Aggregate Demand & Aggregate Supply

Adding Swings in the Overall Price Level to the Model

Outline

1. Aggregate Demand
2. Aggregate Supply
3. Macroeconomic Equilibrium

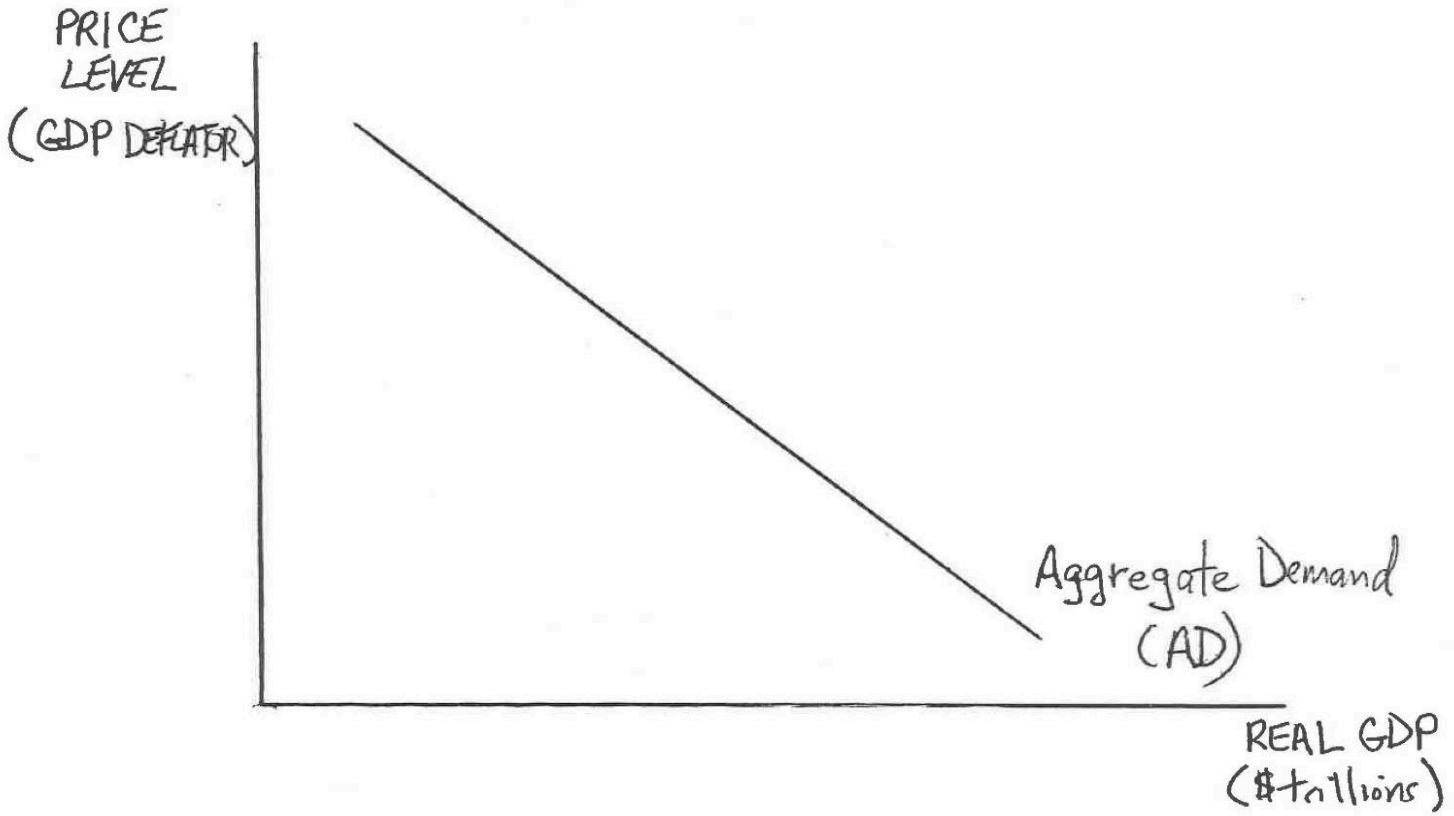
- Textbook Readings: Ch. 13

AD-AS Model

- New model: Links **output changes** to **changes in the price level**
  - AE model looks only at output swings
- How do changes in **demand** affect aggregate output **and the price level**?
- How do changes in **supply** affect aggregate output **and the price level**?
- How do changes in the **price level** affect aggregate output level?

The Aggregate Demand Curve

- A downward sloping AD curve
  - As the overall price level falls, the level of output rises



Why the AD Curve is Downward Sloping?

- Microeconomic theory:
  - Law of demand: When the price of an individual good falls, demand rises
  - **Assuming all other prices are stable!**
  - Why demand curves slope downward?
    - **Substitution effect** – Good is cheaper relative to other goods
    - Income effect – Increase in purchasing power

- The AD curve is DIFFERENT!
  - Aggregate Demand is a **macroeconomic concept**

Why the AD Curve is Downward Sloping?

- Macroeconomic theory:
  - Substitution effects **do not** explain the AD curve

- Aggregate Demand curve depicts the effects on **overall demand**, given a change in the **prices of all** goods and services

- Clearly, substitution of one good for another cannot explain a shift in **overall demand** given a shift in **overall prices**

Why Fall In Price Level Associated With Higher Output?

- **Wealth Effect**:
  - Some HH wealth is held in nominal assets
  - As price level rises, real value of HH wealth declines → **Less consumption**

- **Interest Rate Effect**:
  - When prices rise, HH and firms need more money to finance buying and selling (increase in demand for money)
  - "Price" of holding money (interest rate) rises, **discouraging investments**

- **International Trade Effect**:
  - As price level rises, domestic goods become relatively expensive, **NX fall**

The Wealth Effect Explained

- Ernie has **$20,000** in the bank
  - Prices: Moped = **$8,900**; TV = **$9,200**; Vacation = **$9,700**
- He plans to buy **two** of these three items, after graduation
- By then, prices leap: **Inflation** is **20%**
  - New prices: Moped = **$10,680**; TV = **$11,040**; Vacation = **$11,640**
- Ernie now buys only **one** of the items

The Interest Rate Effect Explained

- HH invest financial wealth in various assets: cash, bonds, stocks
- HH hold enough cash to make it easy to pay their bills
- **If prices jump**, HH must sell some bonds and stocks to **increase** their **cash holdings**
- Sell bonds → Prices fall → **Interest rates rise** → Less investment

The Interest Rate Effect: Example

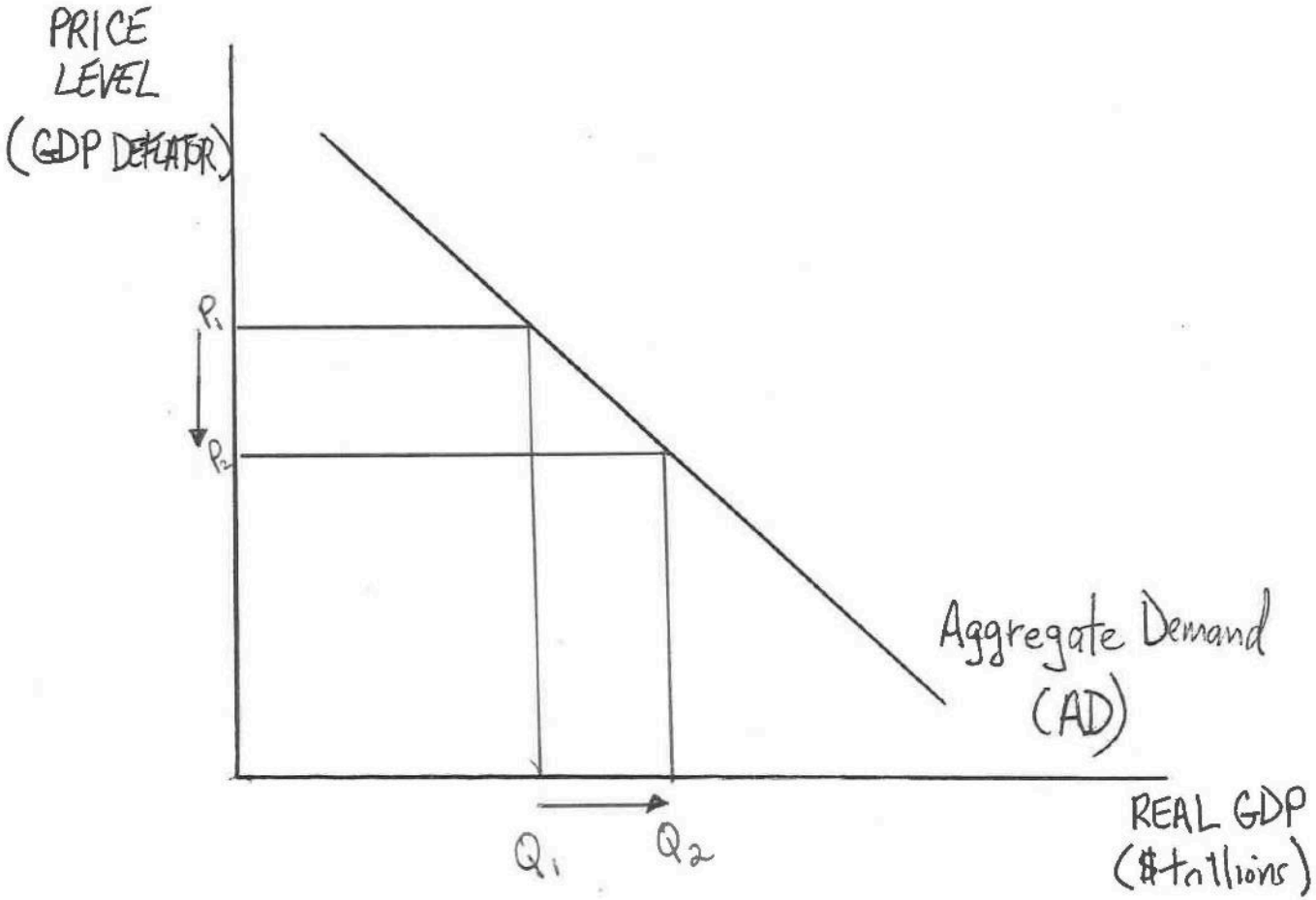
- Bert, Ernie, Big Bird, Miss Piggy and the Count all keep, on average, **$5,000** in their checking account to pay bills
- **Prices fall**: Inflation is -1%
- Now they only need **$3,000** in their accounts to pay bills
- They all buy bonds → Supply of funds rise → **Interest rates fall**
- Lower real rates **boost investment spending** (e.g. home building)

The International Trade Effect Explained

- As domestic **prices go up**, foreigners can afford less domestic goods
  - Exports go down
- Likewise, foreign goods are relatively cheaper
  - Imports go up
- **Net exports go down** unambiguously

A Movement Along the AD Curve

- As the price level falls, output rises



From AE Model to AD-AS Model: A Simple Derivation

- AE model assumes that the overall price level is fixed
  - Reflects assumption that there is enough capacity to increase output
- Here we **relax** that **assumption**
- **Prices jump** from period 1 to period 2, what happens to AE?
  - **AE line falls** at any level of output
  - Equilibrium is now lower
- Thus, we can 'derive' the AD line by manipulating our AE model

AE Model: 'Embedded' in the AD-AS Model

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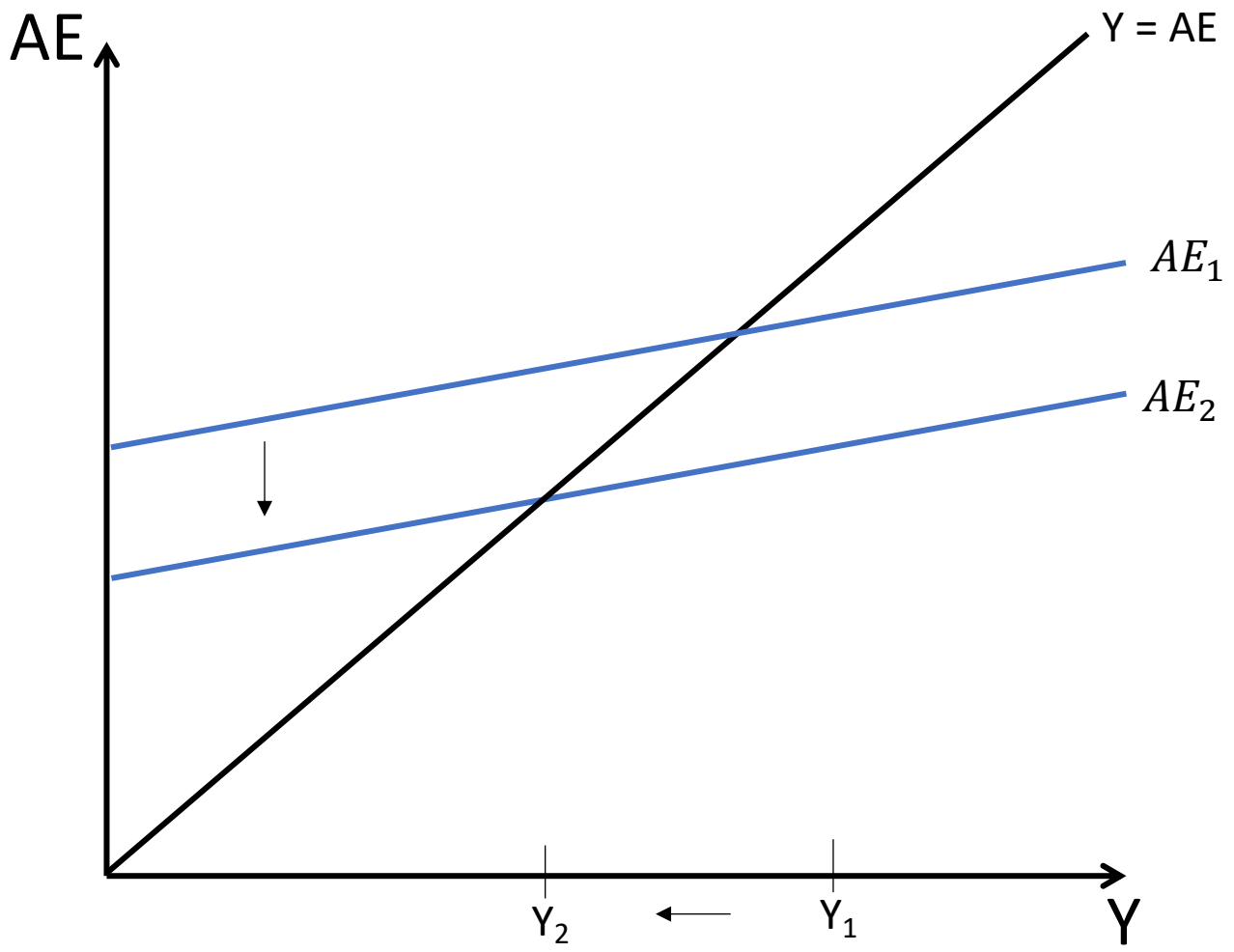
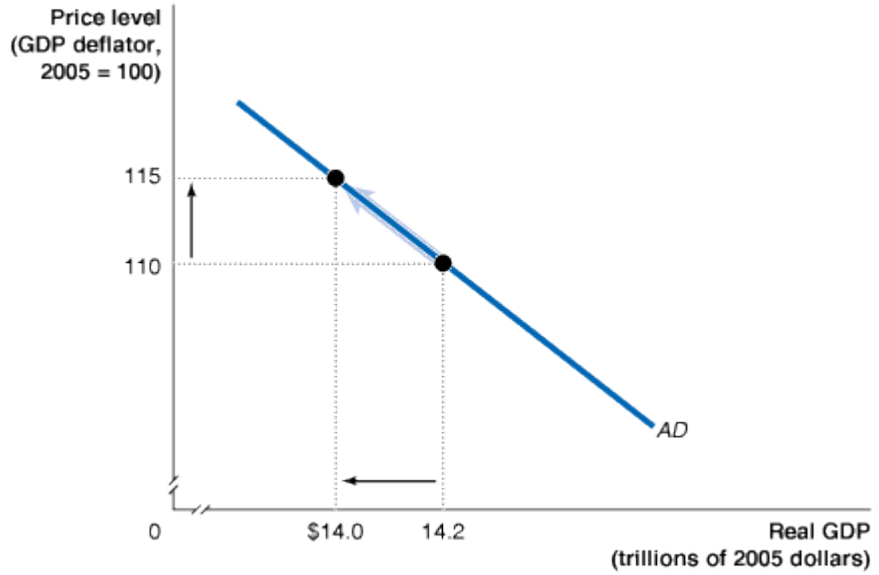
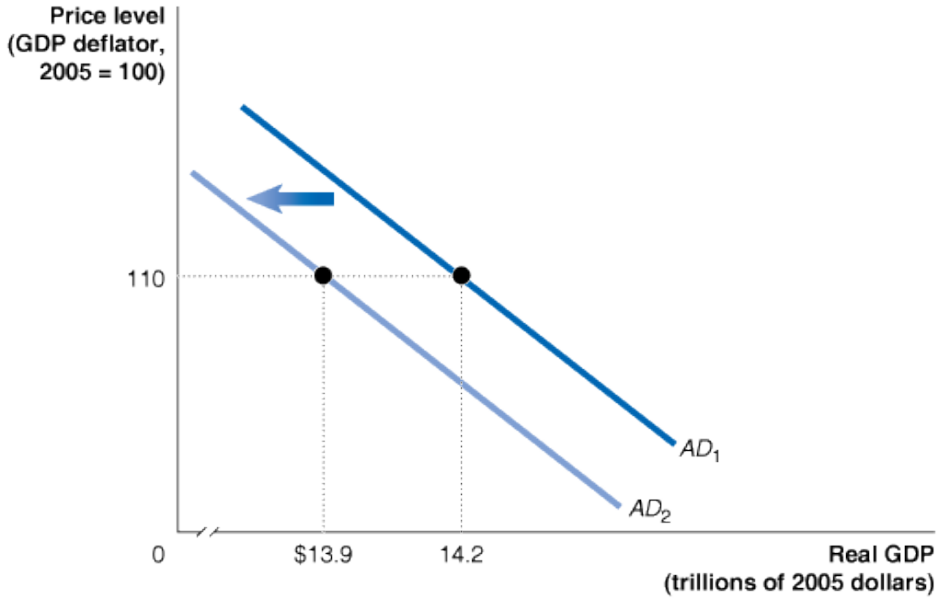


