

ECO 209Y

MACROECONOMIC THEORY AND POLICY

LECTURE 15:

INFLATION AND THE AD AND AS CURVES

INFLATION

- We have constructed the **AD** and **AS** curves as functions of the price level
- Now we will construct the **AD** and the **AS** curves as functions of the rate of inflation (π), where

$$\pi = \frac{P - P_{-1}}{P_{-1}}$$

INFLATION AND UNEMPLOYMENT

- **Question 1:** Is there a trade-off between inflation and unemployment?
 - In the *short-run*, it is *assumed* that inflation can be reduced at the cost of higher unemployment
 - In the *long-run*, however, it is *assumed* that there is no trade-off between inflation and unemployment since unemployment moves back to its natural rate
- **Question 2:** Does inflation stabilization necessarily bring about unemployment and recession?
 - In the *short-run*, it is *assumed* that inflation cannot be reduced without creating a recession at the same time
 - In the *long-run*, however, it is *assumed* that there is no trade-off between inflation and unemployment

INFLATION, EXPECTATIONS, AND THE AS CURVE

- We have before derived the following expression for the **AS** curve:

$$P = P_{-1} [1 + \lambda (Y - Y^*)]$$

- Now, we will modify this **AS** function in two ways:
 - We will transform the **AS** curve into a relationship between output (**Y**) and the inflation rate (**π**), rather than between output (**Y**) and the price level (**P**)
 - We will also take into account expected inflation (**π^e**)
 - Firms and workers also take into account expected changes in the price level when they set wages

INFLATION AND THE AS CURVE

- We can write the following **AS** curve differently:

$$P = P_{-1} [1 + \lambda (Y - Y^*)]$$

$$P = P_{-1} + P_{-1} \lambda (Y - Y^*)$$

$$P - P_{-1} = P_{-1} \lambda (Y - Y^*)$$

$$(P - P_{-1})/P_{-1} = \lambda (Y - Y^*)$$

$$\pi = \lambda (Y - Y^*)$$

- But let's do so from scratch, starting from the **wage-Phillips curve**

WAGE SETTING AND CONDITIONS IN THE LABOUR MARKET

- When setting **wages**, firms and workers react to conditions in the labour market:
 - When **output** and **employment** are high, **wages** tend to rise fast
 - When **output** and **employment** are low, **wages** do not rise quickly and may even fall
- This relation is captured by the **simple** wage-Phillips curve:

$$g_w = -\varepsilon (u - u^*)$$

- The higher the level of output/employment (i.e., the lower the **rate of unemployment**), the greater the rate of **wage-inflation**

THE WAGE-PHILLIPS CURVE AS A FUNCTION OF OUTPUT

$$g_W = -\varepsilon (u - u^*)$$

$$u - u^* = \frac{LF - N}{LF} - \frac{LF - N^*}{LF} = \frac{N^* - N}{LF}$$

$$\begin{aligned} N &= Y/a \\ N^* &= Y^*/a \\ LF &= YF/a \end{aligned}$$

$$\frac{N^* - N}{LF} = \frac{(Y^*/a) - (Y/a)}{YF/a} = \frac{Y^* - Y}{YF}$$

$$g_W = -\varepsilon (Y^* - Y)/YF$$

$$g_W = \lambda (Y - Y^*)$$

where $\lambda = \varepsilon/YF$

This version of the **wage-Phillips curve** summarizes the link between wage inflation and the output gap. This equation indicates that the larger the inflationary gap, the larger the rate of wage increase.

THE EXPECTATIONS-AUGMENTED WAGE-PHILLIPS CURVE

- Note that the *simple* wage-Phillips curve ignores the effects of expected inflation on wage setting
 - $g_w = \lambda (Y - Y^*)$
 - However, firms and workers are both interested in real wages not nominal wages
- When inflation is expected, the wage-Phillips curve becomes:

$$g_w = \pi^e + \lambda (Y - Y^*)$$

- This equation is called the *expectations-augmented* wage-Phillips curve
 - It shows that, all else equal, *wages* rise more the higher the *expected* rate of *inflation*

THE EXPECTATIONS-AUGMENTED AS CURVE

- Let's continue with the assumption that firms maintain a constant *mark-up* of prices over unit labour cost
 - Thus, the rate of increase of prices (π) is equal to the rate of increase in wages (g_w)
 - $\pi = g_w$
- Substituting $\pi = g_w$ into $g_w = \pi^e + \lambda (Y - Y^*)$, we obtain the *dynamic AS* curve or the *expectations-augmented AS* curve:

