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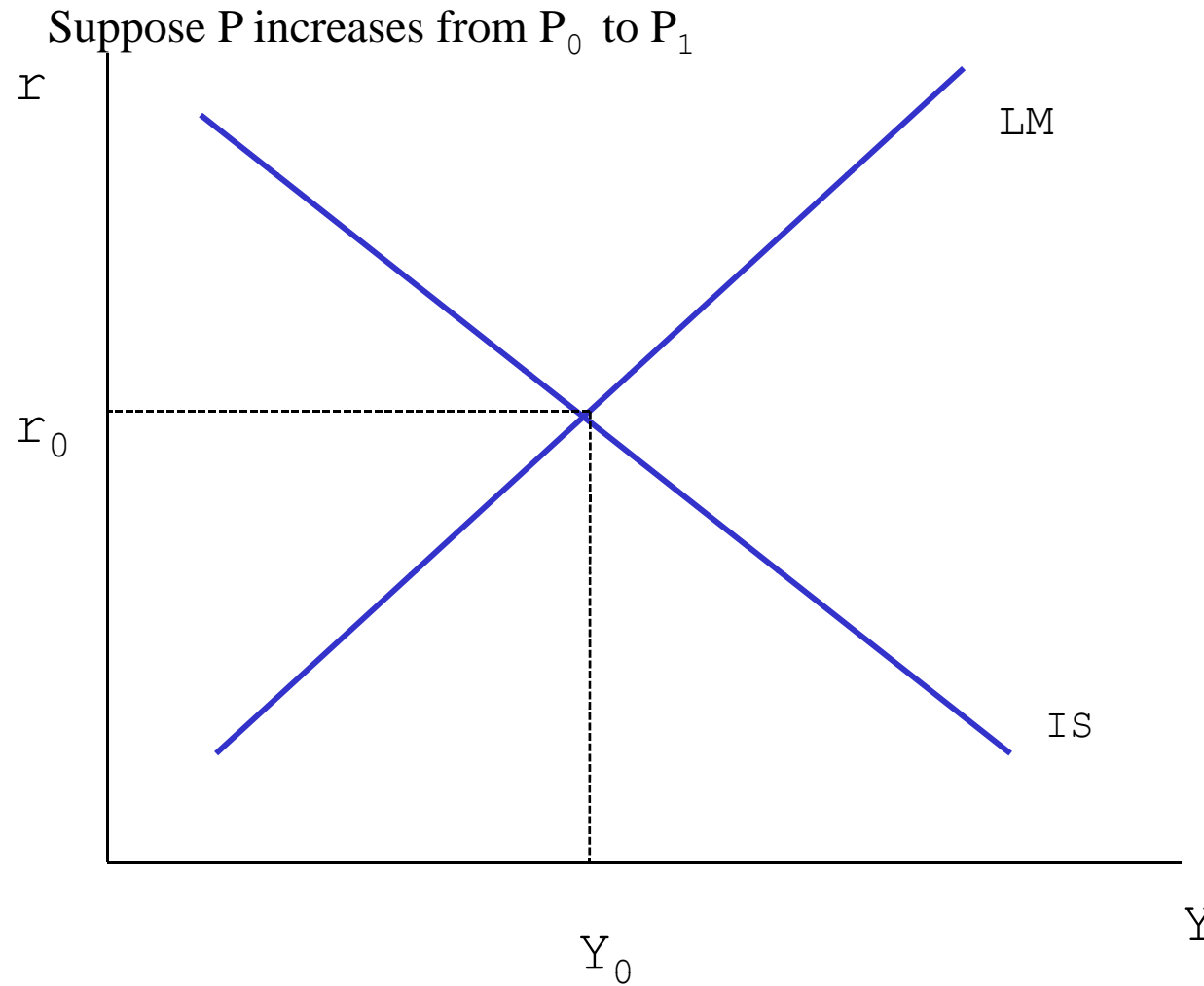
**AS-AD**

# Aggregate Demand Curve (AD)

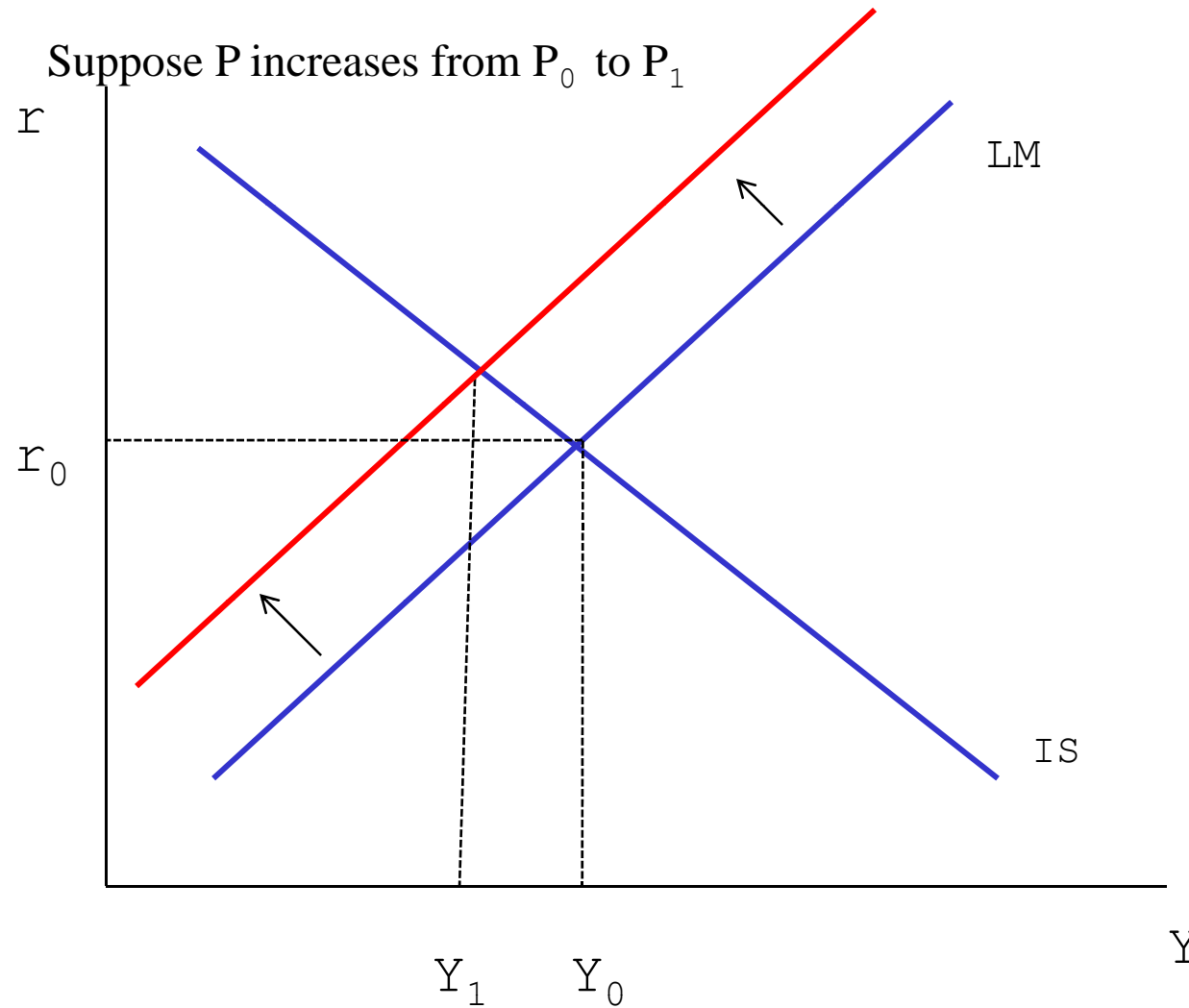
- So far we have worked in the space  $\{Y, r\}$ .
- What happens to aggregate demand if Prices increase?
- The AD curve is drawn in  $\{Y, P\}$  space. It represents how the demand side of the economy responds to a change in prices.
- **As  $P$  decreases (holding everything else fixed),  $M^s/P$  increases. As the supply of real money balances increase to have an equilibrium in the money market interest rate needs to fall, and hence from the equilibrium in the good market,  $I$  and  $C$  rise!**
- Prices affect the demand side of the economy through interest rates.
- Recall: prices do not affect  $C$  (if wages change 1 for 1 with prices PVLR will not change!)

