ENERGY & THE MACROECONOMY

By Vance Ginn

Gross Domestic Product

- **GDP** or **gross domestic product** is the _____of all final goods and services produced in a country in a given time period.

-Two definitions:

- Total expenditure on

  _____

  _____

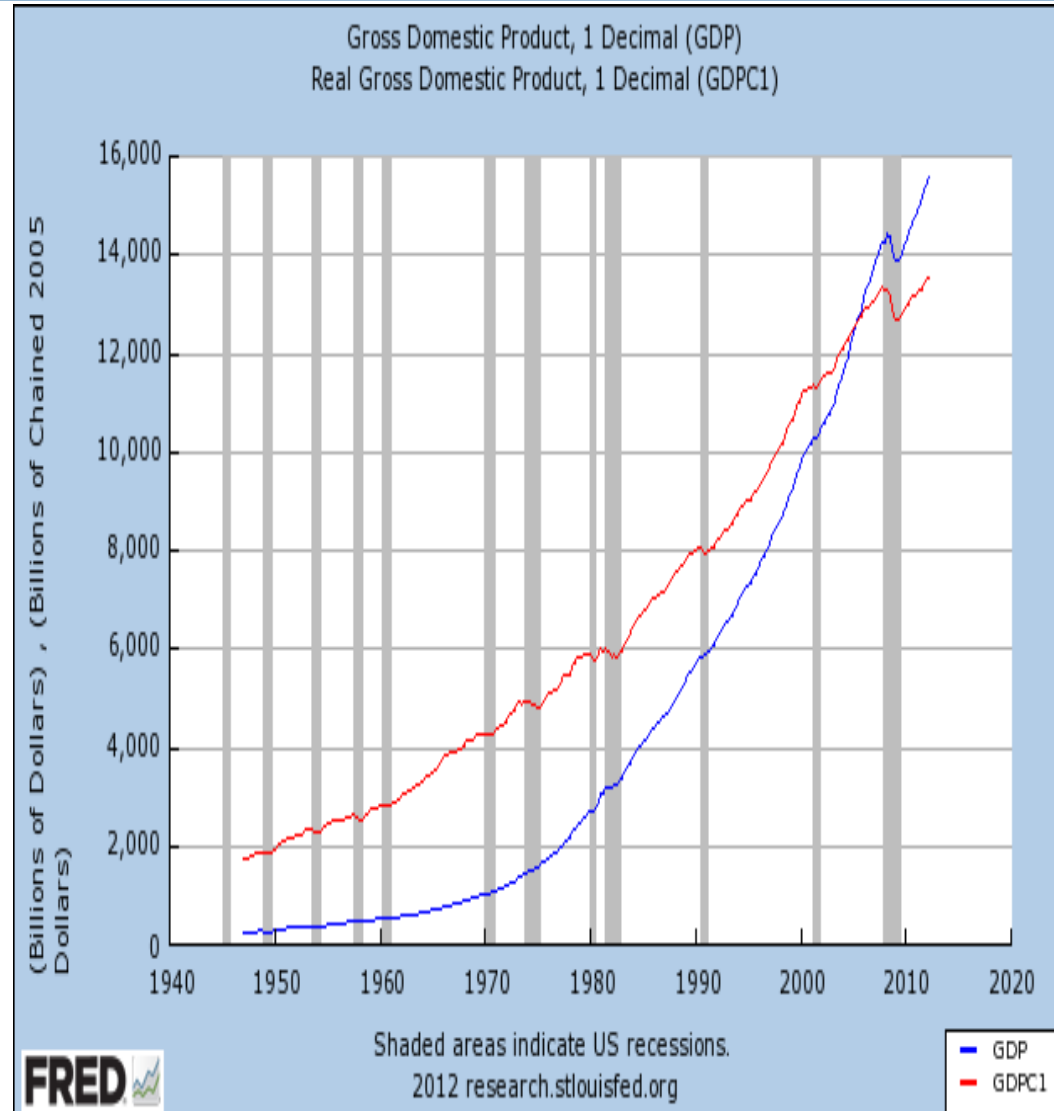- Total income earned by domestically-located factors of production.

- Excludes intermediate goods and services to

  _____

Gross Domestic Product: Expenditure and Income Approaches

Expenditure equals income *because every dollar spent by a buyer becomes income to the seller.*

☐ Nominal GDP was

_____

_____

☐ Real GDP was

_____

_____

Gross Domestic Product, 1 Decimal (GDP)
Real Gross Domestic Product, 1 Decimal (GDPC1)

Shaded areas indicate US recessions.
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GDP
GDPC1

The **expenditure** components of GDP

- consumption, **C**

- investment, **I**

- government spending, **G**

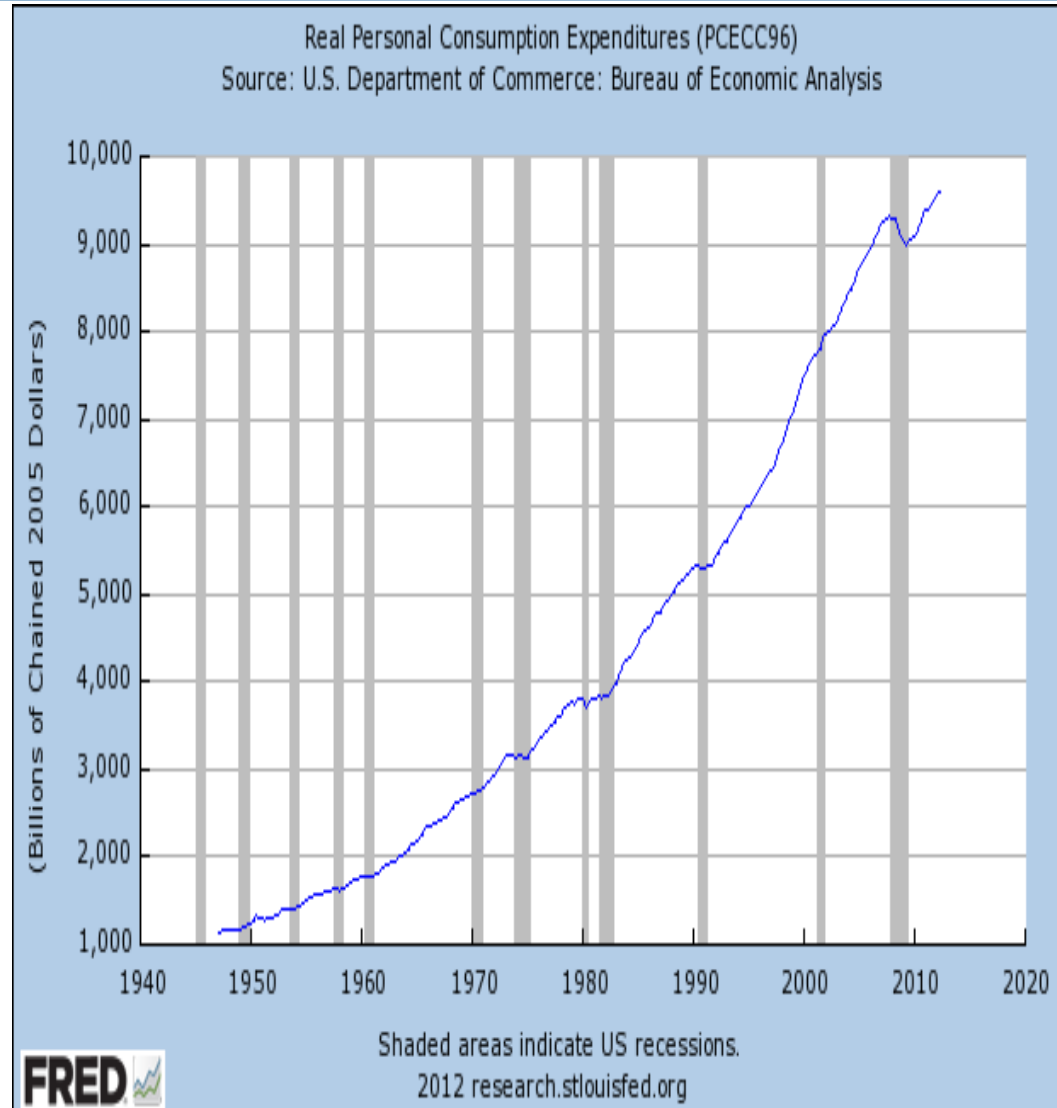- net exports, **NX**

An important identity:

*value of
total output*

*aggregate
expenditure*

Consumption (C) **70% of GDP**

definition: The value of all goods and services bought by households. Includes:

- ☐ _____
  last 3 years or more
  e.g., cars, home appliances

- ☐ _____
  last fewer than 3 years
  e.g., food, clothing

- ☐ _____
  work done for consumers
  e.g., dry cleaning, air travel

Real Personal Consumption Expenditures (PCECC96)
Source: U.S. Department of Commerce: Bureau of Economic Analysis

Shaded areas indicate US recessions.
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Investment (I)15% of GDP

☐ **Spending by businesses on goods bought for future use**
(*i.e.,* capital goods)
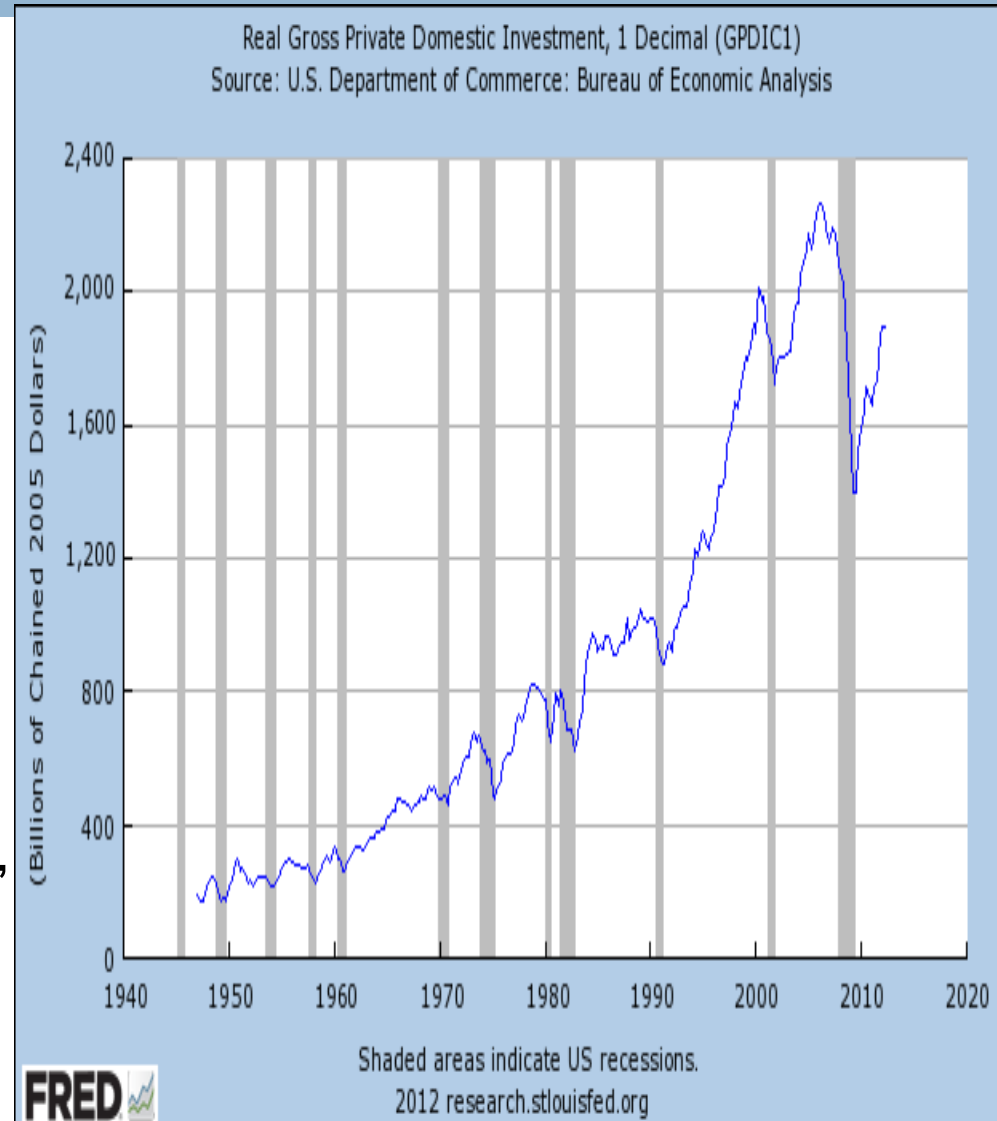
☐ Includes:

- ☐ *Business fixed investment*
  Spending on plant and equipment

- ☐ *Residential fixed investment*
  Spending by banks on housing units

- ☐ *Inventory investment*
  The change in the value of all firms' inventories

Real Gross Private Domestic Investment, 1 Decimal (GPDIC1)
Source: U.S. Department of Commerce: Bureau of Economic Analysis

Shaded areas indicate US recessions.
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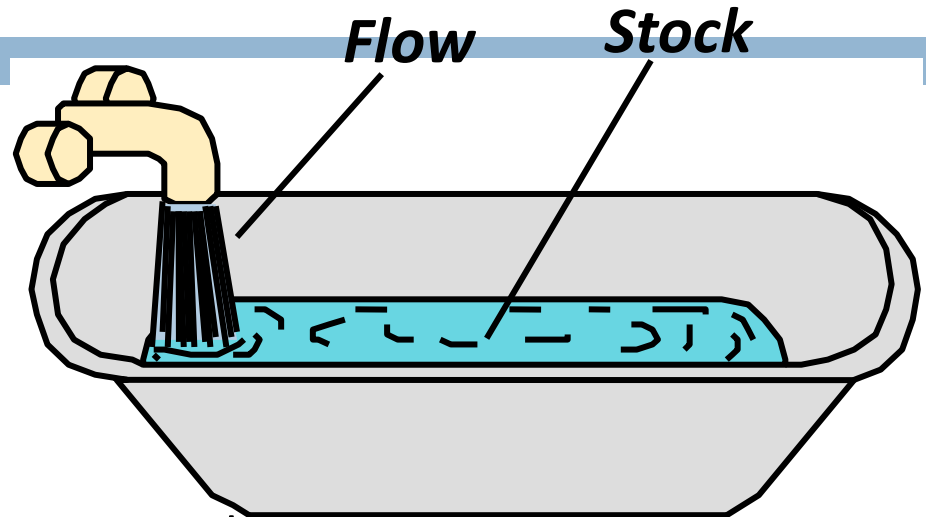
Stocks vs. Flows

Flow   *Stock*

•A **stock** is a quantity measured at a _____.

-*E.g.,* "The U.S. capital stock was $26 trillion on January 1, 2009";"Total oil inventory would be a stock";"Football score: 51-43"

□ A **flow** is a quantity measured _____.

