EE211
PRINCIPLES OF MICROECONOMICS

Topic 9:

Factor Markets

inputs < labors, capital

Topics

- Demand for factor as a derived demand
- The firm's demand for a factor
- The supply of a factor
- Determination of factor prices

Introduction

- Recall that a firm's objective is to maximize its profit:

$$\pi = TR - TC = PQ - (wL + rK)$$

TR TC

- We've talked about the output markets, and how the output price is determined in the previous lecture.
- This lecture will focus on the factor market, and how the factor price is determined. (w) in SR.

- In this class, we only look at the competitive factor market in the short run under 2 scenarios:
  - ✓ ❖Competitive output market ⇒ P = MC
  - ✓ ❖Monopoly output market ⇒ MR = MC ↳ Q_m^* & P_m

(Monopsonist ↳ 1 buyer of factor).

The Demand for Factors (input)

- In previous topics, we talked about the demand for goods – this is the demand by consumers for their own consumption.
- Producers also have a demand for the goods for their production. This producer's demand is a result of consumer's demand for goods, and is called "derived demand".

$P = 30 - Q$ ← Demand for good X

$Q = f(L)$ ← demand for L is the "derived demand".

- **Derived demand** is the **demand for a factor of production** that results from the demand for the products that it is used to make.
- E.g. Demand for wood by carpenters

input for producing tables

Good X

COMPETITIVE FACTOR MARKET & COMPETITIVE OUTPUT MARKET

Producers (take as given)

→ input price are exogenous.

→ Consumers take output price as given.

Assumptions

- There are many buyers and sellers in both factor market and output market.
- In both markets, buyers and sellers are price takers.

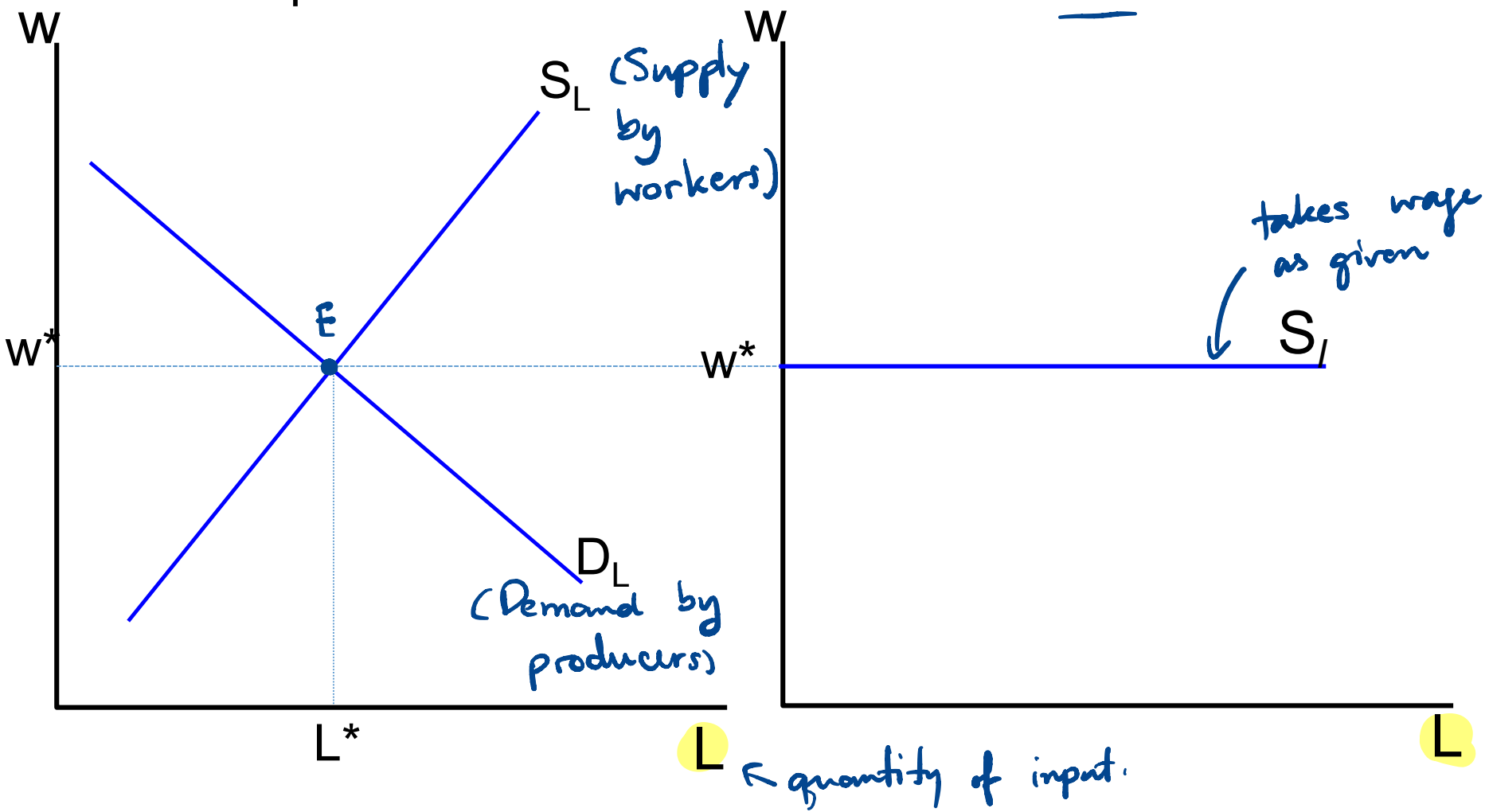
- In the short-run production, labor is the only variable input, where capital is fixed.
  - Wage (input price) is determined by the labor market.
  - Producers in the output market take wage as given.