**The AD curve comes directly from the IS-LM equilibrium. So, in essence, the AD curve is a representation of BOTH the IS curve AND the LM curve.**

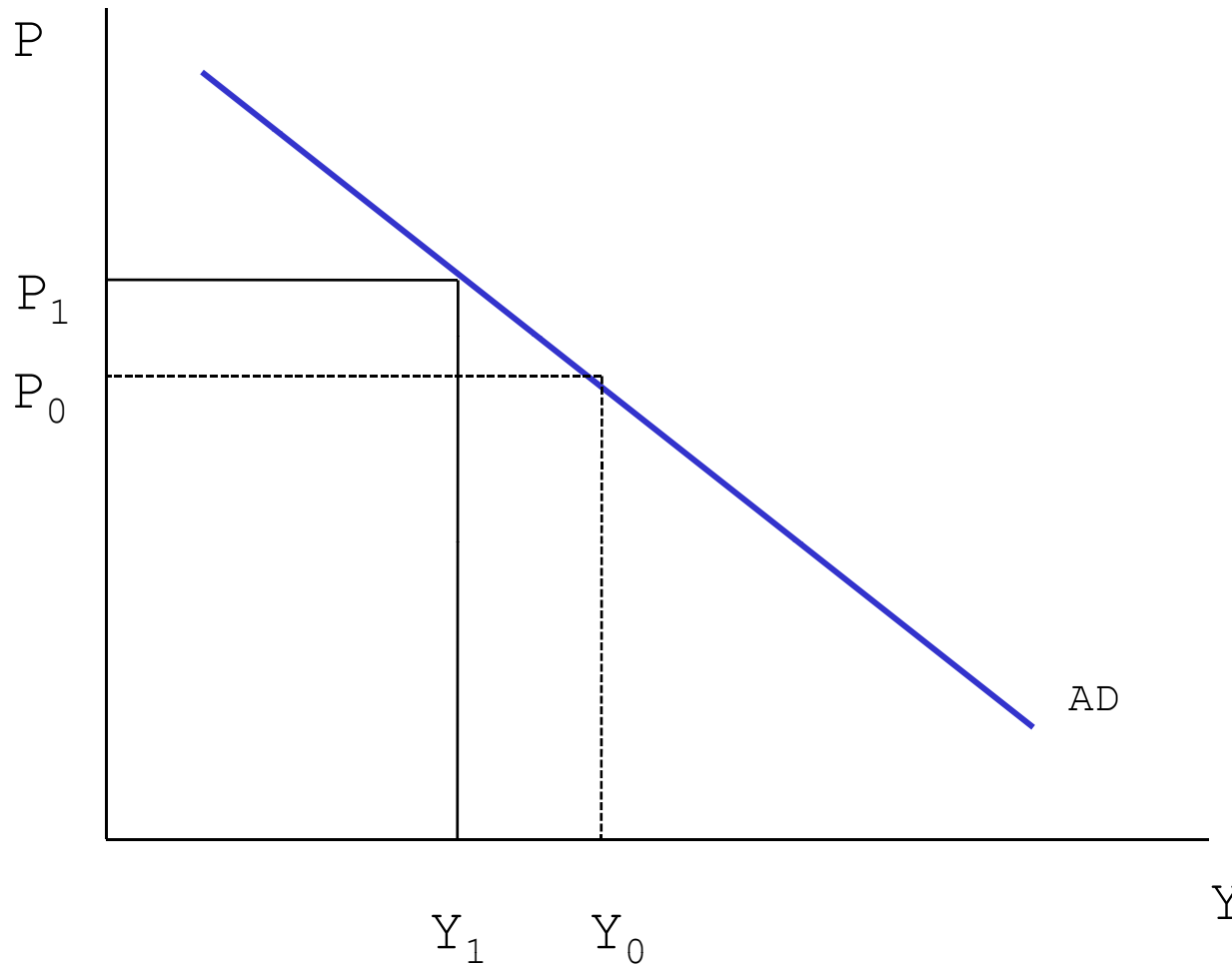
# Constructing the AD – Part 1



# Constructing the AD – Part 1



# Constructing the AD – Part 2



# What Shifts the AD curve?

- As the IS, the AD curve represents the demand side of the economy:  $Y = C+I+G+NX$
- Anything that causes the IS curve to shift to the right cause the AD curve to shift to the right
- Anything that causes the LM curve to shift to the right (except price changes) causes the AD curve to shift to the right.

Example: Nominal money (M) increases,  $r$  will fall,  $I$  will increase, AD will shift right.

**With increase in money:**

- LM shifts right**
- Move along the IS curve**
- Interest rates fall**
- C and I increase**
- AD shifts right.**

