes the process of estimating it inherently difficult and reliant on model-based predictions.
- Different approaches to measuring potential GDP yield different estimates of how fast the economy can grow without leading to inflationary pressure. Therefore, estimates of the output gap should not be taken as the sole indicator of the condition of the economy or as a foolproof indicator of impending inflation pressures.

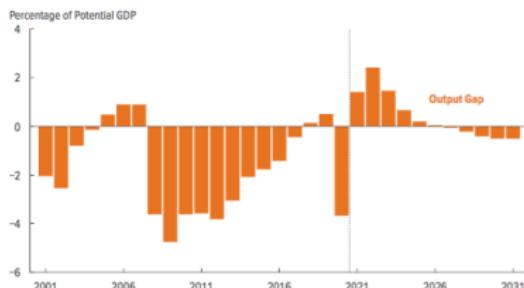
Source: Powell et. al. (2021) What is potential GDP, and why is it so controversial right now? Brookings. (w)



Real GDP Growth and Potential GDP Growth



In CBO's projections, the annual growth of real (inflation-adjusted) GDP exceeds that of real potential GDP until 2023.



The gap between real GDP and real potential GDP (that is, the output gap) rises above 2 percent by 2022 before moving back toward its historical average.

Data source: Congressional Budget Office. See www.cbo.gov/publication/57263#data.

Real values are nominal values that have been adjusted to remove the effects of changes in prices. Source: CBO (2021)

Potential GDP is CBO's estimate of the maximum sustainable output of the economy. Growth of real GDP and of real potential GDP is measured from the fourth quarter of one calendar year to the fourth quarter of the next. The output gap is the difference between GDP and potential GDP, expressed as a percentage of potential GDP. A positive value indicates that GDP exceeds potential GDP; a negative value indicates that GDP falls short of potential GDP. Values for the output gap are for the fourth quarter of each year.

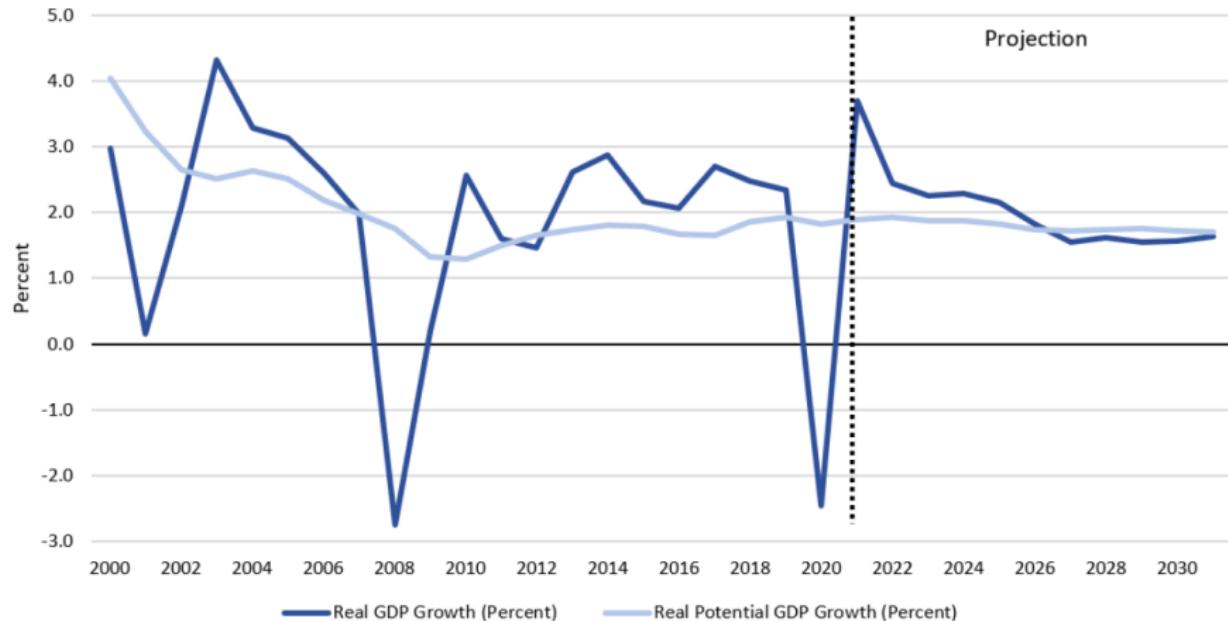


Output Gap: Policy Concerns

- When an economy is functioning below potential, it has a negative output gap and is underutilizing its resources. In business cycle terms, this usually means that the economy is in a recession.
- That is, many offices and factories might be closed or running below full capacity and the unemployment rate is most likely on the rise, indicating that the economy is below full employment.
- A positive output gap (actual output higher than potential output) occurs when the economy is "overachieving." While this might be feasible in the short run, it is rare and, ultimately, unsustainable over time.
- In business cycle terms this usually means that the economy is expanding. When this occurs, the unemployment rate is likely low and decreasing.
- Potential output is important because policymakers consider the output gap when determining whether the economy needs more or less stimulus.

Source: Scott Wolla (2021) "Minding the Output Gap: What Is Potential GDP and Why Does It Matter?"
Page One Economics. Federal Reserve Bank of St. Louis. (w)

Real and Potential GDP Growth Rates



Source: Congressional Budget Office, An Overview of the Economic Outlook: 2021 to 2031

Congressional Budget Office (CBO) estimates of potential GDP growth fell in the early 2000s as labor force growth declined because of factors including population aging and slowing productivity growth. Their estimate of potential has been relatively stable since. Actual GDP growth, on the other hand, shows large cyclical patterns: falling sharply during recessions and increasing more modestly above potential during expansions.





Why does Potential Output Matter?