Shifts vs Movements Along the AD Curve

- AD curve shows the relationship between the price level and real GDP **demanded**, **holding everything else constant**
- A change in a variable **other than the price level** will shift AD curve





Shifts in the AD Curve

- **Demand shock**: Unexpected event that causes AD curve to shift

- AD shifts when:
  - Government policies change
  - Expectations of HH and firms about the future change
  - Foreign variables change

AD Shifts: Changes in Government Policy

- Changes in government policies could shift aggregate demand

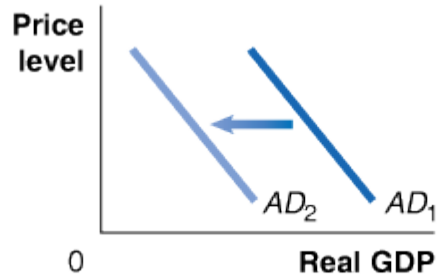
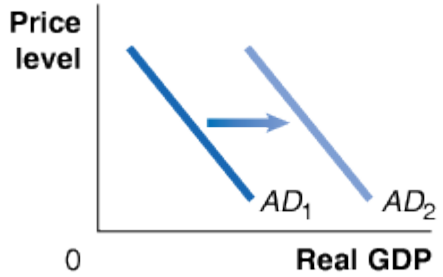
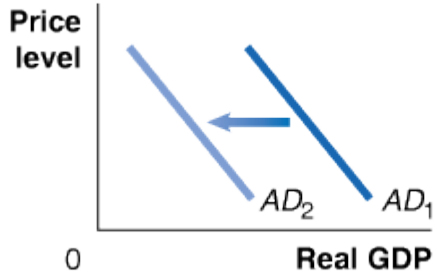
- Two categories of government policies:

1. **Monetary policy**: Central bank manages the money supply and interest rates
   - Example: If it causes interest rates to rise, investment spending will fall

2. **Fiscal policy**: Government collects taxes (T) and spends (G) on goods and services
   - Decisions about T and G shift AD curve

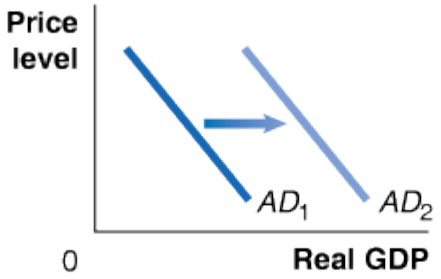
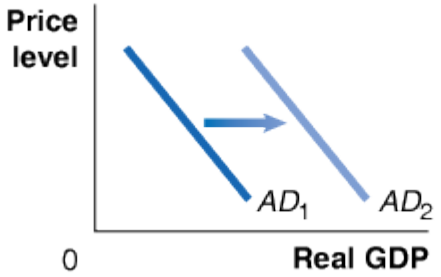
AD Shifts: Changes in Government Policy

Variables That Shift the Aggregate Demand Curve

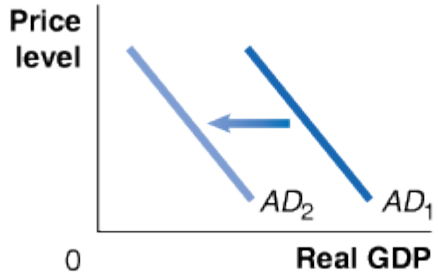
AN INCREASE IN . . .	SHIFTS THE AGGREGATE DEMAND CURVE . . .	BECAUSE . . .
interest rates		higher interest rates raise the cost to firms and households of borrowing, reducing consumption and investment spending.
government purchases		government purchases are a component of aggregate demand.
personal income taxes or business taxes		consumption spending falls when personal taxes rise, and investment falls when business taxes rise.

AD Shifts: Changes in Expectations

Variables That Shift the Aggregate Demand Curve

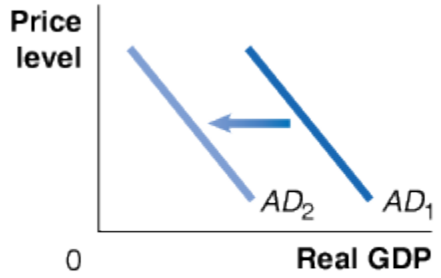
AN INCREASE IN . . .	SHIFTS THE AGGREGATE DEMAND CURVE . . .	BECAUSE . . .
households' expectations of their future incomes		consumption spending increases.
firms' expectations of the future profitability of investment spending		investment spending increases.

AD Shifts: Changes Relative to Foreign Variables

AN INCREASE IN . . .	SHIFTS THE AGGREGATE DEMAND CURVE . . .	BECAUSE . . .
the growth rate of domestic GDP relative to the growth rate of foreign GDP		imports will increase faster than exports, reducing net exports.

- In 2015, many emerging economies fell into **recessions**
  - Their incomes and spending shrunk
  - Their **imports of U.S. goods fell**

AD Shifts: Changes Relative to Foreign Variables

AN INCREASE IN . . .	SHIFTS THE AGGREGATE DEMAND CURVE . . .	BECAUSE . . .
the exchange rate (the value of the dollar) relative to foreign currencies		imports will rise and exports will fall, reducing net exports.

- In 2015, Brazil's **currency rate fell sharply**
  - U.S. exports became more expensive, so foreigners bought less of them

US Net Exports

Time Frame and Aggregate Supply

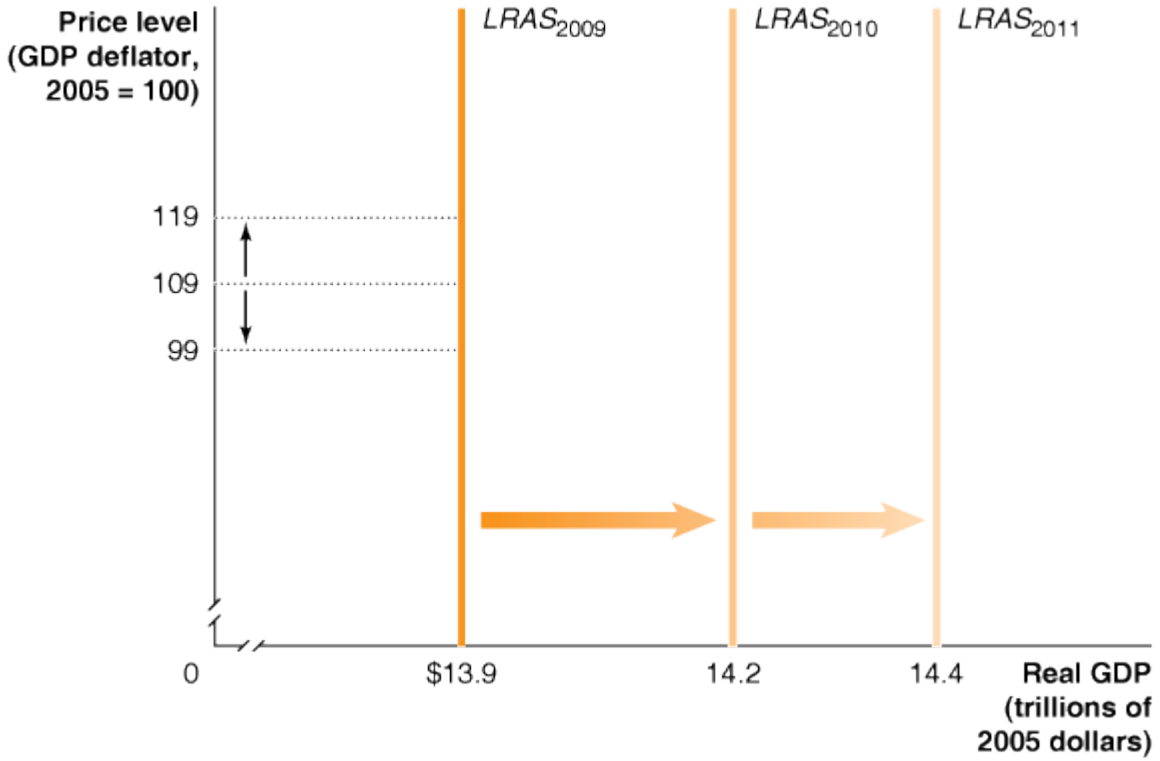
- Aggregate Supply refers to the quantity of G&S that firms are willing and able to supply

- The relationship between this quantity and the price level is **different in** the **long run** and the **short run**

- So we will develop **both** curves: Short-Run Aggregate Supply (SRAS) and Long-Run Aggregate Supply (LRAS)
  - They show the relationship between the price level and quantity of real GDP supplied in different time frames

The Long-Run Aggregate Supply Curve

- In the long run, the level of real GDP is determined by the number of workers, the level of technology, and the capital stock (factories, machinery, etc.)
  - **None** of these elements **is affected by the price level**
- So the long-run AS curve is a **vertical line**, at the level of **potential** or **full-employment GDP**



The Vertical Long-Run Supply Curve

- In the **SHORT RUN**, there is evidence that an economy **can produce more**, if you allow a **rising price level**

- But the **LONG-TERM** trajectory for output **cannot** be lifted by allowing prices to rise faster
  - You can't get more output just by allowing more inflation
  - As we learned:

$$LTSG = Labor\ Productivity\ Growth + Labor\ Force\ Growth$$

The Short-Run Aggregate Supply Curve

- The short-run Aggregate Supply curve is **upward sloping**
  - As the overall price level rises, the level of output rises

- **Why** the SRAS curve is upward sloping?
  - Who provides us with the output (the supply)?

Firms

  - What drives firm decisions?

Profits

  - The simplest profit formula?

Profit = Revenues - Costs

Profits per Item Sold

$$\text{Profits} = \text{Revenues} - \text{Costs}$$

$$\text{Profits/pizza} = (\text{Revenues/pizza}) - (\text{Cost/pizza})$$

- Revenues/pizza = Price of the pizza
- Cost/pizza: 80% are labor costs (wages)

- **Wages are sticky**

- If the price level is rising and wages are sticky, you make **more money per unit sold**

Why Do You Increase Production?

# of ovens	# of workers	pizzas sold per day	cost per worker per day	non labor costs per pizza per day	total labor costs	total non-labor costs	total costs	price per pizza	cost per pizza	profit or loss per pizza
1	5	50	$80	$2	$400	$100	$ 500	$11	$ 10.00	$1.00
1	8	65	$80	$2	$640	$130	$ 770	$11	$ 11.85	($0.85)
1	8	65	$80	$2	$640	$130	$ 770	$15	$ 11.85	$3.15

- If I can raise my prices and not pay my people more, it's profitable to make more pizza

So Why the SRAS Curve is Upward Sloping?

- Contracts make some wages and prices "**sticky**"
  - Prices and wages are said to be "sticky" when they do not respond quickly to changes in demand or supply

- Firms are often **slow to adjust wages**
  - Annual salary reviews are "normal"
  - But firms dislike cutting wages—it's bad for morale

- Other situations of sticky prices?
  - Magazine prices, menu costs

Shifts in the SRAS Curve

- **Supply shock**: Unexpected event that causes SRAS curve to shift

- SRAS shifts when:
  - Input prices change
    - Nominal wages
    - Commodity (e.g. a natural resource) prices
  - Factors of production change
  - Technology changes

SRAS Shifts: Change in Nominal Wages

- Recall: Shifting the SRAS curve requires to look at the **change in relationship** between a given overall price level and the quantity produced

- What happens if the government **raises** the **minimum wage**?