$$\pi = \pi^e + \lambda (Y - Y^*)$$

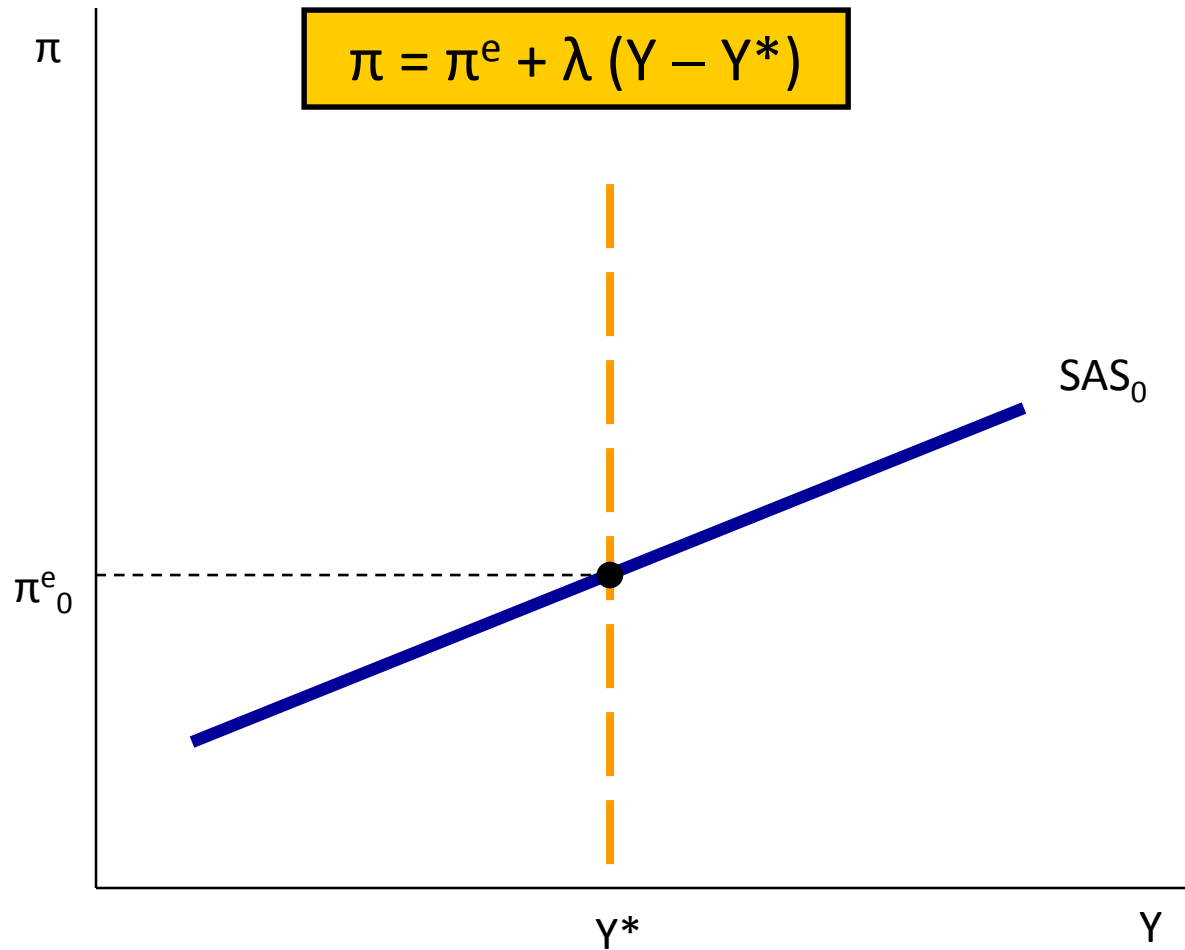
THE SHORT-RUN AS CURVE

- The expected rate of inflation (π^e) is *assumed* to be constant in the short run
- Thus the short-run aggregate supply curve (**SAS**) shows the relationship between the inflation rate and the level of output when the expected rate of inflation (π^e) is held constant

$$\pi = \pi^e + \lambda (Y - Y^*)$$

- Therefore, there is one **SAS** corresponding to each expected rate of inflation
 - The higher π^e , the higher the **SAS**
 - Note that if $Y = Y^*$, then $\pi = \pi^e$