- Over time, an economy can grow without unwelcome inflation only as fast as its potential GDP grows. Think of this as the safe speed limit for economic growth.
- Too much government spending can produce a surge in demand that exceeds the economy's capacity to produce and triggers inflation.
- Understanding potential GDP is important to Federal Reserve policymakers as they decide when and how to change interest rates or use their other tools to deliver on their mandate of price stability and maximum sustainable employment. Having good estimates of potential output allows them to calibrate their choices based, in part, on projections of the output gap.
- Similarly, Congress and the President will look to the output gap to contemplate whether the economy needs fiscal stimulus or restraint.

Powell et. al. (2021) What is potential GDP, and why is it so controversial right now? Brookings. (w)



Inflation Dynamics and Economic Slack

- Understanding how inflation responds to economic conditions is important for monetary policymakers. The main framework to explain inflation dynamics, known as the Phillips curve, links inflation to the amount of unused production capacity in the economy.
- The underlying intuition is that, as the economy heats up, demand can exceed capacity, causing upward pressure on prices and thus higher inflation. In other words, inflation rises as the amount of economic "slack" falls.
- Different ways of measuring the economy's unused capacity, or slack, can result in varying inflation forecasts. Estimates suggest that direct measures of labor market tightness, such as the ratio of job vacancies to unemployment or the rate of employee job switching, provide more accurate forecasts than commonly used measures, such as the unemployment rate or the output gap.

Source: Regis Barnichon and Adam Hale Shapiro (2022) What's the Best Measure of Economic Slack? FRBSF Economic Letters. (w)



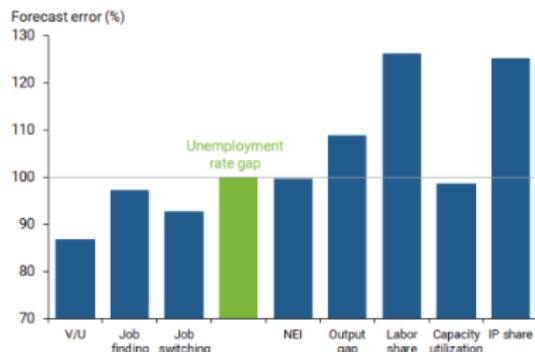
Labor Market Tightness and Economic Slack

- Although the concept of slack may seem straightforward, finding the best proxy to measure it is notoriously difficult.
- A drawback of using the unemployment rate to measure slack is that it ignores workers outside of the labor force. Research shows that these workers tend to return to the labor market at certain phases of the business cycle. If nonparticipants return in strong recovery period, they could reduce upward wage and price pressures by increasing labor supply.
- Another potential drawback of the unemployment rate as a measure of slack is that it does not directly account for the cost of labor. If businesses base their pricing decisions on their costs of expanding production, then the marginal costs of labor and inputs could capture that inflationary pressure.
- Direct measures of the degree of labor market tightness, such as the vacancy-to-unemployment ratio and job-switching rates, provide superior inflation forecasts for prices and wages.

Source: Barnichon and Shapiro (2022) (w)

Forecasting Inflation: Measures of Economic Slack

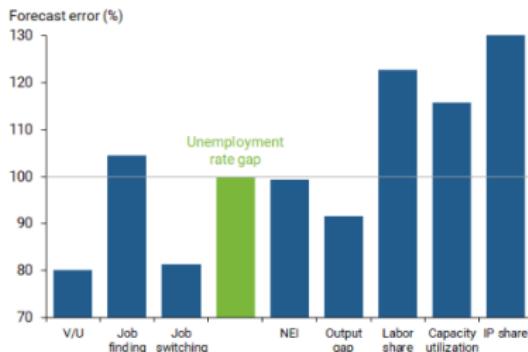
Performance of slack measure forecasts: Core PCE



Note: Forecast errors measured relative to performance of unemployment.

Source: Authors' calculations; see text for data sources and descriptions.

Performance of slack measure forecasts: Wage inflation



Note: Forecast errors measured relative to performance of unemployment.

Source: Authors' calculations; see text for data sources and descriptions.

Figures plot the mean-squared forecast errors of the different slack measures in predicting core personal consumption expenditures (PCE) price inflation one year ahead over 2005-2021. A smaller error indicates that the predicted measures of inflation are closer to the actual rates of inflation and hence shows better forecasting performance. The forecast errors are expressed in percentage terms relative to the baseline performance of the unemployment rate (green bar); thus, they can be interpreted as indicating how much better or worse they perform than the unemployment rate. Source: Barnichon and Shapiro (2022)



Outline

1 Business Cycle Fluctuations

2 Inflation & Unemployment

3 Output & Unemployment

4 The AD-AS Model

AD-AS Model: Function and Assumption

- All societies experience short-run economic fluctuations around long-run trends. These fluctuations are irregular and largely unpredictable. When recessions occur, real GDP and other measures of income, spending, and production fall, while unemployment rises.
- To analyze the economy's short-run fluctuations, Economists develop the model of aggregate demand and aggregate supply (AD-AS). Students will learn about some of the sources for shifts in the AD curve and the AS curve and how these shifts can cause recessions. This section also introduces actions policymakers might undertake to offset recessions.
- Classical economic theory is based on the assumption that nominal variables such as the money supply and the price level do not influence real variables such as output and employment. Most economists believe that this assumption is accurate in the long run but not in the short run.
- According to the AD-AS model, the output of goods and services and the overall level of prices adjust to balance AD and AS.

Source: N. G. Mankiw (2021) CH33, Principles of Economics, 9e, Cengage.



Aggregate Demand Theory: $AD=C+I+G+NX$

Aggregate-demand curve shows the quantity of goods and services that households, firms, and the government want to buy at each price level.

According to Keynes' theory, aggregate demand in the economy is composed of consumption, investment, government purchases, and net exports. The aggregate-demand curve slopes downward for three reasons.

- ① The first is the wealth effect: A lower price level raises the real value of households' money holdings, which stimulates consumer spending.
- ② The second is the interest-rate effect: A lower price level reduces the quantity of money households demand; as households try to convert money into interest-bearing assets, interest rates fall, which stimulates investment spending.
- ③ The third is the exchange-rate effect: As a lower price level reduces interest rates, the dollar depreciates in the market for foreign-currency exchange, which stimulates net exports.