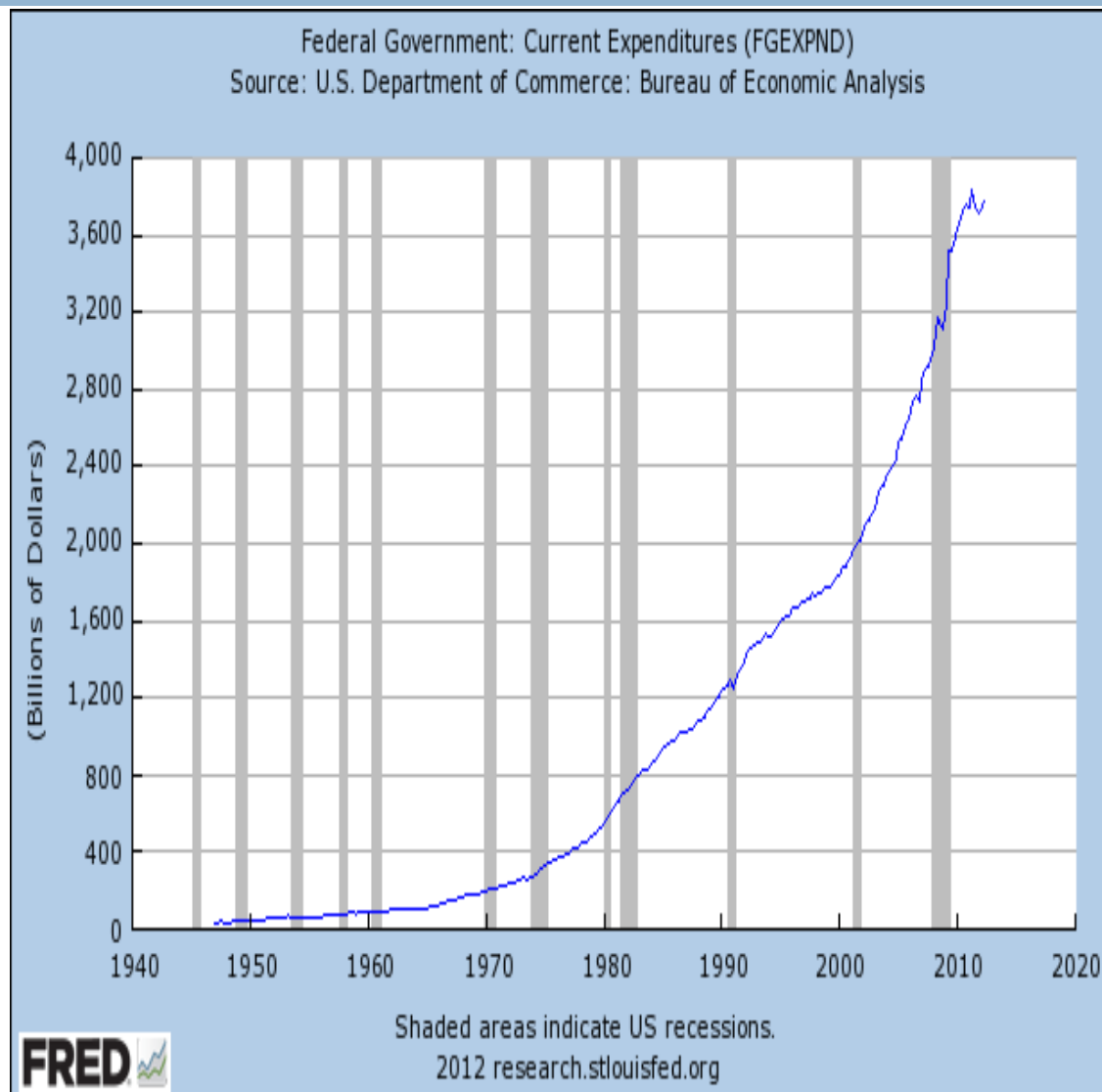-*E.g.,* "U.S. investment was $2.5 trillion during 2009."

"Oil production this year would be a flow"; "Touchdown"

Government spending (G)

- **G** includes all government spending on goods and services.

- **G** excludes transfer payments (e.g., unemployment insurance payments), because they do not represent spending on goods and services.

- **Historically, G makes up around 20% of GDP**

- **Why G rises (video)**

Federal Government: Current Expenditures (FGEXPND)
Source: U.S. Department of Commerce: Bureau of Economic Analysis

(Billions of Dollars)

Shaded areas indicate US recessions.
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Net Exports: NX = X − M

☐ definition: the value of total exports (X) minus the value of total imports (M). Makes up -5% of GDP. Currently there is a current account deficit of **$639.6 billion or -4.8% of GDP**
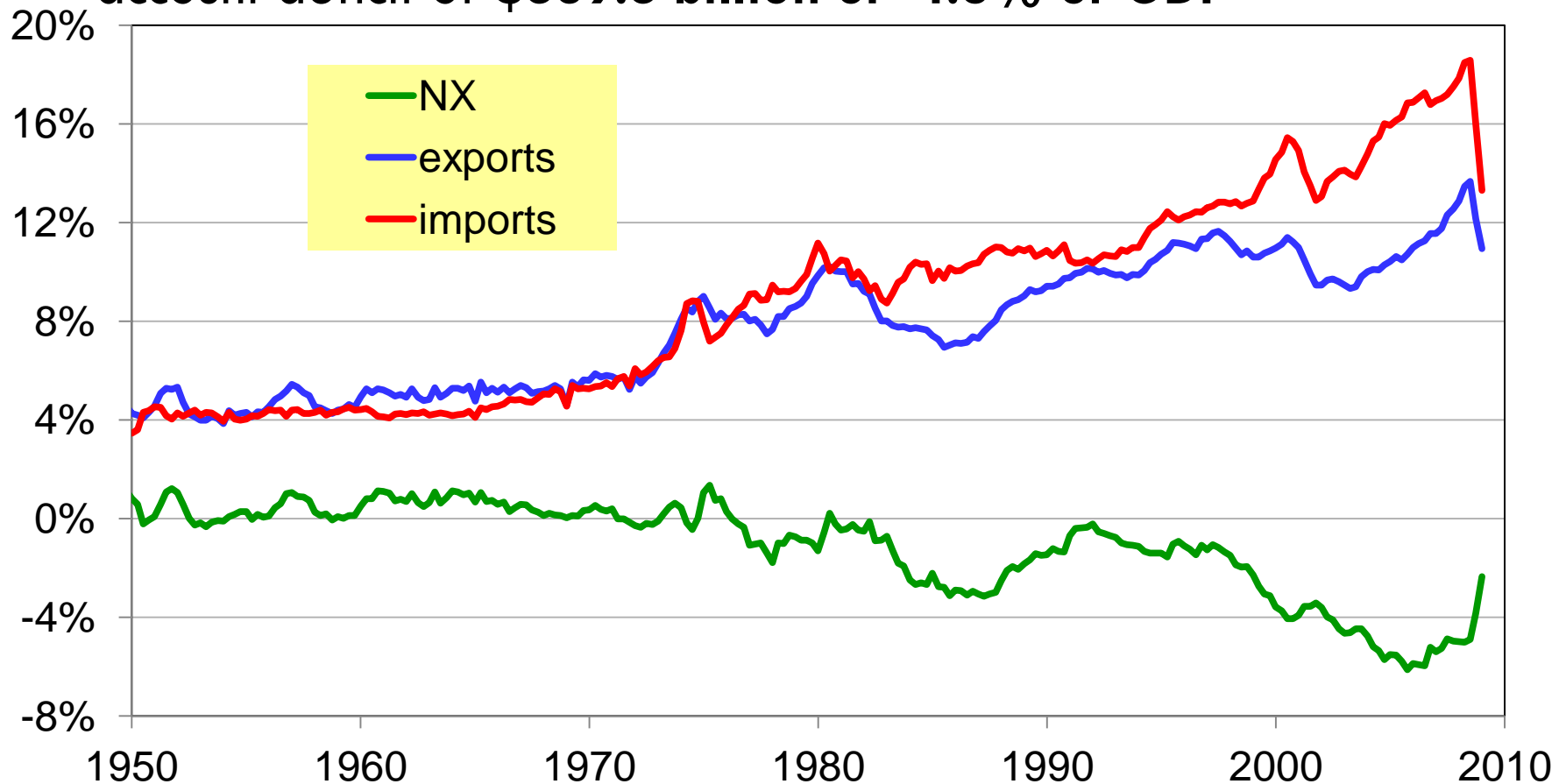
Nominal GDP World Rankings (CIA World Factbook)

Rank	Country	GDP (millions of USD-2011)	
	World	**69,990,000**	
	European Union	17,330,000	(25%)
1	United States	15,090,000	(22%)
2	China	7,298,000	(10%)
3	Japan	5,869,000	(8%)
4	Germany	3,577,000	(5%)
5	France	2,776,000	(4%)

2. Consumer Price Index (CPI)

□ A measure of the overall level of prices

□ Published by the Bureau of Labor Statistics **(BLS)**

□ Uses:

  ◘ tracks changes in the typical household's cost of living

  ◘ adjusts many contracts for inflation ("COLAs")

  ◘ allows comparisons of dollar amounts over time

How the BLS constructs the CPI

1. Survey consumers to determine composition of the typical consumer's _____ of goods

2. Every month, collect data on prices of all items in the basket; compute cost of basket
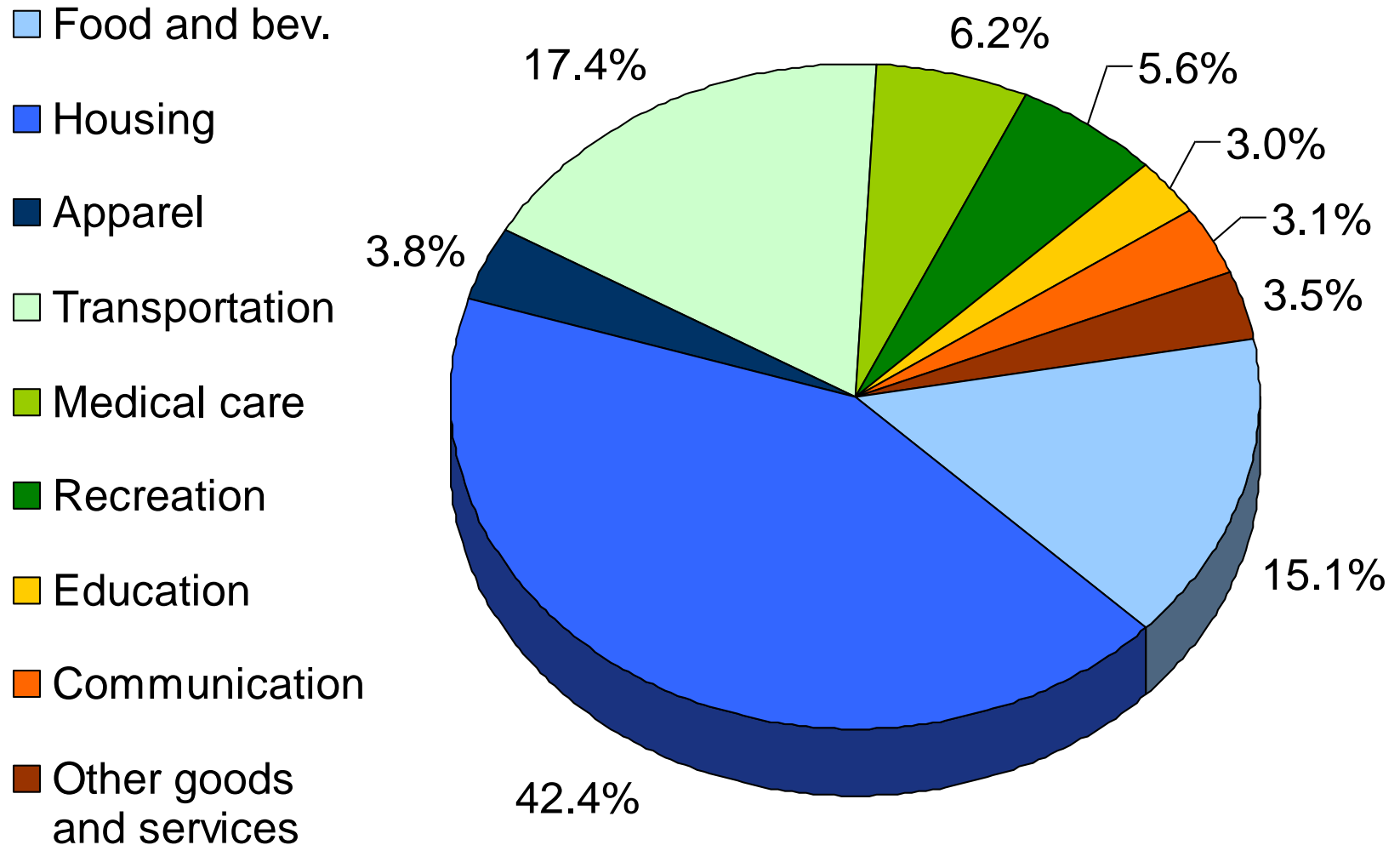
3. CPI in any month equals:

$$100 \times \frac{\text{Cost of basket in that month}}{\text{Cost of basket in base period}}$$

4. Core CPI: _____.
    This is due to the fact that these prices are highly volatile.

    _____

The Federal Open Market Committee (FOMC) wants the core CPI between **1.5%-2% for year over year inflation numbers**.

The composition of the CPI's "basket"

Legend:
- Food and bev.
- Housing
- Apparel
- Transportation
- Medical care
- Recreation
- Education
- Communication
- Other goods and services

6.2%
5.6%
3.0%
3.1%
3.5%
15.1%
42.4%
3.8%
17.4%

Why the CPI may overstate inflation

☐ **Substitution bias**:
The CPI uses fixed weights, so it cannot reflect consumers' ability to substitute toward goods whose relative prices have fallen.

☐ **Introduction of new goods**:
The introduction of new goods makes consumers better off and, in effect, increases the real value of the dollar. But it does not reduce the CPI, because the CPI uses fixed weights.

☐ **Unmeasured changes in quality**:
Quality improvements increase the value of the dollar, but are often not fully measured.

The size of the CPI's bias and Costs

- In 1995, a Senate-appointed panel of experts estimated that the CPI overstates inflation by about 1.1% per year.

- So the BLS made adjustments to reduce the bias.

- Now, the CPI's bias is probably under 1% per year.

- 4 major costs of inflation:

  1. International Competition

  2. Distorts resources (taxes [seinorage] & bracket creep)

  3. Increases in interest rates to slow inflation

  4. _____: walking to bank is a cost

  - What are the costs of price controls? (video)

Facts about the business cycle (Ch9)

- Real GDP growth averages **3–3.5** percent per year over the long run with large fluctuations in the short run.

- Consumption and investment fluctuate with GDP, but consumption tends to be less volatile and investment more volatile than GDP.

- Unemployment rises during recessions and falls during expansions.

- _____: the negative relationship between GDP and unemployment.

Time horizons in macroeconomics

☐ <u>Long run</u>

Prices are flexible (_____),
respond to changes in supply or demand.

☐ <u>Short run</u>

Many prices are "sticky" at a predetermined level.

*The economy behaves much differently
when prices are sticky.*

Recap of classical macro theory

- The _____, the separation of variables into two groups:
  - Real – quantities, relative prices
  - Nominal – measured in terms of money

- The _____:
  Changes in the money supply affect nominal but not real variables.

- Output is determined by the supply side:
  - supplies of capital, labor
  - technology

- Changes in demand for goods & services (C, I, G) only affect prices, not quantities.

- Assumes complete price flexibility & Applies to the **long run**.