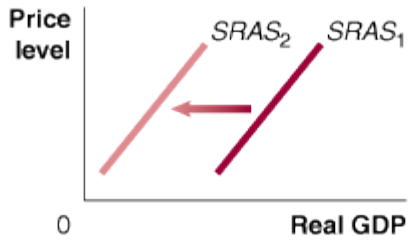
  - What happens if you must pay $100/day instead of $80/day?

What Happens to Pizza Output?

# of ovens	# of workers	pizzas sold per day	cost per worker per day	non labor costs per pizza per day	total labor costs	total non-labor costs	total costs	price per pizza	cost per pizza	profit or loss per pizza	total profits
1	5	50	$80	$2	$400	$100	$ 500	$11	$ 10.00	$1.00	$50.00
1	8	65	$80	$2	$640	$130	$ 770	$11	$ 11.85	($0.85)	-$55.00
1	8	65	$80	$2	$640	$130	$ 770	$14	$ 11.85	$2.15	$140.00
1	8	65	$100	$2	$800	$130	$ 930	$14	$ 14.31	($0.31)	-$20.00
1	5	50	$100	$2	$500	$100	$ 600	$14	$ 12.00	$2.00	$100.00

SRAS Shifts: Unexpected Changes in Prices of Resources

- Unexpected **increases in input prices** would shift **SRAS** to the **left**
  - Example: Surge in oil prices
  - With no change in final goods prices, same as an increase in labor costs
  - Produce less at a given price so SRAS shifts to the left

AN INCREASE IN . . .	SHIFTS THE SHORT-RUN AGGREGATE SUPPLY CURVE . . .	BECAUSE
the expected price of an important natural resource		costs of producing output rise.

SRAS Shifts: Change in Technology

- What happens if we experience a big change in labor productivity (a technological change)?

- Let's go back to the pizza parlor:

# of ovens	# of workers	pizzas sold per day	pizzas per worker
1	5	50	10
1	8	64	8
1	8	80	10

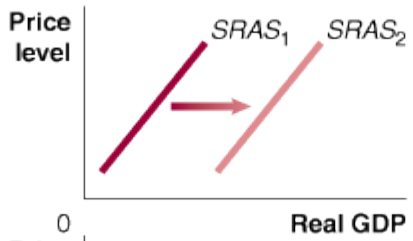
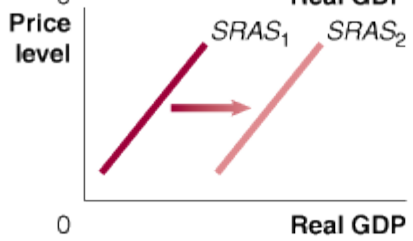
SRAS Shifts: Change in Technology

# of ovens	# of workers	pizzas sold per day	cost per worker per day	non labor costs per pizza per day	total labor costs	total non-labor costs	total costs	price per pizza	cost per pizza	profit or loss per pizza	total profits
1	8	64	$100	$2	$800	$128	$ 928	$14	$ 14.50	($0.50)	-$32.00
1	8	80	$100	$2	$800	$160	$ 960	$14	$ 12.00	$2.00	$160.00

- Labor **productivity jumped** → Cost/pizza fell
- We **increase** pizza **production** and still are profitable

SRAS Shifts: Technology and Factors of Production

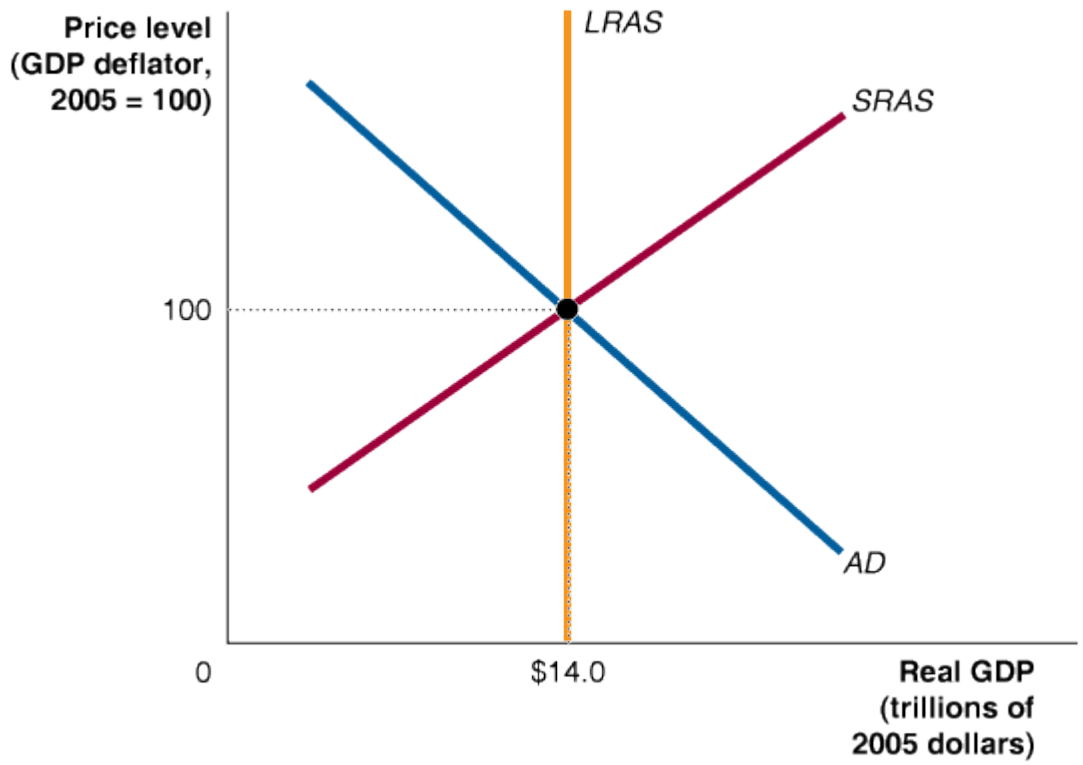
- **Improvements in technology** allow productivity to improve, and hence level of production at any given price level increases
- An increase in the **availability of the factors of production**, like labor and capital, allows more production at any price level

AN INCREASE IN . . .	SHIFTS THE SHORT-RUN AGGREGATE SUPPLY CURVE . . .	BECAUSE
productivity		costs of producing output fall.
the labor force or the capital stock		more output can be produced at every price level.

Long-Run Macroeconomic Equilibrium

- In the long-run, we expect the economy to produce at the level of **potential GDP**—i.e. the LRAS level

- So **long-run macroeconomic equilibrium** occurs when the AD and SRAS curves intersect at the LRAS level



Analysis of Shocks to Aggregate Demand and Aggregate Supply

Static Model

- For simplicity, assume:
  1. No inflation: the current and expected-future price level is 100
  2. No long-run growth: LRAS curve is not moving

- These assumptions will help us analyze **recessions**, **expansions** and **supply shocks**

- We will see **why** long-run macroeconomic equilibrium cannot occur at a level of output other than **potential GDP**

Characterizing Changes in Key Variables as Shocks

- **Why** call them shocks?
- Most economic models are **equilibrium seeking**
- When something occurs outside of the forces that drive the model, it **SHOCKS** the system and the model pushes toward a different equilibrium

Types of AD Shocks

- **Changes** in variables that **determine the position** of the **AD curve**

Δ HH expectations → Δ Autonomous consumption

Δ Personal taxes → Δ Y_d → Δ C

Δ Profit expectations → Δ Investment

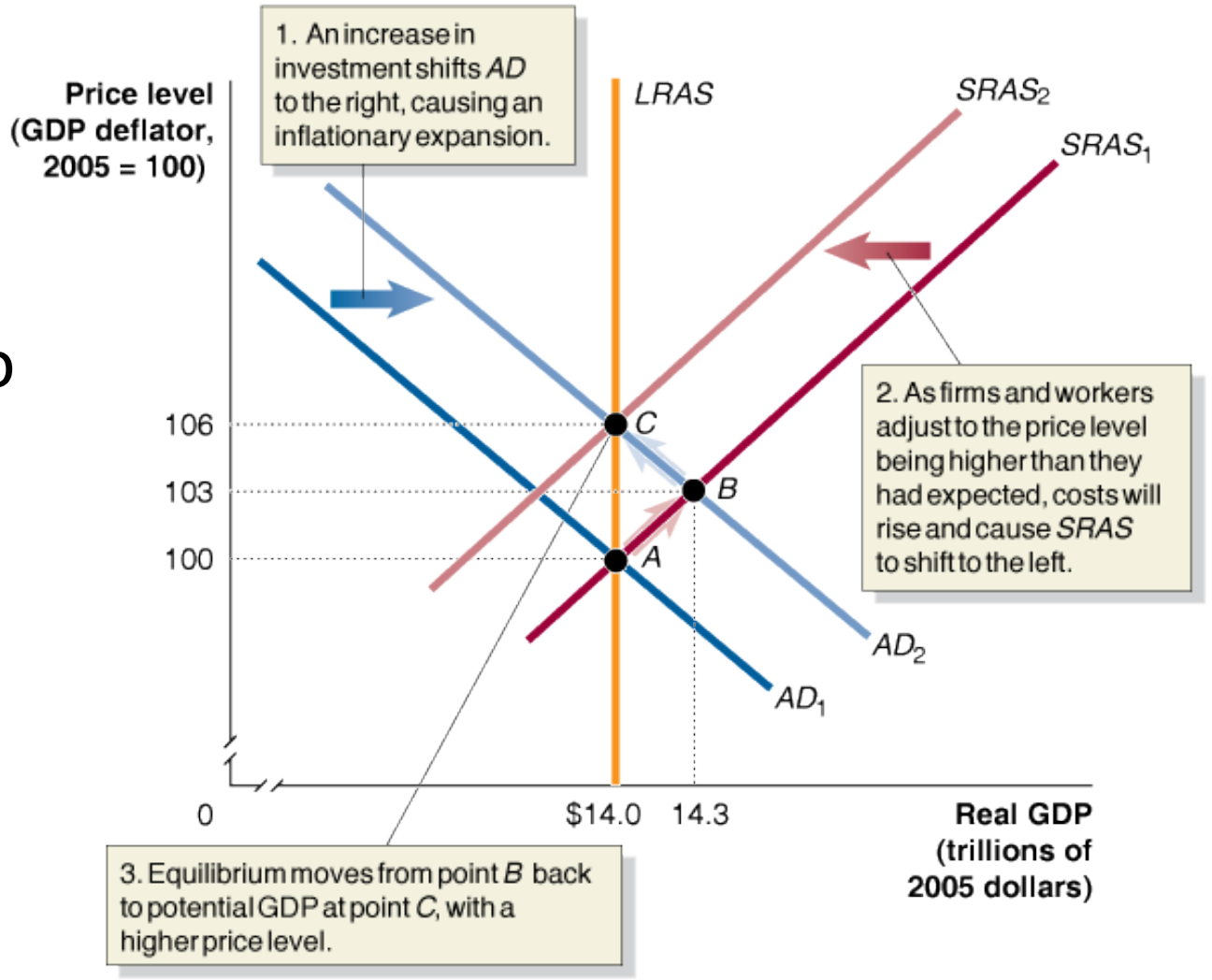
Δ Interest Rates → Δ Investment

Types of AS Shocks

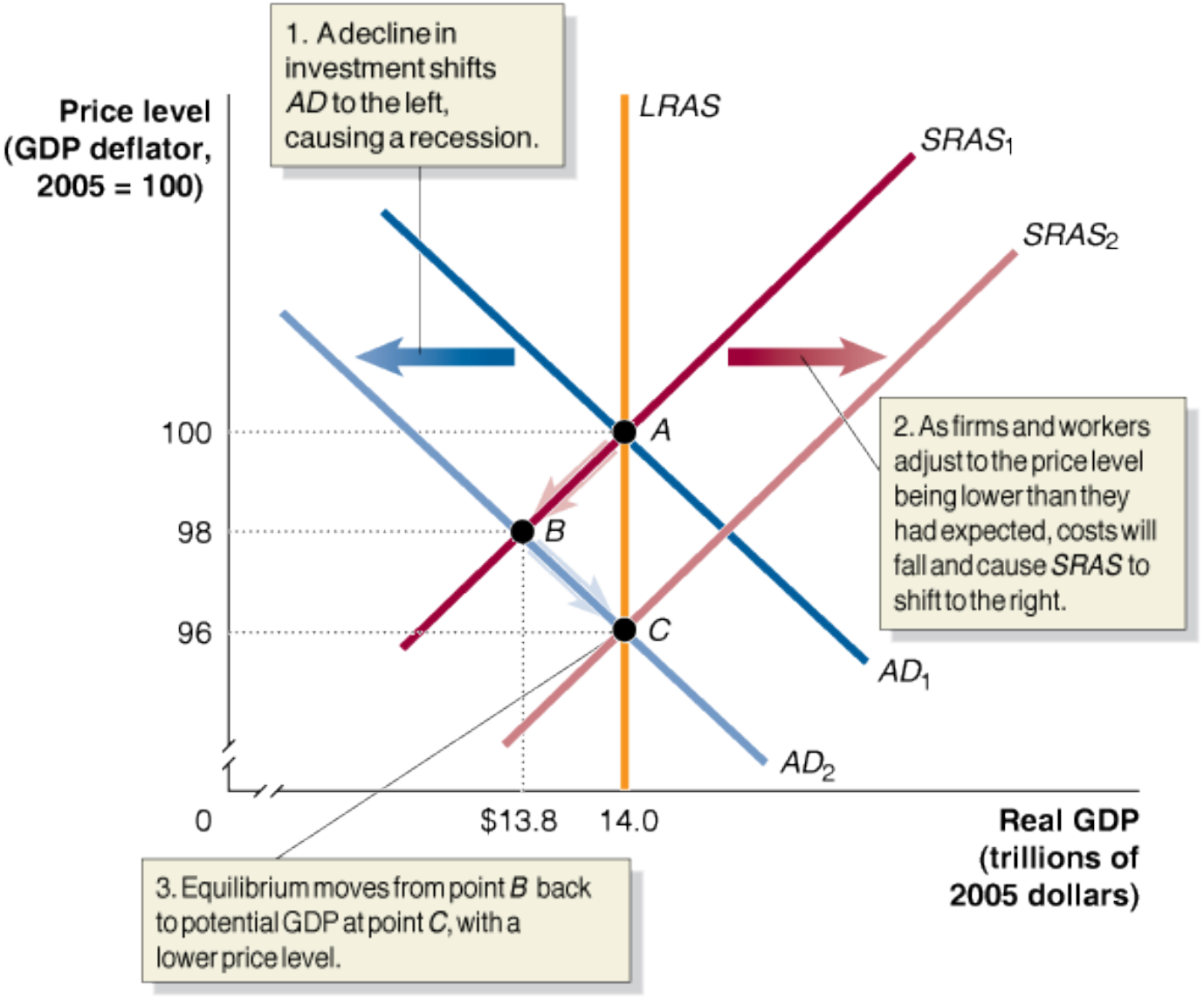
- **Changes** in variables that **determine the position** of the **AS curve**
  - Wages (W)
  - Productivity (Z)
  - Capital Stock (K)
  - Resource Prices (RP)