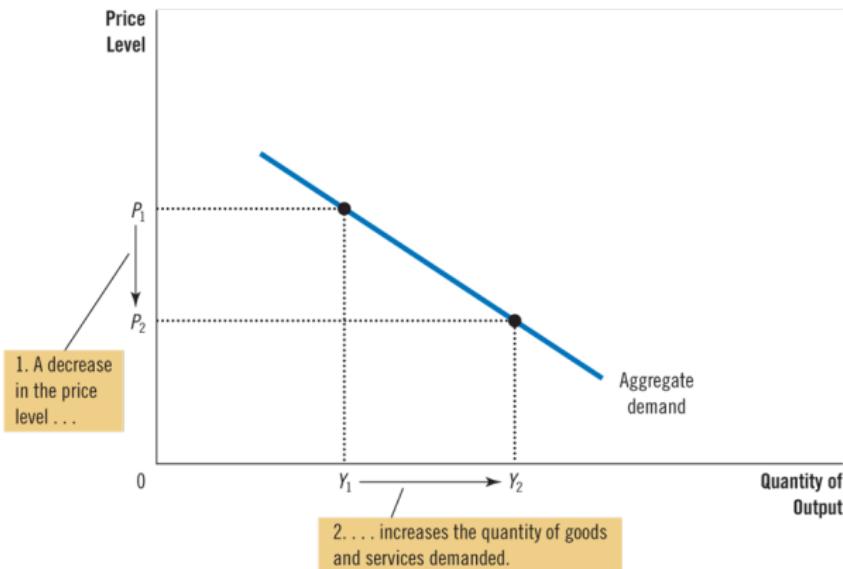
Source: N. G. Mankiw (2021) CH33, Principles of Economics, 9e, Cengage.

The Aggregate Demand Curve

FIGURE 3

The Aggregate-Demand Curve

A fall in the price level from P_1 to P_2 increases the quantity of goods and services demanded from Y_1 to Y_2 . There are three reasons for this negative relationship. As the price level falls, real wealth rises, interest rates fall, and the exchange rate depreciates. These effects stimulate spending on consumption, investment, and net exports. Increased spending on any or all of these components of output means a larger quantity of goods and services demanded.



Any event or policy that raises consumption, investment, government purchases, or net exports at a given price level increases aggregate demand. Any event or policy that reduces consumption, investment, government purchases, or net exports at a given price level decreases aggregate demand. $AD \Rightarrow \text{Total Expenditure}$.

Source: N. G. Mankiw (2021) CH33, Principles of Economics, 9e, Cengage.

Aggregate Supply in the Long Run

Aggregate-supply curve shows the quantity of goods and services that firms choose to produce and sell at each price level. The relationship between the price level and the quantity of goods and services supplied depends on the time horizon being examined. AS \Rightarrow Total Production.

- In the long run, production of goods and services depends on its supplies of resources along with the available production technology.
- Because the price level does not affect these determinants of output in the long run, the long-run aggregate-supply curve is vertical.
- The vertical long-run aggregate-supply curve is a graphical representation of the classical dichotomy and monetary neutrality.

Classical economic theory is based on the assumption that nominal variables such as the money supply and the price level do not influence real variables such as output and employment. Most economists believe that this assumption is accurate in the long run but not in the short run.

Source: N. G. Mankiw (2021) CH33, Principles of Economics, 9e, Cengage.

The Long-Run Aggregate Supply

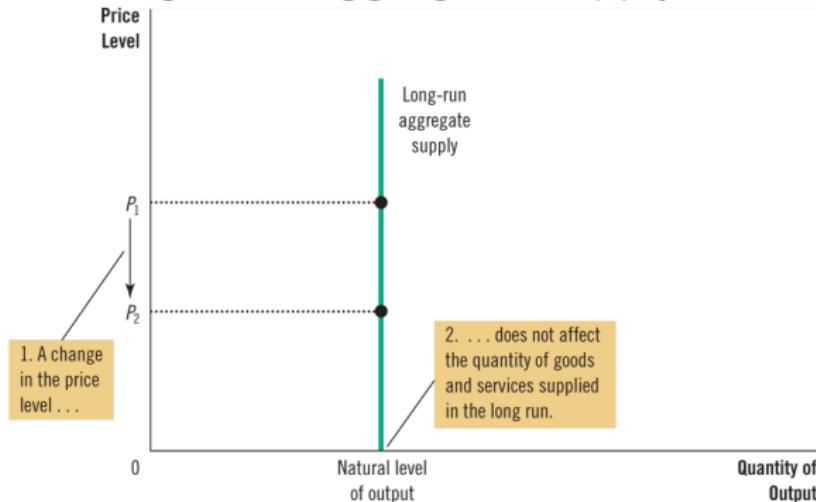


FIGURE 4

The Long-Run Aggregate-Supply Curve

In the long run, the quantity of output supplied depends on the economy's quantities of labor, capital, and natural resources and on the technology for turning these inputs into output. Because the quantity supplied does not depend on the overall price level, the long-run aggregate-supply curve is vertical at the natural level of output.

The long-run aggregate-supply curve is vertical. In the long run, the quantity of goods and services supplied depends on the economy's labor, capital, natural resources, and technology, but not on the overall level of prices. The long-run production function is independent of the price level in the economy: $Y_L = F(K, L)$. The LRAS is vertical because of the classical assumption of money neutrality.

Source: N. G. Mankiw (2021) CH33, Principles of Economics, 9e, Cengage.



The Long-Run Aggregate Supply: Factors

The long-run aggregate-supply curve is vertical. In the long run, the quantity of goods and services supplied depends on the economy's labor, capital, natural resources, and technology, but not on the overall level of prices.