THE DYNAMIC AS CURVE

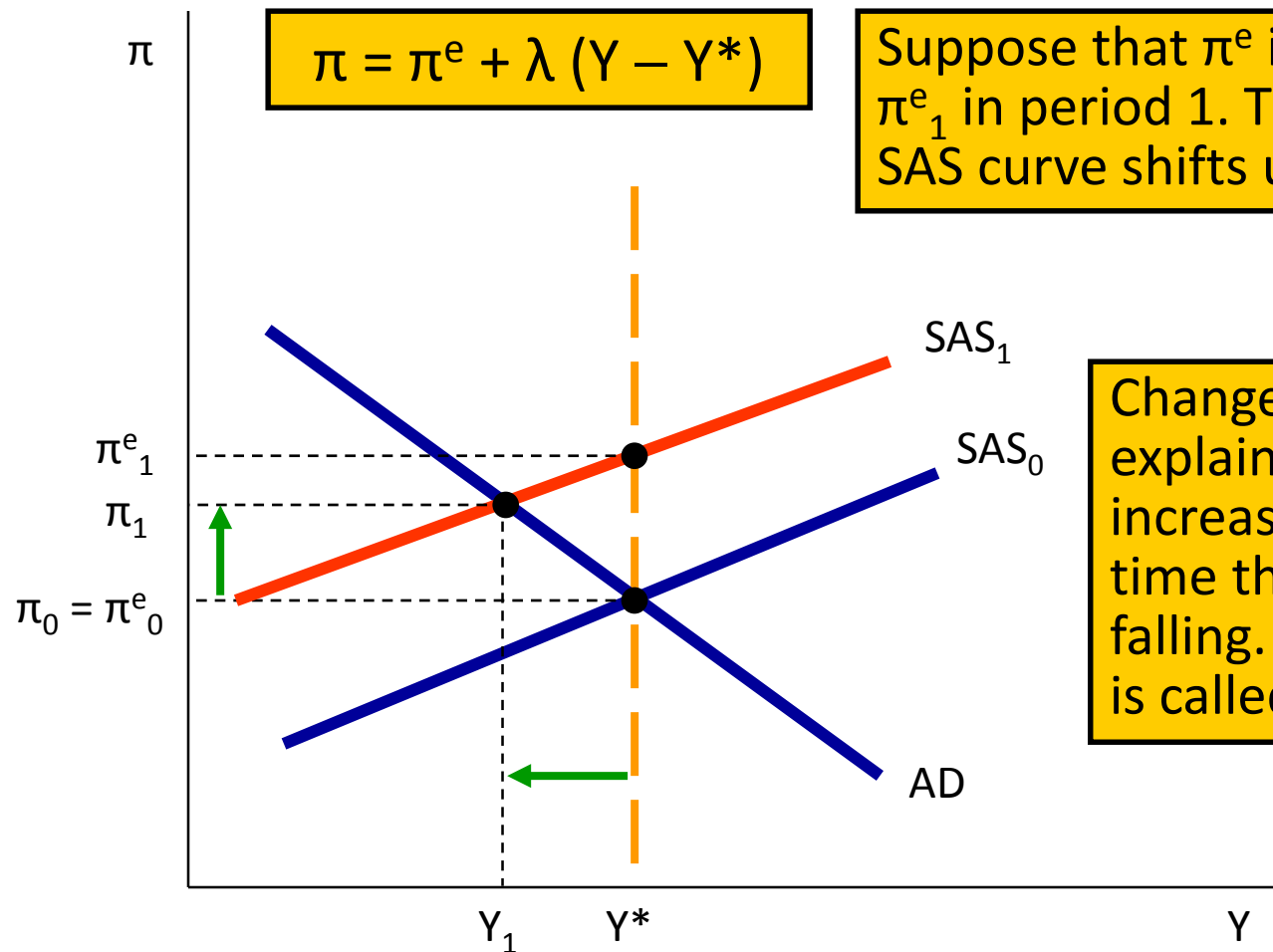


THE SHORT-RUN AS CURVE (CONT'D)

$$\pi = \pi^e + \lambda (Y - Y^*)$$

- Given π^e , the **SAS** curve shows that the *inflation* rate rises with the level of *output*
 - This is so because higher *output* represents higher *employment*, and thus higher *wages* and higher *prices*
 - Therefore, there is a *trade-off* between *inflation* and *output* in the *short-run*
- Therefore, in order to reduce the *inflation* rate it is necessary to reduce the level of *output*
 - The creation of a *recession* forces the rate of *wage* increase down through higher *unemployment*, thus causing a lower *inflation* rate