Expansion

- Start in LR equilibrium
- Firms more optimistic → I raises → **AD shifts right**
- Unemployment falls **below** its **natural rate**, forcing employers to pay more
- Increased demand for goods **raises prices**
- Firms and workers raise their expectations about price level → **SRAS shifts left** – restoring LR equilibrium

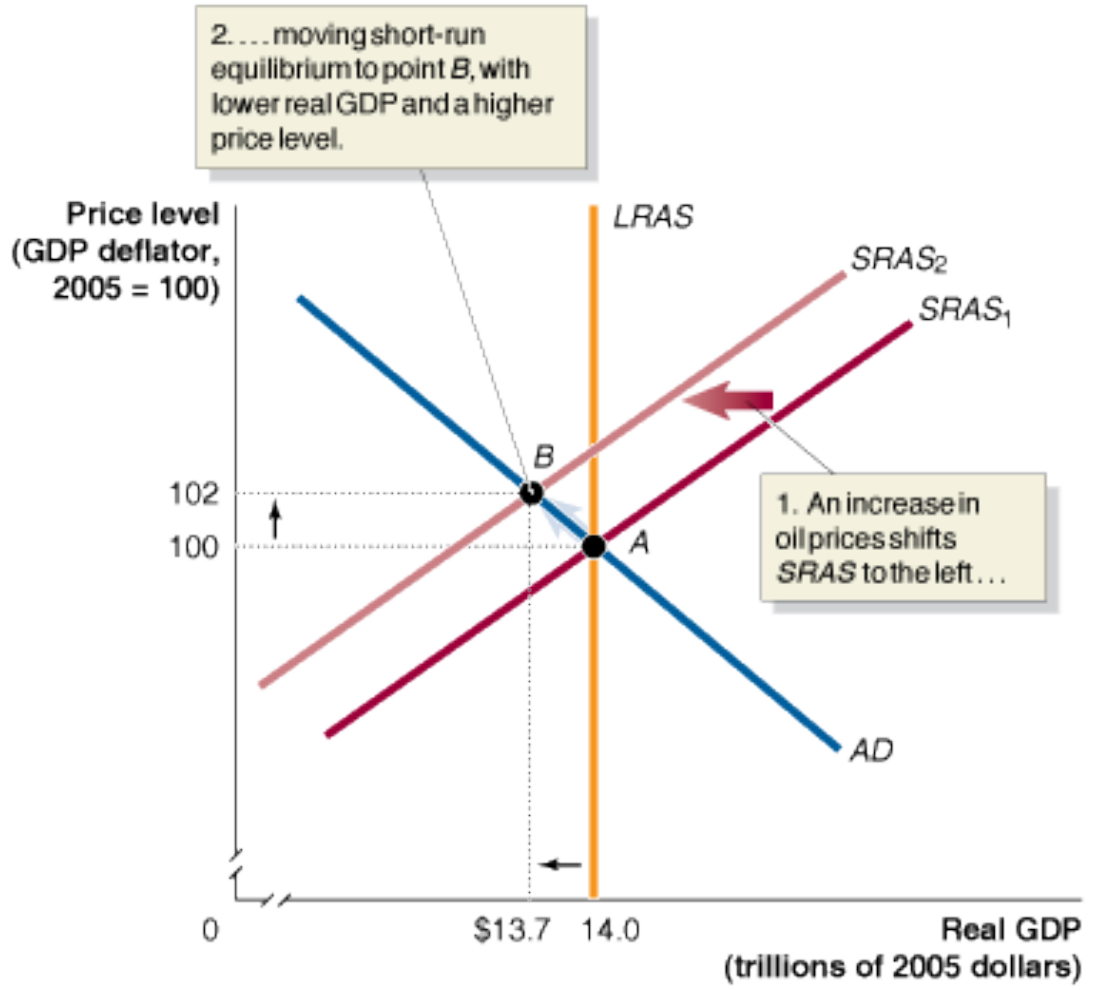


Recession


1. A decline in investment shifts AD to the left, causing a recession.
Price level (GDP deflator, 2005 = 100)
LRAS
SRAS1
SRAS2
100
98
96
A
B
C
AD1
AD2
2. As firms and workers adjust to the price level being lower than they had expected, costs will fall and cause SRAS to shift to the right.
0
$13.8
14.0
Real GDP (trillions of 2005 dollars)
3. Equilibrium moves from point B back to potential GDP at point C, with a lower price level.

Supply Shocks

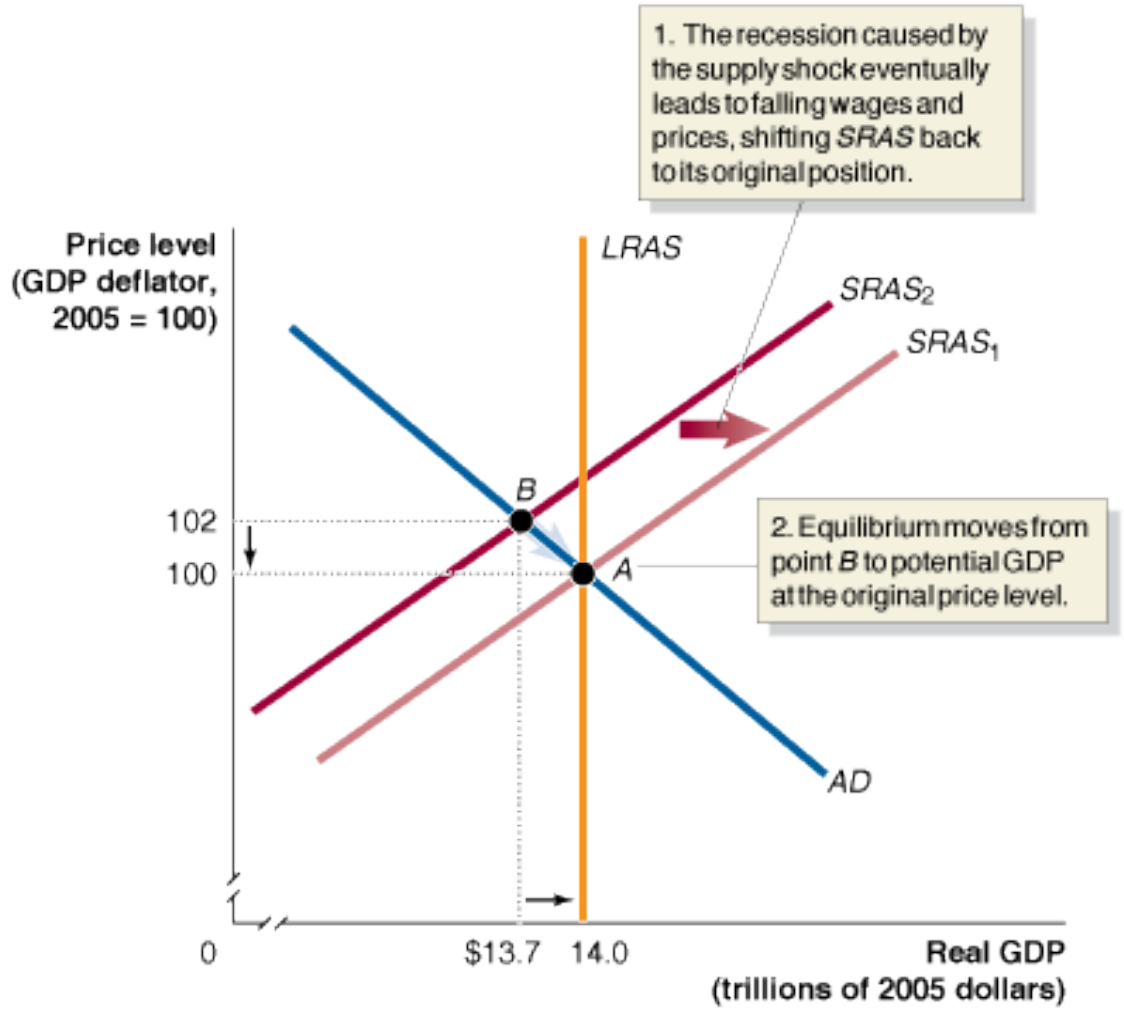
- What happens when we have a Mid-East war?
- **Supply shock**: SRAS of oil shrinks suddenly
- This causes **stagflation**
  - Combination of inflation and recession, usually resulting from a supply shock



(a) A recession with a rising price level–the short-run effect of a supply shock

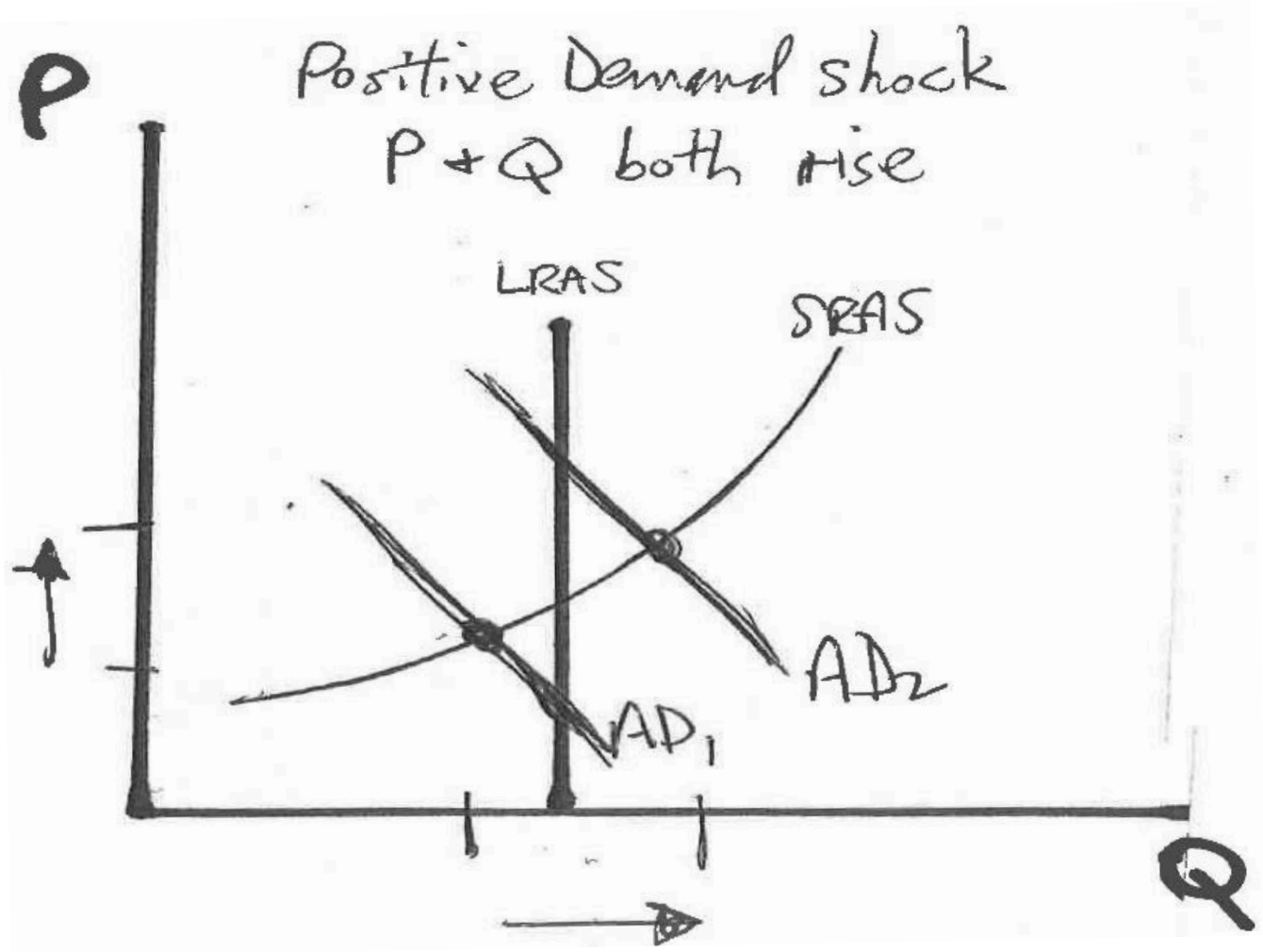
Adjustment Back to Potential GDP from A Supply Shock

- Lower output + Unsold products (higher inventories, lay off people) ➞ Lower employment
- **Higher unemployment** ➞ Workers accept lower wages ➞ **Firms cut prices** to clear inventories
- Decrease in expected prices ➞ **SRAS moves right** – restoring LR equilibrium



(b) Adjustment back to potential GDP–the long-run effect of a supply shock

A Positive Demand Shock May Be A Mixed Blessing



Dynamic Interpretation

- Few focus on the price level, or the level of GDP
- $\frac{\Delta P}{\Delta t} = \pi$ The world watches the inflation rate.

More specifically:

- $\frac{\Delta \pi}{\Delta t}$ = The change in the pace of price changes.