When prices are sticky…

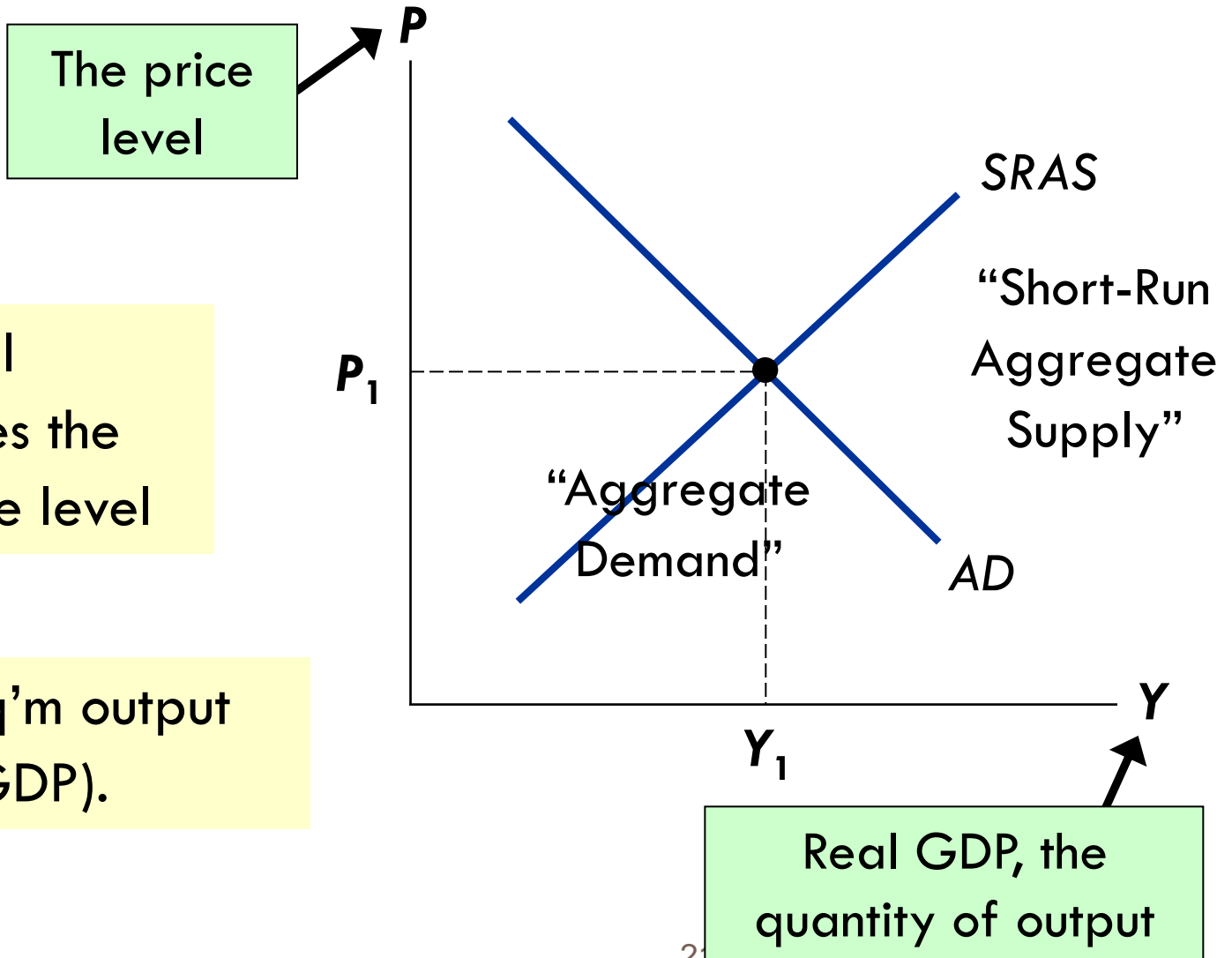…output and employment also depend on demand, which is affected by:

- fiscal policy (G and T)

- monetary policy (M)

- other factors, like exogenous changes in C or I

The model of aggregate demand and supply

☐ The paradigm most mainstream economists and policymakers use to think about economic fluctuations and policies to stabilize the economy

☐ Definition: Shows how the

_____

are determined and shows how the economy's behavior is different in the short run and long run

☐ The _____shows the relationship between the price level and the quantity of output demanded.

The Model of Aggregate Demand and Aggregate Supply

The price level

The model determines the eq'm price level

and eq'm output (real GDP).

P

P_1

SRAS

"Short-Run Aggregate Supply"

"Aggregate Demand"

AD

Y_1

Y

Real GDP, the quantity of output

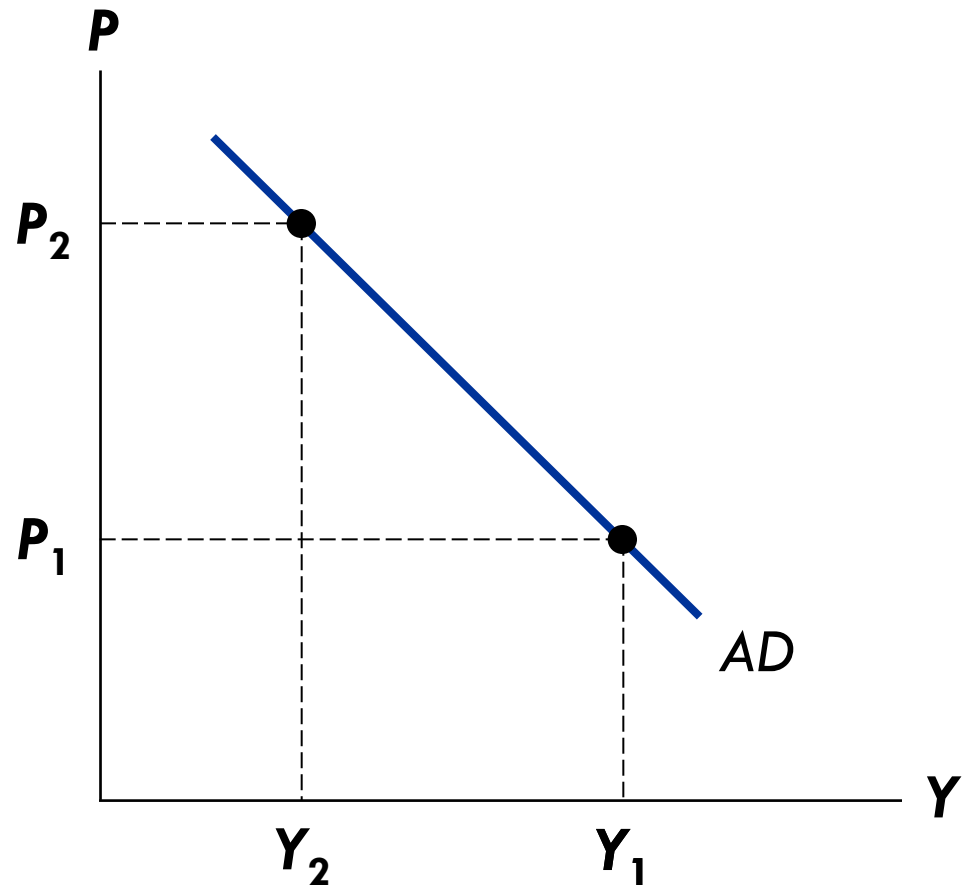# The Aggregate-Demand (*AD*) Curve

The **AD curve** shows the quantity of all g&s demanded in the economy at any given price level.
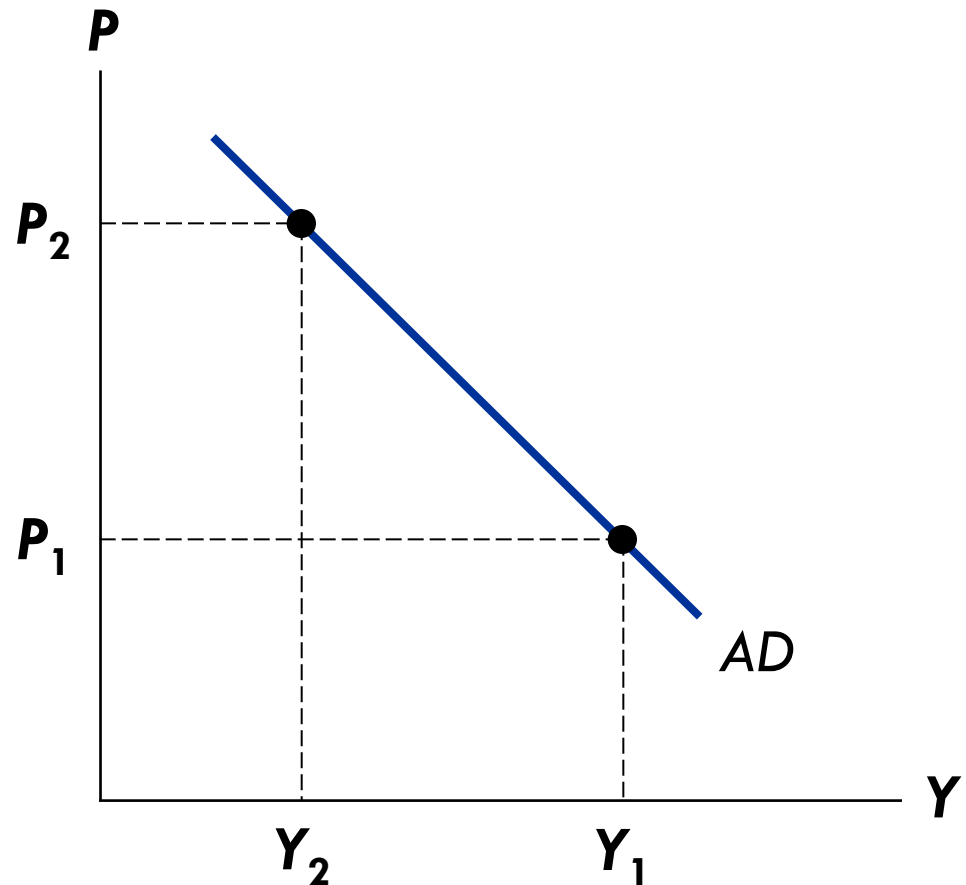
Why the *AD* Curve Slopes Downward

Assume **G** fixed by govt policy.

To understand the slope of *AD*, must determine how a change in **P** affects **C**, **I**, and **NX**.

The _____ (*P* and *C*)

Suppose ***P*** rises.

- ☐ The dollars people hold buy fewer g&s, so real wealth is lower.

- ☐ People feel poorer.

Result: ***C*** falls.

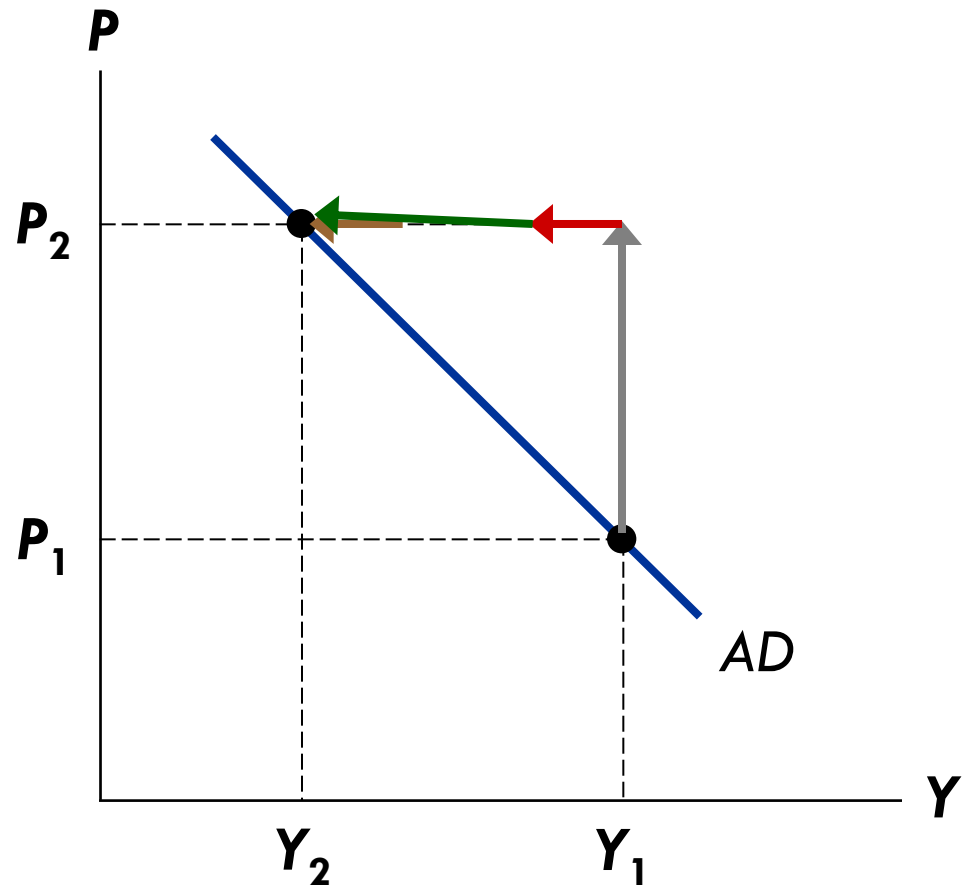# The _____(*P* and *I*)

Suppose *P* rises.

☐ Buying g&s requires more dollars.

☐ To get these dollars, people sell bonds or other assets.

☐ This drives up interest rates.

Result: *I* falls.
(Recall, *I* depends negatively on interest rates.)

The Slope of the *AD* Curve: Summary

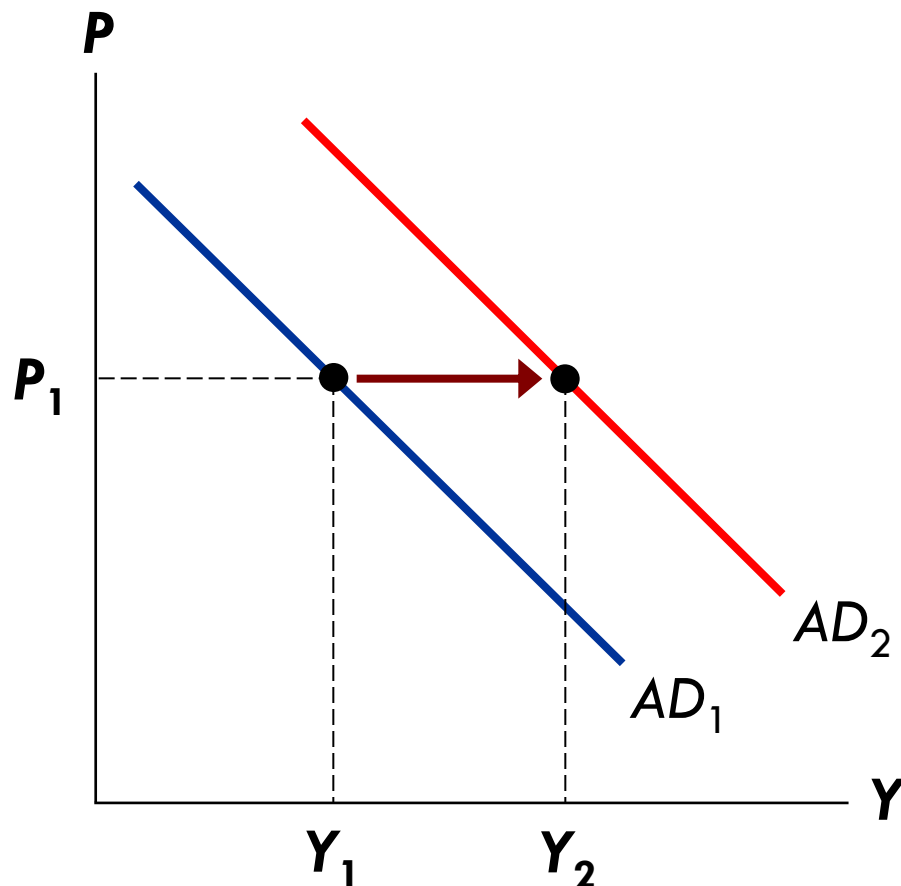An increase in **P** reduces the quantity of g&s demanded because:

- ☐ _____
  _____

- ☐ _____
  _____

Why the *AD* Curve Might Shift

Any event that changes **C, I, G, Money Supply (Fed)** or **NX**

– except a change in **P** – will shift the *AD* curve.

Example:

A decrease in energy prices makes households feel wealthier, **C** rises, the *AD* curve shifts right.

Why the *AD* Curve Might Shift

- Changes in **C**
  - Oil market boom/crash
  - Preferences re: consumption/saving tradeoff
  - Tax hikes/cuts

- Changes in **I**
  - Expectations, optimism/pessimism: OPEC oil embargo
  - Interest rates, monetary policy
  - Investment Tax Credit or subsidies

- Changes in **G**
  - Federal spending, *e.g.,* defense, renewable energy
  - State & local spending, *e.g.,* roads, schools
  - Does not include transfer payments

ACTIVE LEARNING *1*
The Aggregate-Demand curve

What happens to the *AD* curve in each of the following scenarios?

A. A ten-year-old investment tax credit expires for oil producers.

B. The price of gasoline increases by 20%.

C. A fall in prices increases the real value of consumers' wealth.

D. Government subsidies are given to solar power companies.

ACTIVE LEARNING *1*
Answers

A. An investment tax credit expires for oil producers.

   _____

B. The price of gasoline falls.

   _____

C. A fall in the overall price level increases the real value of consumers' wealth.

   _____

D. Government subsidies increase to solar power companies, which use these funds to make investments.

   _____

Aggregate supply in the long run

□ Recall:

In the long run, output is determined by factor supplies and technology

$$\overline{Y} = F(\overline{K}, \overline{L})$$

$\overline{Y}$ is the _____(potential GDP) level of output, at which the economy's resources are fully employed.