**A change in prices cause the LM to shift, but cause only a movement along the AD curve.**

# Example: Temporary Increase in G

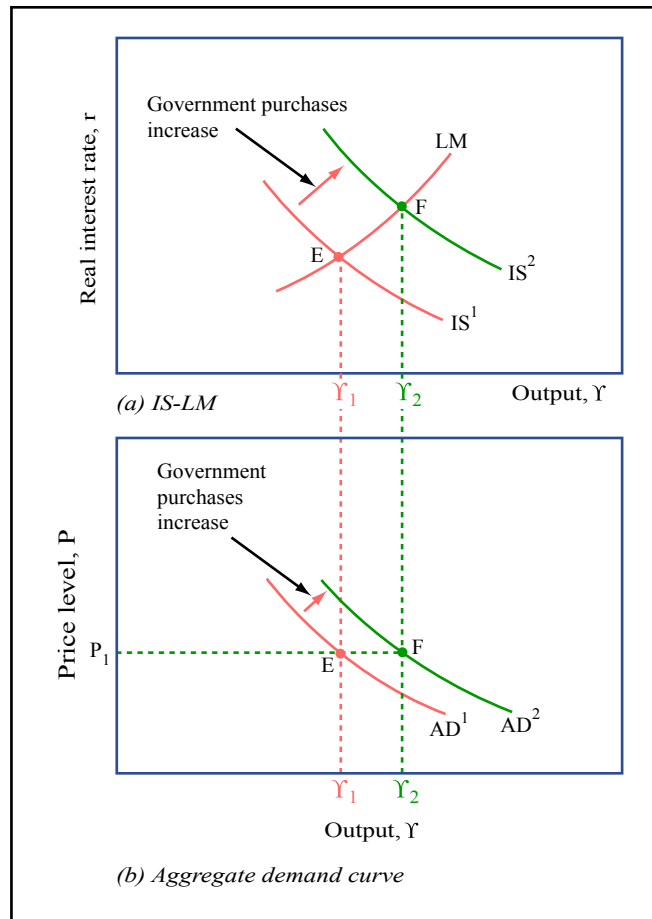
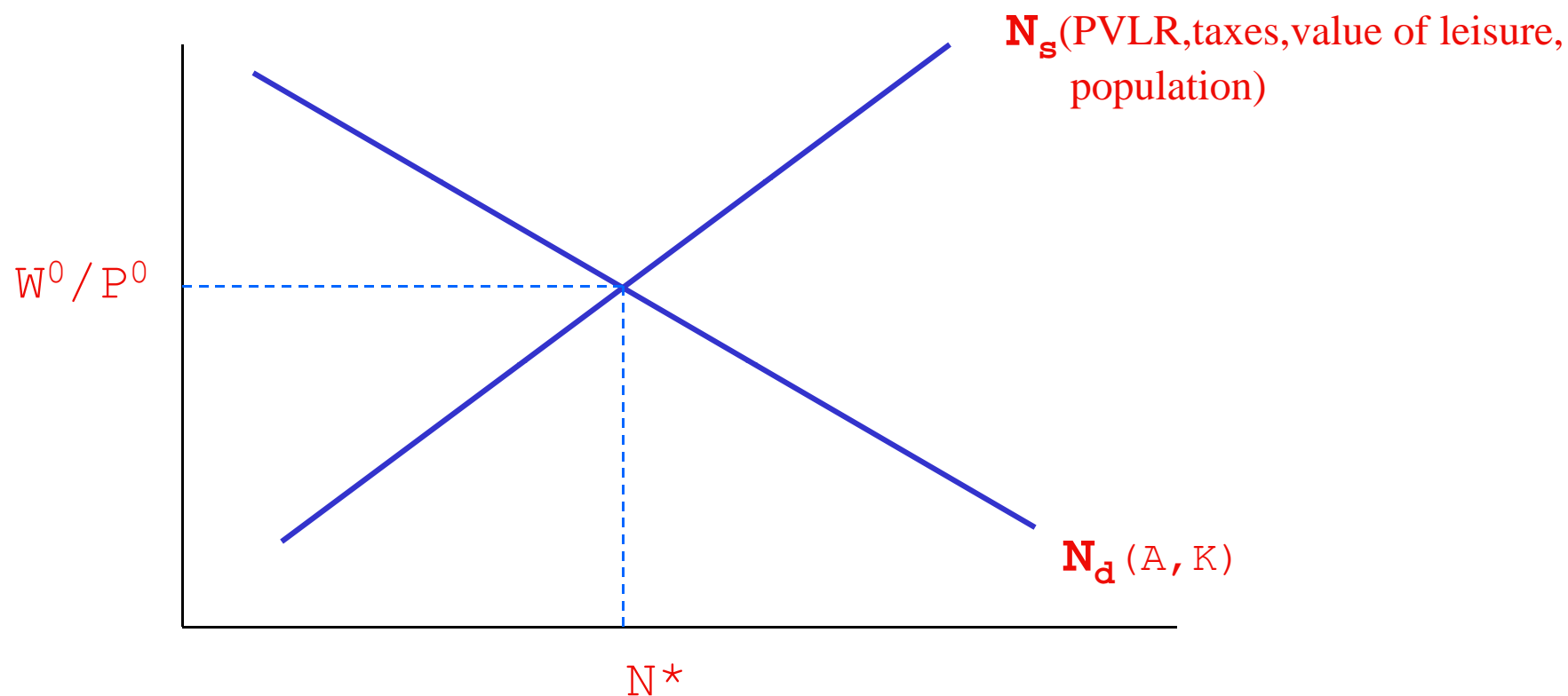


Figure by MIT OpenCourseWare.

# The Supply Side

*Labor Market:*



What is set in this market:  $N^*$  (and real wages).



# Aggregate Supply Curve in the Long Run (LRAS)

- In the long run, the labor market clears and we are at  $N^*$ !
- The full employment level of output is the level of output  $Y^*$  associated with  $N^*$ :

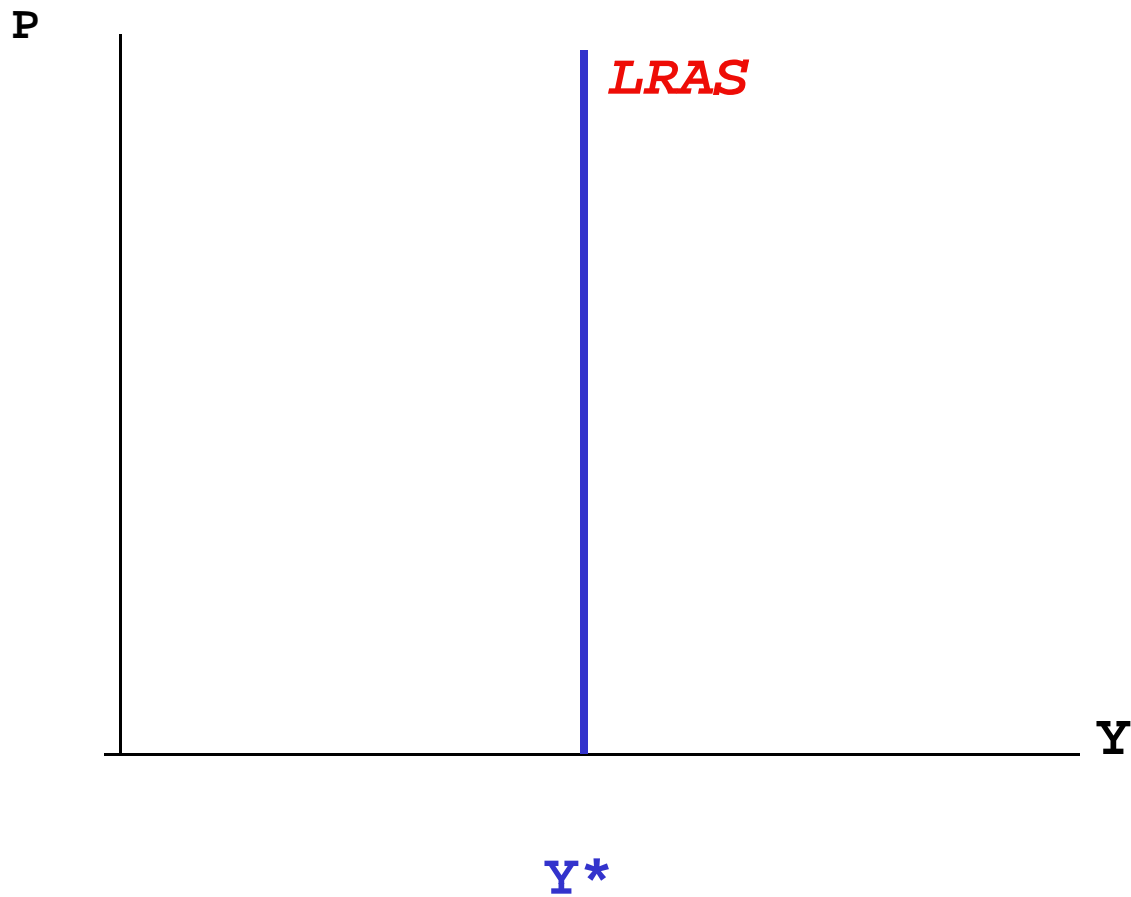
$$Y^* = A F(K, N^*, \text{Raw Materials})$$