Supply of Labor Faced By Firm

input

Competitive Market

Firm



Firm's Demand for a Factor

- Firm will hire an additional worker as long as:

the additional cost (paid to additional worker) <

the additional revenue (received from additional worker).

- The additional cost for one extra unit of factor is called **"marginal factor cost (MFC)"**.
- In this case, MFC is wage (w).

- The additional revenue received from one extra unit of factor is called **"marginal revenue product (MRP)"**:

$$MRP_L = MR \times MP_L.$$

$$MRP = \frac{\Delta(TR)}{\Delta L} \approx \frac{d[TR(Q(L))]}{dL}$$

(optional)

$$MRP = \frac{\Delta(TR)}{\Delta L} \approx \frac{d[TR(Q(L))]}{dL}$$

$$\frac{d[TR(Q(L))]}{dL} = \frac{d(TR)}{dQ} \cdot \frac{dQ}{dL} \quad \text{(by chain rule)}$$

$$= MR \cdot MP_L$$

$$= MRP_L = \text{Addition revenue gained from hiring an additional worker.}$$

Firm's Demand for a Factor (Cont'd)

- **Value of marginal product (VMP)** of labor is the marginal product of labor multiplied by the output price:

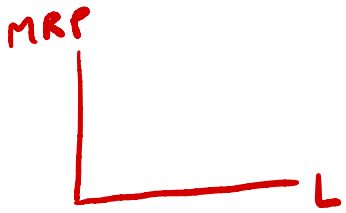
$$VMP_L = \$P \times MP_L.$$

P = MR = AR (b/c P is constant).

- In perfectly competitive market, P = MR.
- Hence,

$$MRP_L = MR \times MP_L = P \times MP_L$$

Example (Assume P = $10)