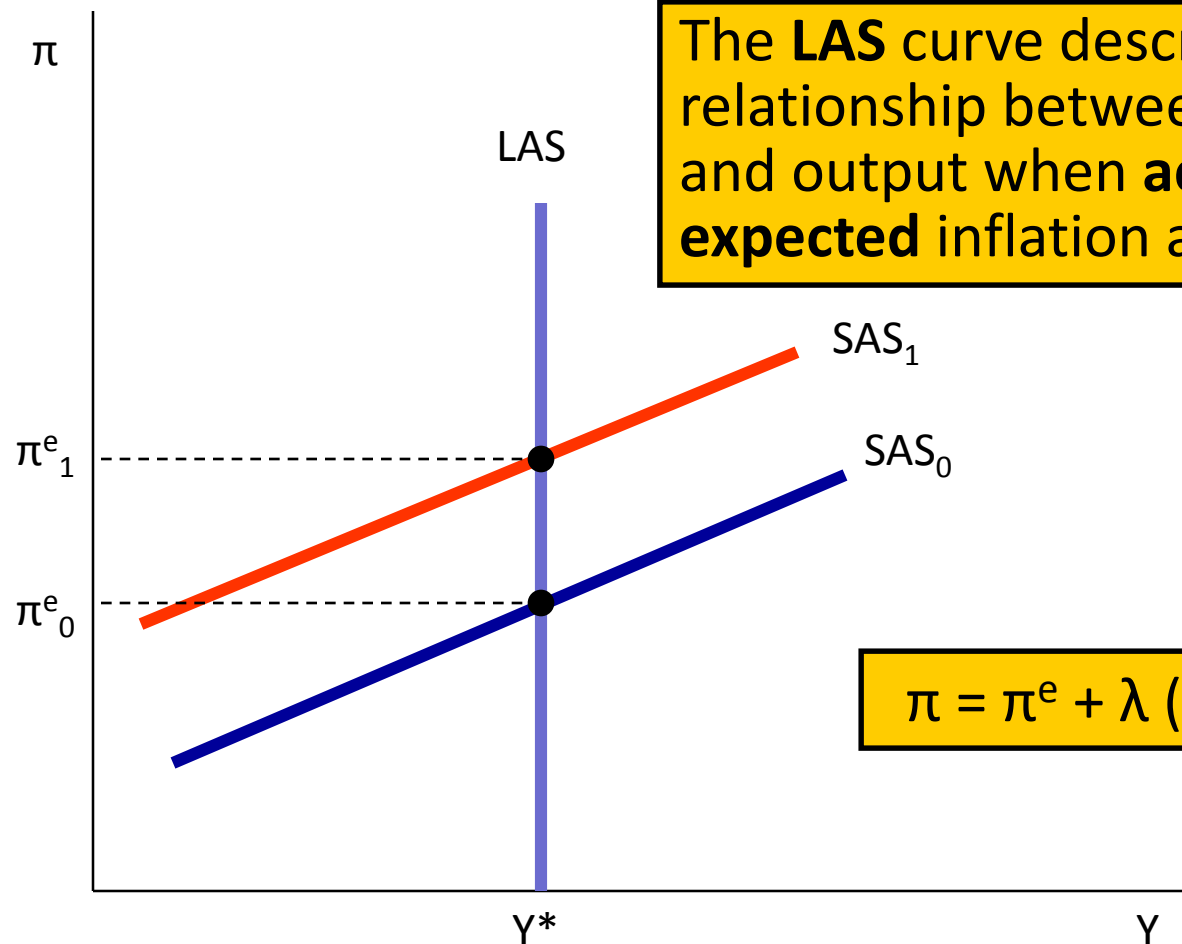
THE EFFECT OF A CHANGE IN π^e



THE LONG-RUN AS CURVE

- The π^e is constant on each **SAS** curve
 - That is, there is one **SAS** curve for each π^e
- If π remains constant for a long time, firms and workers will expect this particular rate to continue so $\pi^e = \pi$
- This is the situation in the *long run*, when $Y = Y^*$
 - Therefore, the **LAS** curve describes the relationship between π and Y when $\pi = \pi^e$
- The **LAS** is a vertical line at the level of Y^*
 - Thus, there is no trade-off between π and Y in the *long run*
 - Note, however, that this is not a theoretical *conclusion* of the model but rather an *assumption*

THE LONG-RUN AS CURVE



The **LAS** curve describes the relationship between inflation and output when **actual** and **expected** inflation are equal.

$$\pi = \pi^e + \lambda (Y - Y^*)$$

THE ROLE OF EXPECTED INFLATION

- The inclusion of π^e in the **AS** function is a *controversial* point in macroeconomics
- There are *three* main *questions* to be answered:
 - 1) How does π^e come to be reflected in wages?
 - 2) Is it changes in π^e or compensation for past inflation that shifts the **SAS** curve?
 - 3) What determines π^e ?

WAGE ADJUSTMENTS

- **Wages** tend to increase when $u < u^*$
- **Wages** may *also* be adjusted for two other reasons:
 - Because prices are now higher, i.e., because of *past inflation*
 - Because inflation is expected (π^e), i.e., because of *future inflation*
- In this way, a process of *inflation* gets under way
 - **Wages** set in each successive period are higher than before
- But since *wage* contracts are negotiated every 2 or 3 years, it takes time for π^e to work its way into *wage* adjustment

COMPENSATION FOR PAST INFLATION OR EXPECTED INFLATION?

- It is argued that wage agreements compensate workers not only for π^e but also for *past inflation*
 - But compensation for past inflation refers to *unexpected* inflation
- It is difficult, however, to distinguish an adjustment for π^e from compensation for *past unexpected inflation*
 - Nevertheless, this distinction is important to determine how quickly it takes for the inflation rate to change
- If wage adjustment reflects compensations for *past inflation*, then inflation today reflects last year's inflation and π changes only gradually
- But if it reflects compensation for π^e , then a radical change in policy that changes π^e could also change π quickly

DETERMINANTS OF EXPECTED INFLATION

- One hypothesis used in the 1950s and 1960s is that expectations are *adaptive*, that is, they are formed based on the past behaviour of the variable
 - For instance, the expected rate of inflation could be equal to the previous period rate of inflation:

$$\pi^e = \pi_{-1}$$

- Or it could be a weighted average of some previous periods:

$$\pi^e = \theta_1 \pi_{-1} + \theta_2 \pi_{-2} + \theta_3 \pi_{-3} + \dots + \theta_n \pi_{-n}$$

- In this case, it's difficult to determine whether the π^e in the **AS** curve represents expected inflation or compensation for past inflation

DETERMINANTS OF EXPECTED INFLATION (CONT'D)

- Another hypothesis is that expectations are formed rationally
 - The *rational expectations hypothesis* is the assumption that people base their expectations of inflation (or of any other economic variable) on all the information available about the future behaviour of that variable
- The rational expectations hypothesis implies that people do not make systematic mistakes in forming their expectations
 - They make mistakes but not systematic mistakes
 - That is, people continually correct past mistakes, thus changing the way in which they form expectations
- Implicit in the rational expectations hypothesis is the assumption that people know the environment

ADAPTIVE EXPECTATIONS

- In what follows, we will work with *adaptive* expectations of the form:

$$\pi^e = \pi_{-1}$$

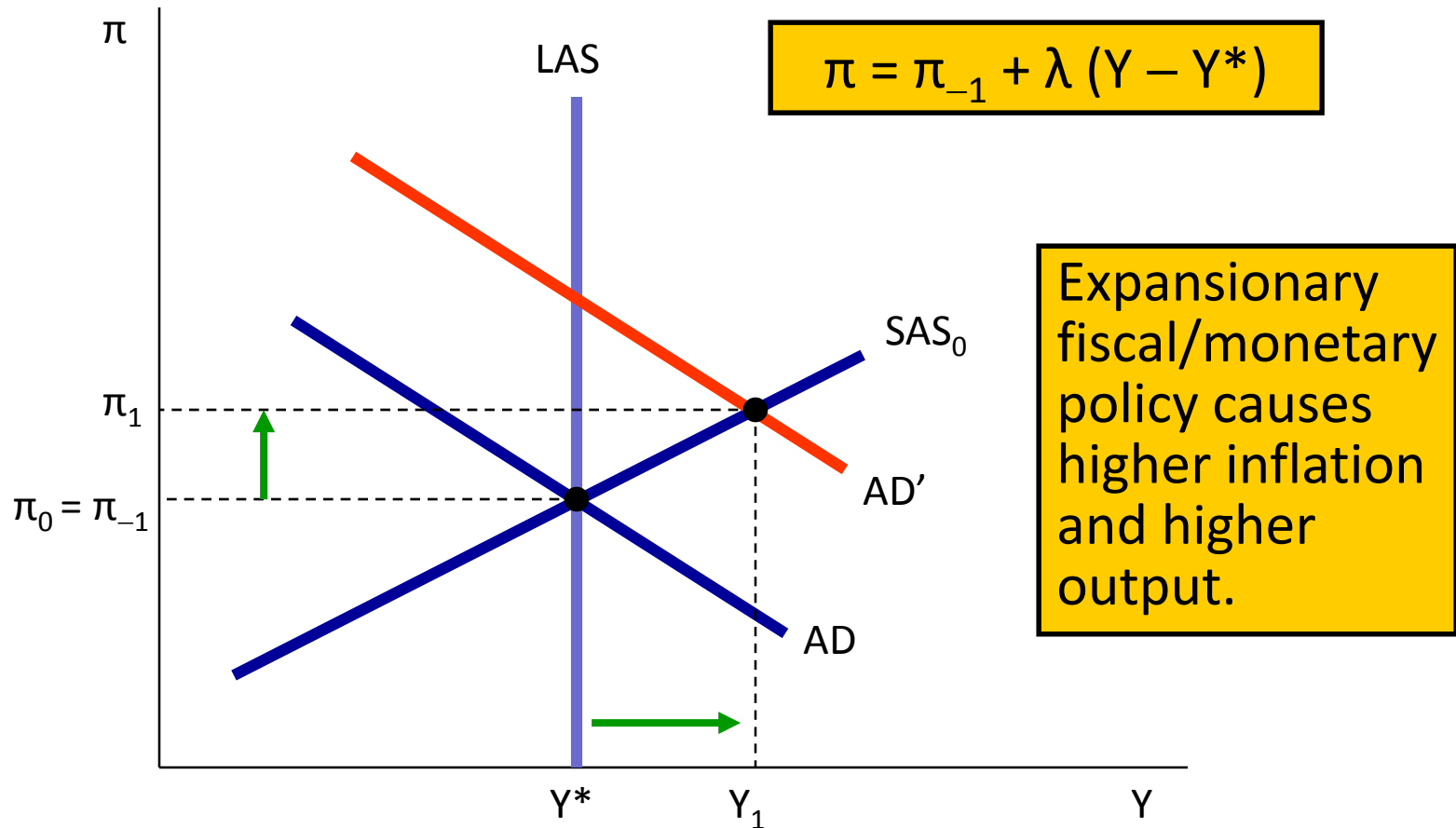
- Therefore, the short-run dynamic aggregate supply curve (**SAS**)