"Full employment" means that unemployment equals its natural rate (not zero).
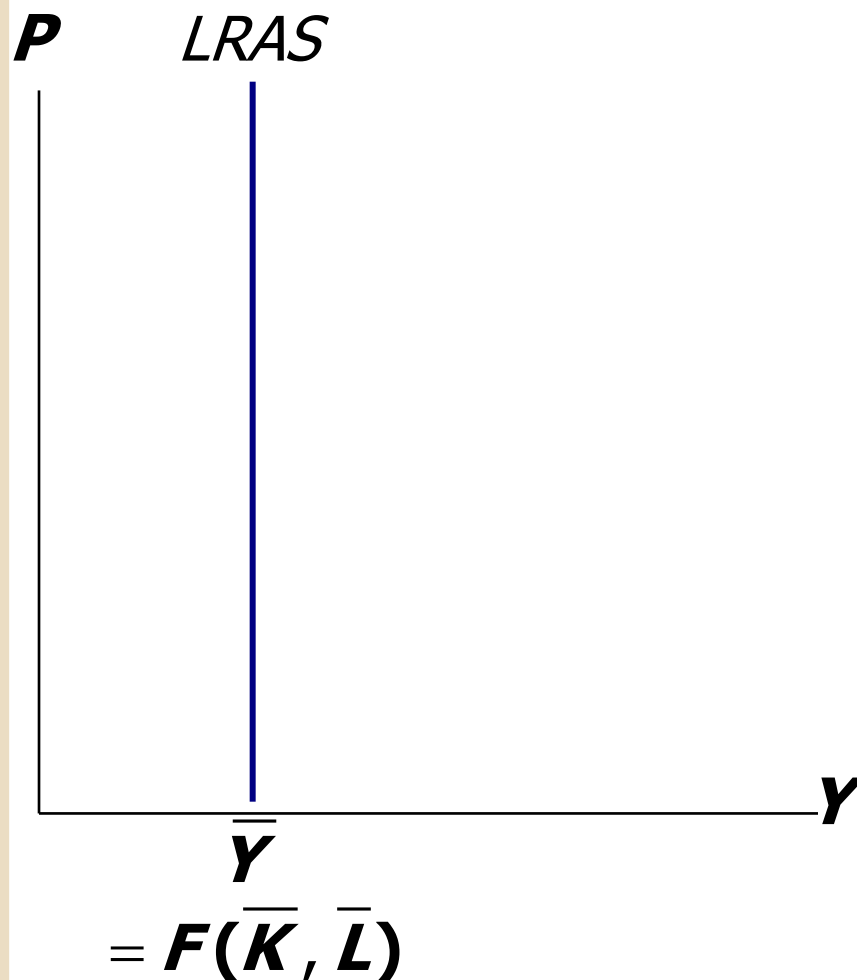
The long-run aggregate supply (LRAS) curve

$\overline{Y}_{32}$ does not depend on **P**, so *LRAS* is **vertical.**

"P" on the vertical axis is the economy's overall price level – the average price of EVERYTHING.
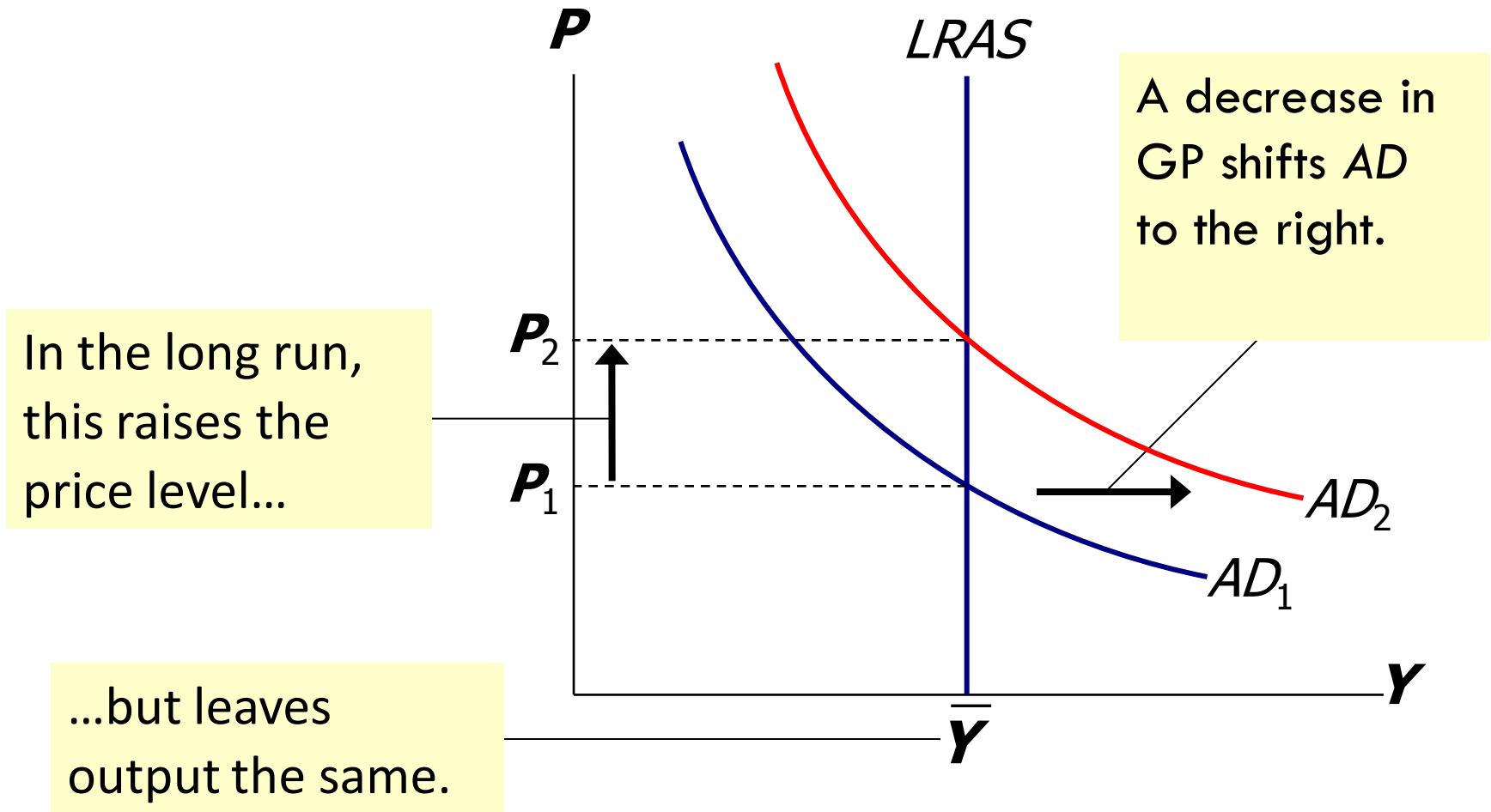
Why is it vertical?

A 10% increase in the price level means that, on average, EVERYTHING costs 10% more. Thus, a firm can get 10% more revenue for each unit it sells. But the firm also pays an average of 10% more in wages, prices of intermediate goods, advertising, and so on.

Thus, the firm does not have any incentive to increase output.

$$P \qquad LRAS$$

$$Y$$

$$\overline{Y}$$

$$= F(\overline{K}, \overline{L})$$

Long-run effects of a decrease in the gasoline price (GP)

P

$LRAS$

A decrease in GP shifts *AD* to the right.

P_2

In the long run, this raises the price level…

P_1

AD_2

AD_1

Y

…but leaves output the same.

$\overline{Y}$

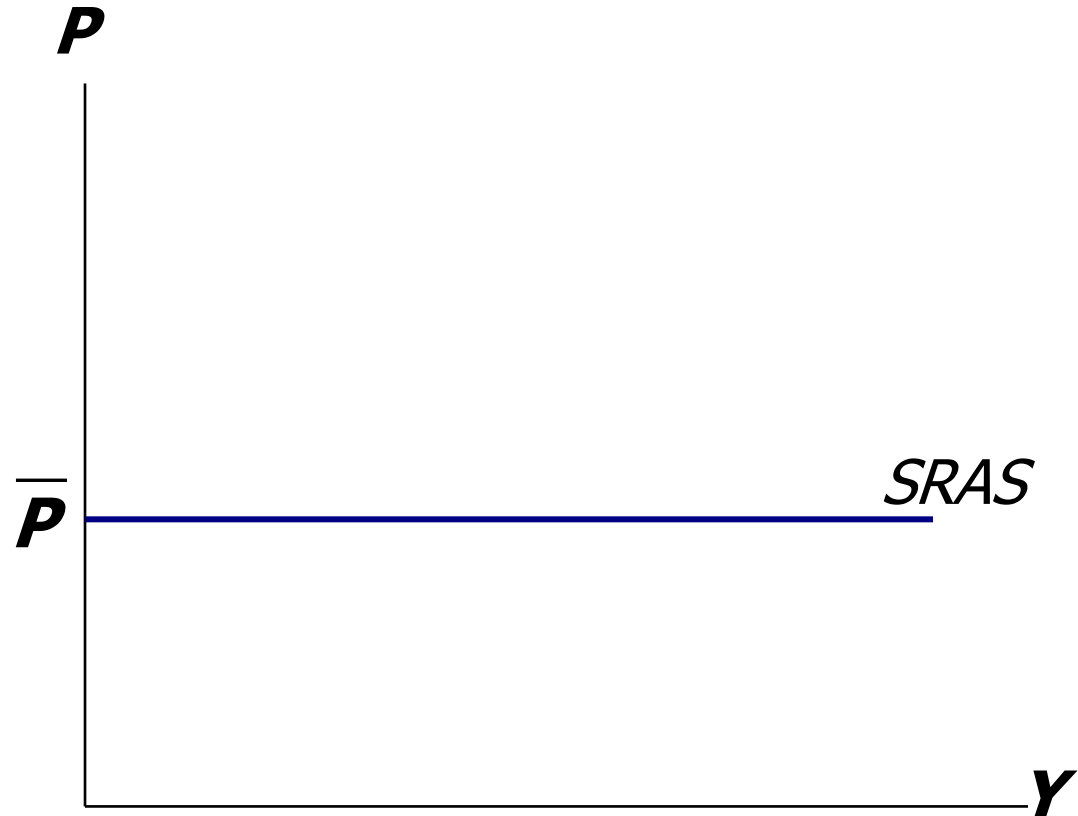# Aggregate supply in the short run

- Many prices are sticky in the short run.
- Let's assume
  - <u>all</u> prices are stuck at a predetermined level in the short run.
  - firms are willing to sell as much at that price level as their customers are willing to buy.
  - some type of market imperfection exists that does not allow prices to adjust
- result:

Output deviates from its natural rate when the actual price level deviates from the price level people expected.

- Therefore, the short-run aggregate supply (*SRAS*) curve is _____.

The short-run aggregate supply (SRAS) curve

The *SRAS* curve is horizontal:

The price level is fixed at a predetermined level, and firms sell as much as buyers demand.
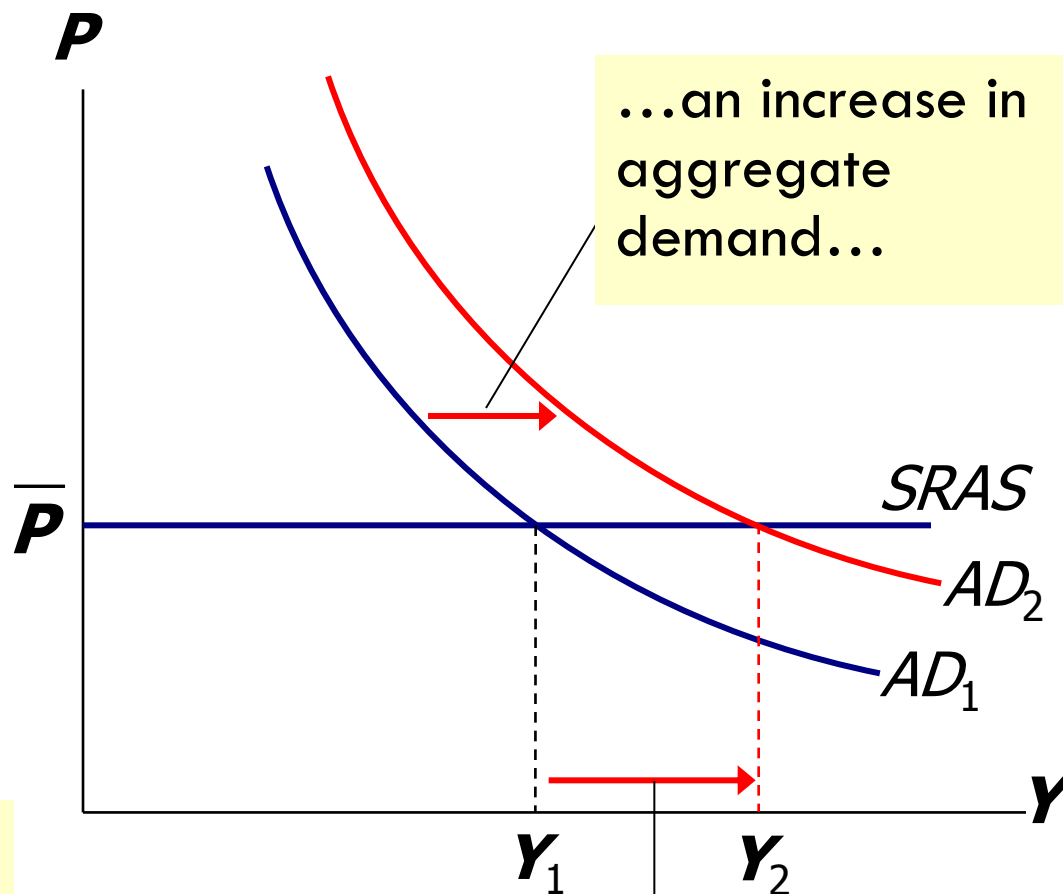
P

$\overline{P}$

$SRAS$

Y

Short-run effects of a decrease in GP

In the short run when prices are sticky,…

…an increase in aggregate demand…

P

$\overline{P}$

$SRAS$

AD_2

AD_1

Y

Y_1 Y_2

…causes output to rise.

From the short run to the long run

Over time if the economy is left to its own devices, prices gradually become "unstuck."

When they do, will they rise or fall?

In the short-run equilibrium, if	then over time, P will...
$Y > \bar{Y}$	_____
$Y < \bar{Y}$	_____
$Y = \bar{Y}$	_____

The adjustment of prices is what moves the economy to its long-run equilibrium.
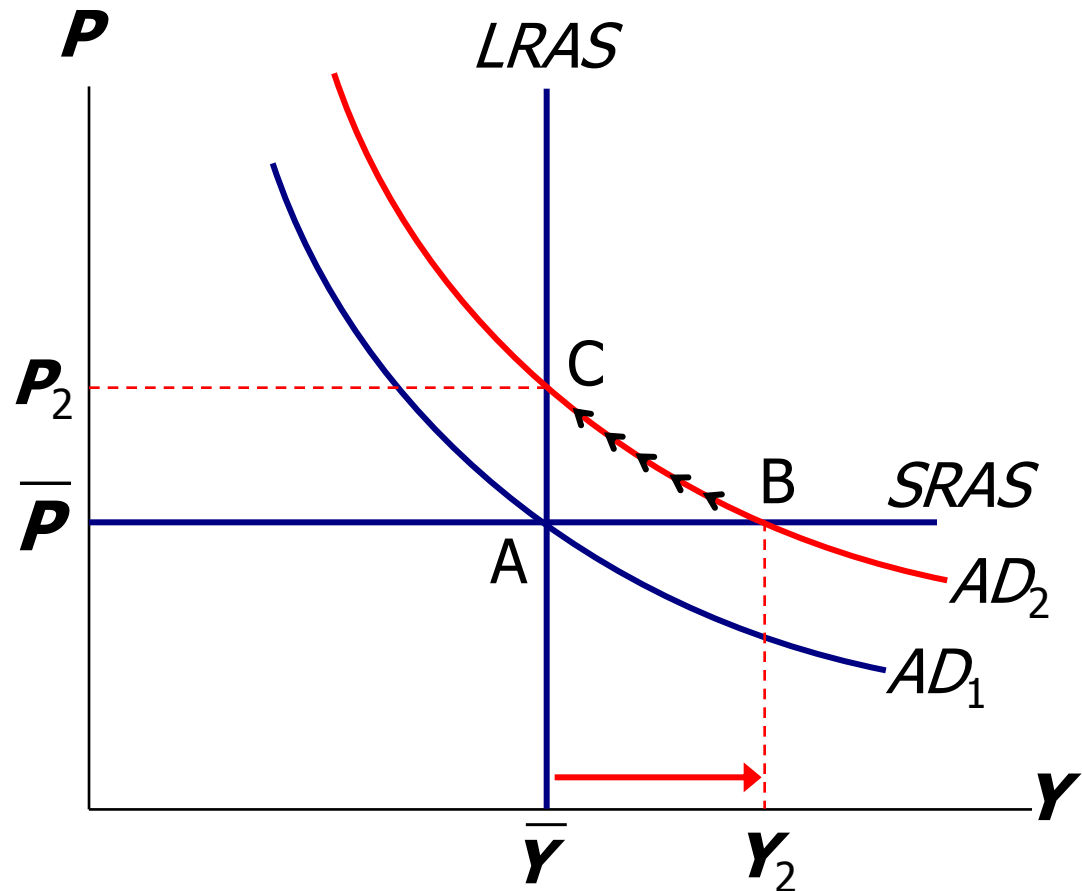
The SR & LR effects of $\Delta GP < 0$

A = initial
   equilibrium

B = new short-run
   eq'm after a
   decrease in
   GP

C = long-run
   equilibrium

How shocking!!!