- $\frac{\Delta Y}{\Delta t} = \dot{Y}$ $\dot{Y}$ = real growth rate for the economy

- A Positive demand Shock:

π accelerates $\dot{Y}$ accelerates

How Policymakers and Businessmen Think About AD-AS

- We don’t have a stable price level
- We have a **stable inflation rate**
- We don’t have a stable output level
- We have a **stable growth rate**

Static vs Dynamic Model

- Our AD-AS model so far has been **static** because:
  - Price level was constant (no inflation)
  - There was no long-run growth

- We can form a **dynamic** AD-AS model by incorporating:
  - Continually-increasing real GDP, shifting LRAS to the right
  - AD also ordinarily shifting to the right
  - SRAS shifting to the right except when workers and firms expect high rates of inflation

What Constitutes a Dynamic Equilibrium

- We posited before that

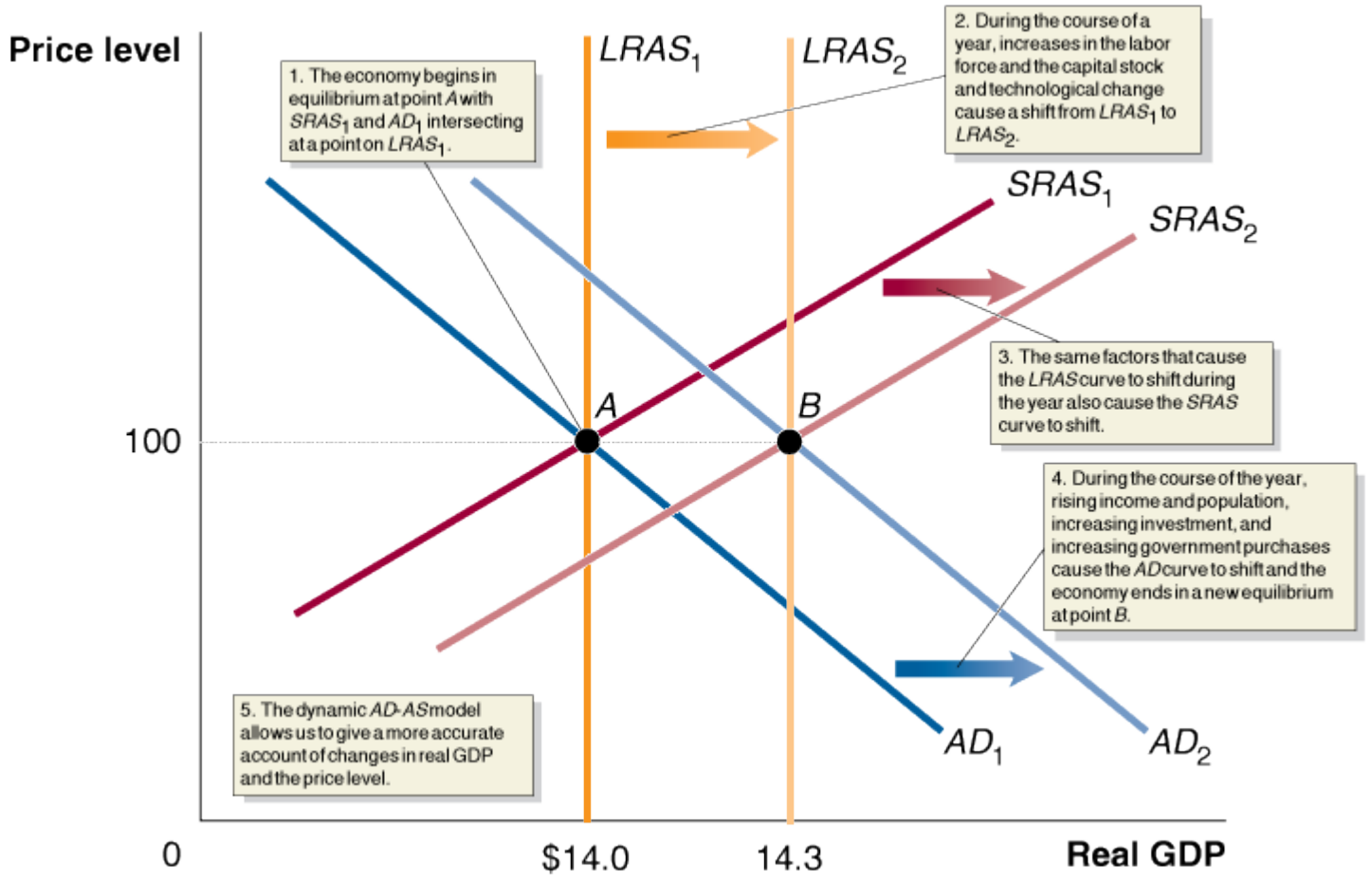
  Long-term Sustainable Growth Rate = 2%

- We now posit that

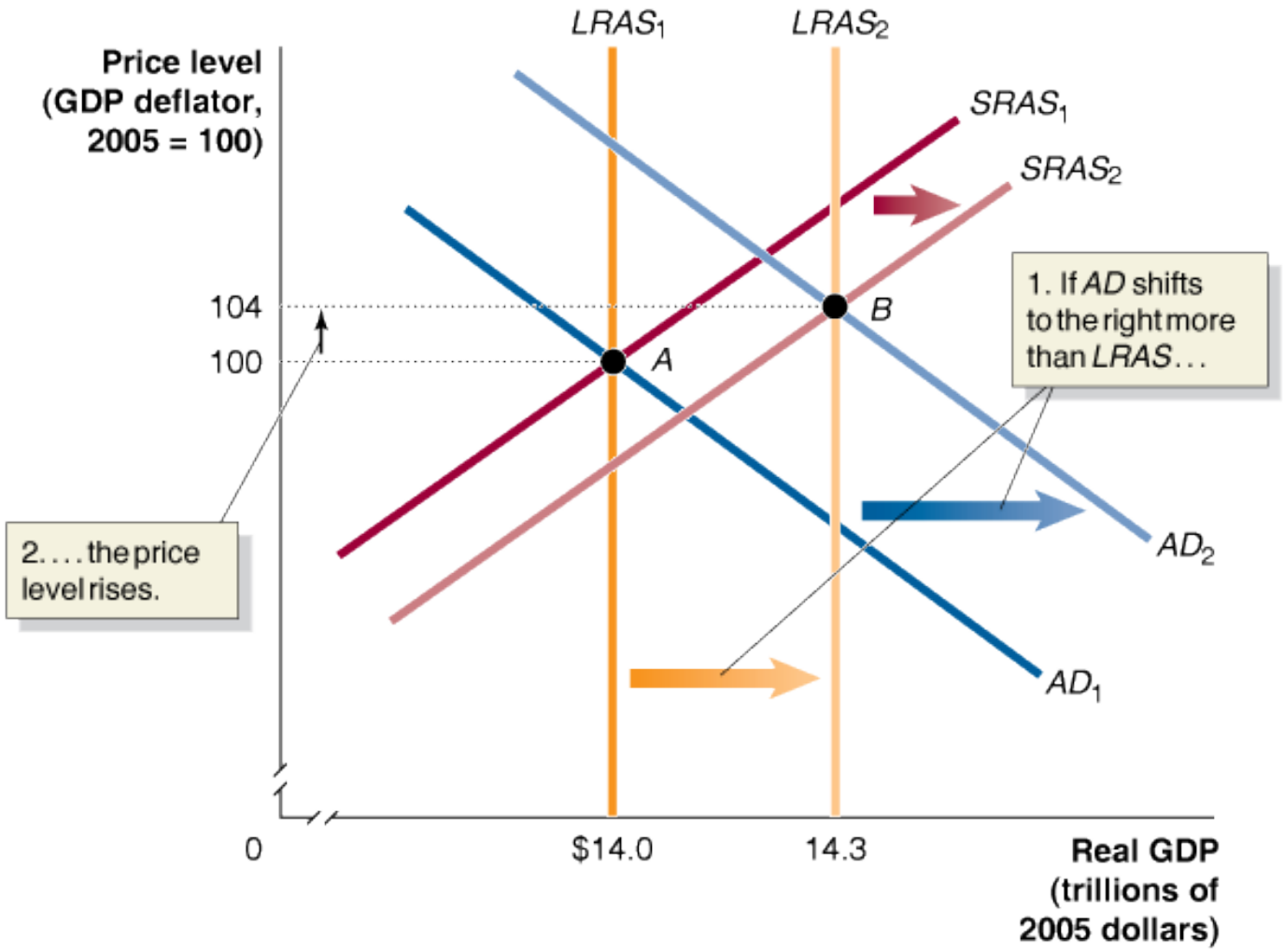
  Ideal Inflation Rate = 2%

- **Dynamic equilibrium**: Output and prices are shifting so that **prices** are **rising** 2% per year and **output** is **growing** 2% per year

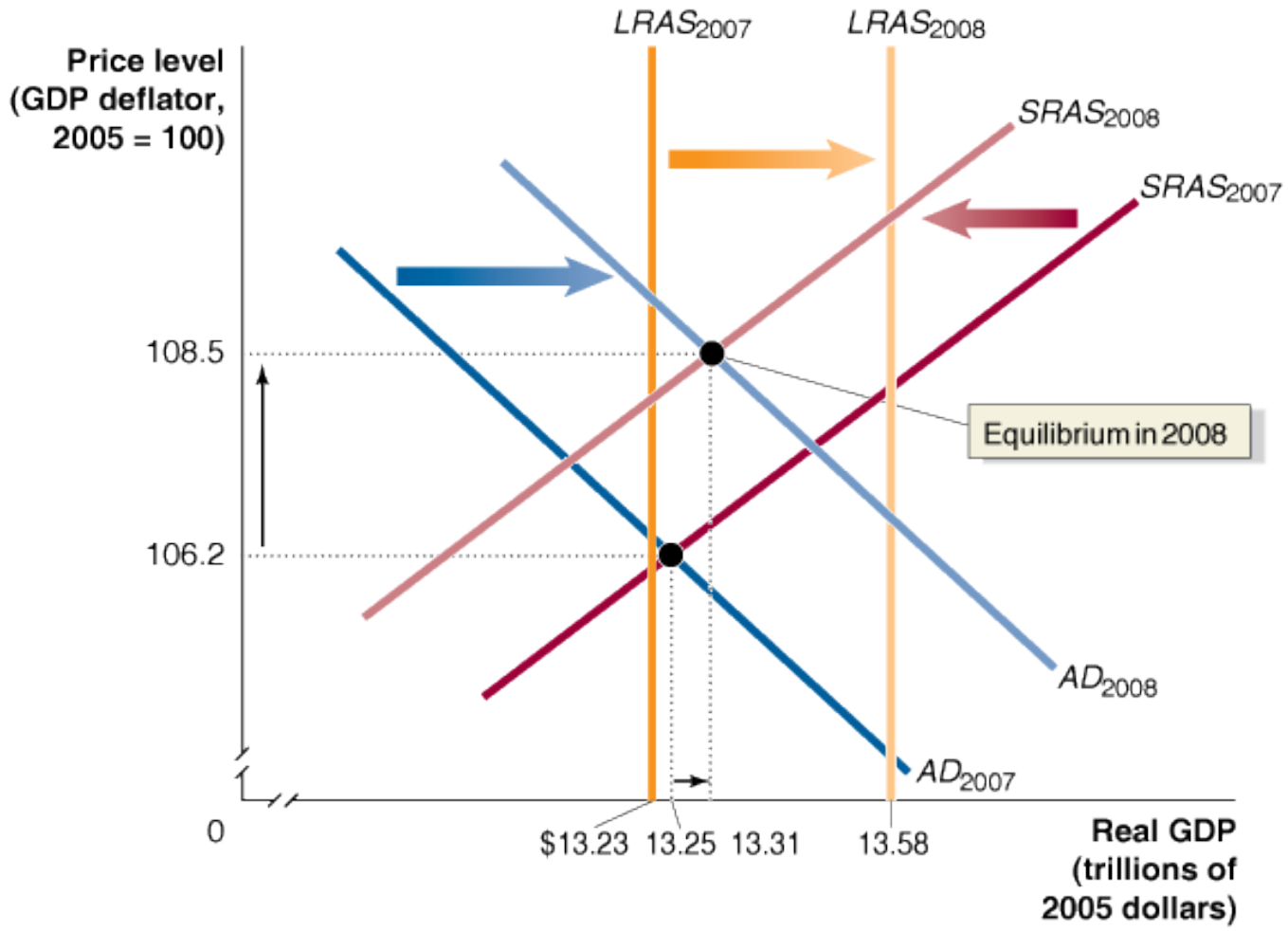
A Dynamic AD-AS Model



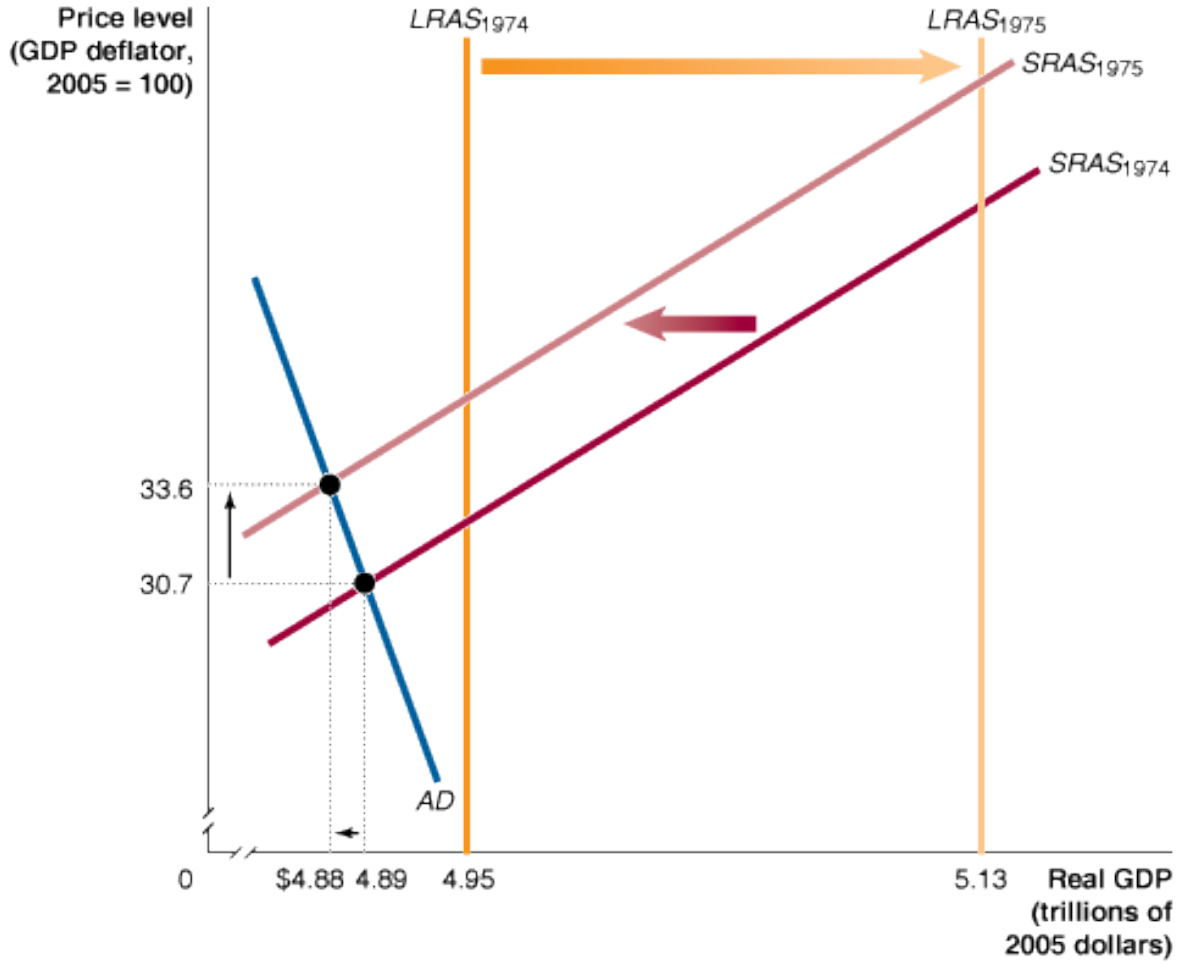
What Is the Usual Cause of Inflation?