- Define **LRAS = long run aggregate supply** is a curve vertical at  $Y^*$  (or **FE line**)
- In the long run, the labor market clears and

$$\begin{aligned} (w/p)^e &= \text{the real wage in labor market equilibrium} \\ N^* &= \text{hours worked in labor market equilibrium} \end{aligned}$$

- What shifts the Long Run AS Curve:  **$N^*$  or A or Raw Materials**
- Assume  $K$  is fixed, if I do not specify otherwise.

# The LRAS Curve



## Notes on the Potential Level of GDP ( $Y^*$ )

*The Equilibrium level  $Y^*$  is not necessarily optimal:* Tax distortions can mean  $Y^*$  is lower than is economically efficient. Equilibrium just means *balance* between private costs and benefits (in this case to household supply of labor and firm demand for labor). At an equilibrium, there is no incentive for people to change their behavior.

*The Equilibrium is not constant:* Changes to  $A$ ,  $K$  and  $N^*$  change  $Y^*$ , and hence shift the LRAS.  $Y^*$  trends upward in most countries (because  $A$  and  $K$  and population grow over time - shifting out  $N^*$ ). **Many economists believe its growth rate is fairly stable.**

# Long-run Equilibrium

Equilibrium is a point of attraction for the economy:

Most macroeconomists believe that, in the absence of shocks, the economy would reach equilibrium after perhaps 5 years. Thus the economy is in equilibrium in the “long run” (after 5 years).

Is the economy ever in long run equilibrium?

Given that shocks are always hitting, the economy is not likely to be in long run equilibrium at any point in time. Yet the force of attraction of equilibrium keeps the economy hovering around the equilibrium.

Why is the long run equilibrium point attractive?

Because at this point the labor market clears. Away from  $Y^*$  workers are not on their labor supply curve (and firms may be off their labor demand curve). Maximizing behavior by workers and firms push the economy towards long run equilibrium. Shocks push the economy away temporarily.

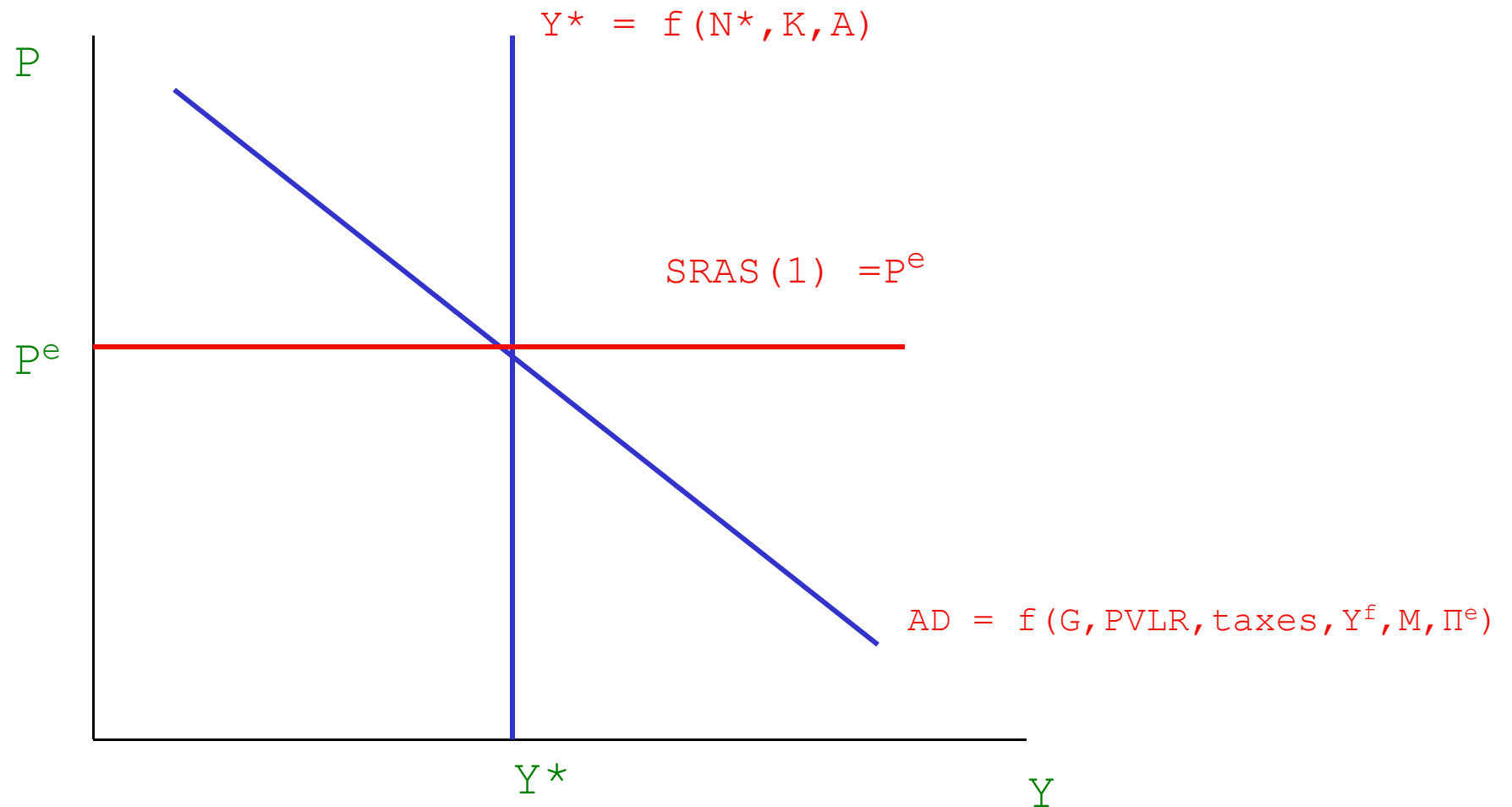
# Aggregate Supply: Short Run versus Long Run