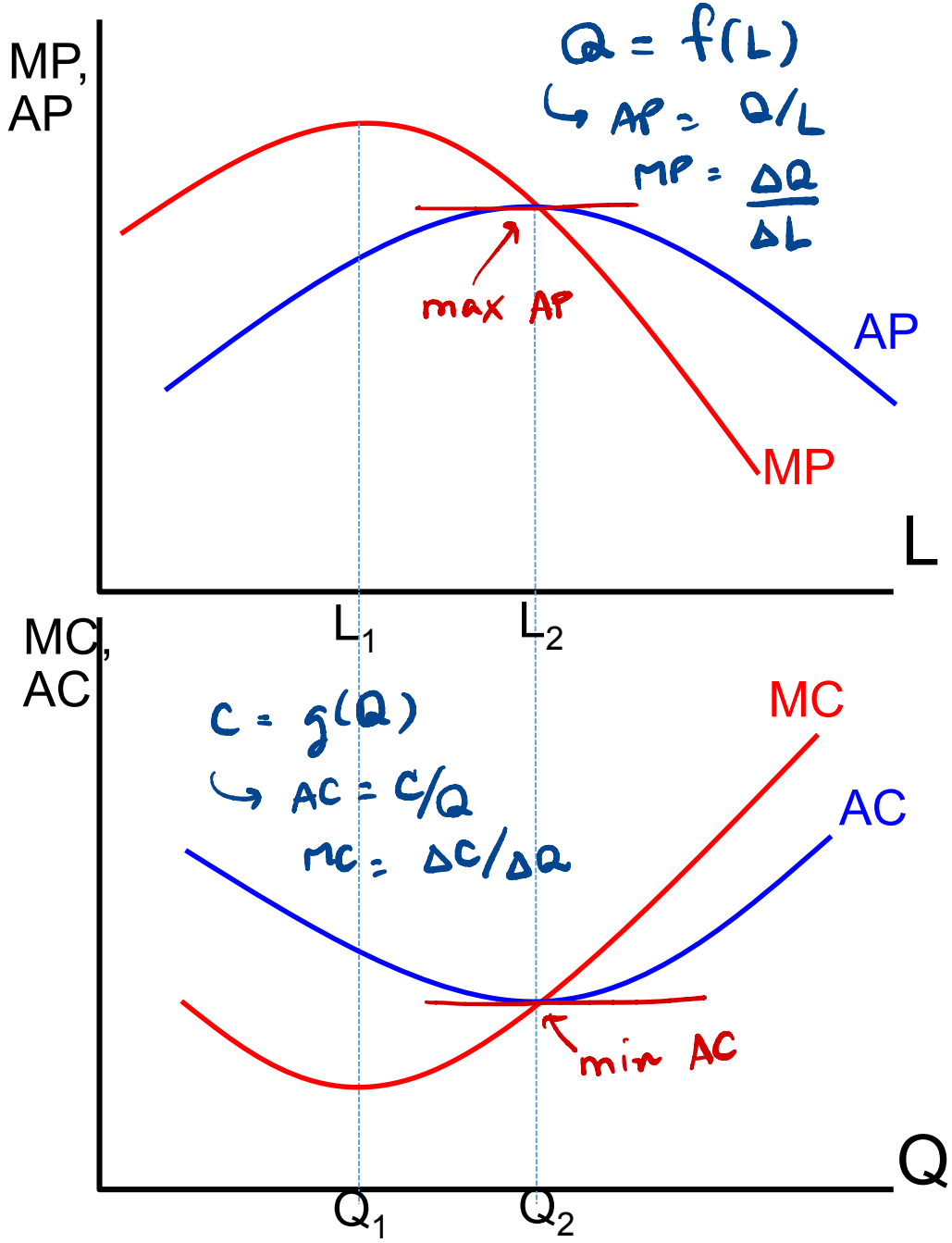


L	Q	$MP_L = \frac{dQ}{dL}$	MR $=\Delta TR/\Delta Q$	TR=PxQ $=10Q$	MRP $=\Delta TR/\Delta L$ = PxMP
0	25	n/a		250	
1	40	15	10	400	150
2	75	35	10	750	350
3	100	25	10	1,000	250
4	120	20	10	1,200	200
5	130	10	10	1,300	100