- **Shocks**: _____

- Shocks temporarily push the economy away from full employment.

- When in a recession, the economy --- left to its own devices --"fixes" itself: the gradual adjustment of prices helps the economy recover from the shock and return to full employment.

- Of course, before the economy has finished self-correcting, a period of low output and high unemployment is endured.
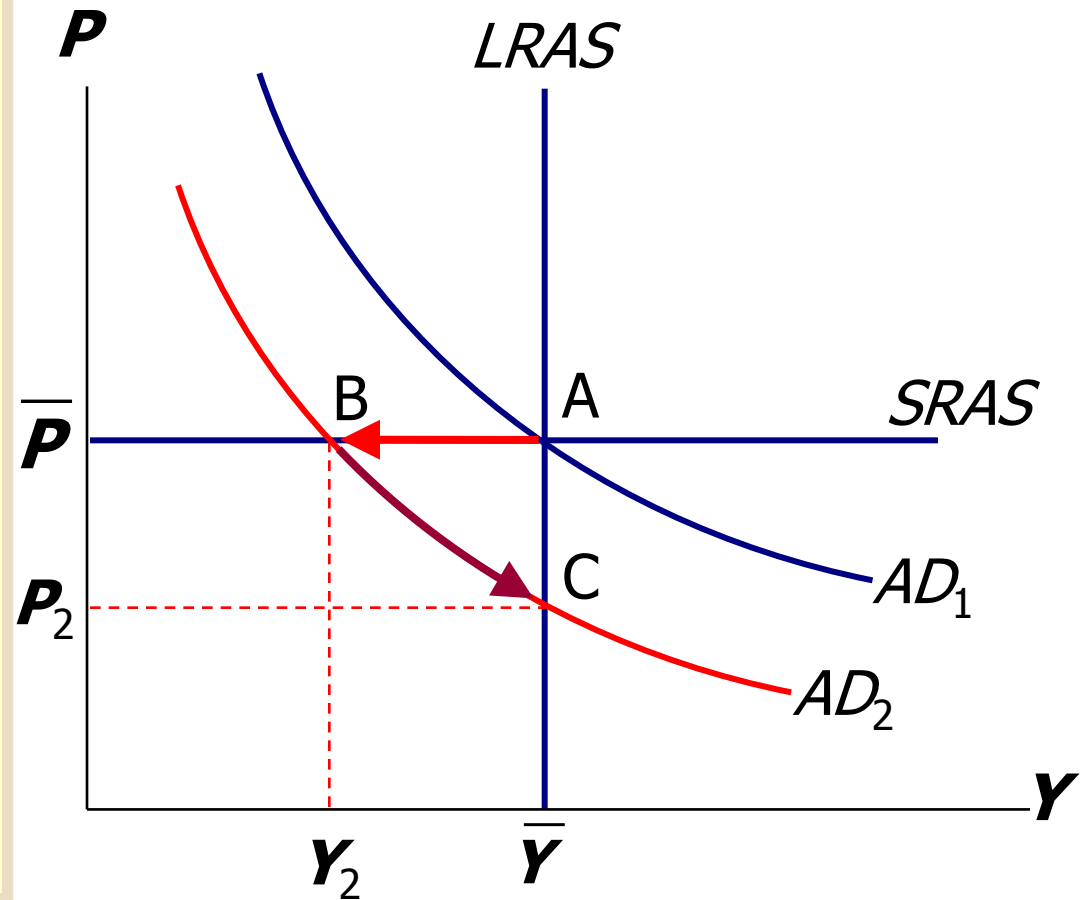
The effects of a _____

Example: Increase in the price of gasoline

-If everything else is held constant, an increase in the price of gasoline means people will be using their money in fewer transactions for other goods, causing a decrease in demand.

AD shifts left, depressing output and employment in the short run.

Over time, the economy fixes itself as prices fall and the economy moves down its demand curve toward full-employment.

Supply shocks

- A **supply shock** alters production costs, affects the prices that firms charge. (also called **price shocks**)
- Examples of *adverse ("bad")* supply shocks:
  - Bad weather reduces corn crop yields, pushing up corn prices and subsequently the price of ethanol.
  - An increase in energy costs, increases production costs, decreasing aggregate supply.
  - New environmental regulations require firms to reduce emissions. Firms charge higher prices to help cover the costs of compliance.
- *Favorable* ("good") supply shocks lower costs and prices.
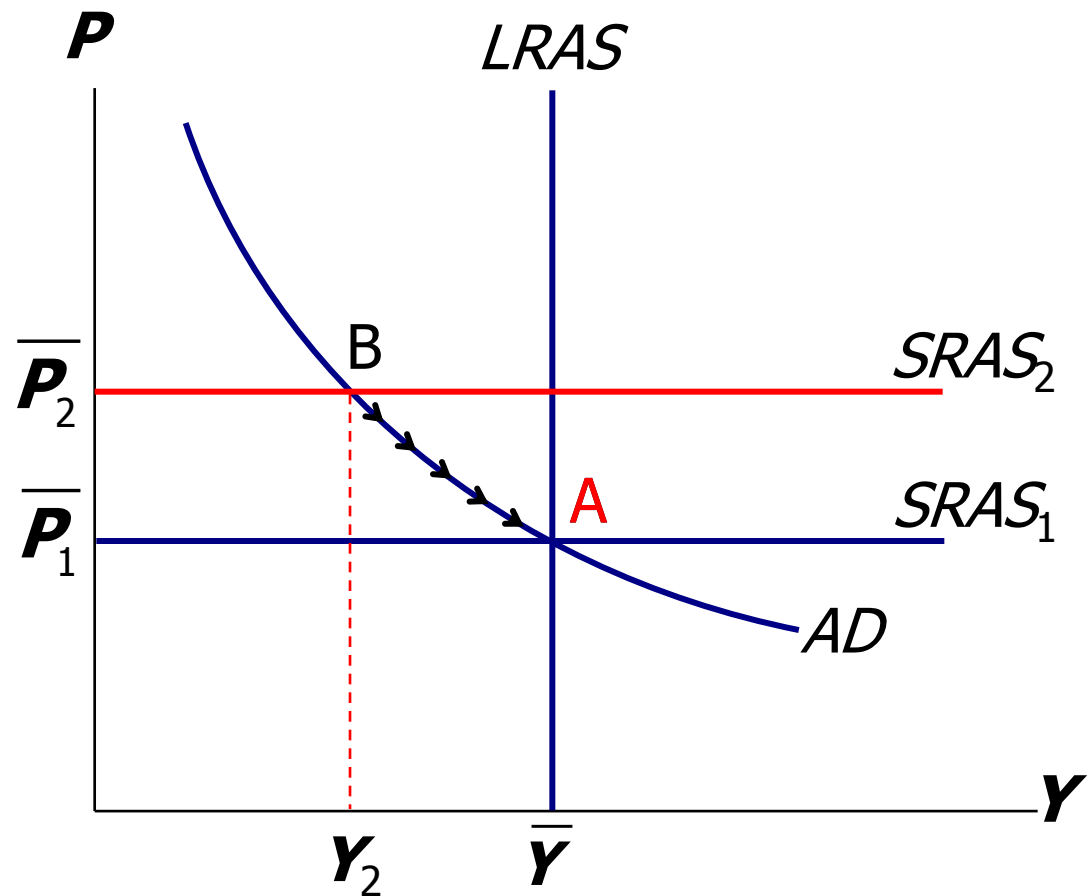
CASE STUDY: The 1970s oil shocks

- Early 1970s: OPEC (Organization of the Petroleum Exporting Countries) coordinates a reduction in the supply of oil.

- Oil prices rose
    - 11% in 1973
    - 68% in 1974
    - 16% in 1975

- Such sharp oil price increases are supply shocks because they significantly impact production costs and prices.

- Oil is required to heat the factories in which goods are produced, and to fuel the trucks that transport the goods from the factories to the warehouses to Walmart stores.

- A sharp increase in the price of oil, therefore, has a

_____.

CASE STUDY:
The 1970s oil shocks

The oil price shock shifts **SRAS** up, causing output and employment to fall.

In absence of further price shocks, prices will **fall** over time and economy moves back toward full employment.
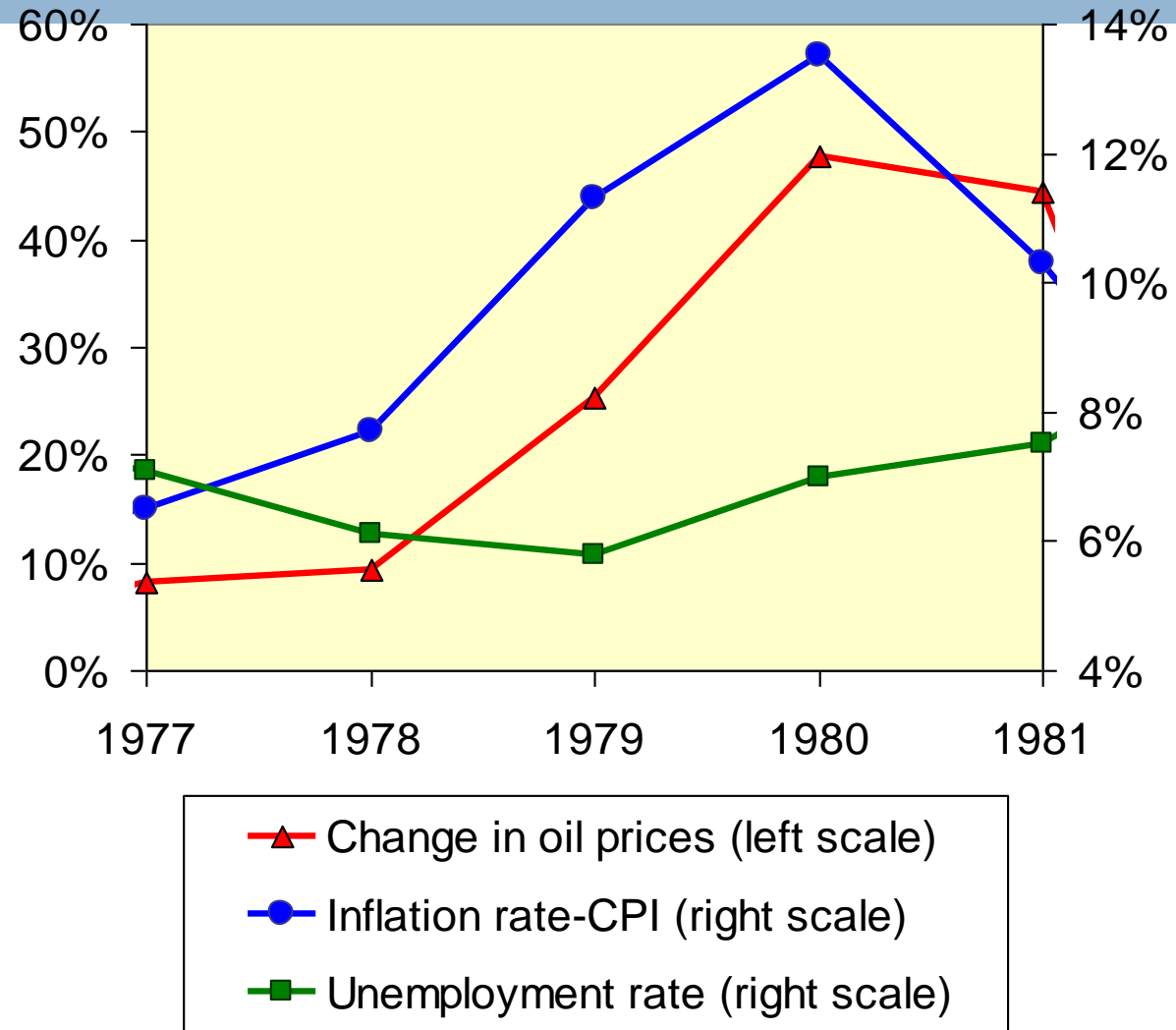
CASE STUDY:
The 1970s oil shocks

Late 1970s:

As economy was recovering, oil prices shot up again, causing another huge supply shock!!!

- This second shock was associated with the **revolution in Iran.** The new leader, Ayatollah Khomeini, was considerably less friendly toward the West. (He even forbade his citizens from listening to Western music.)

Legend:
- Change in oil prices (left scale)
- Inflation rate-CPI (right scale)
- Unemployment rate (right scale)
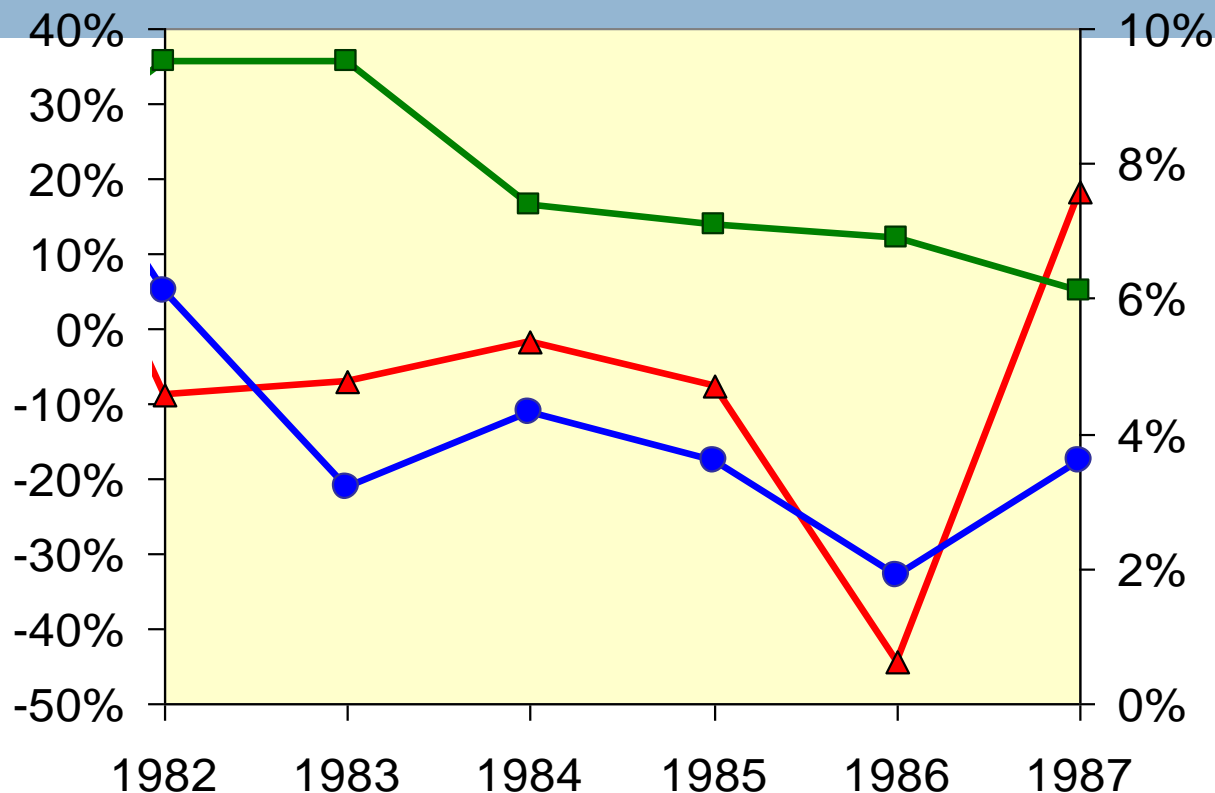
CASE STUDY:
The 1980s oil shocks

1980s:

A favorable supply shock--a significant fall in oil prices.