- ① Shifts arising from changes in labor
- ② Shifts arising from changes in capital
- ③ Shifts arising from changes in natural resources
- ④ Shifts arising from changes in technological knowledge

The long-run aggregate supply curve occurs at the natural level of output: the production of goods and services that an economy achieves in the long run when unemployment is at its natural rate. Any change in the economy that alters the natural level of output shifts the long-run aggregate-supply curve. The position of the aggregate-supply curve occurs at an output level sometimes referred to as potential output or full-employment output.

Source: N. G. Mankiw (2021) CH33, Principles of Economics, 9e, Cengage.



Long-Run Growth and Inflation

The AD-AS equilibrium model can be applied to the explanation of economic growth and inflation in the long term.

- Two important forces that govern the economy in the long run are technological progress and monetary policy. Technological progress shifts the long-run aggregate-supply curve to the right. The central bank increases the money supply over time, which raises aggregate demand.
- The government also invests in public infrastructure, education, health, and business environment.
- The combined result is growth in output and continuing inflation (increases in the price level).
- Although the purpose of developing the model of aggregate demand and aggregate supply is to describe short-run fluctuations, these short-run fluctuations should be considered deviations from the long-run trends of output growth and inflation.

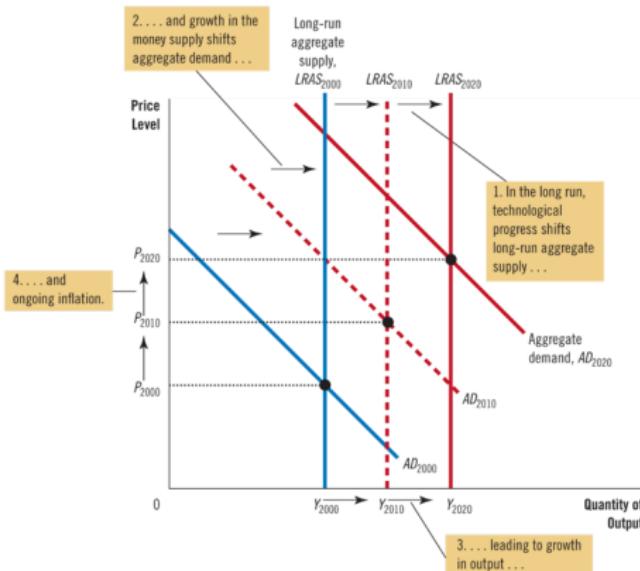
Source: N. G. Mankiw (2021) CH33, Principles of Economics, 9e, Cengage.

Long-Run Growth and Inflation: Model

FIGURE 5

**Long-Run Growth and Inflation
in the Model of Aggregate
Demand and Aggregate Supply**

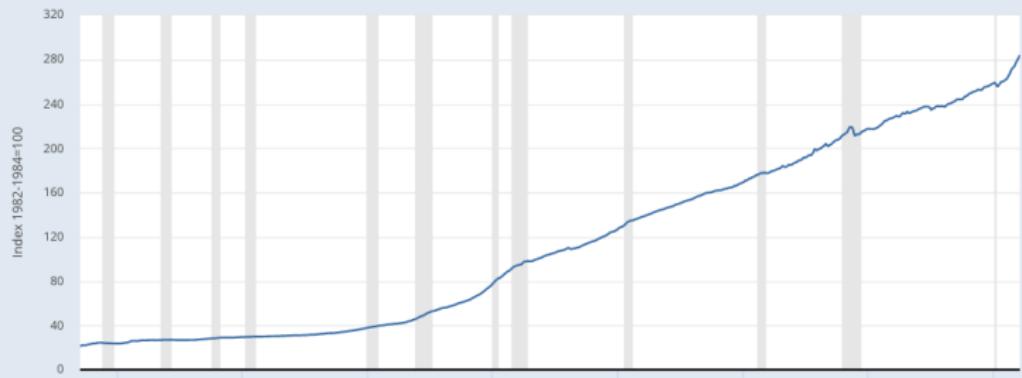
As the economy becomes better able to produce goods and services over time, primarily because of technological progress, the long-run aggregate-supply curve shifts to the right. At the same time, as the Fed increases the money supply, the aggregate-demand curve also shifts to the right. In this figure, output grows from Y_{2000} to Y_{2010} and then to Y_{2020} , and the price level rises from P_{2000} to P_{2010} and then to P_{2020} . Thus, the model of aggregate demand and aggregate supply offers a new way to describe the classical analysis of growth and inflation.



Source: N. G. Mankiw (2021) CH33, Principles of Economics, 9e, Cengage.

**FRED**

Consumer Price Index for All Urban Consumers: All Items in U.S. City Average

**FRED**

Real Gross Domestic Product



Shaded areas indicate U.S. recessions.

Source: U.S. Bureau of Economic Analysis

fred.stlouisfed.org



Short-Run Aggregate Supply Theories

Three theories have been proposed to explain the upward slope of the short-run AS curve, implying that output deviates from its natural level when the actual price level deviates from the price level that people expected.

- ① Sticky-wage theory, an unexpected fall in the price level temporarily raises real wages, which induces firms to reduce employment and production.
- ② Sticky-price theory, an unexpected fall in the price level leaves some firms with prices that are temporarily too high, which reduces their sales and causes them to cut back production.
- ③ Misperceptions theory, an unexpected fall in the price level leads suppliers to mistakenly believe that their relative prices have fallen, which induces them to reduce production.

The effects of the change in the price level will be temporary. Eventually people will adjust their price level expectations and output will return to its natural level; thus, the aggregate-supply curve will be vertical in the long run.

Source: N. G. Mankiw (2021) CH33, Principles of Economics, 9e, Cengage.

Short-Run Aggregate Supply Curve: Movements

Why the Short-Run Aggregate-Supply Curve Might Shift?

- ① Events that shift the long-run aggregate-supply curve will shift the short-run aggregate-supply curve as well.
- ② Expectations of the price level will affect the position of the short-run aggregate-supply curve even though it has no effect on the long-run aggregate-supply curve.
- ③ An increase in the expected price level decreases the quantity of goods and services supplied and shifts the short-run aggregate-supply curve to the left. A decrease in the expected price level increases the quantity of goods and services supplied and shifts the short-run aggregate-supply curve to the right.