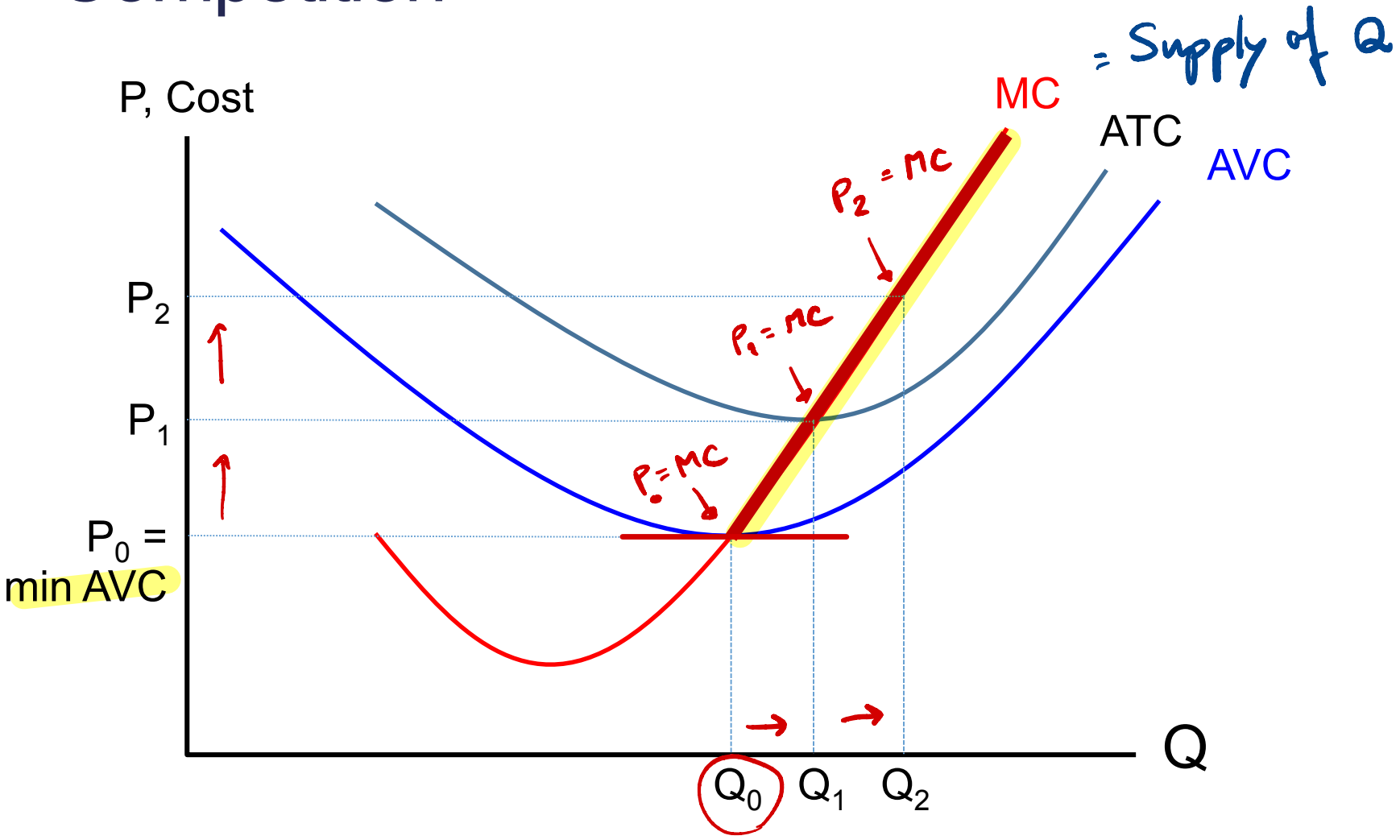
MP_L x MR = MRP

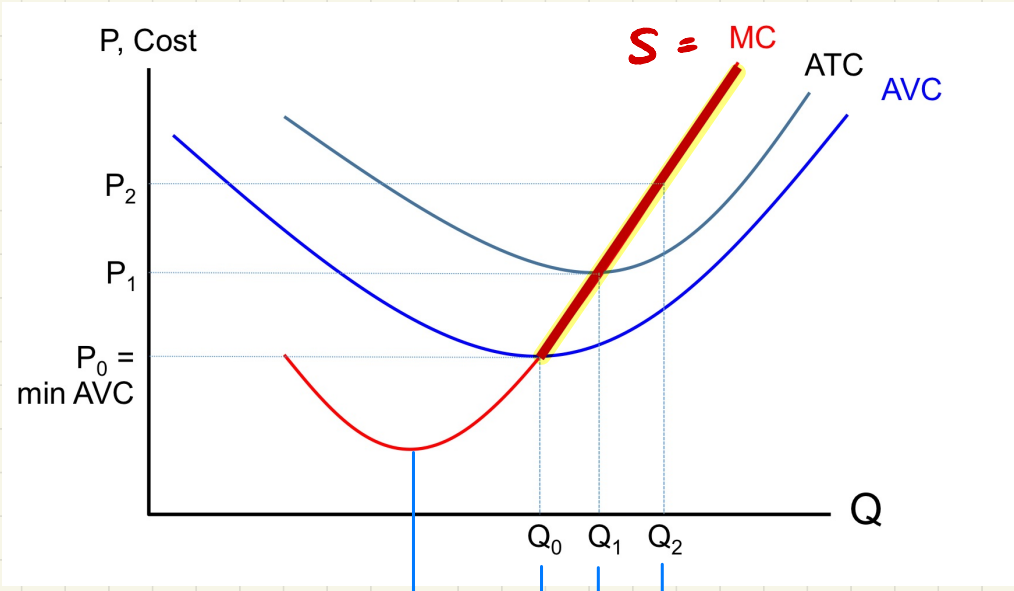
Relationship between MP&AP and MC&AC