As the model predicts, inflation and unemployment fell:

-at first glance, it may seem that the fall in oil prices doesn't occur until 1986. Be sure to look at the correct scale, on which 0 is in the middle, not at the bottom. Oil prices fell about 10% in 1982, and generally fell during most years between 1982 and 1986.
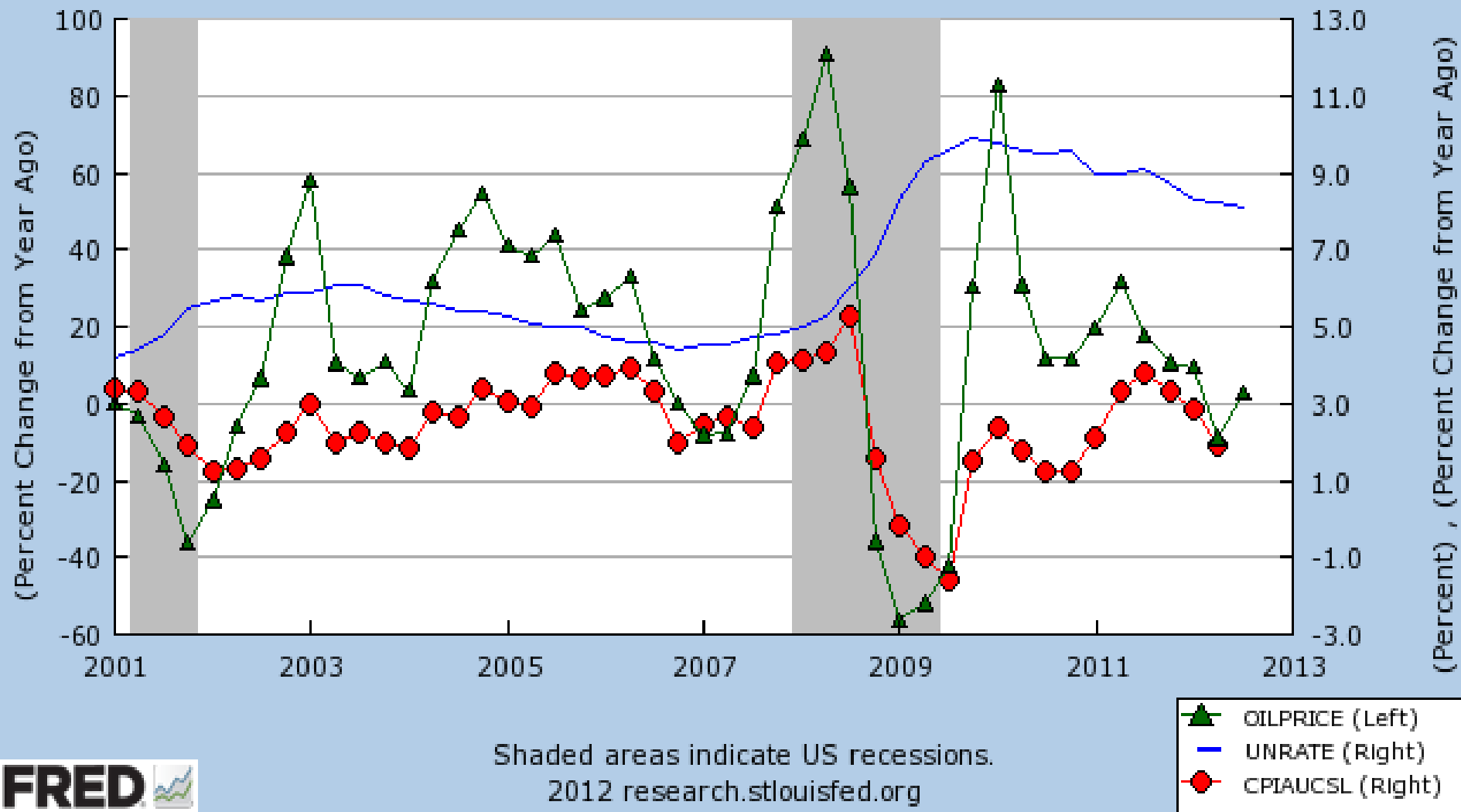

Legend:
- Change in oil prices (left scale)
- Inflation rate-CPI (right scale)
- Unemployment rate (right scale)

Case Study: 2000s

Civilian Unemployment Rate (UNRATE)
Consumer Price Index for All Urban Consumers: All Items (CPIAUCSL)
Spot Oil Price: West Texas Intermediate (OILPRICE)

Shaded areas indicate US recessions.
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OILPRICE (Left)
UNRATE (Right)
CPIAUCSL (Right)

Increase in unemployment during recessions

peak	trough	*increase in no. of unemployed persons (millions)*
July 1953	May 1954	2.11
Aug 1957	April 1958	2.27
April 1960	February 1961	1.21
December 1969	November 1970	2.01
November 1973	March 1975	3.58
January 1980	July 1980	1.68
July 1981	November 1982	4.08
July 1990	March 1991	1.67
March 2001	November 2001	1.50

Increase from 12/2007 thru 6/2009: 7.4 million!!!

Arguments for active policy (against passive policy)

- Recessions cause economic hardship for millions of people and through active government policy the hope is for the size of the hardship to be reduced.
  - frequent shocks lead to unnecessary fluctuations in output and employment
  - fiscal and monetary policy can stabilize the economy
- The _____ stated the following: "It is the continuing policy and responsibility of the Federal Government to…promote full employment and production."

Arguments against active policy (for passive policy)

- the long & variable lags associated with monetary and fiscal policy render them ineffective and possibly destabilizing
  - inept policy increases volatility in output, employment

- Policies act with long & variable lags, including:

  _____: the time between the shock and the policy response.

  - takes time to recognize shock

  - takes time to implement policy, especially fiscal policy (An Act of Congress)

  _____: the time it takes for policy to affect economy.

  If conditions change before policy's impact is felt,
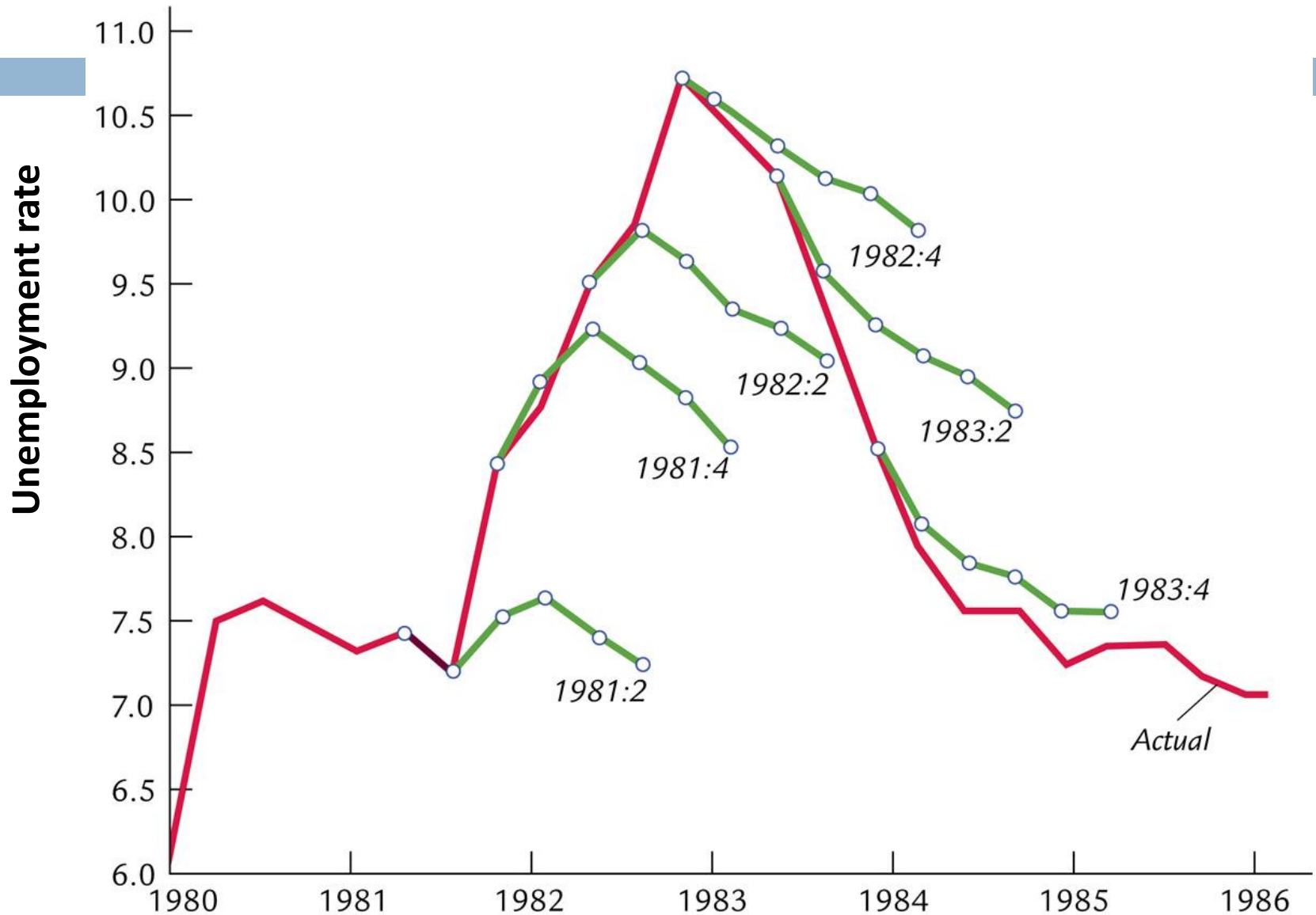 *the policy may destabilize the economy.*

Automatic stabilizers

- definition: policies that stimulate or depress the economy when necessary without any deliberate policy change.

- Designed to reduce the lags associated with _____.

- Examples:

  - income tax:
    - Each person's tax bill depends on her income. In a recession, average incomes fall, so the average person pays less taxes. It's as if the government automatically gives people a tax cut in recessions.

  - unemployment insurance
    - In a recession, people who become unemployed experience a fall in their income, and therefore reduce their spending, which further reduces aggregate demand. Unemployment insurance reduces the fall in the income of the unemployed, and so helps to reduce the drop in aggregate demand during a recession.
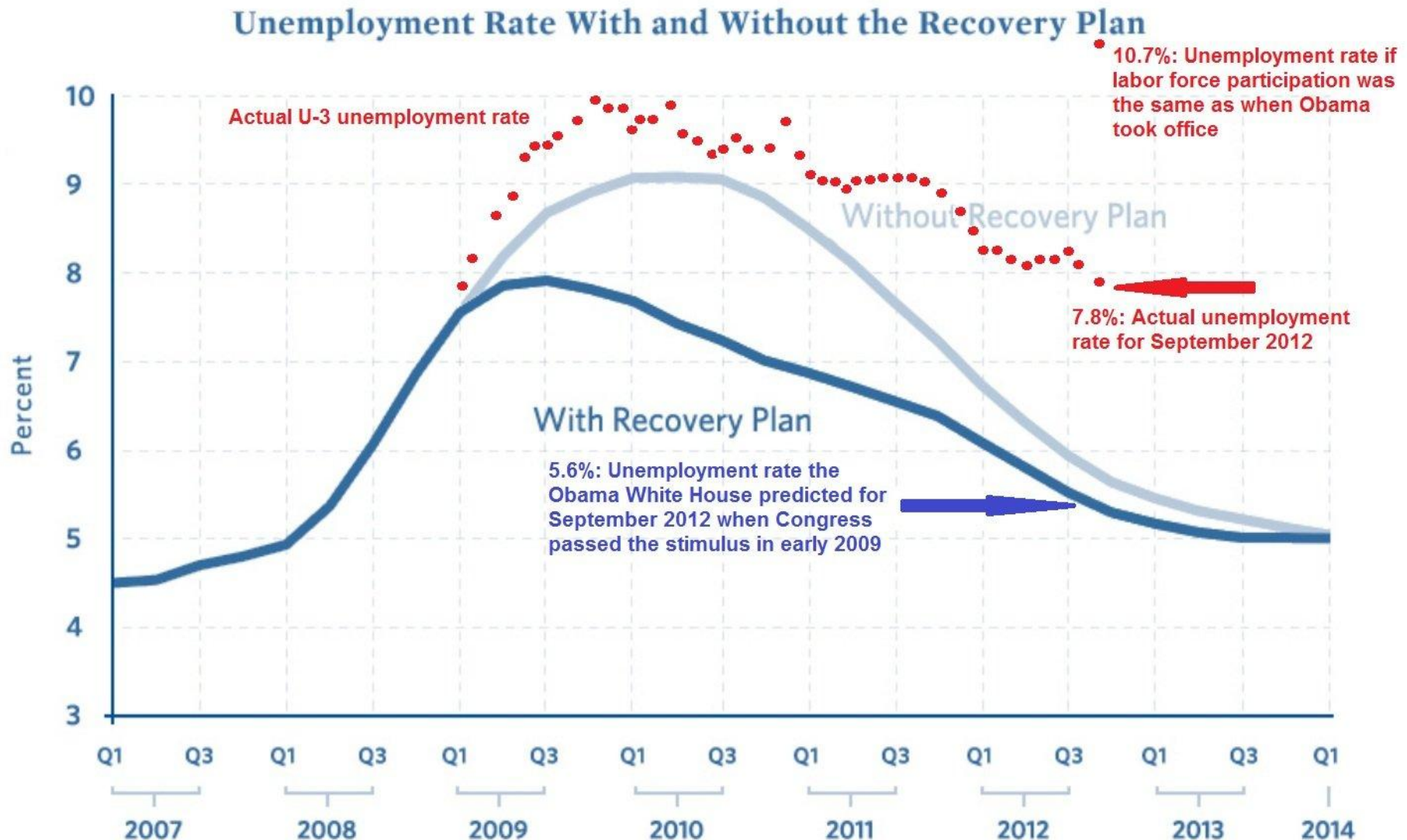
  - welfare

Forecasting the macroeconomy

Because policies act with lags, policymakers must try to predict future conditions.