Source: N. G. Mankiw (2021) CH33, Principles of Economics, 9e, Cengage.

Short-Run Aggregate Supply Curve

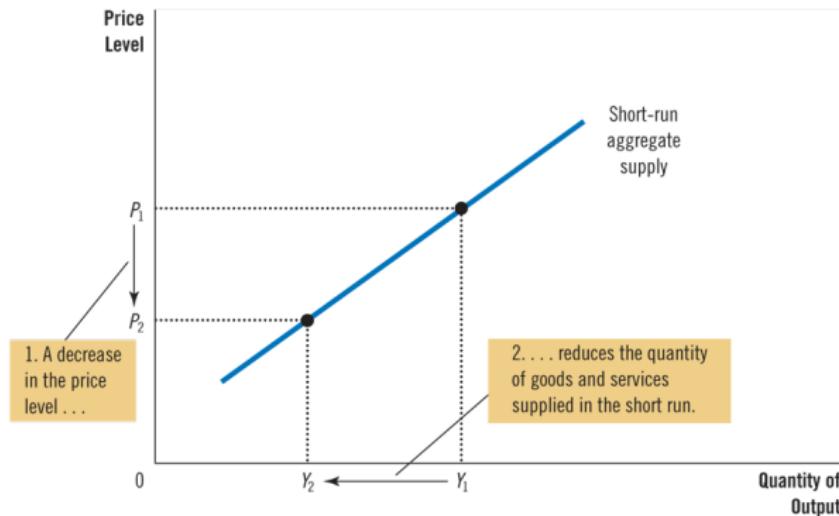


FIGURE 6

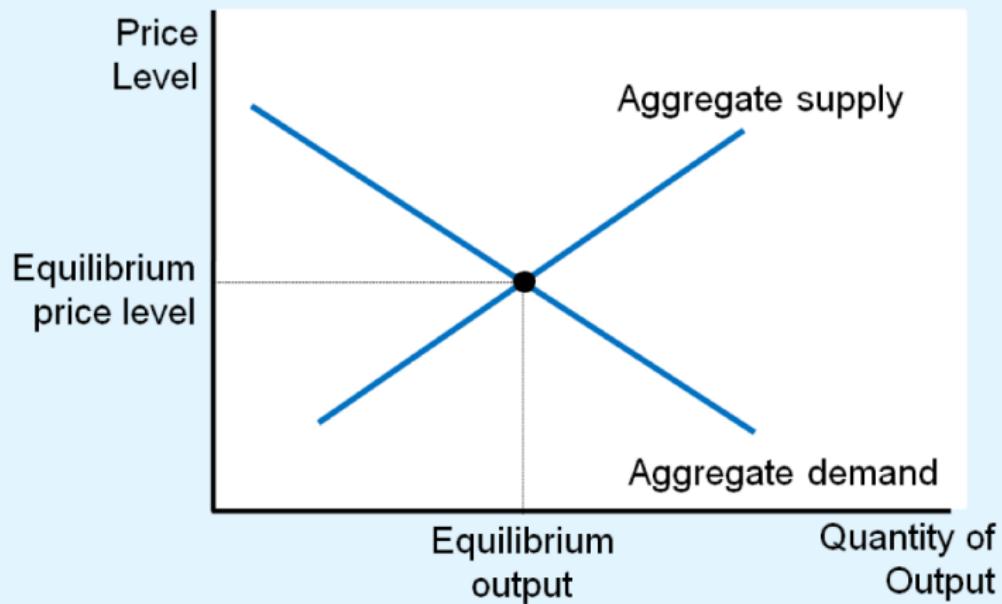
The Short-Run Aggregate-Supply Curve

In the short run, a fall in the price level from P_1 to P_2 reduces the quantity of output supplied from Y_1 to Y_2 . This positive relationship could be due to sticky wages, sticky prices, or misperceptions. Over time, wages, prices, and perceptions adjust, so this positive relationship is only temporary.

Events that alter the economy's ability to produce output, such as changes in labor, capital, natural resources, or technology, shift the short-run aggregate-supply curve (and may shift the long-run aggregate-supply curve as well). In addition, the position of the short-run aggregate-supply curve depends on the expected price level.

Source: N. G. Mankiw (2021) CH33, Principles of Economics, 9e, Cengage.

Aggregate Demand and Aggregate Supply



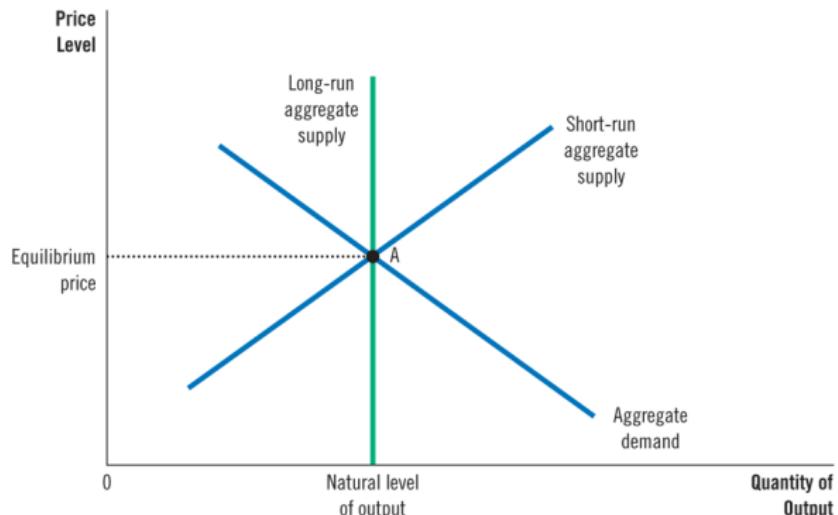
Economists use the model of aggregate demand and aggregate supply to analyze economic fluctuations. On the vertical axis is the overall level of prices. On the horizontal axis is the economy's total output of goods and services. Output and the price level adjust to the point at which the AS and AD curves intersect.
Source: N. G. Mankiw (2021) CH33, Principles of Economics, 9e, Cengage.