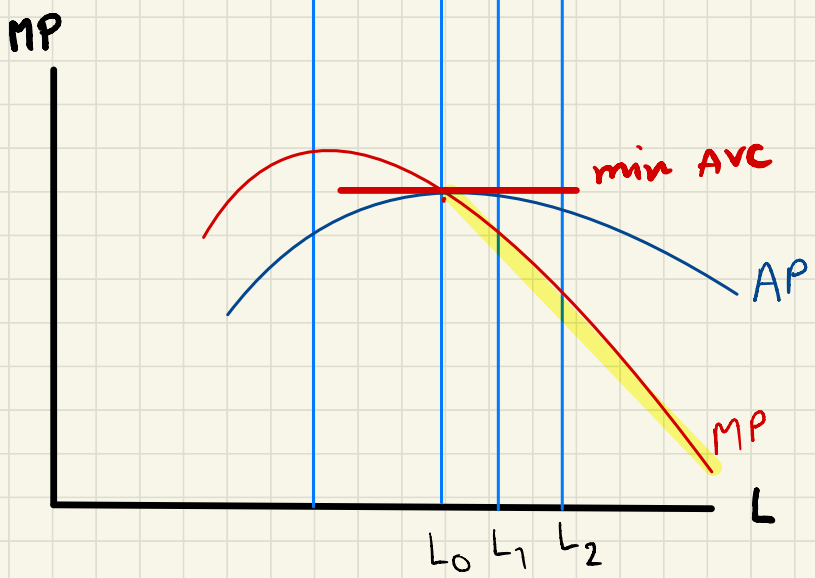
in output market



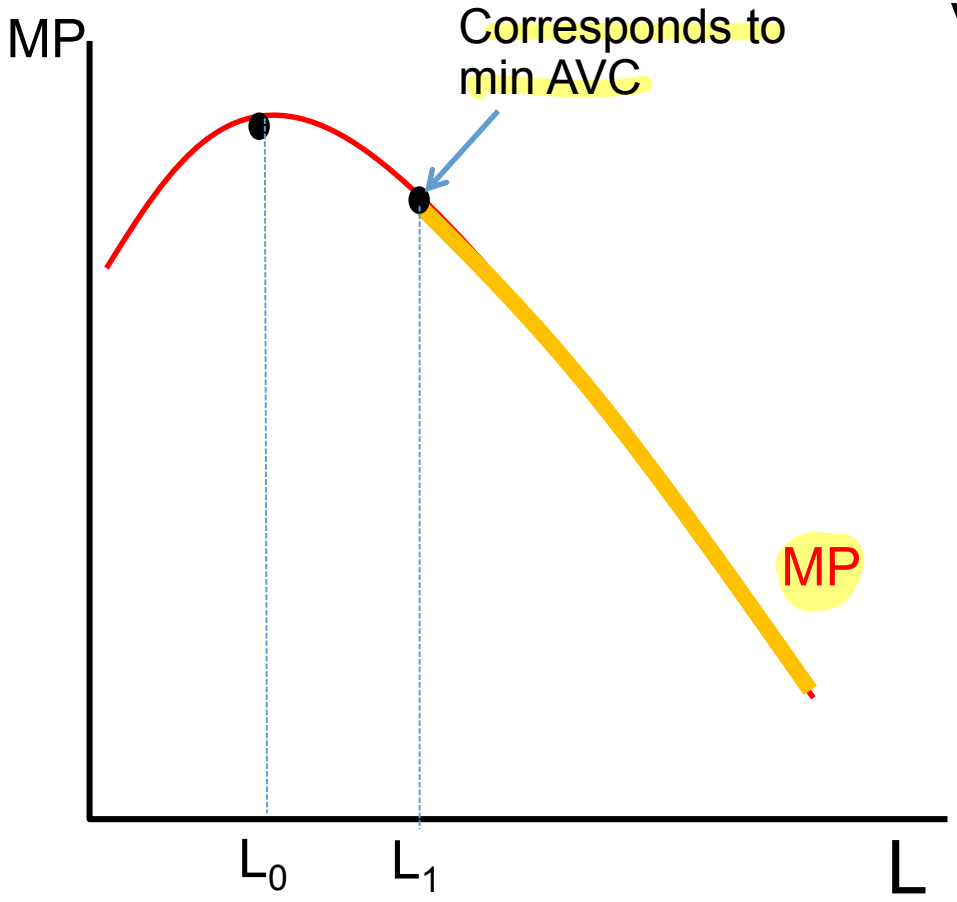
Firm's Short-Run Supply Curve in Perfect Competition