Two ways economists generate forecasts:

- _____

  data series that fluctuate in advance of the economy

- _____

  Large-scale models with estimated parameters that can be used to forecast the response of endogenous variables to shocks and policies

- These models still have many problems
  - Booms & Busts (Video)

Mistakes forecasting the 1982 recession

Mistakes forecasting the Unemployment Rate

Unemployment Rate With and Without the Recovery Plan

The adverse supply shock (i.e. oil shock, drought, tsunami) moves the economy to point B.
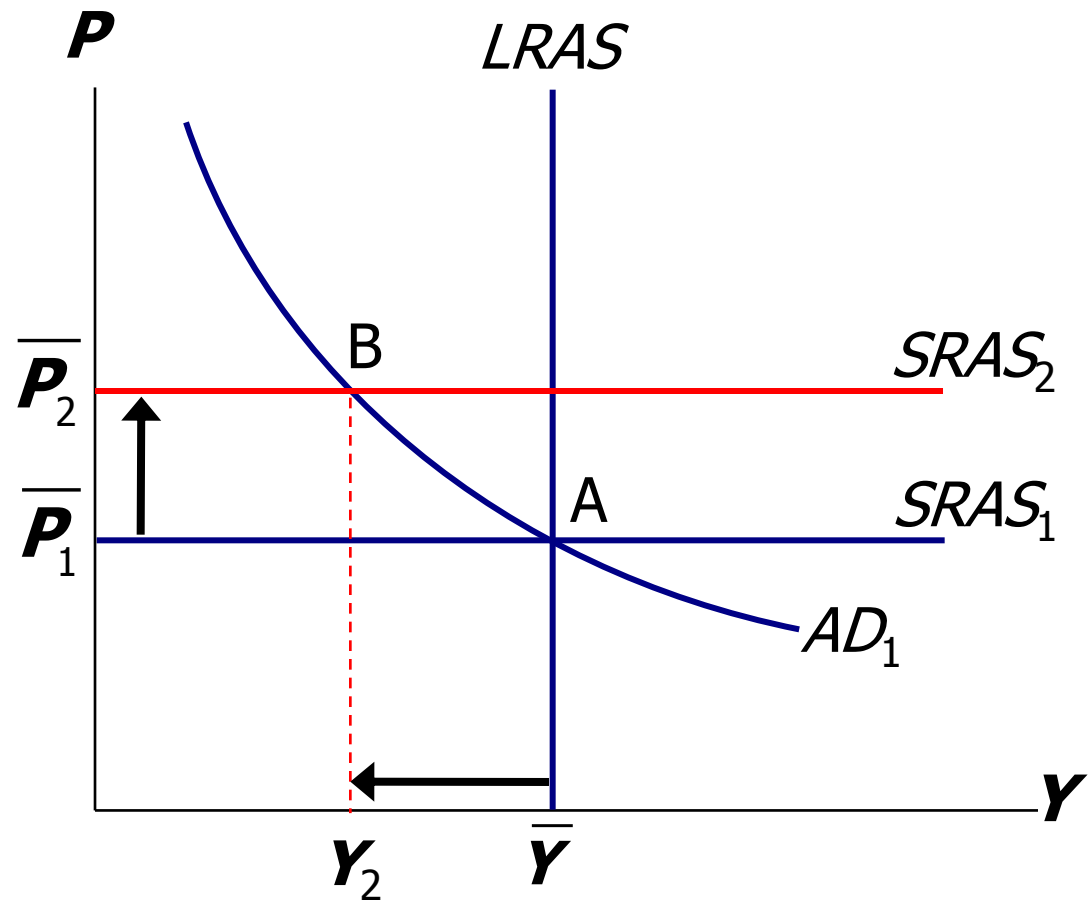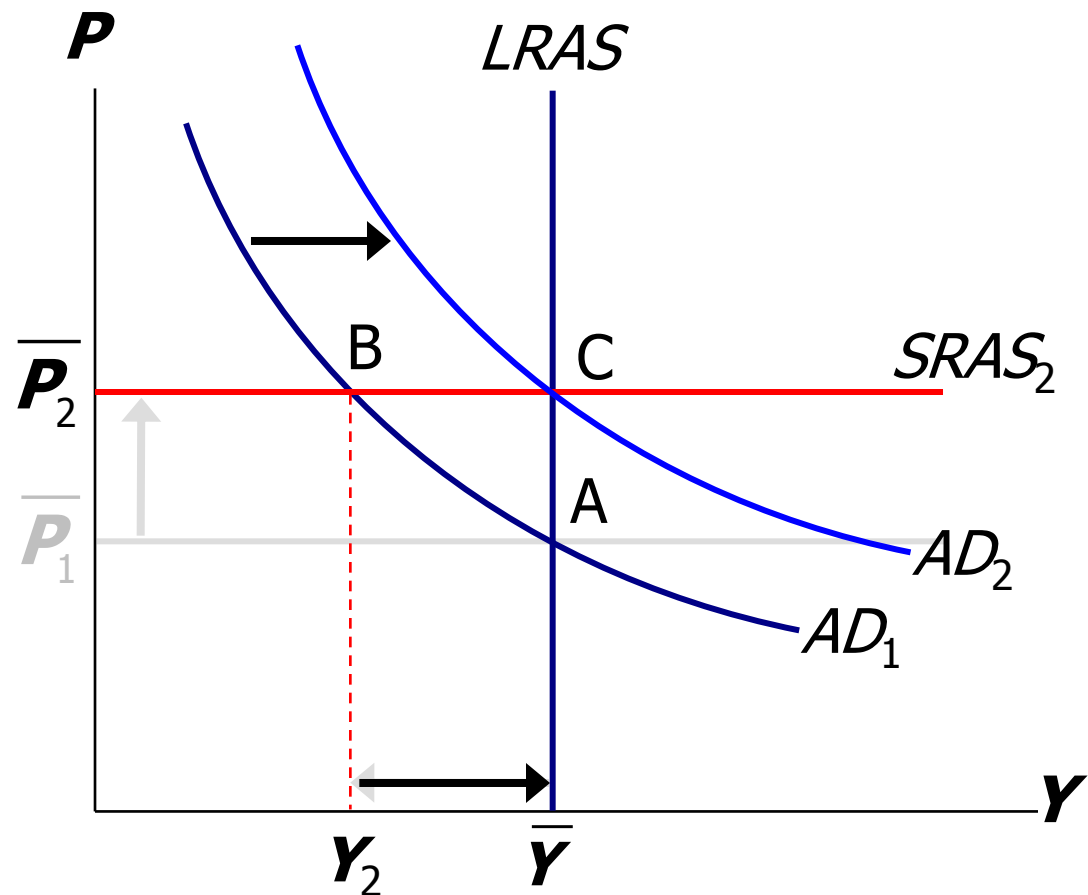
Stabilizing output with monetary policy OR fiscal policy

But the Fed accommodates the shock by raising agg. Demand by increasing M.

results:

P is permanently higher, but **Y** remains at its full-employment level.

A Similar Scenario with Fiscal Policy

- Fiscal Policy
  - Changes in _____
  - Changes in _____
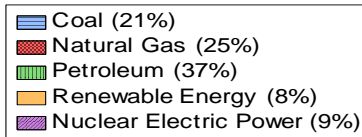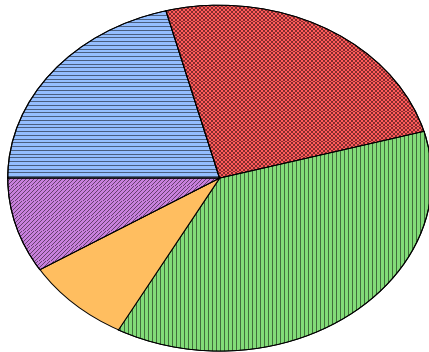- Why not add to deficits by increasing government spending and cut taxes? (Video)
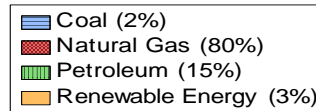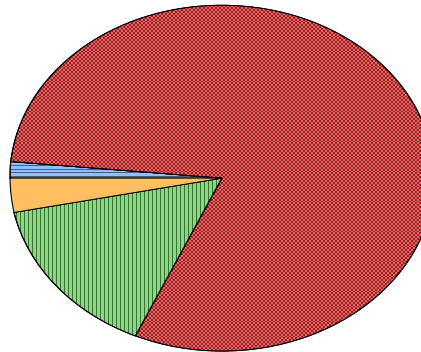
Energy Prices & Macroeconomy

- Most economic recessions in the United States since WWII have been _____.
  - 10 out of the last 11 recessions.

- Energy prices provide valuable information for business cycles. (Hamilton, 1983; Kilian, 2008)

- Transmission of energy price shocks and their effects on the economy.

- Which energy prices should we focus on?

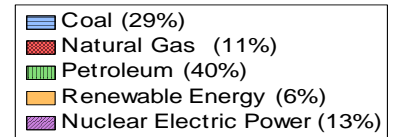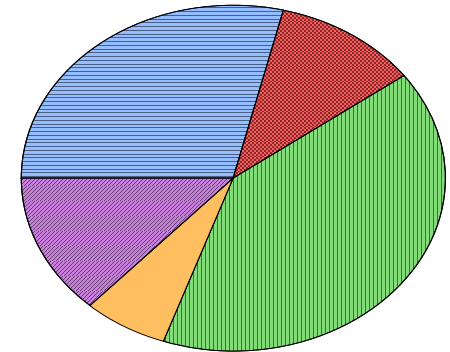# Figure 2: U.S. Total Primary Energy Consumption by Sources and Sectors, 2009

Energy Consumption Sources
- Coal (21%)
- Natural Gas (25%)
- Petroleum (37%)
- Renewable Energy (8%)
- Nuclear Electric Power (9%)

Commercial Sector
- Coal (2%)
- Natural Gas (80%)
- Petroleum (15%)
- Renewable Energy (3%)

Electric Power Sector
- Coal (29%)
- Natural Gas (11%)
- Petroleum (40%)
- Renewable Energy (6%)
- Nuclear Electric Power (13%)

Industrial Sector
- Coal (7%)
- Natural Gas (44%)
- Petroleum (39%)
- Renewable Energy (10%)

Residential Sector
- Coal (0%)
- Natural Gas (74%)
- Petroleum (17%)
- Renewable Energy (9%)

Transportation Sector
- Coal (0%)
- Natural Gas (3%)
- Petroleum (94%)
- Renewable Energy (3%)

Total U.S. Energy Consumption = 94.6 Quadrillion Btu
Source: Energy Information Administration, *Annual Energy Review 2009*

Petroleum

- Petroleum products are the most relevant and can help to _____.

- Petroleum includes crude oil, gasoline, distillate (diesel), heating oil, propane, jet oil, and other petroleum products.

- What percentage of GDP is petroleum expenditures?

EIA Data for Shares of GDP

Figure 1: U.S. Annual Energy and Petroleum Expenditures Shares of Gross Domestic Product
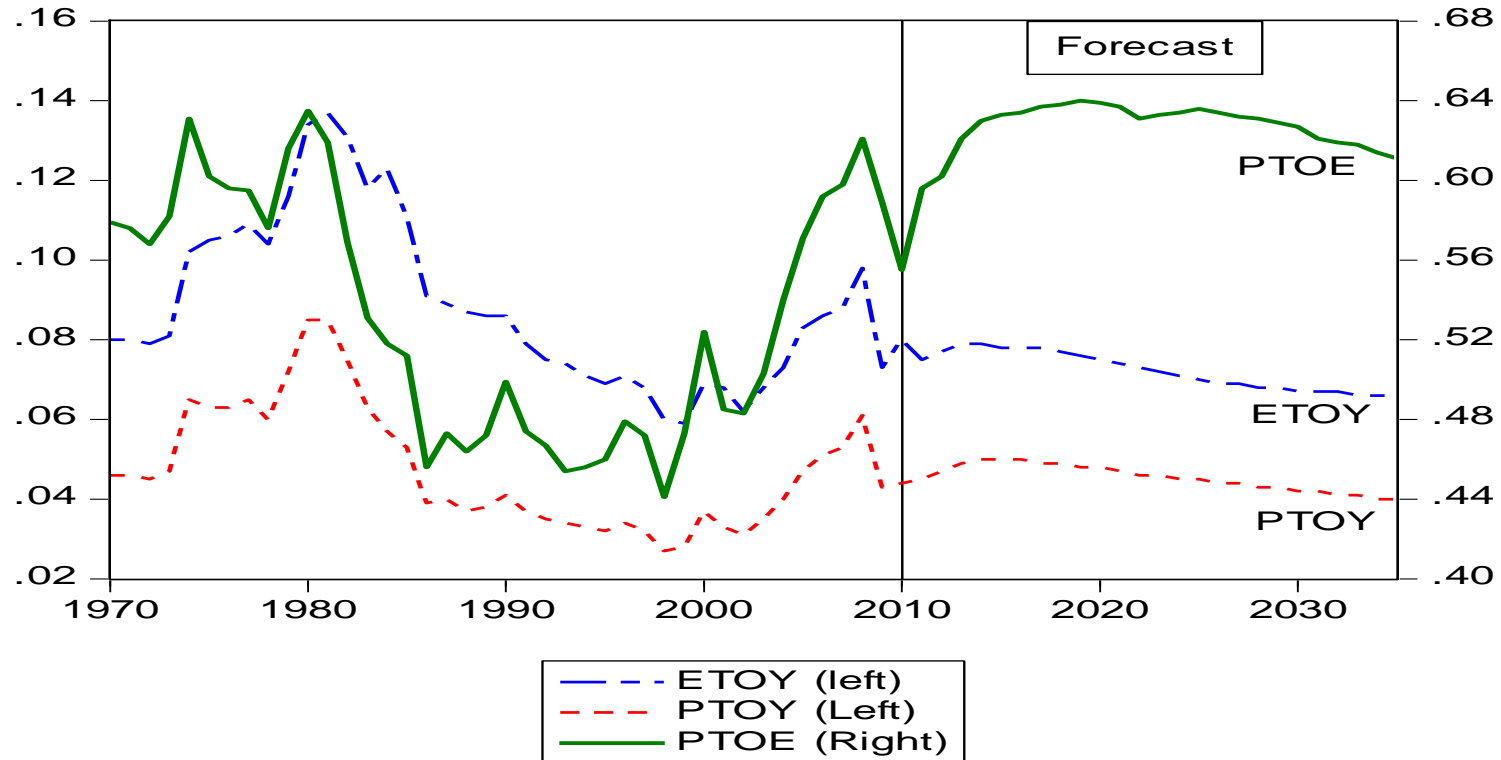
Table 1: Petroleum and Total Energy Expenditure as Shares of GDP

Mean per Period	1970-1979	2000-2009	**1970-2010**	**2011-2035**	1970-2035
PTOY = Petrol exp./y	.0572	.0431	**.0476**	**.0454**	.0468
ETOY = Energy exp./y	.0962	.0768	**.0885**	**.0722**	.0823
PTOE = PTOY/ETOY	.5945	.5612	**.5379**	**.6288**	.5687

Which Petroleum Products?

- The EIA notes that _____is used to produce gasoline and diesel.

- Oil price effects on the economy have declined and their volatility may _____. (Blanchard and Gali, 2007; Barsky and Kilian, 2004)

- Gasoline prices impact the _____of the economy by reducing the purchasing power of individuals (Edelstein and Kilian, 2009).

- Diesel prices effect the _____of the economy through the transportation sector.

Transmission Mechanisms

☐ The mechanisms by which oil-related shocks transmit through the economy are also of interest when examining the macroeconomic effects of these shocks.

☐ In the literature, there are three primary transmission mechanisms for oil price fluctuations:

▫ _____

▫ _____

▫ _____

Transmission Mechanism: Aggregate Supply

- Kim and Loungani (1992) find that the effects from technology and petroleum price shocks on producers can explain business cycles.

- Rotemberg and Woodford (1996) also note negative economic effects of energy price increases in an imperfectly competitive model, whereby firms price goods above marginal cost.

- Finn (2000) argues that similar negative effects from an energy price shock result from a decline in the use of capital in a _____. (See Slides)

- Therefore, _____ macroeconomic effects would tend to occur when the oil price transmission mechanism is through aggregate supply.

Transmission Mechanism: Aggregate Demand

- Edelstein and Kilian (2009) describe how rising petroleum prices reduce the purchasing power of consumers and decrease their expenditures on other goods and services.

- Mehra and Peterson (2005) show that an increase in the price of oil negatively affects output from a decline in the consumption of durable goods.

- Ramey and Vine (2011) note that vehicle manufacturers have made significant improvements in fuel efficiency over the last 40 years, but oil price shocks and subsequent increases in gasoline prices have reduced expenditures on automobiles.

- Each of these effects on aggregate demand puts

from an oil price shock.

Transmission Mechanism:
Term Structure of Interest Rates

- Bernanke, Gertler, and Watson (1997) explain this transmission mechanism as a _____.

    - Specifically, a positive oil price shock tends to raise the public's inflation expectations, steepening the yield curve for Treasury securities, pressuring the Fed to increase its federal funds rate target, and causing economic growth to slow.

    - Therefore, economic fluctuations are not a direct result from an oil price shock, but an indirect result from its effect on the term structure of interest rates.

- However, Hamilton and Herrera (2004) modify the model proposed by Bernanke et al. and find that oil price shocks do matter for business cycles.