The Long-Run AD-AS Equilibrium

FIGURE 7

The Long-Run Equilibrium

The long-run equilibrium of the economy is found where the aggregate-demand curve crosses the long-run aggregate-supply curve (point A). When the economy reaches this long-run equilibrium, the expected price level will have adjusted to equal the actual price level. As a result, the short-run aggregate-supply curve crosses this point as well.



Long-run equilibrium is found where the aggregate-demand curve intersects with the long-run aggregate-supply curve. Output is at its natural level. Also at this point, perceptions, wages, and prices have all adjusted so that the short-run aggregate supply curve intersects at this point as well.

Source: N. G. Mankiw (2021) CH33, Principles of Economics, 9e, Cengage.

AD-AS Model: Application Steps

Four Steps for Analyzing Macroeconomic Fluctuations:

- ① Decide whether the event shifts the aggregate-demand curve or the aggregate-supply curve (or perhaps both).
- ② Decide the direction in which the curve shifts.
- ③ Use the diagram of aggregate demand and aggregate supply to determine the impact on output and the price level in the short run.
- ④ Use the diagram of aggregate demand and aggregate supply to analyze how the economy moves from its new short-run equilibrium to its new long-run equilibrium.

The long-run AS curve provides an "anchor" of the equilibrium output. In the short run, economic fluctuations are explained by the AD or/and AS factors or/and shocks. Deviation of short run equilibrium from the long run output level constitutes economic fluctuations.

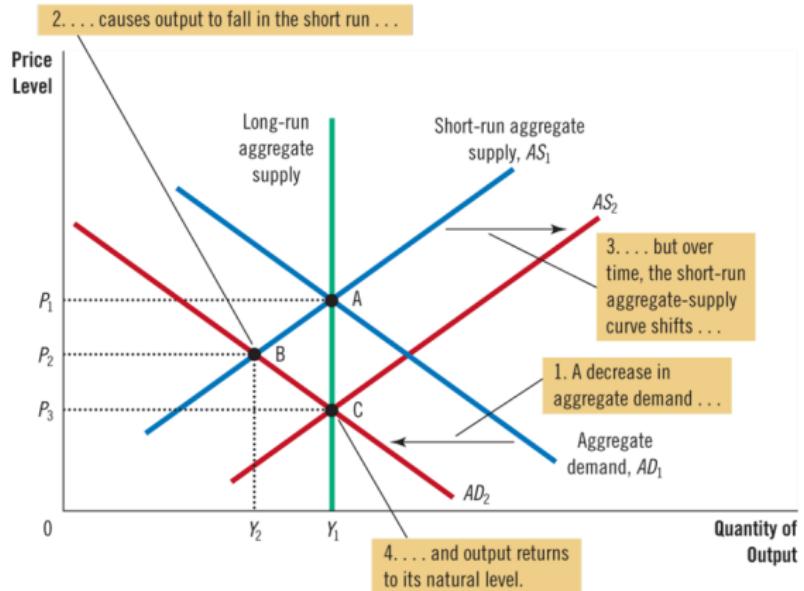
Source: N. G. Mankiw (2021) CH33, Principles of Economics, 9e, Cengage.

Negative Aggregate Demand Shocks

FIGURE 8

A Contraction in Aggregate Demand

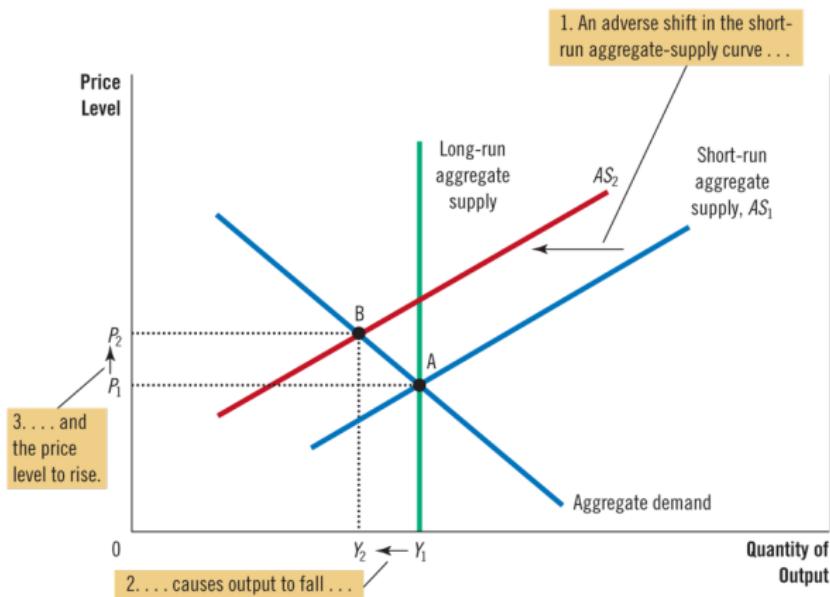
A fall in aggregate demand is represented by a leftward shift in the aggregate-demand curve from AD_1 to AD_2 . In the short run, the economy moves from point A to point B. Output falls from Y_1 to Y_2 , and the price level falls from P_1 to P_2 . Over time, as the expected price level adjusts, the short-run aggregate-supply curve shifts to the right from AS_1 to AS_2 , and the economy reaches point C, where the new aggregate-demand curve crosses the long-run aggregate-supply curve. In the long run, the price level falls to P_3 , and output returns to its natural level, Y_1 .



One possible cause of economic fluctuations is a shift in aggregate demand. When the aggregate-demand curve shifts to the left, output and prices fall in the short run. Over time, as a change in the expected price level causes perceptions, wages, and prices to adjust, the short-run aggregate supply curve shifts to the right. This shift returns the economy to its natural level of output at a new, lower price level.