- 1) **Long Run:** labor market is in equilibrium,  $N=N^*$
- 2) **Short Run:** labor market is not in equilibrium: cyclical unemployment may occur ( $N$  adjusts, but it need not be at  $N^*$ ,  $K$  is fixed)
  1. **Version 1:** Firms cannot adjust prices nor wages, that is, all **prices are “sticky”!**  
*Firms are always willing to produce extra output to meet the increased demand*
  2. **Version 2:** **nominal wages are “sticky”**. Then  $W$  is fixed, but not  $W/P$ !  
*Firms can change somehow prices in the short run in reaction to changes in demand, but cannot change wages*

# SRAS: Version 1

- Some Macro Economists believe that **prices are fixed in the short run**. It is costly to keep changing your prices when faced with every given shock. As a result, prices in the market tend to change slowly (price of milk at Dominick's!)
- **Firms keep prices and wages fixed and just meet demand by requiring workers to work a little harder sometimes and a little less hard during other times.** This is how they meet changes in demand without changing prices.
- This is what we have assumed so far, when we were working with the IS-LM framework keeping  $P$  as fixed.
- In this case - the labor market isn't really in equilibrium at all in the short run.
- In such a case - prices are fixed..... **SRAS is horizontal**

# AD-AS Equilibrium (Version 1)



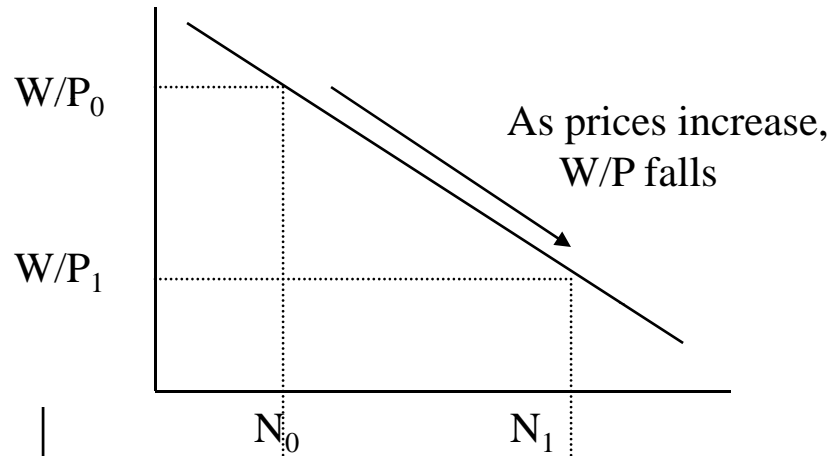
## SRAS: Version 2

- **The Short Run Aggregate Supply Curve (the relationship between output and prices) in the short run is positive → SRAS is upward sloping!**
- If there is a positive demand shock, firms may choose to produce more (at a given fixed nominal wage) to satisfy demand. To take advantage of the higher demand, firms may raise prices (optimally) which drives down  $W/P$ . The lower real wages causes firms to optimally hire more labor - causing output to increase.
- *However,  $N_d$  has not shifted!* Firms decide to meet the increase in demand for their product by hiring more workers because of the lower short run real wage. Firms remain on their labor demand curve, while workers are off their labor supply curve temporarily (workers have little bargaining power, options in the short run).
- → there is disequilibrium in the labor market!