- Although there is uncertainty concerning this oil price transmission mechanism, it appears the effects through the term structure of interest rates will be

Can oil price futures predict spot retail gas prices?-Download Paper-Published 2009
Vance Ginn & Ron D. Gilbert

- Near-term futures prices of unleaded gasoline may be used to predict retail gas prices

- Another method was used by noting the relationship between crude oil futures and retail gasoline prices
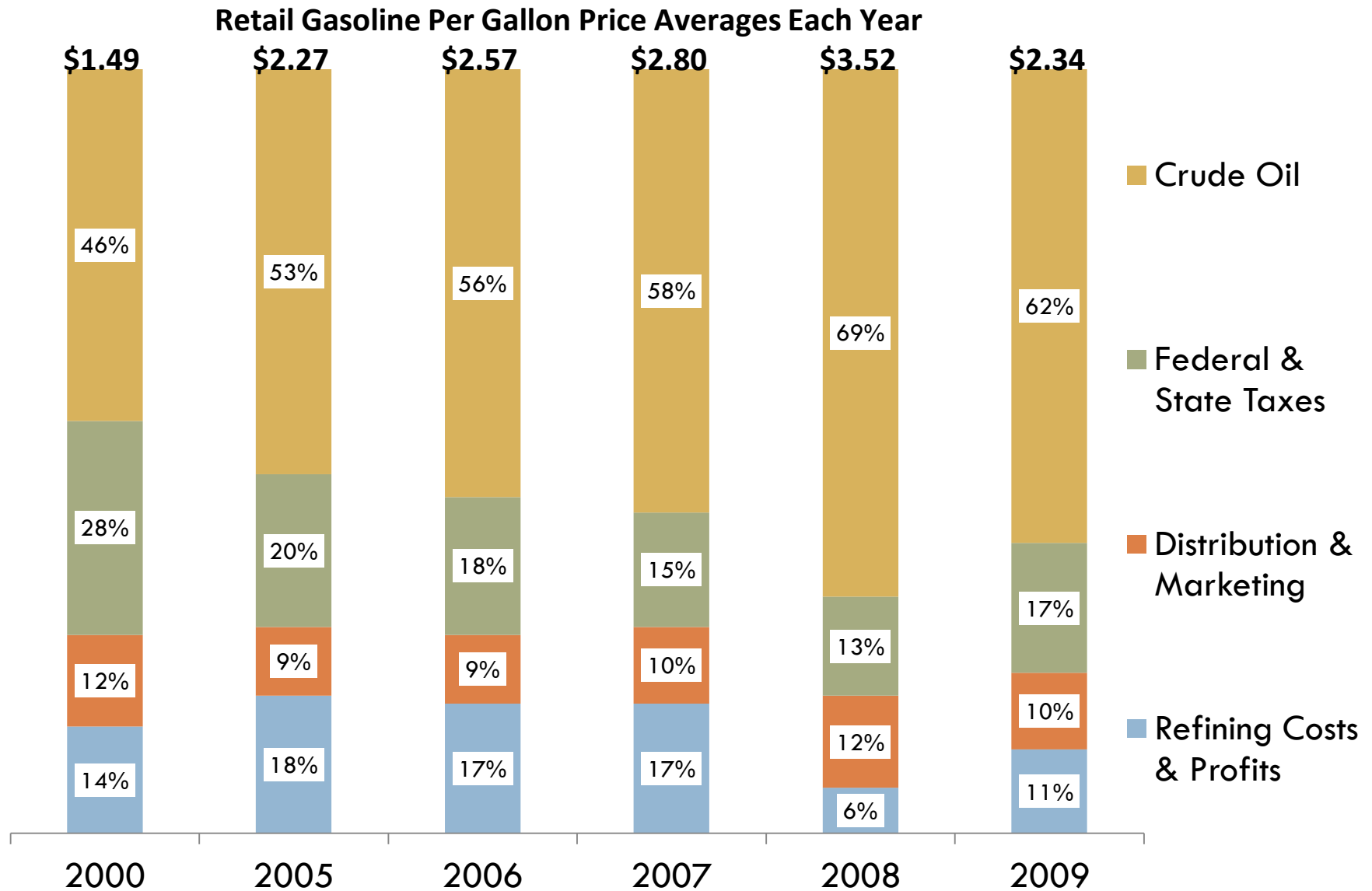
- Initial model expressed as the following:

$$E(G_{t+1}) - G_t = [G_t/O_t](O_t - O_{t-1})$$

- Formal model using the first difference of the log values

$$G_t = \alpha_1 + \beta_0 O_t + \beta_1 O_{t-1} + \beta_2 O_{t-2} + \beta_3 O_{t-3} + \varepsilon_t$$

Figure 1: Average Yearly Retail Gasoline Components

Retail Gasoline Per Gallon Price Averages Each Year

Year	Price	Crude Oil	Federal & State Taxes	Distribution & Marketing	Refining Costs & Profits
2000	$1.49	46%	28%	12%	14%
2005	$2.27	53%	20%	9%	18%
2006	$2.57	56%	18%	9%	17%
2007	$2.80	58%	15%	10%	17%
2008	$3.52	69%	13%	12%	6%
2009	$2.34	62%	17%	10%	11%

Source: Energy Information Administration, Washington, DC

Institutional Knowledge

- _____ product retail station (ex. Kroger's)
  - Prices gasoline one cent cheaper on average than branded
  - Purchases gasoline from cheapest refinery
    - San Antonio vs. Midland

- _____ product retail station (ex. Chevron)
  - Less flexibility between refineries as unbranded
  - Guaranteed daily supply

Table 1
Estimates of Gas Price Expectations
Using the First Difference of the Logged Values

$$G_t = \alpha_1 + \beta_0 O_t + \beta_1 O_{t-1} + \beta_2 O_{t-2} + \varepsilon_t$$

Variable	Coefficient	Std. Error	
Const	0.000579	0.000482	
O_t	0.210254	0.012398	***
O_{t-1}	0.101589	0.012405	***
O_{t-2}	0.082453	0.012289	***

$R^2 = 0.324757$
SBC = -5.578013

$$G_t = \alpha_1 + \beta_0 O_t + \beta_1 O_{t-1} + \beta_2 O_{t-2} + \beta_3 O_{t-3} + \varepsilon_t$$

Variable	Coefficient	Std. Error	
Const	0.000475	0.000473	
O_t	0.204354	0.012244	***
O_{t-1}	0.108747	0.012302	***
O_{t-2}	0.072072	0.012228	***
O_{t-3}	0.077643	0.012085	***

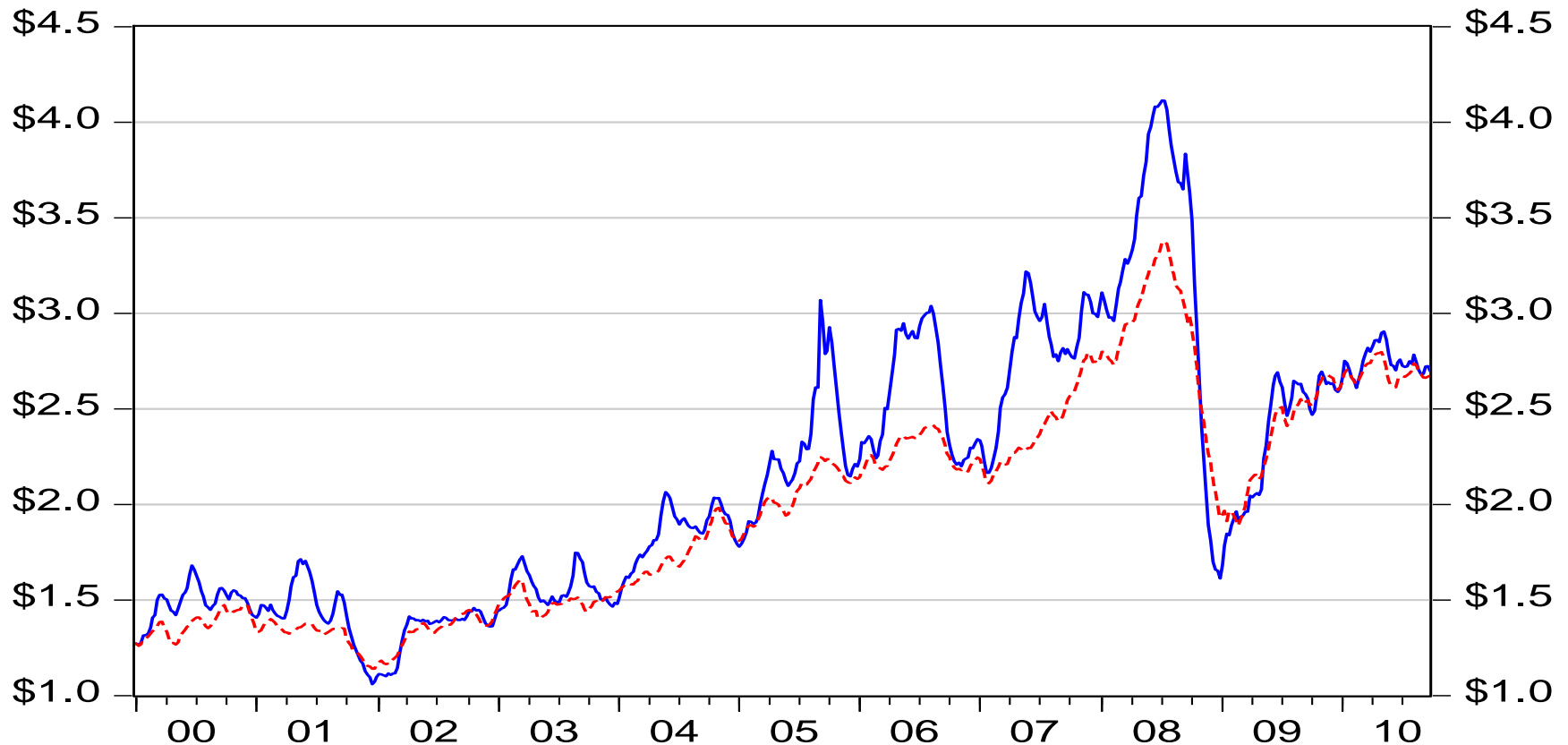$R^2 = 0.353728$
SBC= -5.613580

Note: The data set that was used is the first difference of the logged values of the weekly average prices of a gallon of retail gasoline (G_t) and the weekly average of futures prices of a barrel of crude oil (O_t) from August 20, 1990 to August 25, 2008. ε_t is a normal and i.i.d. error term.

*** statistically significant.
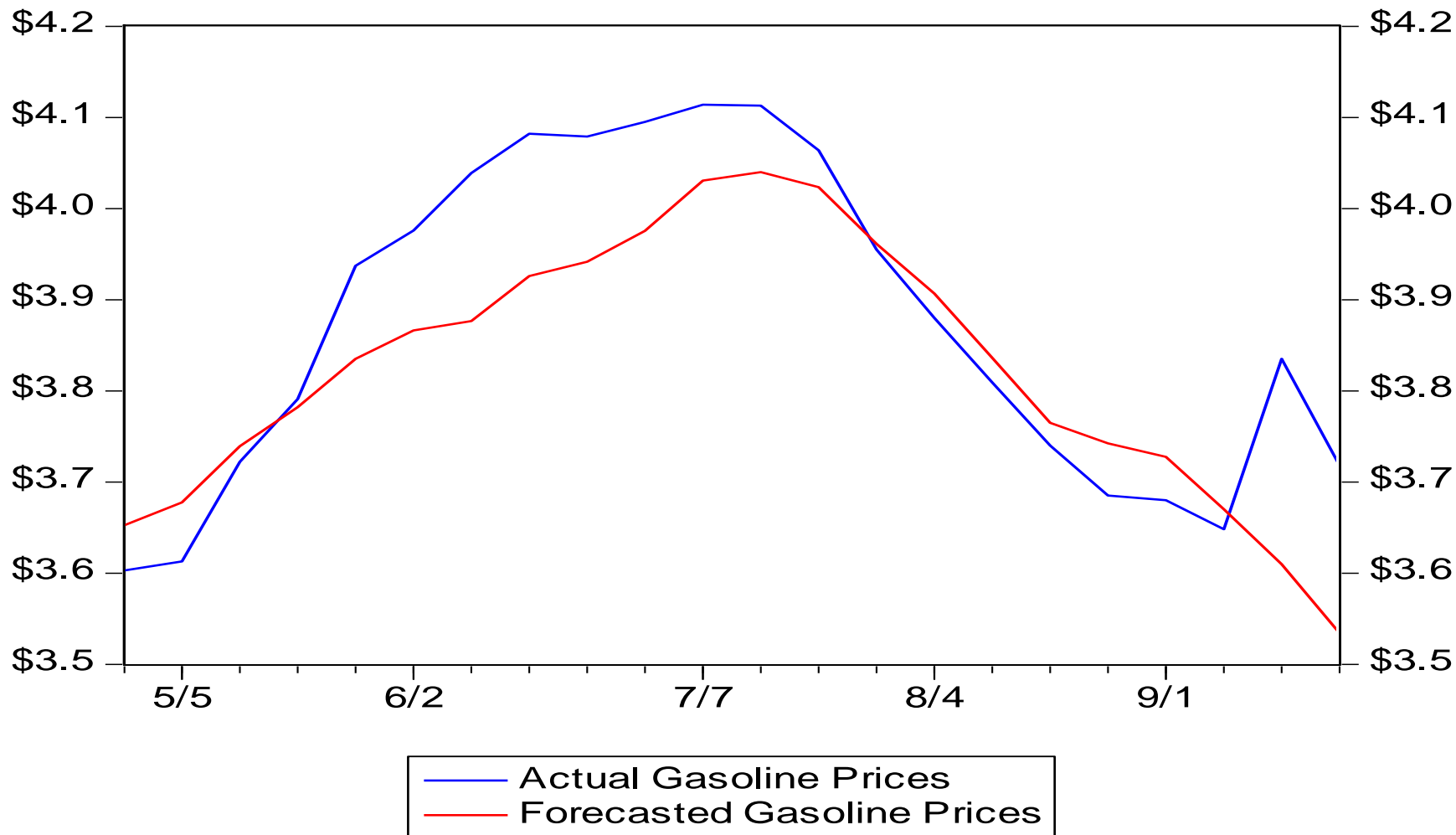
Actual and Estimated Gas Prices, 2000-2010

	Actual	Estimate
8/23/2010	2.70	2.70
8/30/2010	2.68	2.68
9/06/2010	2.68	2.66
9/13/2010	2.72	2.66
9/20/2010	2.72	2.67
9/27/2010	2.69	2.67

- Note: Data are from January 1, 2000 to September 27, 2010.

Graph 8: Dynamic Forecasted and Actual Retail Gasoline Prices

Legend:
— Actual Gasoline Prices
— Forecasted Gasoline Prices

□ Note: The values used in this graph to attain the forecast for the period April 28, 2008 to September 22, 2008 from the model are the first difference of the logged values of the weekly average prices of a gallon of retail gasoline (G) and the weekly average of futures prices of a barrel of crude oil (O) from April 28, 2008 to September 22, 2008.

□ Values on the Y axis are the level of the average weekly retail gasoline prices in dollars

Conclusions of Crude Oil-Gas Price

- The weekly average futures price of crude oil can predict spot retail unleaded gasoline prices.

- A 10% increase in the current week's futures price of crude oil will cause an increase in the current week's

  _____

- What about other indicators? "Forecasting Fuel Prices During an Era of Rising and Volatile Petroleum Prices" (See Slides)

Chapter Summary

1. Long run: prices are flexible, output and employment are always at their natural rates, and the classical theory applies.

   Short run: prices are sticky, shocks can push output and employment away from their natural rates.

2. Aggregate demand and supply:
   a framework to analyze economic fluctuations

3. The aggregate demand curve slopes downward.

4. The long-run aggregate supply curve is vertical, because output depends on technology and factor supplies, but not prices.

5. The short-run aggregate supply curve is horizontal, because prices are sticky at predetermined levels.

Chapter Summary

6. Shocks to aggregate demand and supply cause fluctuations in GDP and employment in the short run.

7. The Fed and Congress can attempt to stabilize the economy with monetary policy and fiscal policy, respectively.