Source: N. G. Mankiw (2021) CH33, Principles of Economics, 9e, Cengage.

Negative Aggregate Supply Shocks

**FIGURE 10**

An Adverse Shift in Aggregate Supply

When some event increases firms' costs, the short-run aggregate-supply curve shifts to the left from AS_1 to AS_2 . The economy moves from point A to point B. The result is stagflation: Output falls from Y_1 to Y_2 , and the price level rises from P_1 to P_2 .

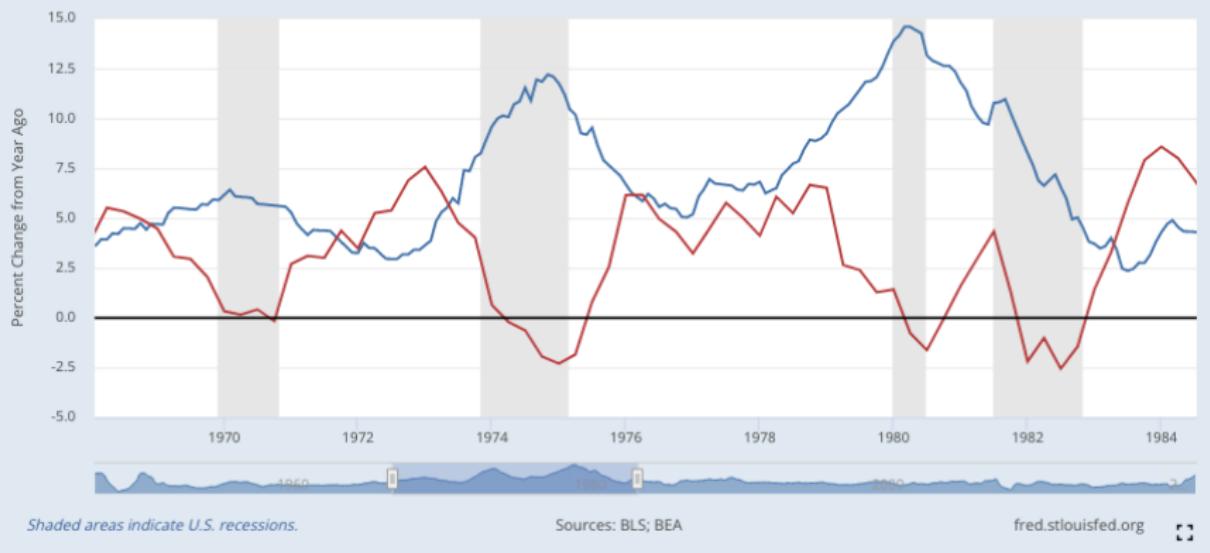
A second possible cause of economic fluctuations is a shift in aggregate supply. When the short-run aggregate supply curve shifts to the left, the effect is falling output and rising prices—a combination called stagflation. Over time, as perceptions, wages, and prices adjust, the short-run aggregate-supply curve shifts back to the right, returning the price level and output back to their original levels.

Source: N. G. Mankiw (2021) CH33, Principles of Economics, 9e, Cengage.

Negative Oil-Shock and Stagflation, 1965-1982

FRED 

— Consumer Price Index for All Urban Consumers: All Items in U.S. City Average
— Real Gross Domestic Product



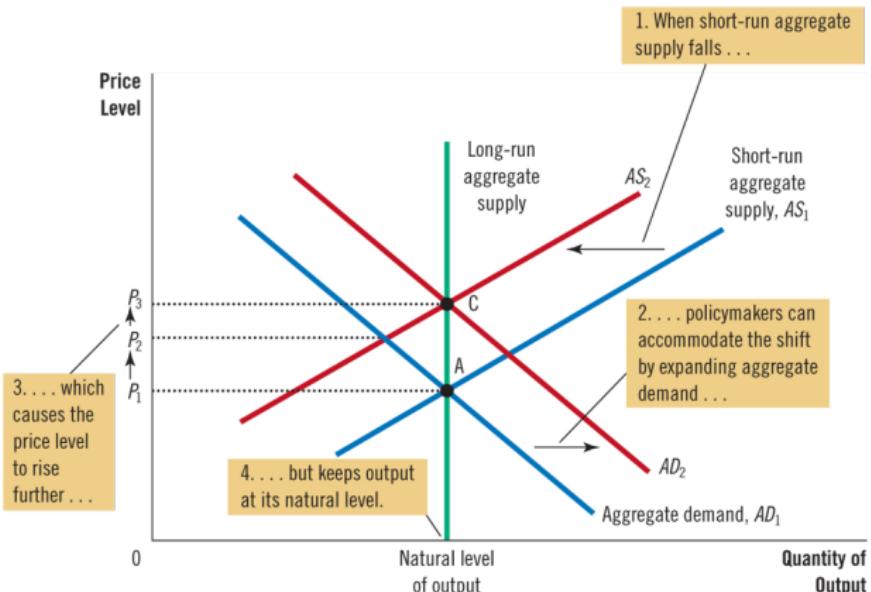
Stagflation refers to a combination of stagnant economic growth and rising price level. The last major stagflation period in the U.S. lasted from 1965 until 1982. In 1964 inflation was roughly 1 percent and unemployment was 5 percent. Ten years later, inflation was over 12 percent and unemployment was above 7 percent. The economy in the 1970s suffered two supply side shocks that resulted in higher prices: the Oil Shocks of 1973 and 1979. Known as the Great Inflation, it was only ended by the tenacity and determination of Former Fed Chair Paul Volcker and required a very deep recession. Source: Ferguson (2022) (w)

Combating Adverse AS Shocks

FIGURE 11

Accommodating an Adverse Shift in Aggregate Supply

Faced with an adverse shift in aggregate supply from AS_1 to AS_2 , policymakers who can influence aggregate demand might try to shift the aggregate-demand curve to the right from AD_1 to AD_2 . The economy would move from point A to point C. This policy would prevent the supply shift from reducing output in the short run, but the price level would permanently rise from P_1 to P_3 .