$$\pi = \pi^e + \lambda (Y - Y^*)$$

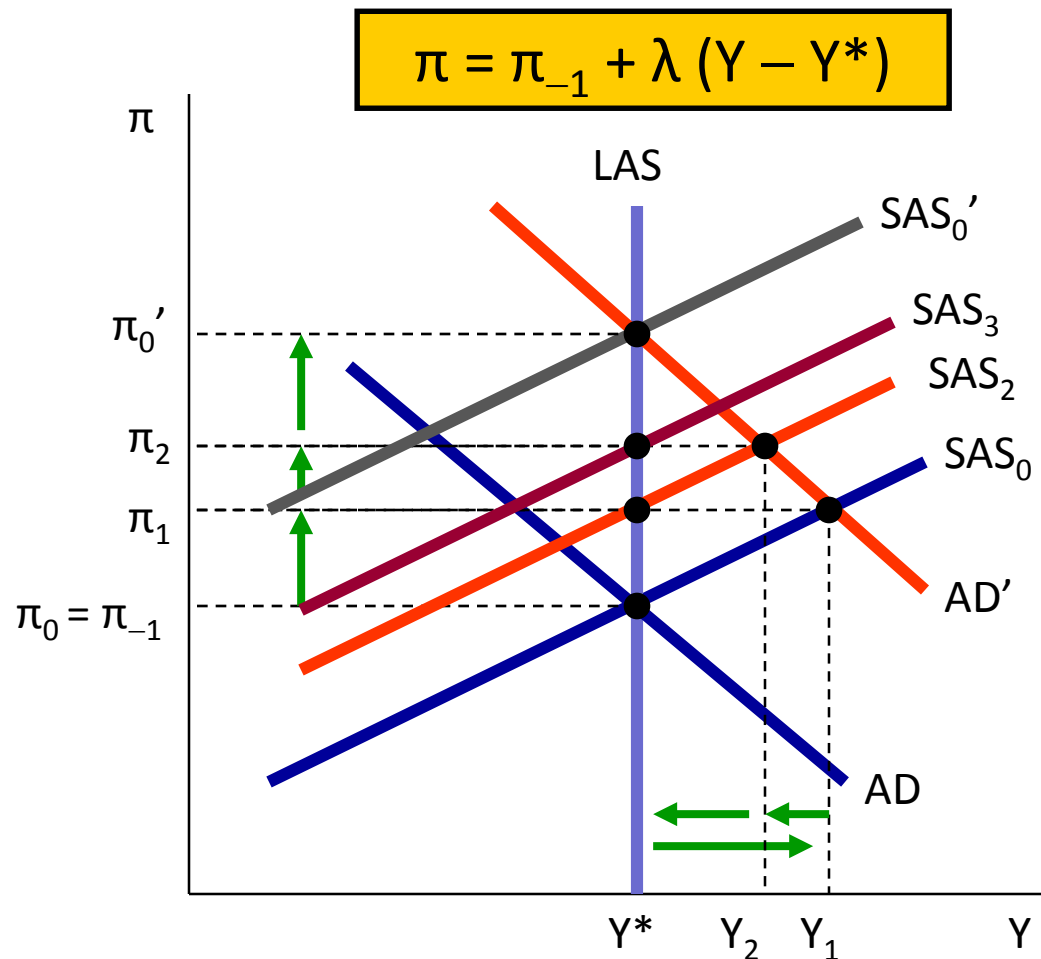
becomes

$$\pi = \pi_{-1} + \lambda (Y - Y^*)$$

SHORT-RUN EFFECT OF EXPANSIONARY FISCAL/MONETARY POLICY



MEDIUM- AND LONG-RUN EFFECT OF EXPANSIONARY FISCAL/MONETARY POLICY



Expansionary fiscal/monetary policy causes higher inflation and higher output in the short-run.

$$g_W = \pi_{-1} + \lambda (Y - Y^*)$$

In the medium-run, inflation continues to increase while output starts to decrease.

In the long-run, inflation is higher while output is back to Y^* .

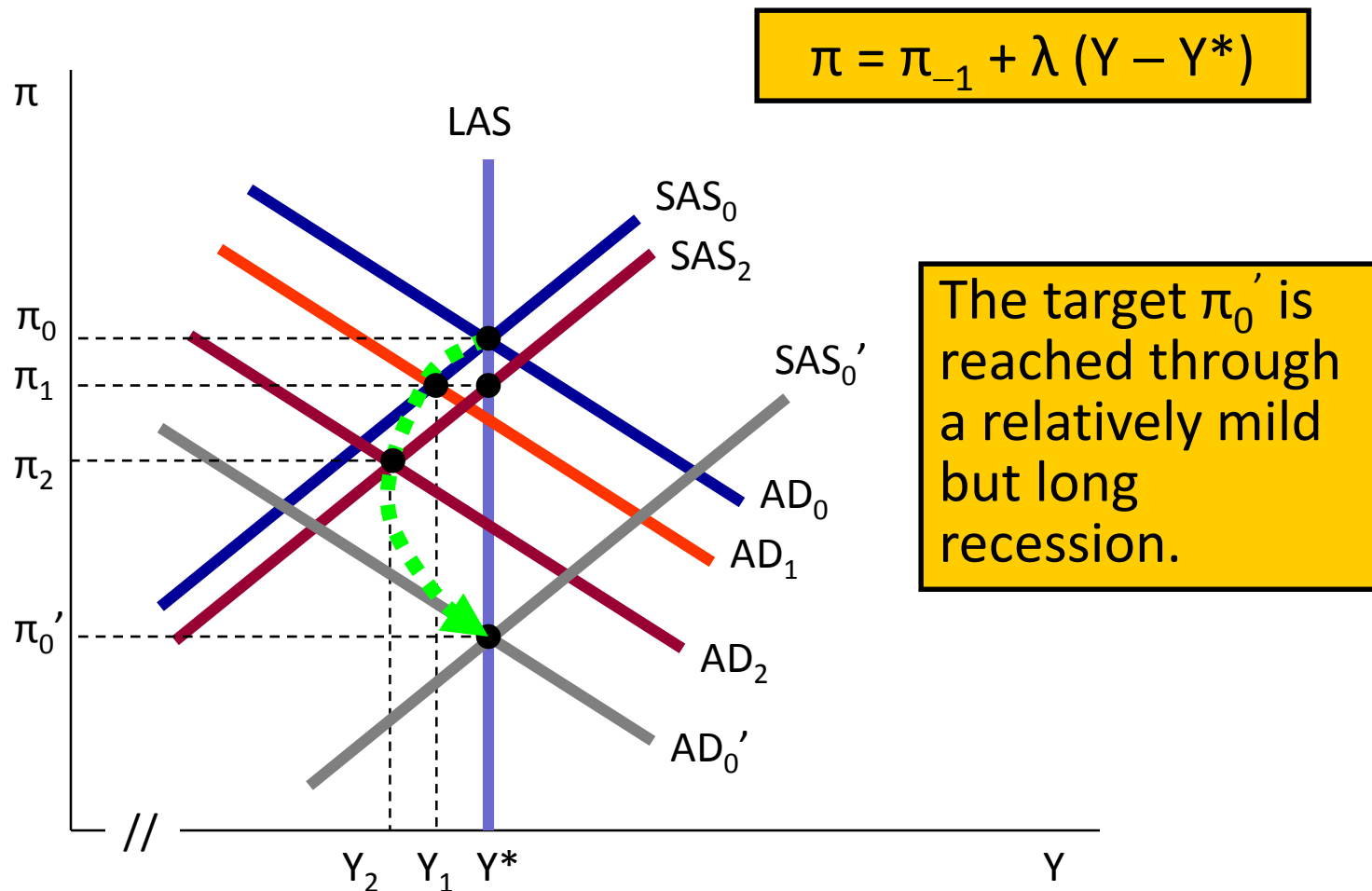
ALTERNATIVE STRATEGIES TO REDUCE INFLATION