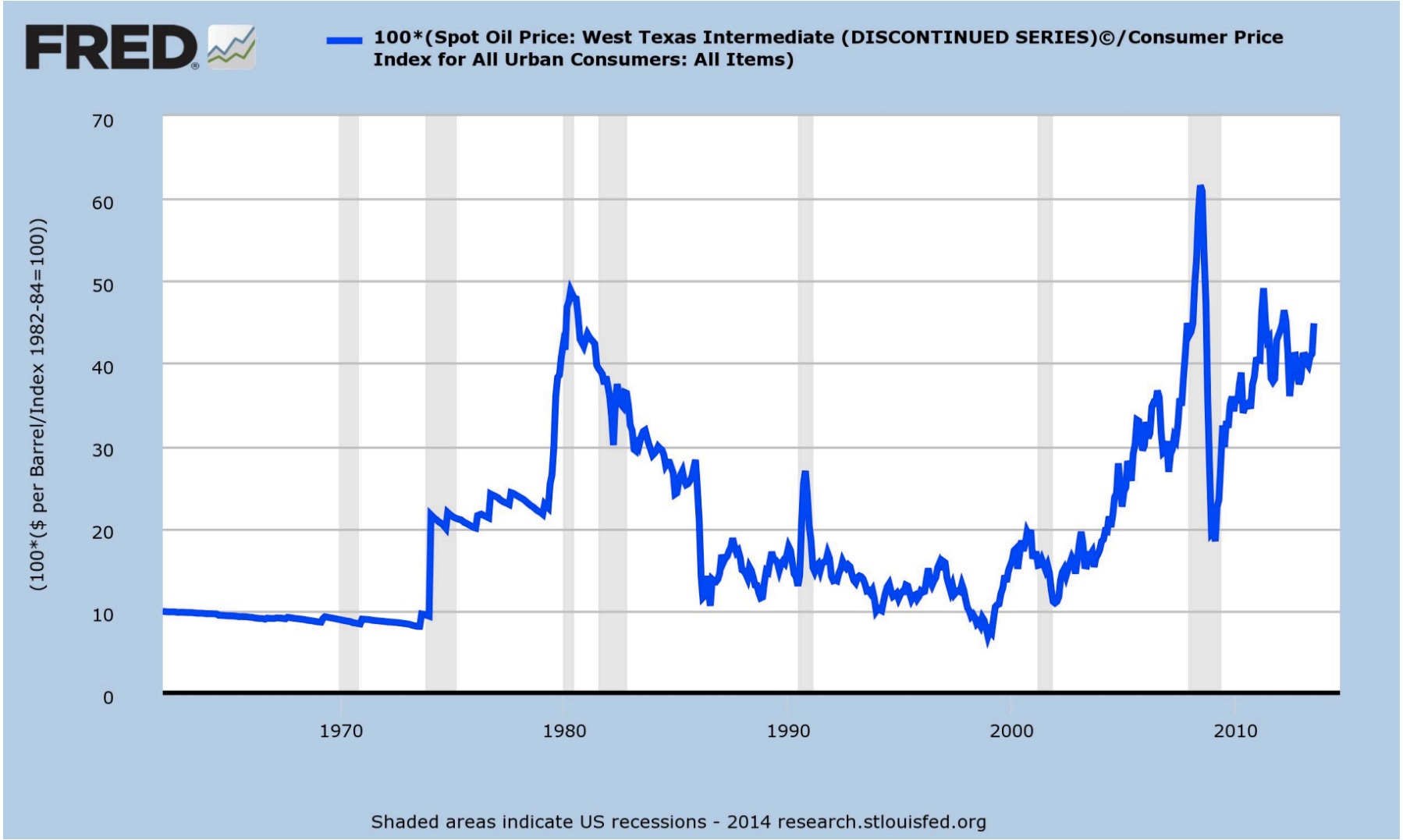
The Recession of 2007-2009



The Oil Shock of 1974–1975

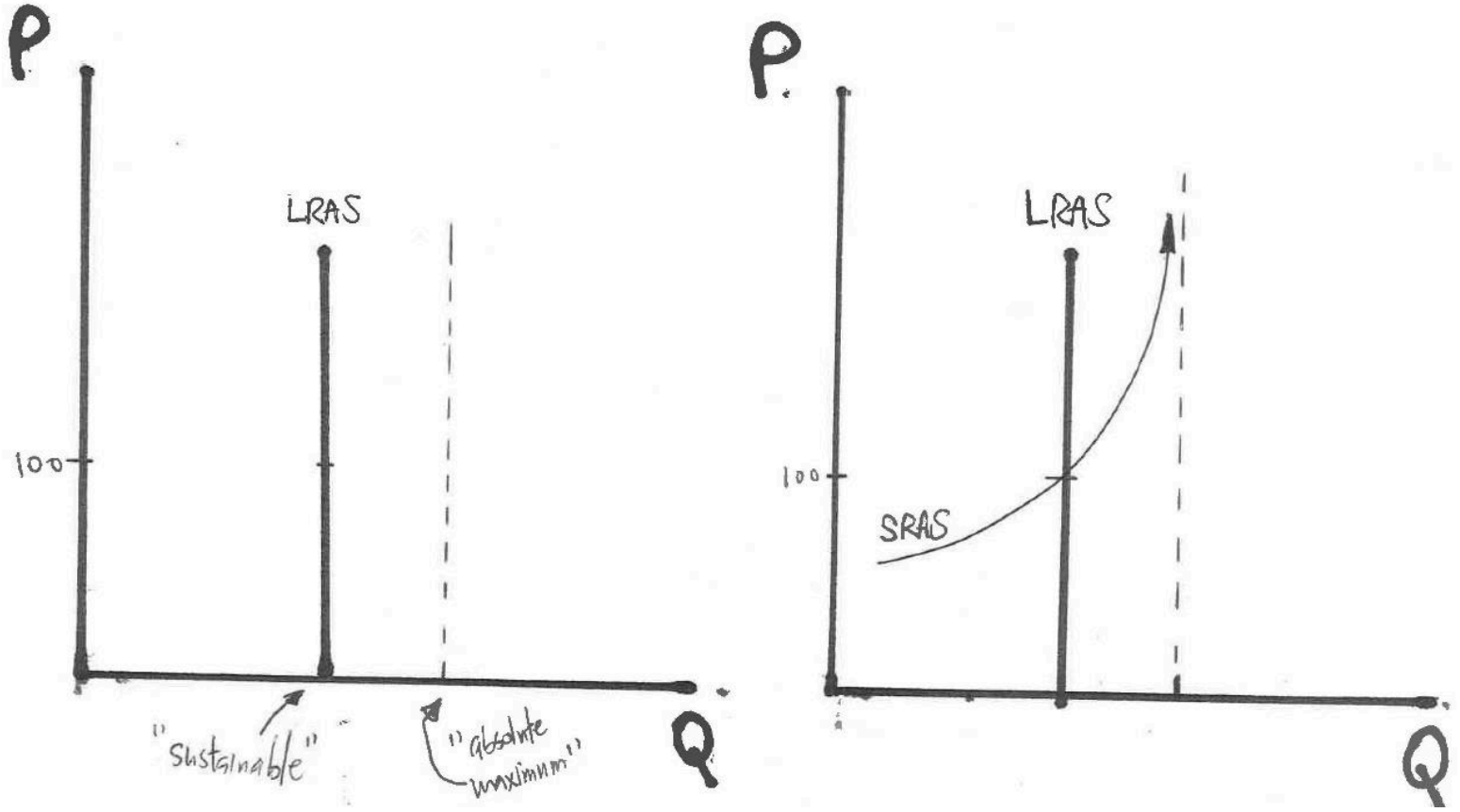


Oil Shocks: A Part of Every Recession 1970 to 2014



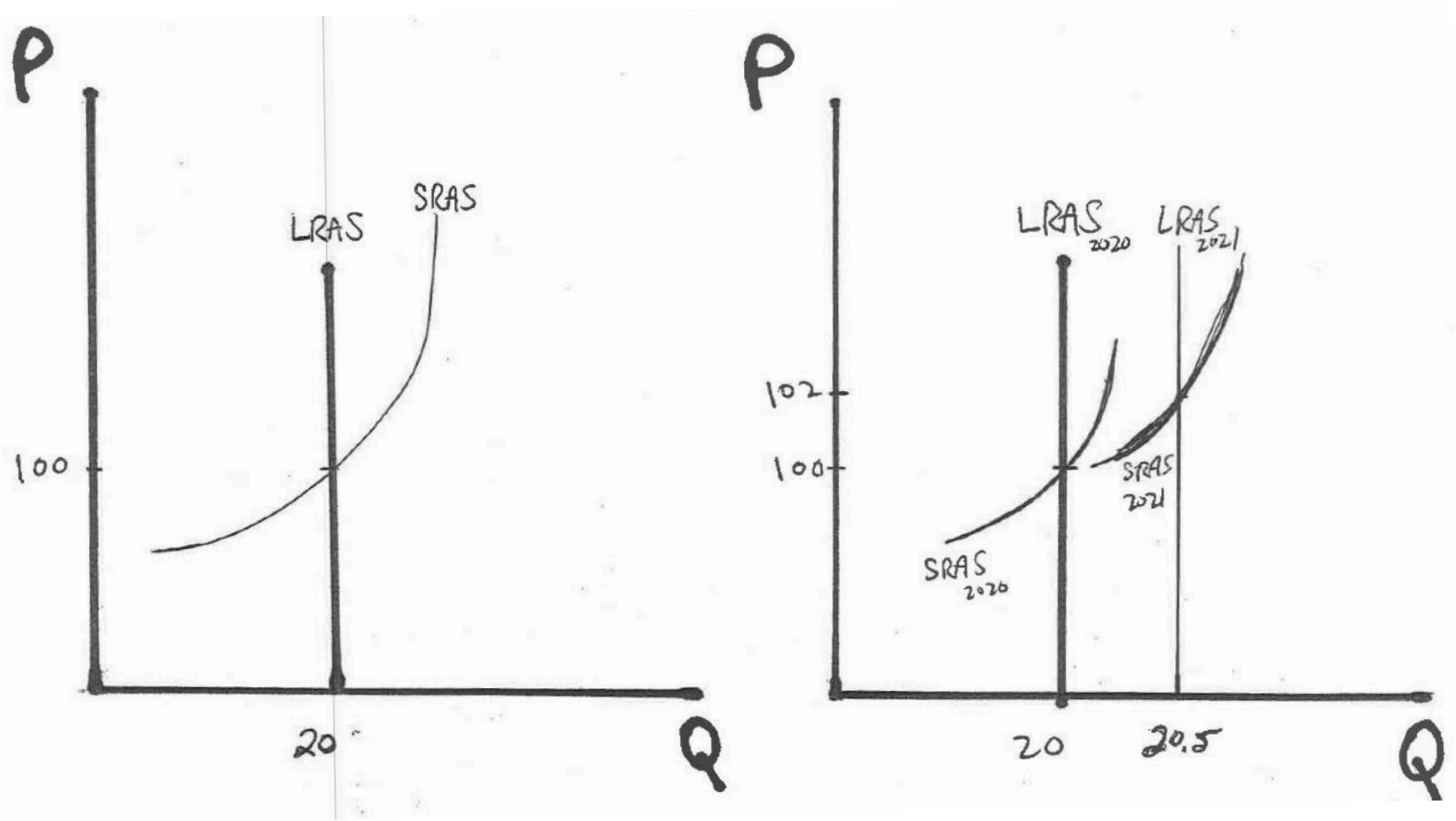
Aggregate Supply **CURVE**

- A **CURVE** for AS allows us to better characterize economic snapshots



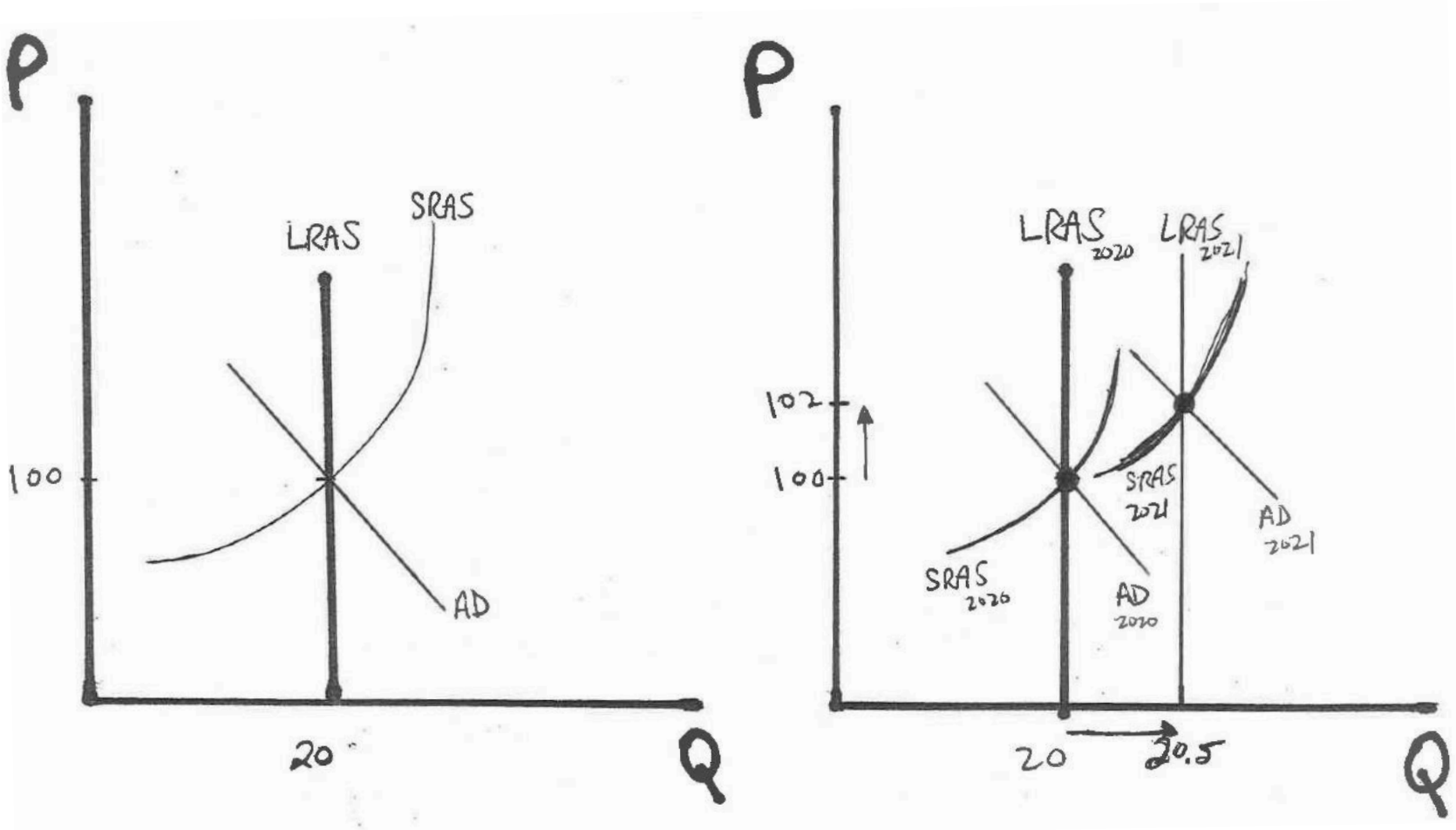
A Dynamic Depiction: 2020 to 2021

1. **Supply potential grows** as population lifts **labor force** and **productivity** gains increase output per hour