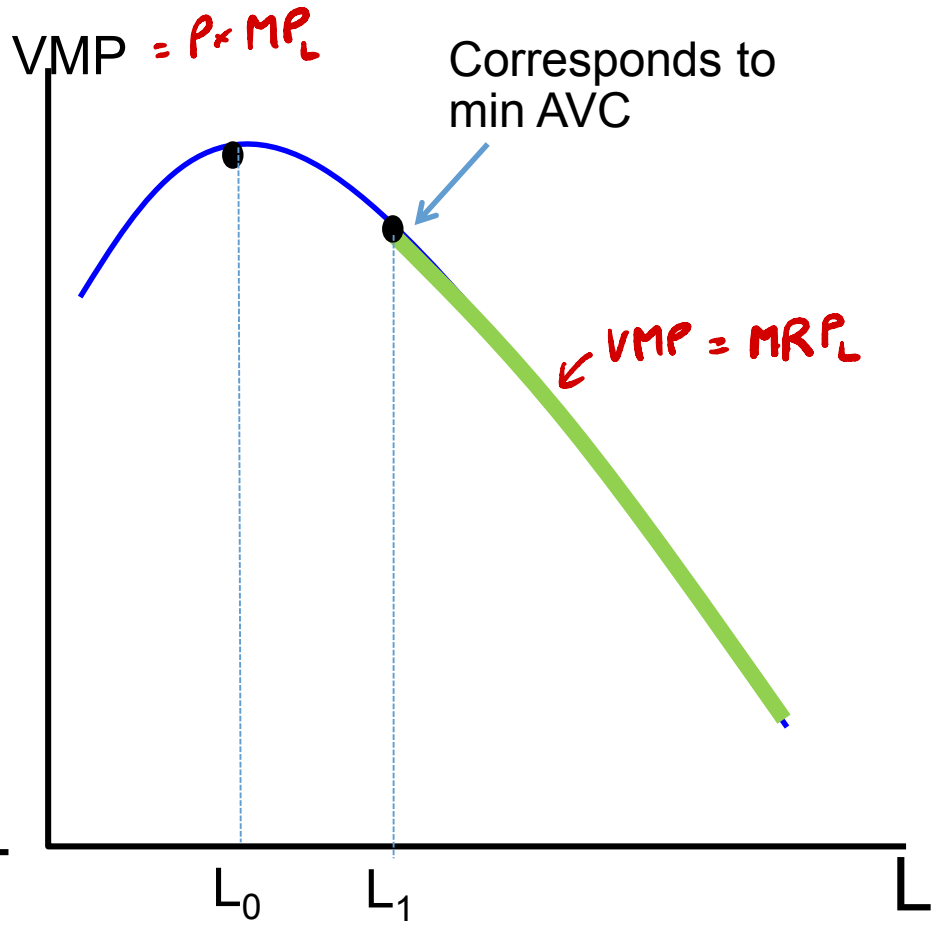



P, Cost
S = MC
ATC
AVC
P2
P1
P0 = min AVC
Q
Q0 Q1 Q2

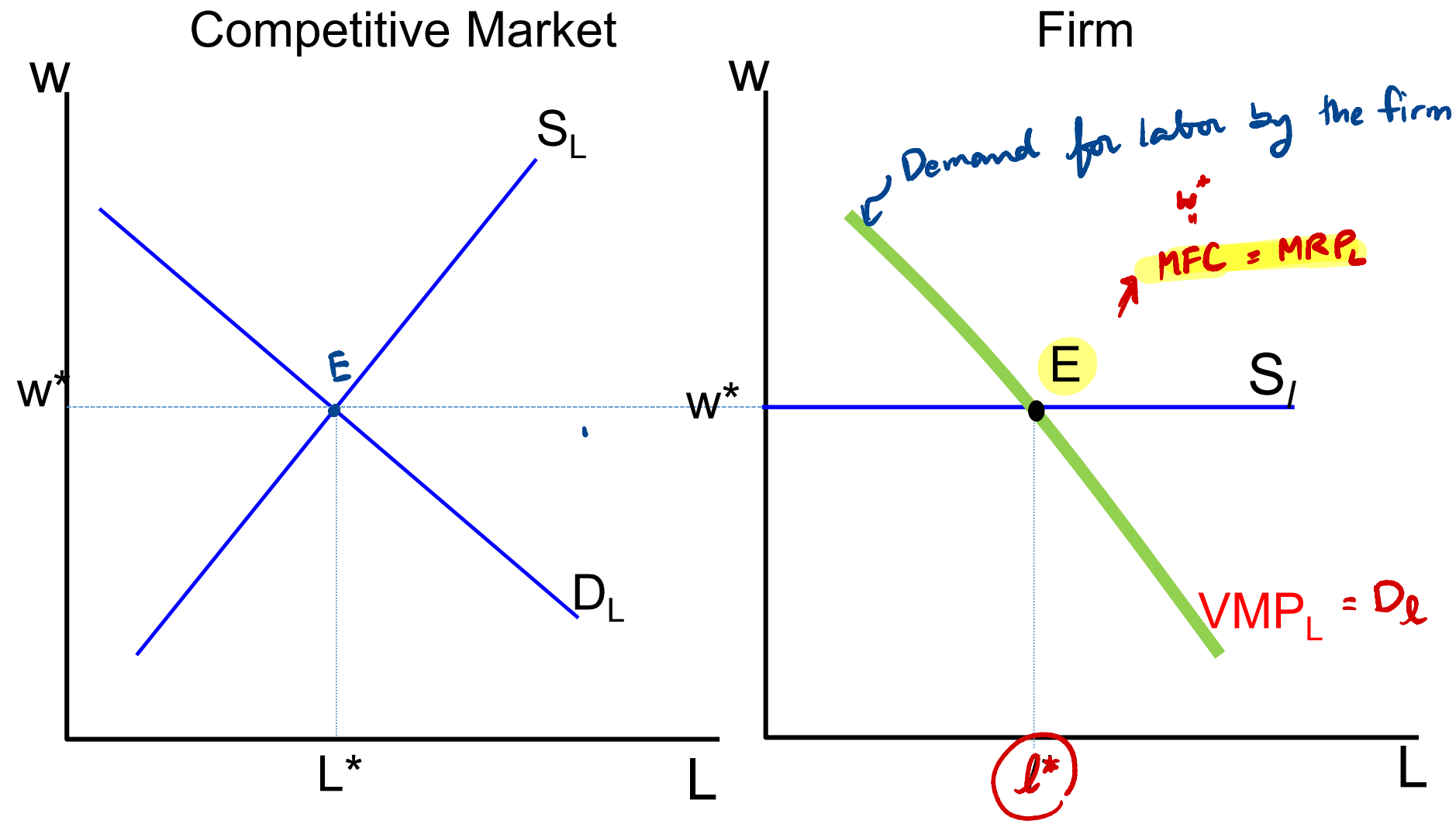

MP
min AVC
AP
MP
L
L0 L1 L2

The Firm's Demand Curve for a Factor





Equilibrium in the Labor Market