- The basic method of disinflation is to reduce the rate of growth of *aggregate demand*
 - This can be done by using contractionary fiscal or monetary policy
- We will consider two strategies to reduce inflation through changes in *monetary policy*
 - *Gradualist* strategy
 - *Cold-turkey* strategy (or *shock therapy*)

GRADUALIST STRATEGY

- A policy of *gradualism* attempts a slow and steady return to low inflation
 - It consists of period after period small reductions in the rate of growth of the nominal money supply (M)
 - That is, M/P decreases as long as the percentage increase in M is less than the percentage increase in P
- A reduction in the real money supply (M/P) shifts the AD curve downward and reduces π
 - In turn, a lower π reduces π^e and shifts the SAS downward the following period
 - The process is repeated until the target π is reached

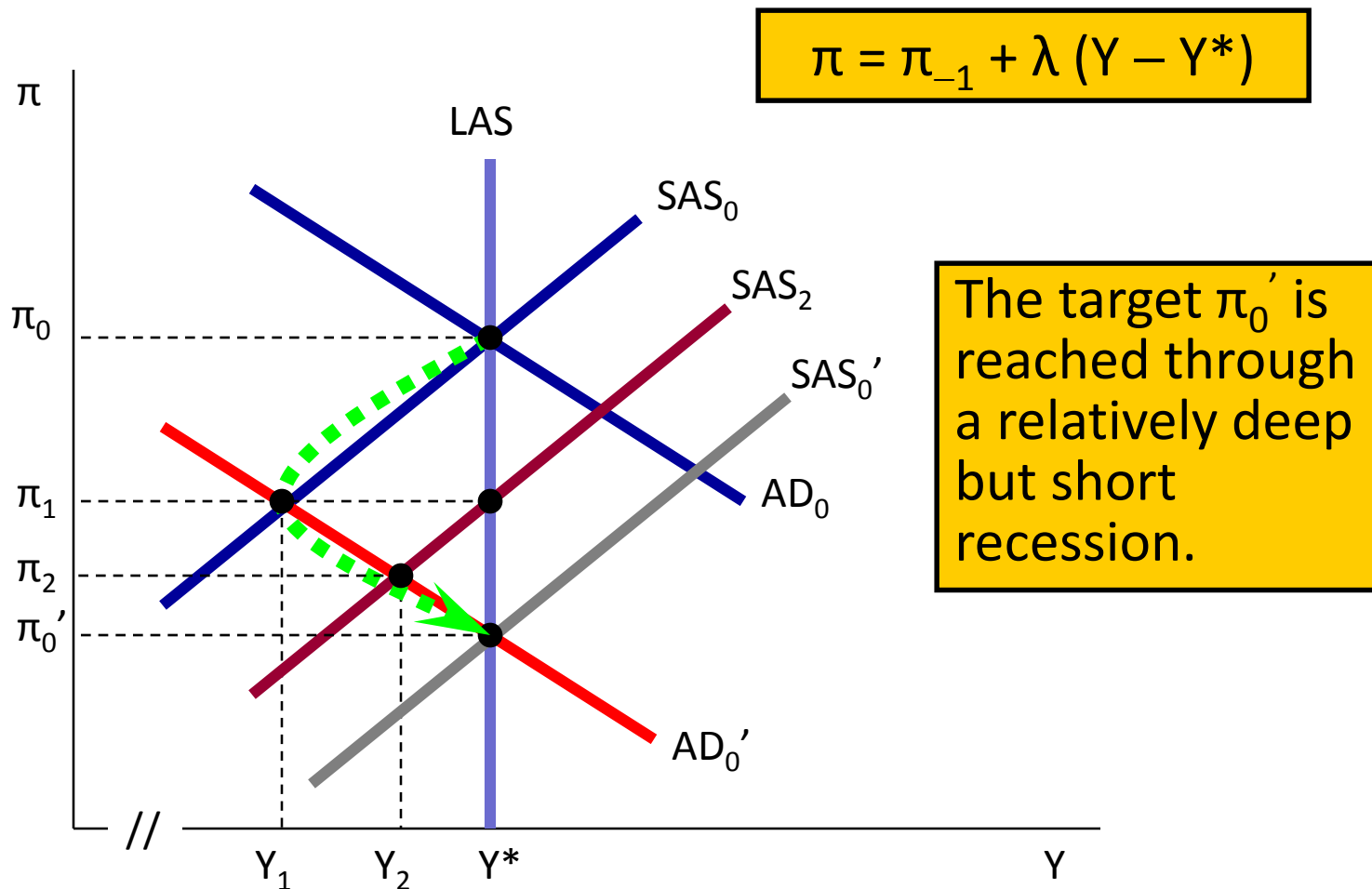
GRADUALIST STRATEGY



COLD-TURKEY STRATEGY

- The *cold-turkey* strategy tries to cut the inflation rate fast
 - The strategy starts with an initial sharp reduction in the rate of growth of money supply
- A large decrease in the money supply shifts significantly the **AD** curve downward and reduces π
 - In turn, a lower π reduces π^e and shifts the **SAS** downward the following period
 - The latter process is repeated until the target π is reached
- Therefore, the cold turkey strategy causes a large recession
 - The larger fall in π causes the **SAS** curve to move down faster (as compared to the gradual case)