A Dynamic Depiction: 2020 to 2021

2. Increased incomes lift **consumption** and **investment** → **AD grows**



Dynamic Equilibrium: Review

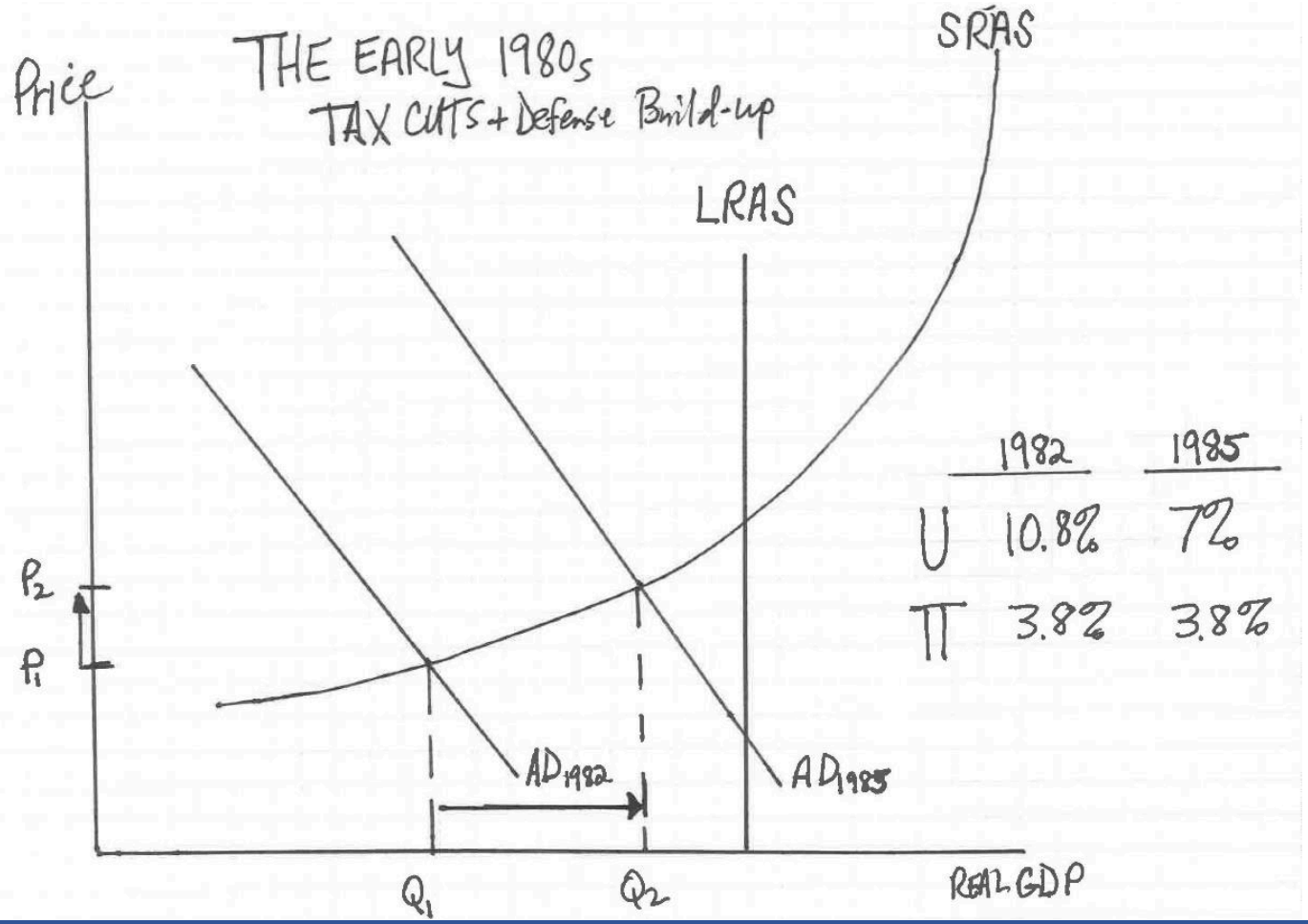
- Over a year,
  - Potential GDP (LRAS) rises by 2% due to labor force and productivity
  - SRAS curve similarly shifts
  - Demand shifts, reflecting larger workforce and more investment
- A 2% rise in prices accompanies this equilibrium shift
  - Inflation expectations well anchored
- **Real GDP** gains **2%**, **prices** rise **2%**
- **LRAS = SRAS = AD**

Shocks Deliver What?

- **Effects** of demand and supply shocks **depend** in part **on** the state of the **economy before** the **shock**
- With high U and ample capacity, the supply curve is **flattish**
- With very low U and little room to grow, the supply curve is **very steep**

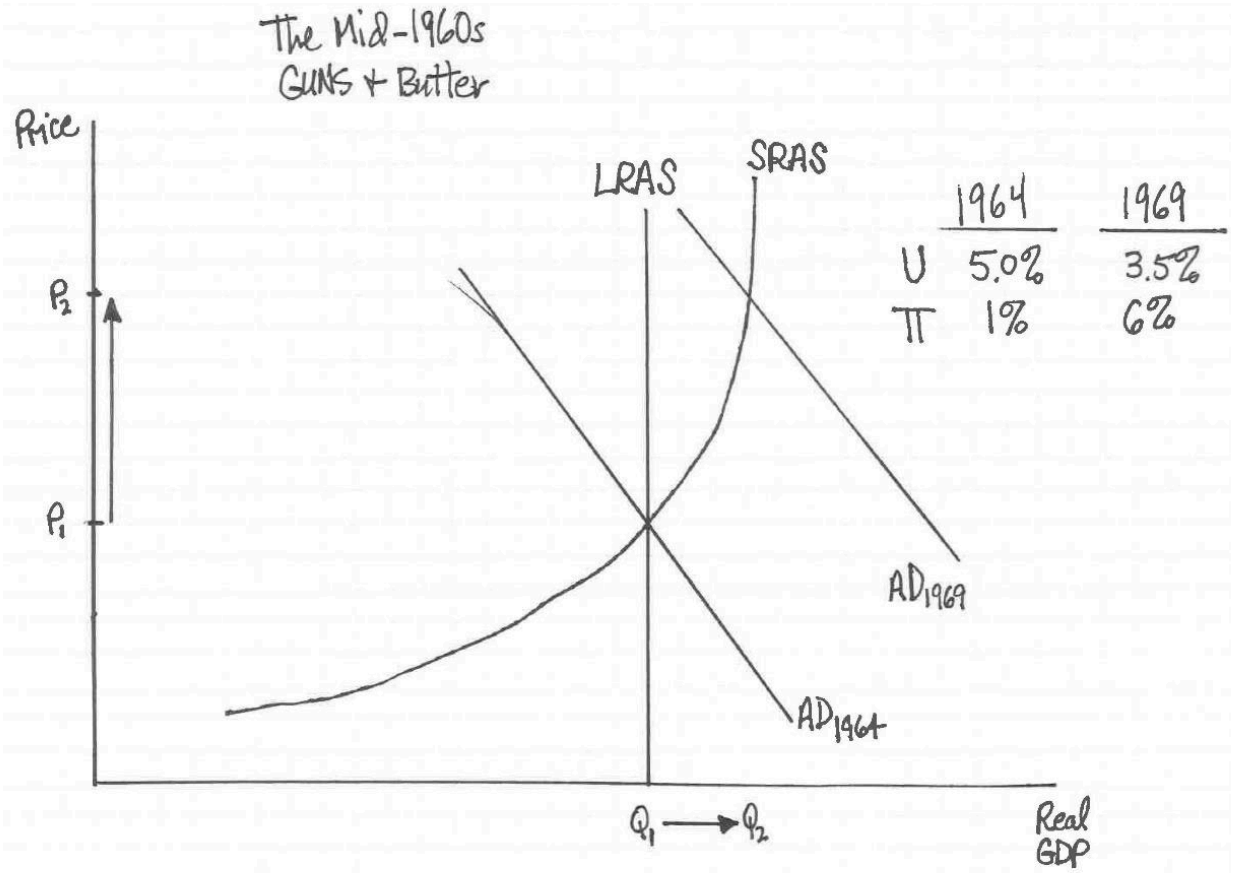
With Ample Excess Capacity…

- … a positive demand shock lifts **output** **meaningfully** and does **little** to **prices**



If the Economy Is Operating At Full Employment…

- … a positive demand shock lifts **output modestly** and **prices leap**



Types of Aggregate Supply Shocks

- **Adverse** AS Shocks: Changes in variables that shift AS to the **left**
  - Rising Wages
  - Rising Resource Price
  - Falling Productivity
  - Falling Capital

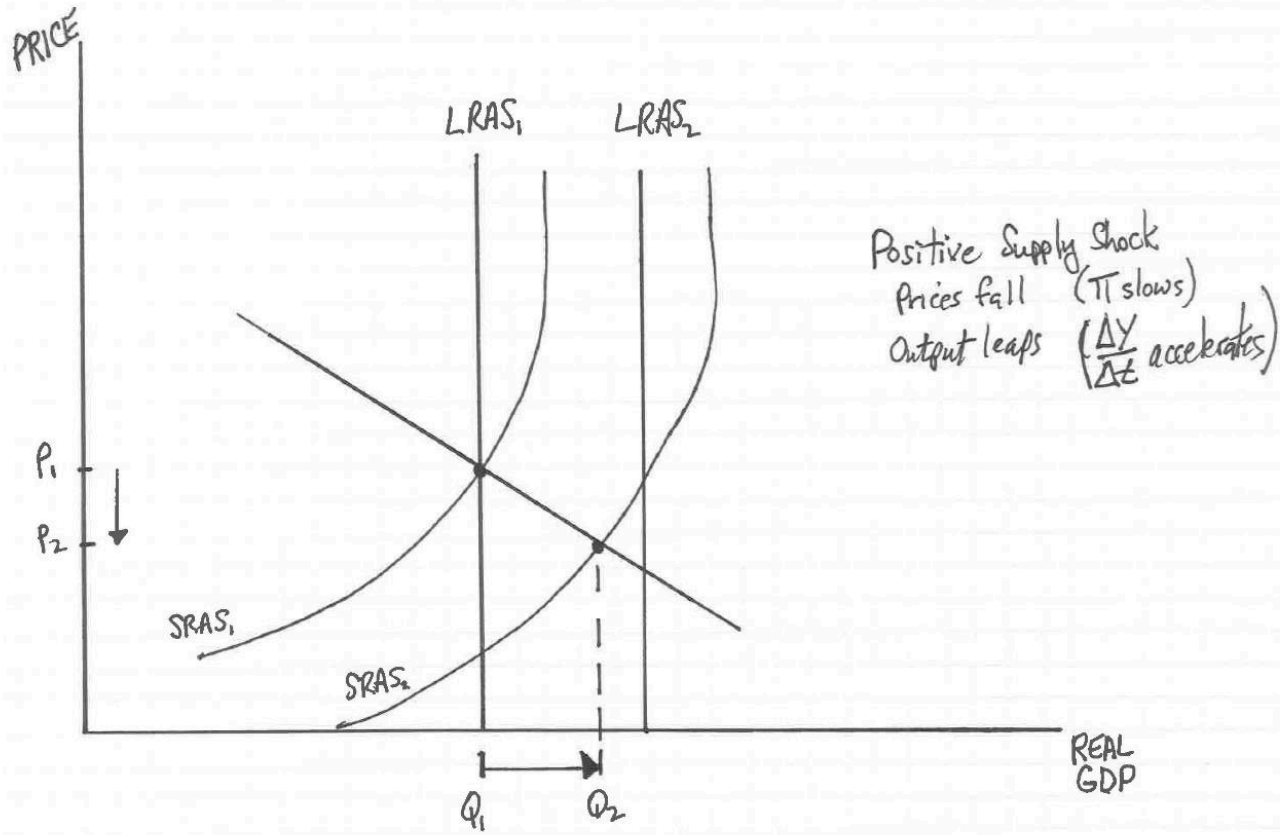
- **Favorable** AS Shocks: Changes in variables that shift AS to the **right**
  - Falling Wages
  - Falling Resource Price
  - Rising Productivity
  - Rising Capital

A Positive Productivity Shock

- The best news for the long run
- Technology inventions lay the groundwork
- With **productivity**, we shift people to new endeavors
- That means we have more output, at a given price level
- **AS shifts** to the **right**
  - Prices Fall
  - Output Rises

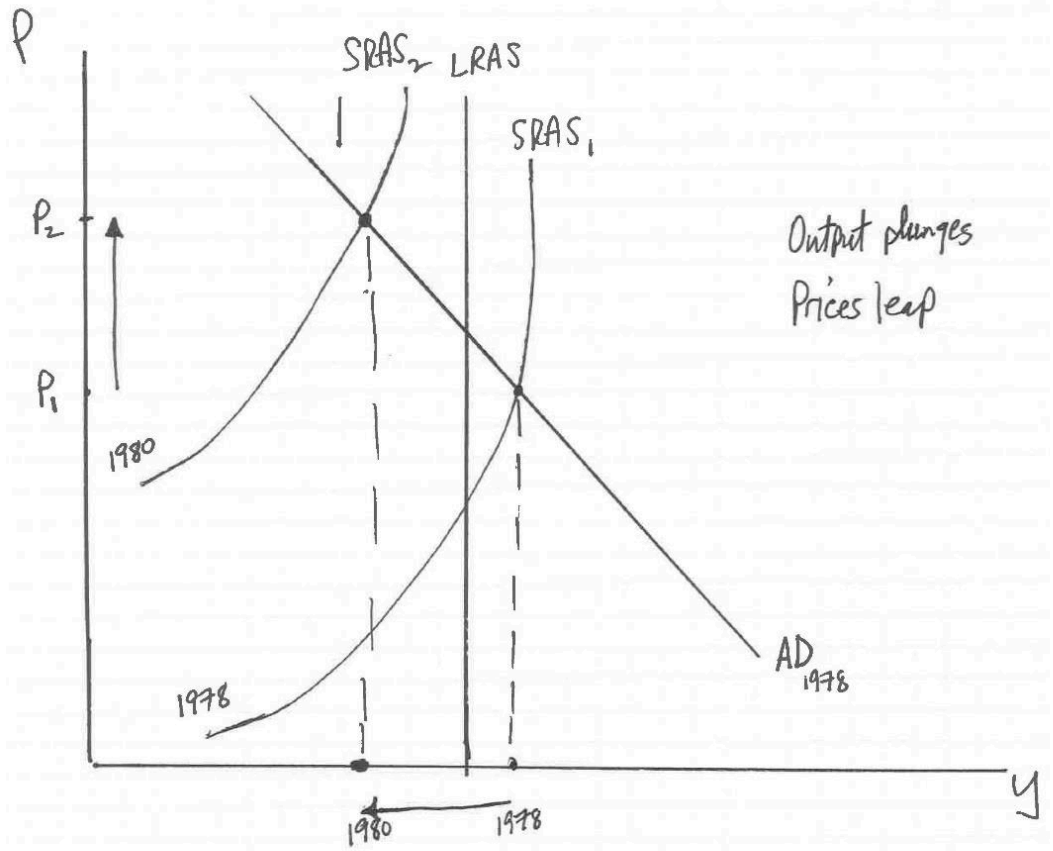
A Positive Productivity Shock

- A jump in productive capacity allows for **more growth** amid **little price pressure**