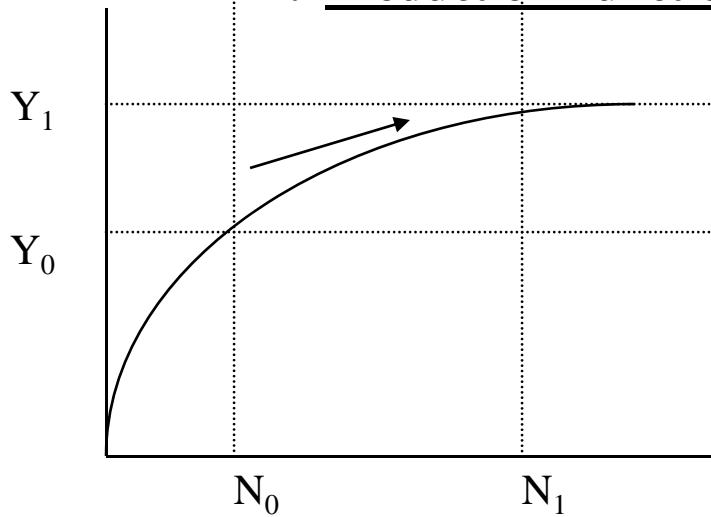


# The SRAS Curve (Version 2)

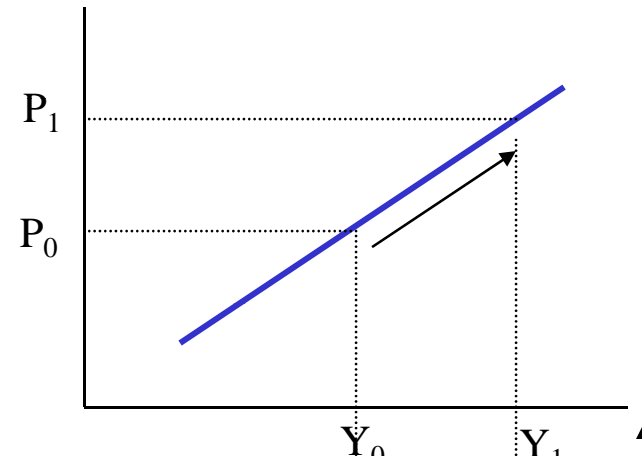
## 1. Labor Demand Curve



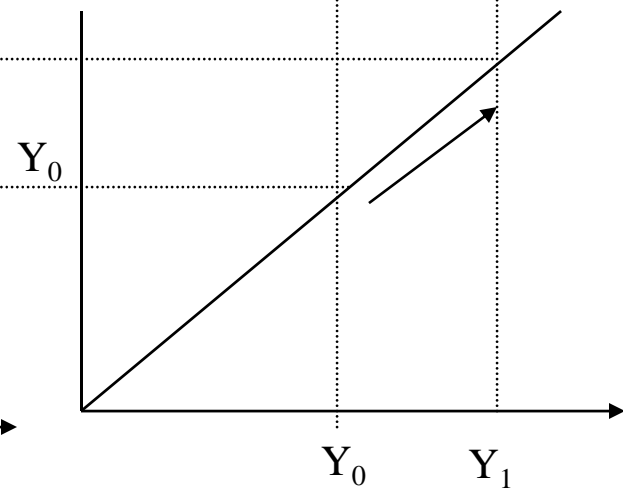
## 2. Production Function



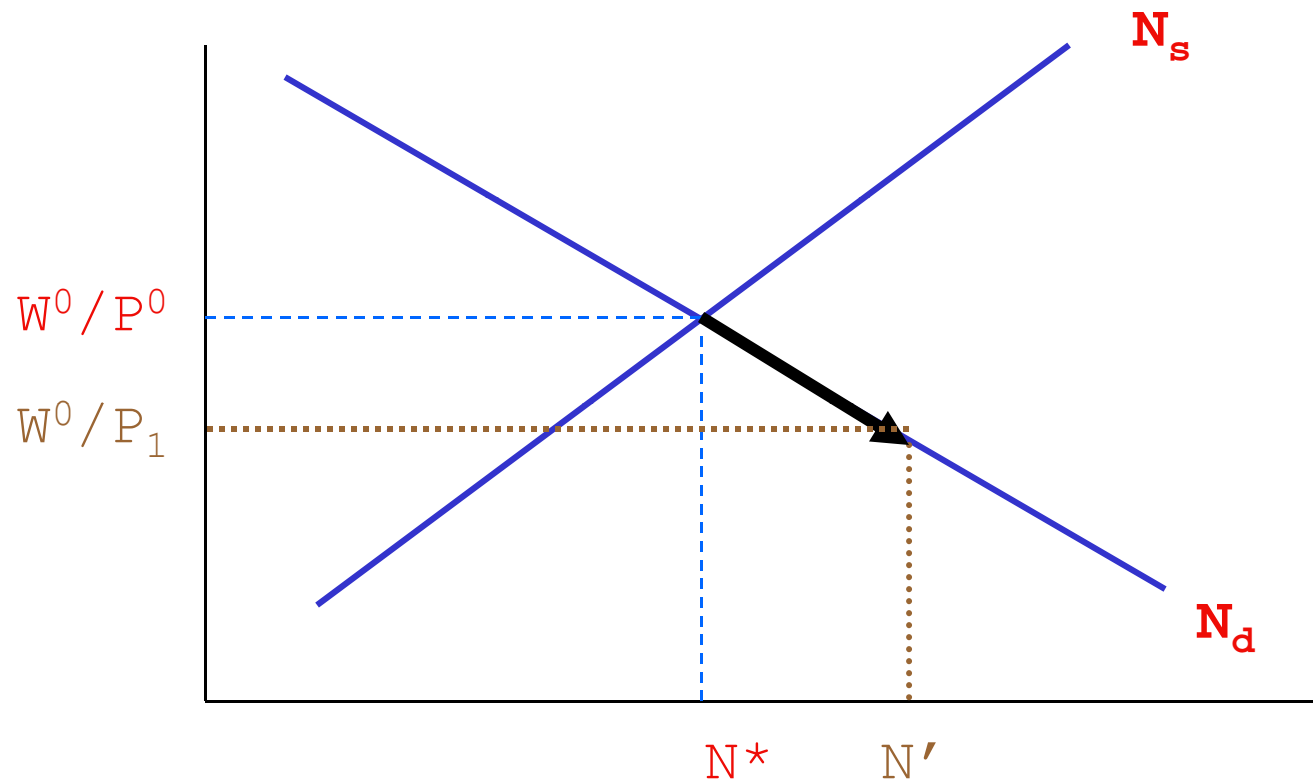
## 4. Short Run Aggregate Supply



## 3. 45 degree line



# Labor Market Disequilibrium



## Notes on SRAS (Version 2)

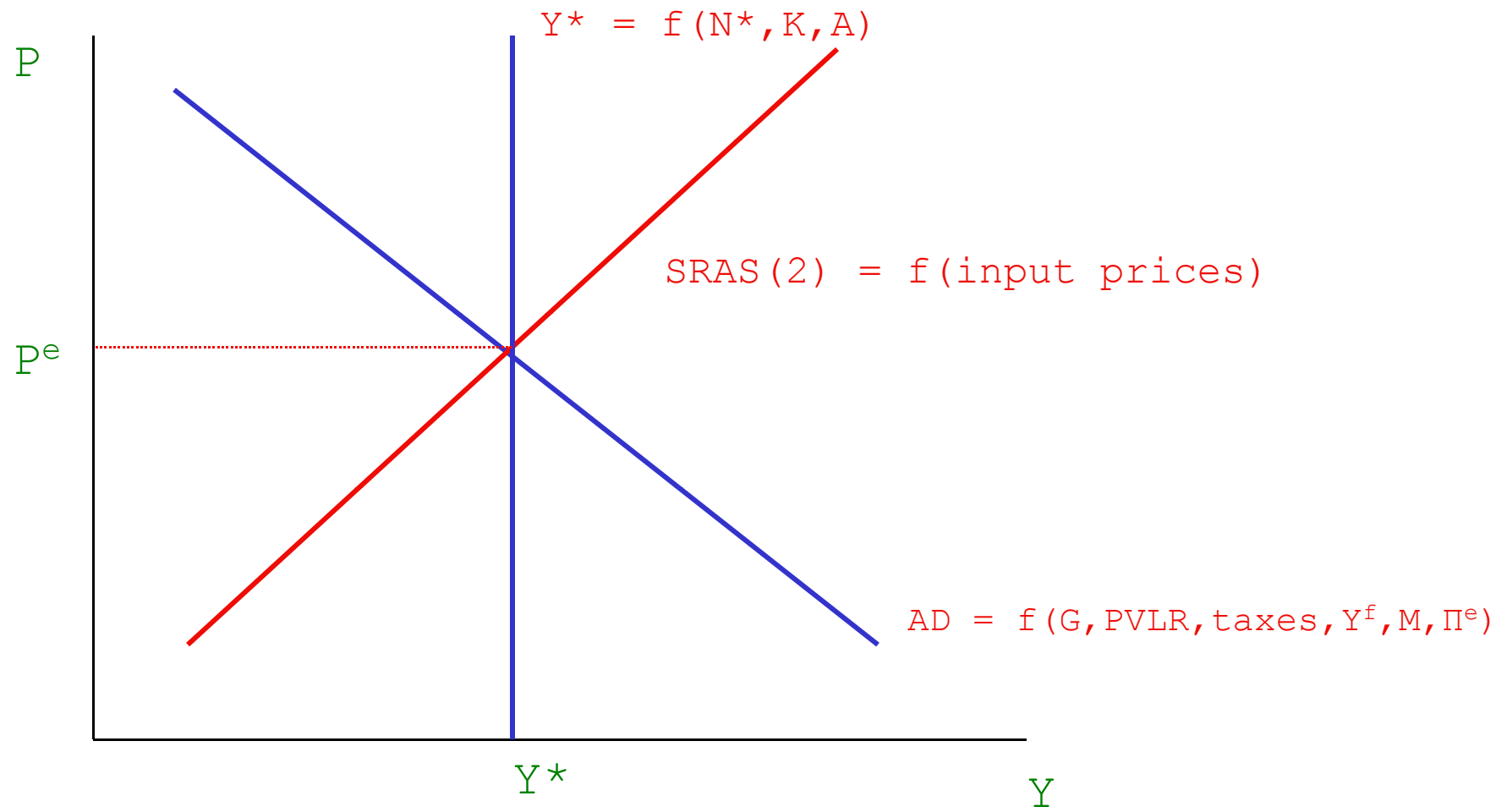
- If firms get a positive demand shock (demand for goods increase), **firms will raise prices, but wages stay fixed.** Hence real wages will decline making firms willing to hire more labor and produce more.
- **SRAS Curve Slopes Upwards because an increase in prices reduces real wages and causes firms to hire more workers and hence to produce more.**
- Hence,  $N > N^*$  and  $Y > Y^*$  and  $U < U^*$

$U$  = current unemployment rate

$U^*$  – Natural Rate of Unemployment (only frictional and structural, no cyclical unemployment)

- In our model  $U^*=0!$

# AD-AS Equilibrium (Version 2)



# What Shifts the SRAS

We will work with both the **horizontal (Version 1)** and the **upward sloping (Version 2)** SRAS curves.