Derivation of the condition MRP = MFC (Optional). — in SR

Firm's objective: Max π and $\pi = TR - TC$.

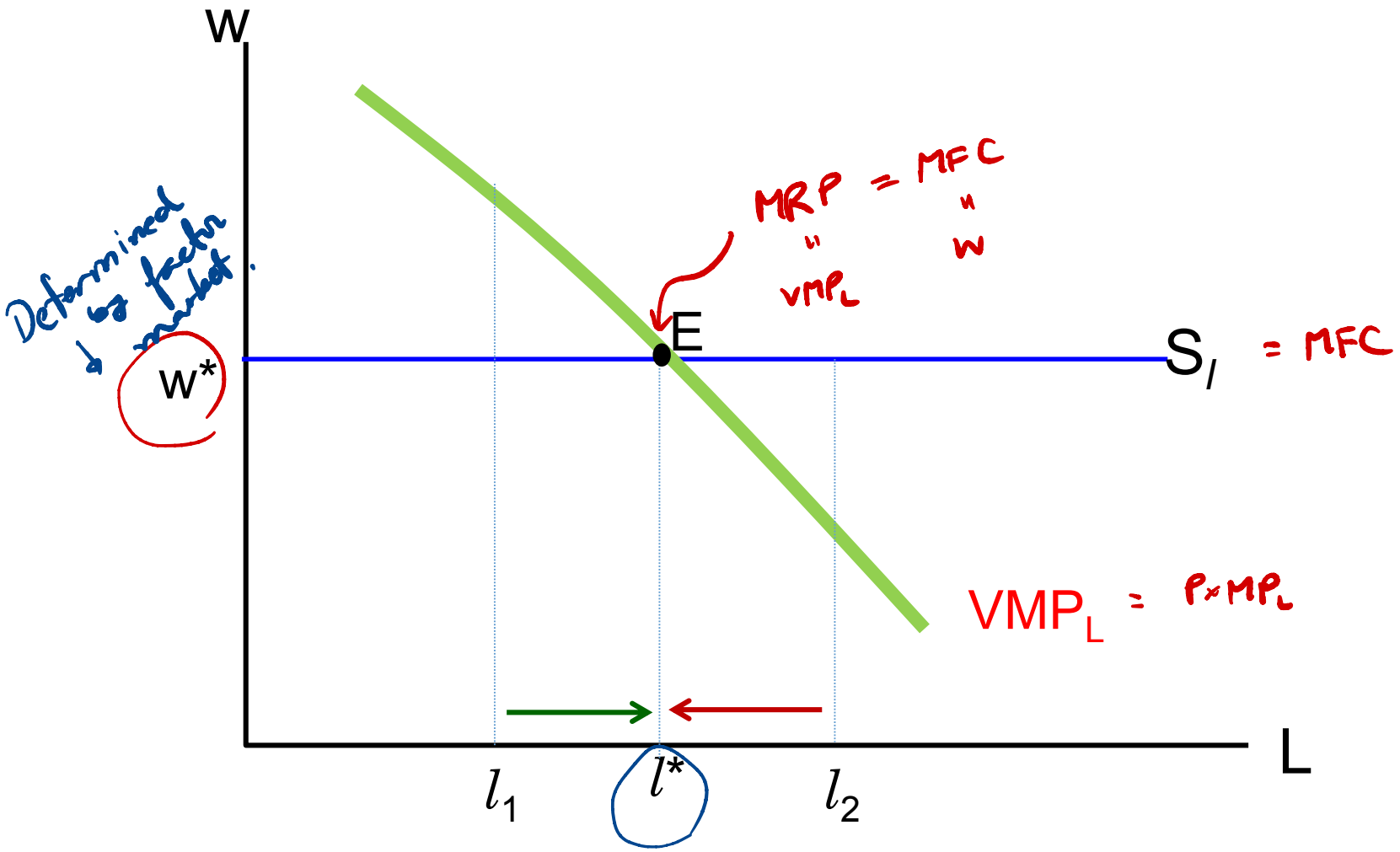
$$\underset{L}{\text{Max}}\ \pi(L, \bar{K}) = \underbrace{TR[Q(L, \bar{K})]}_{TR} - \underbrace{(wL + r\bar{K})}_{TC}$$