Oil Shock

- OPEC quadrupled oil prices in 1978 → **Inflation surged** and **output plunged**



AS Shocks

- Equilibrium price and output move in **opposite directions**

- A **positive** supply shock (e.g. surge in labor force):
  - Prices Fall
  - Output Rises

- An **adverse** supply shock (e.g. oil prices surge):
  - Prices Rise
  - Output Falls

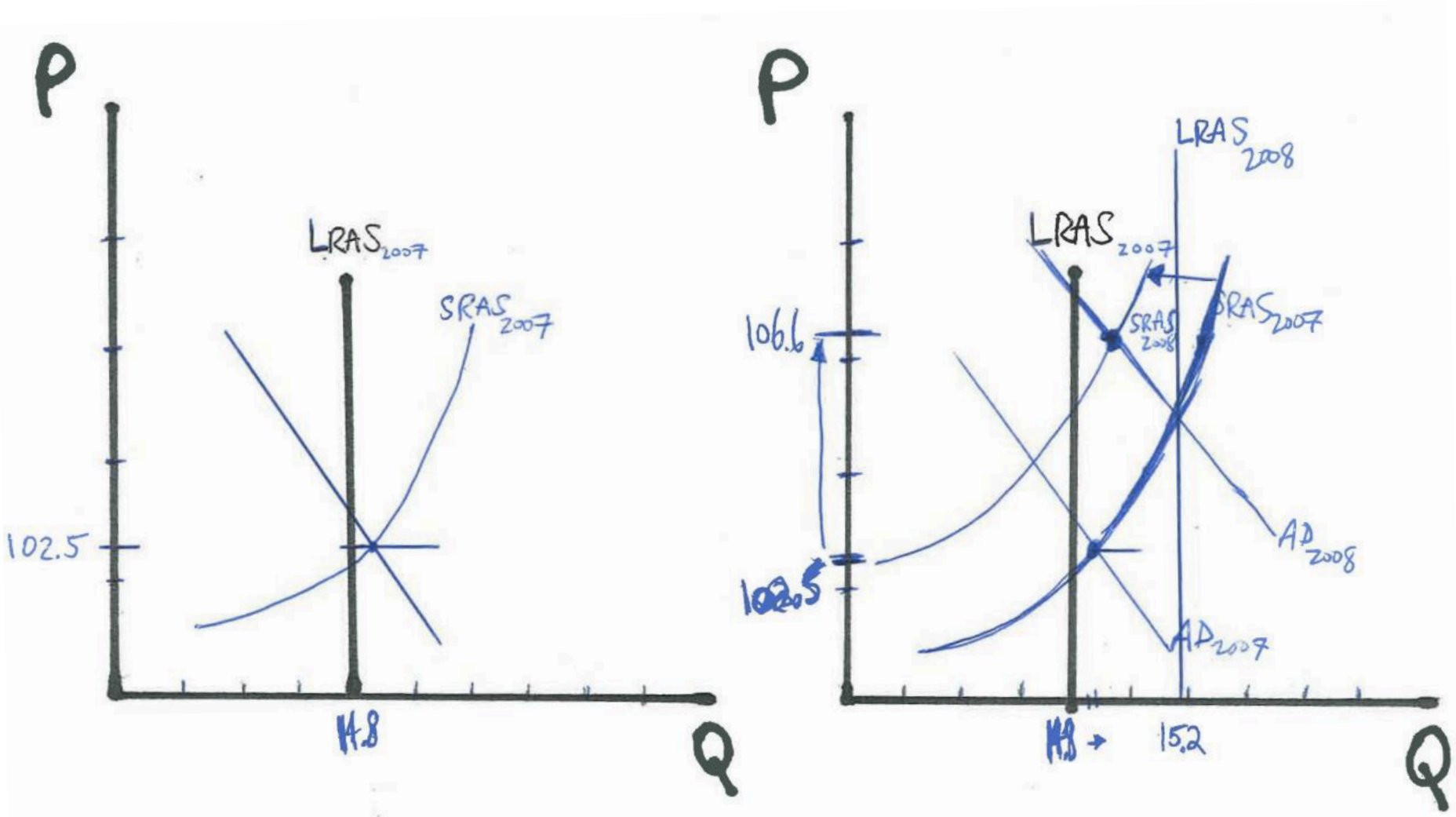
The Great Recession/Recovery: A Three Part Story

- **Act I**: Q2:2007 to Q2:2008
  - A standard **adverse supply shock** as oil prices surge
- **Act II**: Q2:2008 to Q2:2009
  - An **adverse demand shock** as interest rates surge and consumer and business confidence plunge
- **Act III**: Q2:2009 to Q2:2010
  - A **positive demand reversal** as government spending jumps, confidence rises and interest rates fall

Bare Facts of the 3-Year Swing for Output and Inflation

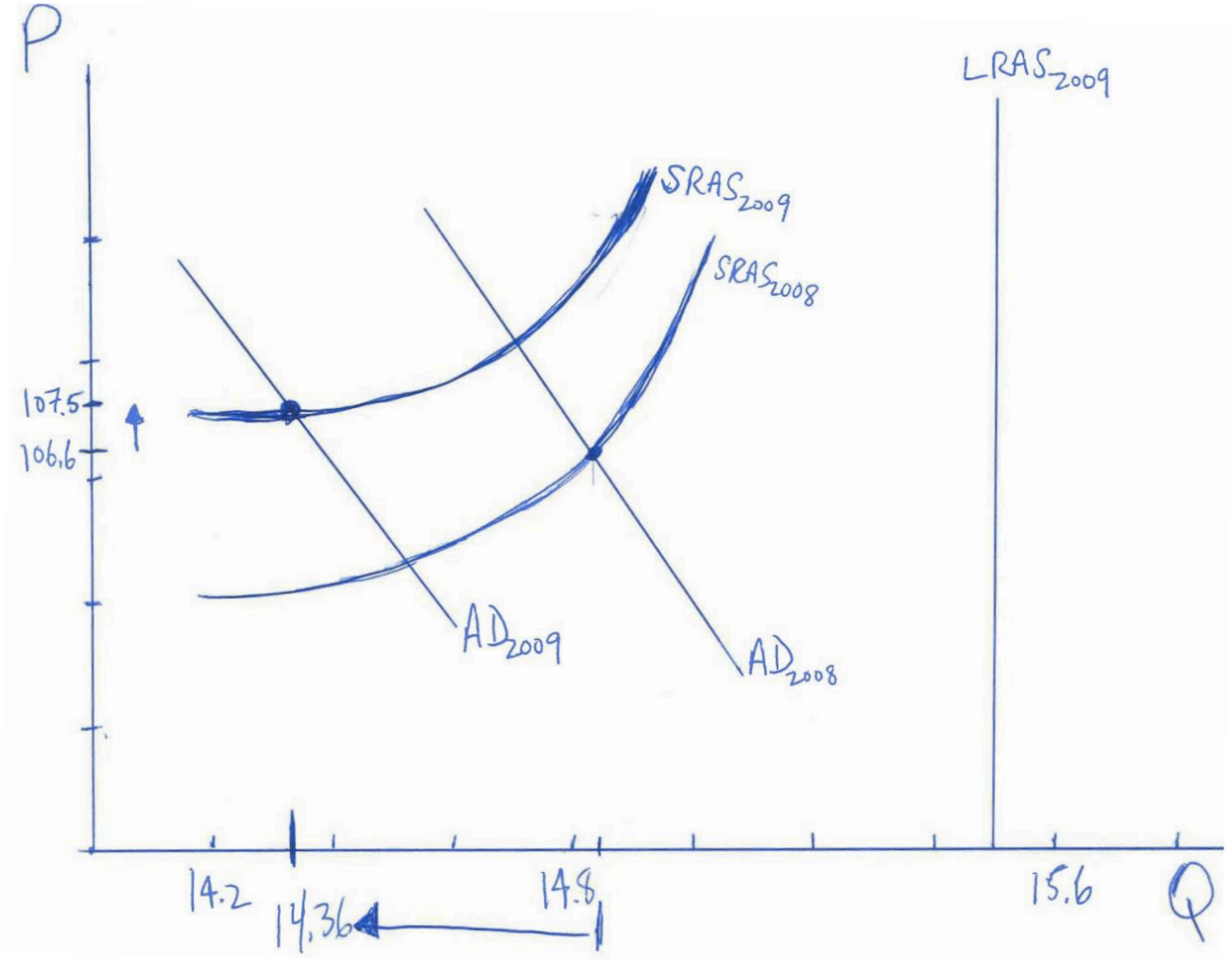
	REAL GDP ($ BILLIONS)	4-QTR CHANGE	CPI INDEX (LEVEL)	4-QTR CHANGE	Potential GDP	4-QTR CHANGE
Q2:2007	14,839		102.5	2.5%	14,800	
Q2:2008	14,963	0.8%	106.6	4.0%	15,170	2.5%
Q2:2009	14,356	-4.1%	107.5	0.8%	15,473	2.0%
Q2:2010	14,746	2.7%	108.7	1.2%	15,783	2.0%

Act I: Oil Prices Surge - A Negative SRAS Shock



Act II: A Mild Supply Shock, A Violent Demand Shock

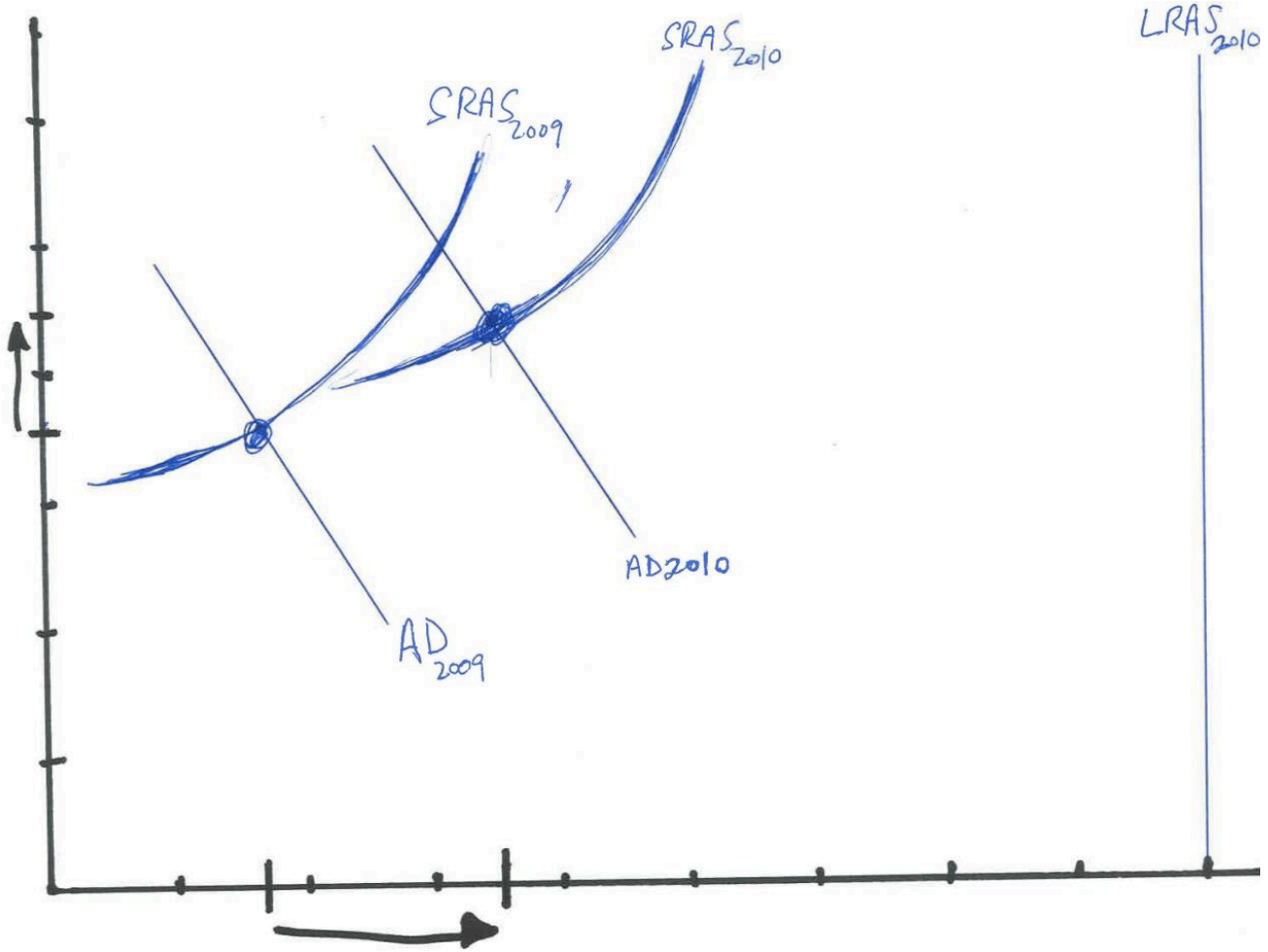
- A **mild supply shock** as productivity is soft
- A **violent demand shock**: Interest rates rise and confidence falls
  - Investment down
  - Consumption plunges, despite falling oil
  - Note: **prices** rise **less than 2%** as output falls



Act III: A Positive Supply Shock, A Positive Demand Shock

- A **positive supply shock**: Productivity jumps

- A **positive demand shock**:
  - Government stimulus lifts growth
  - Rising confidence lifts C
  - Falling interest rates lift I
  - NONETHELESS, **prices** rise **less than 2%**



Things to Ponder About 2010

- Why did inflation rise less than 2% despite aggressive government fiscal stimulus?
- Why did risky interest rates fall despite an explosive increase in government borrowing?
- Why did confidence rise despite an explosive rise in the size of the U.S. budget deficit?
- Why SRAS curve was drawn ‘very flat’?
- Despite stimulus, where is GDP vs potential?

Conclusion 1: Supply Shocks

- **Adverse supply shocks** are the **worst** of both worlds:
  - Inflation accelerates **and** output falls

- **Positive supply shocks** are the **best** of all possible worlds:
  - Inflation rates fall **and** real GDP growth accelerates

Conclusion 2: Demand Shocks

- **Adverse demand shocks** have **good and bad** elements:
  - Inflation decelerates as output falls (assuming you are not in or near a **deflation**)

- **Positive demand shocks** have **good and bad** elements:
  - Inflation rates accelerate as real GDP growth accelerates

Optimal Macroeconomic Adjustment

- **Stabilization policy**: Monetary and fiscal policies designed to keep output at (or near) its **full employment** level

- We want to understand:
  - How employment and inflation **respond** to monetary and fiscal policies
  - How monetary and fiscal policies should be used **in response to shocks**

Keynesian Framework

- How to **reduce imbalances** with two policy instruments: **fiscal policy** and **monetary policy**?