What Shifts any SRAS curve?

$$\text{SRAS} = F(\text{A}, \text{K}, \text{N}, \text{raw materials}).$$

- **K** is fixed
- an increase in **A** shifts the SRAS down
- an increase in price of **raw materials** shifts the SRAS up. For given labor and capital, if the price of raw materials get more expensive, firms will produce less
- Moreover, **nominal wages will adjust between the short run and the long run** - that will cause the SRAS to shift between the short run and the long run!

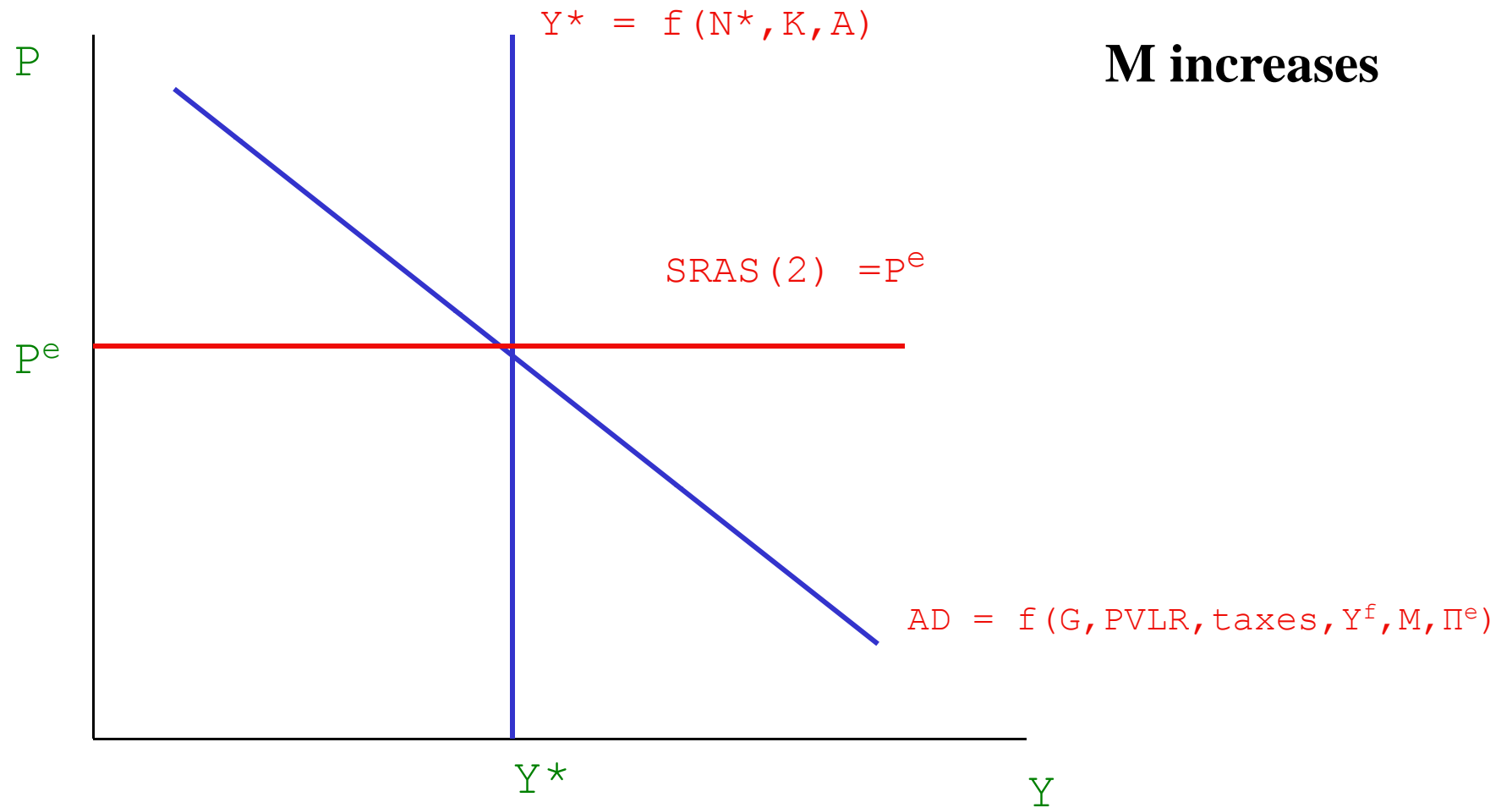
# IS-LM versus AD-AS

- **The IS-LM and the AD-AS models are equivalent!**
- Two different representations:  $(Y, r)$  and  $(Y, P)$
- They are based on the same economic assumptions and give the same answers
- Why bother?
- Very useful to think to different models for different questions!  
(e.g. International Borrowing or Lending vs Inflation and Unemployment)