COLD-TURKEY STRATEGY



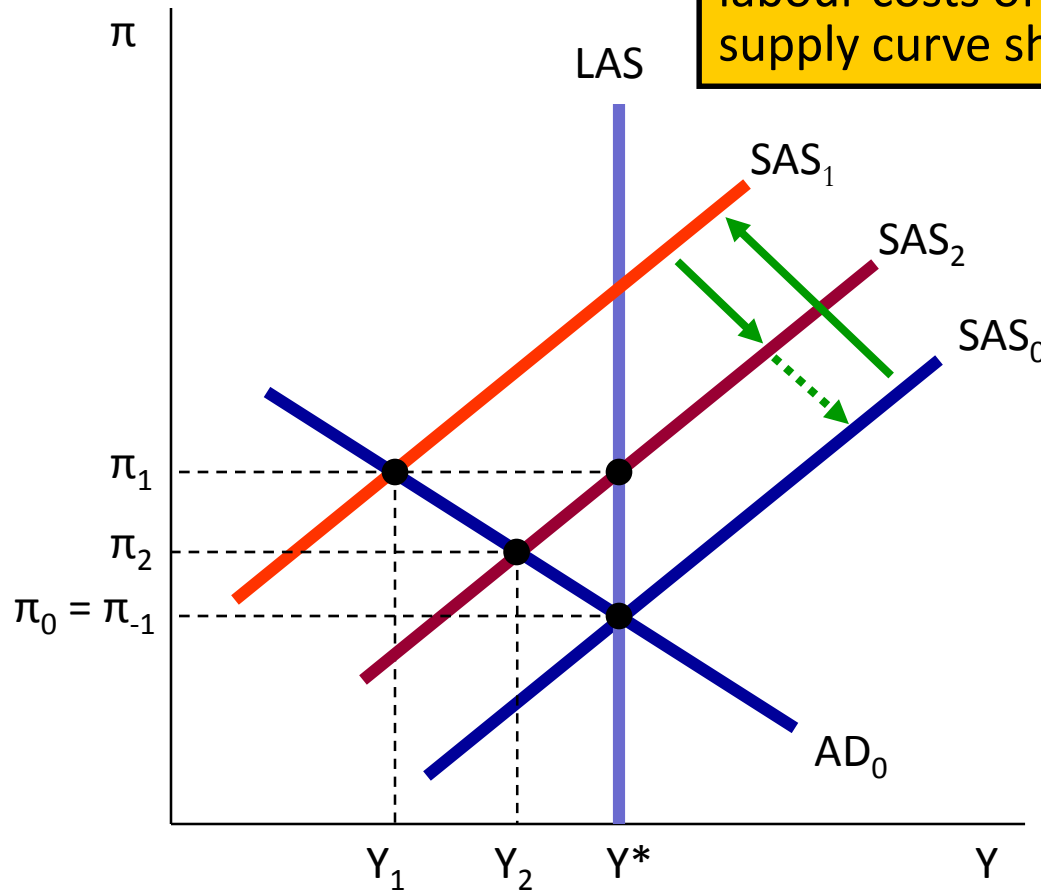
GRADUALISM Vs. COLD TURKEY

- The *gradualist* strategy initially reduces M only slightly, and therefore the economy never moves very far from u^* (but π comes down slowly)
- The *cold turkey* strategy initially reduces M very sharply causing a large recession (and π comes down much faster)
- If expectations are formed rationally, then people will be more likely to believe that policy has changed under the cold turkey strategy than under gradualism
 - Moreover, a belief that the policy has changed will by itself drive the π^e down
- Some economists believe that if a policy could be made credible, π could come down without requiring a recession

A NEGATIVE SUPPLY SHOCK

$$\pi = \pi_{-1} + \lambda (Y - Y^*)$$

Firms increase the mark-up over unit labour costs to cover the higher non-labour costs of production, and the supply curve shifts up to SAS_1 .



In the new long-run equilibrium the rate of inflation returns to its initial long-run equilibrium. This implies that higher non-labour costs of production have caused a temporary increase in inflation.

Rate of inflation drops due to **lower real wages** reducing real unit cost of labour.

A NEGATIVE SUPPLY SHOCK (CONT'D)

■ Short-run impact:

- Constant mark-up over unit labour cost increases to cover higher non-labour costs of production
- Stagflation

■ Medium-run impact:

- W are adjusted up because of π^e and down because $u > u^*$
- Real wages gradually decrease since $g_w < \pi^e$
- Actual inflation lower than π^e so π^e gradually falls

■ Long-run impact:

- Back to full-employment output and initial rate of inflation
- All prices increase in the same proportion as the price of the material input that caused the supply shock
- Real wages below their previous long-run equilibrium level

IS THERE A LONG-RUN NON-VERTICAL PHILLIPS CURVE?

- Some authors argue that there exists a non-vertical long-run Phillips curve, and therefore a trade-off between inflation and unemployment in the long-run
- For instance, Graham & Snower argue that in a rational expectations model with staggered wage contracts, a permanent increase in money growth leads to a permanent increase in the rate of inflation and a permanent reduction in the level of unemployment
- Satterfield & Leblond argue that permanent increases in productivity in the face of some wage rigidity could translate into a lower rate of unemployment and higher inflation in the long-run