If policymakers want to end the stagflation, they can shift the aggregate-demand curve. Note that they cannot simultaneously offset the drop in output and the rise in the price level. If they increase aggregate demand, the recession will end, but the price level will be permanently higher.

Source: N. G. Mankiw (2021) CH33, Principles of Economics, 9e, Cengage.



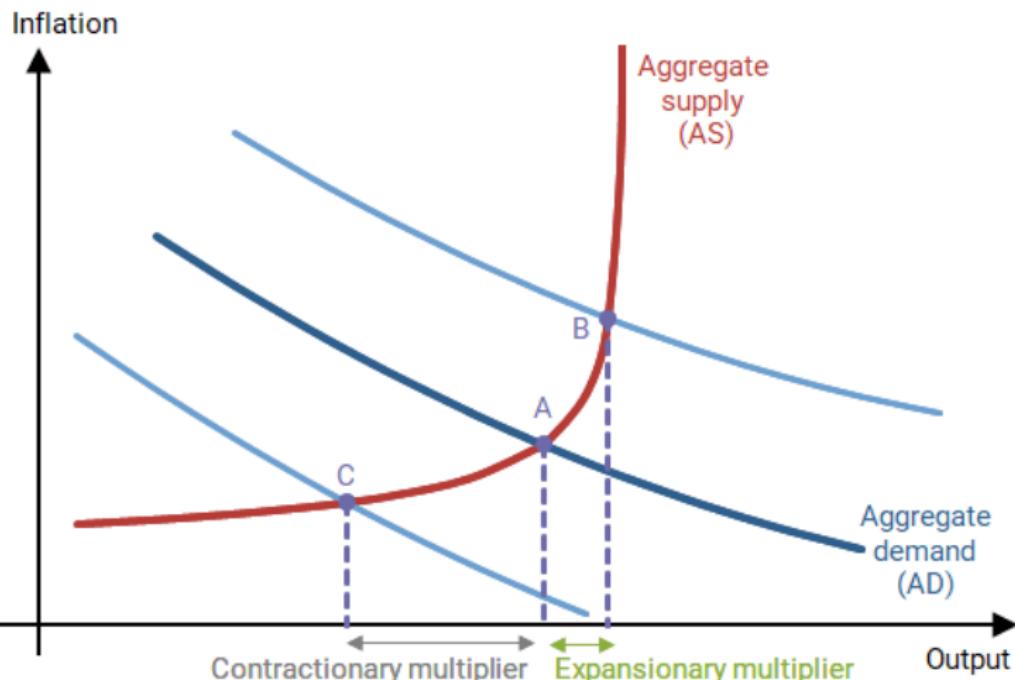
Price Stickiness in the AD-AS Model

In the 18th century, David Hume and other economists wrote about the relationship between monetary changes and important macroeconomic variables such as production, employment, real wages, and real interest rates. Classical dichotomy holds the theoretical separation of nominal and real variables. Monetary neutrality is the proposition that changes in the money supply do not affect real variables.

- ① Short-run assumption: price level is fixed, corresponding to a horizontal AS. Changes in AD are ultra effective in driving output in equilibrium.
- ② Median-run assumption: price level is sticky, corresponding to an upward-sloping AS. Changes in AD determine both output and price.
- ③ Long-run assumption: price level is fully flexible, corresponding to a vertical AS. Changes in AD are only driving inflation but not output.

Depending on the aggregate supply condition in the economy, aggregate demand driven public policy can be very effective, mildly effective, or ineffective in stimulating real output.

Price Stickiness in the AD-AS Model



The assumption of "price stickiness" in different time horizons affects the slope of the AS curve, hence, the equilibrium in the economy. Source: Barnichon et. al. (2021) (w)

Appendix: Business Cycle Dating Committee

The Business Cycle Dating Committee was created in 1978, and since then there has been a formal process of announcing the NBER determination of a peak or trough in economic activity. (w)

- Robert Hall, Stanford University, Chair, 1978-
- Robert J. Gordon, Northwestern University, 1978-
- James Poterba, Massachusetts Institute of Technology, 2008-
- Valerie Ramey, University of California, San Diego, 2017-
- Christina Romer, University of California, Berkeley, 2003-2008, 2010-
- David Romer, University of California, Berkeley, 2003-2009, 2010-
- James Stock, Harvard University, 2009-2012, 2016-
- Mark W. Watson, Princeton University, 2009-

<https://www.nber.org/research/business-cycle-dating/business-cycle-dating-committee-members>

Business Cycle Dating Committee - Past Members

The NBER President appoints the members, who are experts in business cycle research and macroeconomics. The NBER was founded in 1920, and published its first business cycle dates in 1929.

- Ben Bernanke, Princeton University, 2000-2002
- William Branson, Princeton University, 1978-1991
- Martin Feldstein, Harvard University, 1978-1982, 1984-2019
- Jeffrey Frankel, Harvard University, 1993-1996, 1999-2019
- Benjamin Friedman, Harvard University, 1978-1991
- N. Gregory Mankiw, Harvard University, 1991-2000
- Geoffrey Moore, Columbia University and Rutgers University, 1978-2000
- Eli Shapiro, Massachusetts Institute of Technology, 1982-1984
- Victor Zarnowitz, University of Chicago, 1978-2009

<https://www.nber.org/research/business-cycle-dating/business-cycle-dating-committee-members>

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Gene Smiley: Great Depression. Econlib - Encyclopedia [\(w\)](#)

[Kevin D. Hoover: Phillips Curve. Econlib - Encyclopedia [\(w\)](#)

Christina D. Romer: Business Cycle. Econlib - Encyclopedia [\(w\)](#)

The Hutchins Center Explains: The Phillips Curve. [\(w\)](#)

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