# The Self Correcting Mechanism

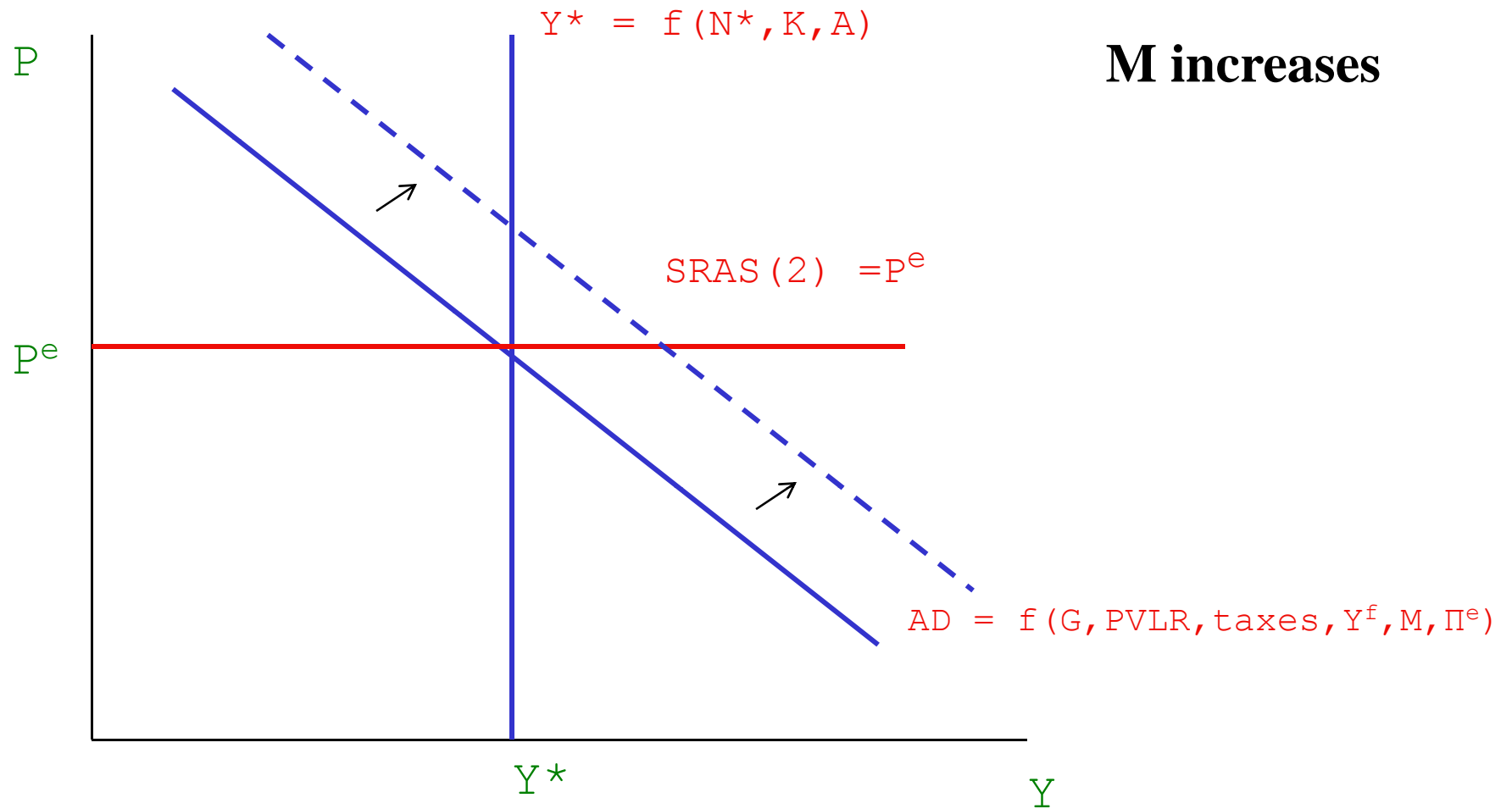
- When the economy is in disequilibrium for a while ( $Y$  not equal  $Y^*$ ), the economy will naturally move towards  $Y^*$ .
- Reason: **Labor market will eventually clear**. The reason that  $Y$  does not equal  $Y^*$  is because  $N$  does not equal  $N^*$ . As soon as the labor market clears, we will be back at  $N^*$ .
- How does the labor market eventually clear? **Workers will not continue to work off their labor demand supply for long periods of time.**
- When  $N > N^*$ , workers will be working more than their desired amount and will require the firm to raise nominal wages ( $W$ ) so as to compensate them for their additional effort. Doing so, will cause labor market to clear.
- But, as  $W$  increases, the short run AS will shift in (higher cost of production).
- The exact opposite will work when  $N < N^*$ .
- As the labor market starts to clear, the **SRAS will adjust to bring us back to  $Y^*$ .**

# Monetary Policy with AD-AS

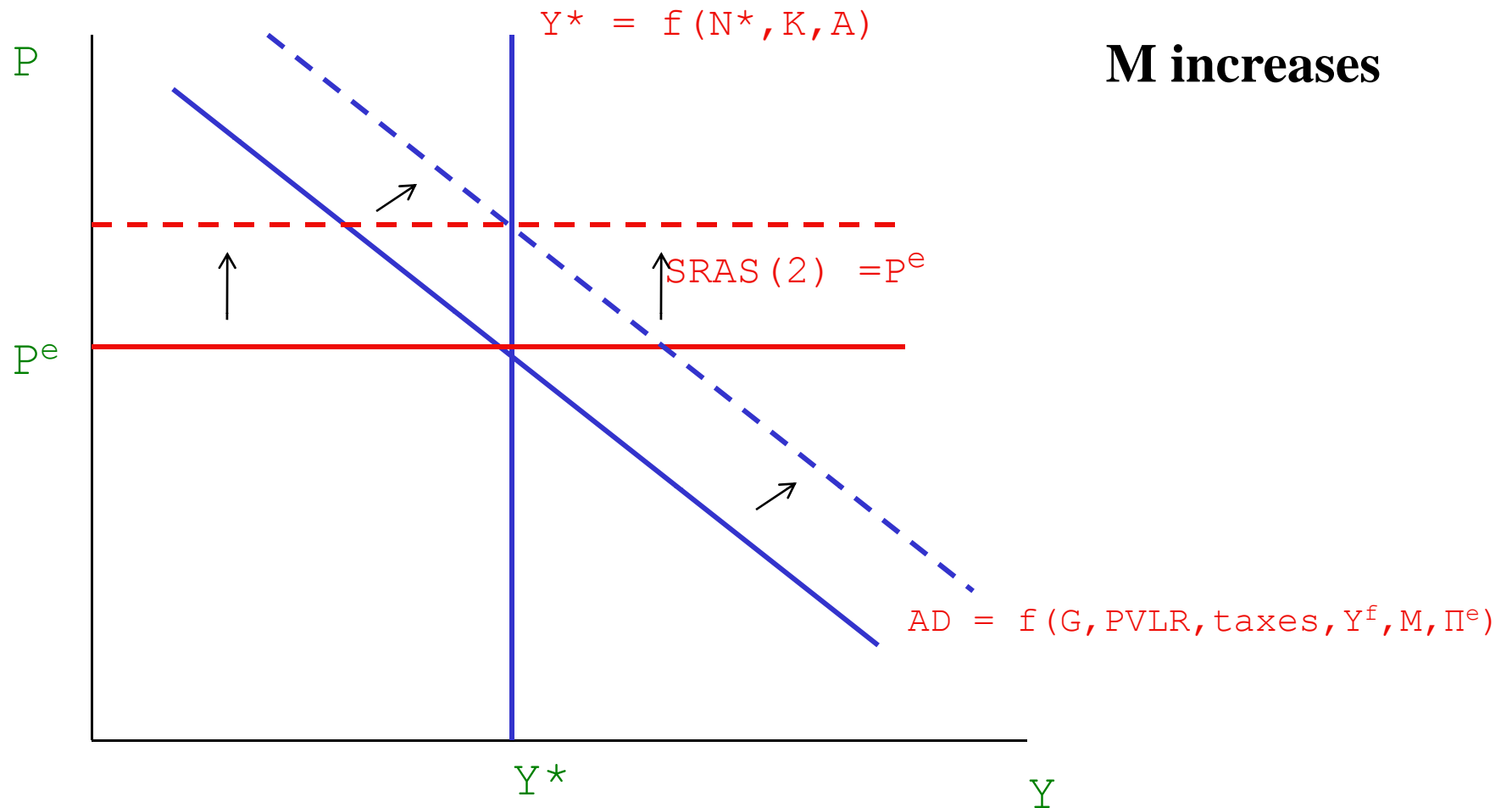




# SR Monetary Non-Neutrality



# LR Monetary Neutrality



$Y_1 > Y^*$  then firms will eventually increase their prices up to the point that output demanded =  $Y^*$ !

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14.02 Principles of Macroeconomics  
Fall 2009

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