FOC: $\frac{d\pi}{dL} = 0 \Leftrightarrow \frac{d(TR)}{dQ} \cdot \frac{dQ}{dL} - \frac{d(TC)}{dL} = 0$

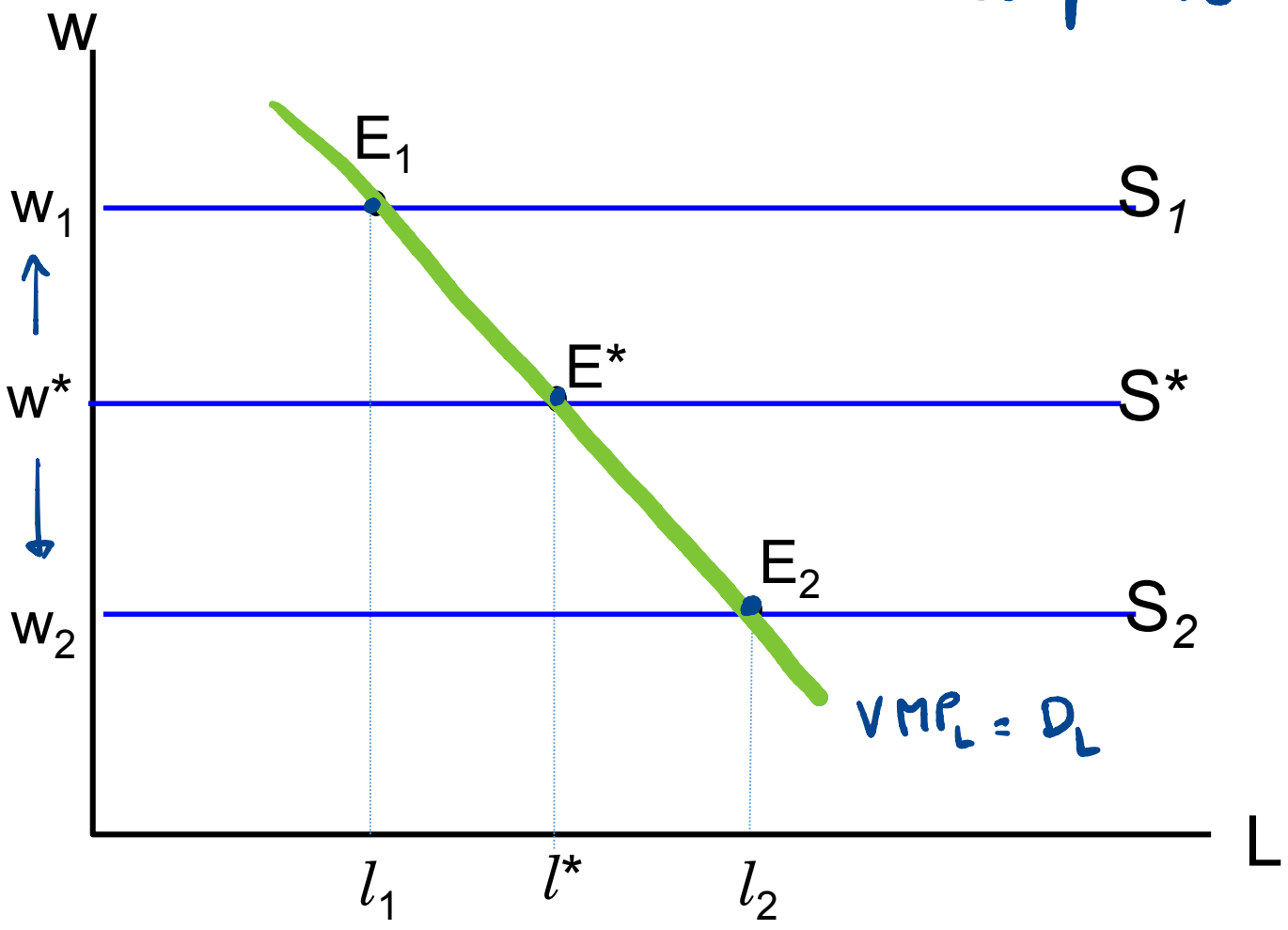
$$\Rightarrow MR \cdot MP_L = MFC$$

$$\Rightarrow \underbrace{MRP_L = W = MFC}_{\Downarrow L^*}$$

Firm's Decision in Hiring Labor



Firm's Derived Demand for Labor for competitive output mkt.



COMPETITIVE FACTOR MARKET & MONOPOLY OUTPUT MARKET

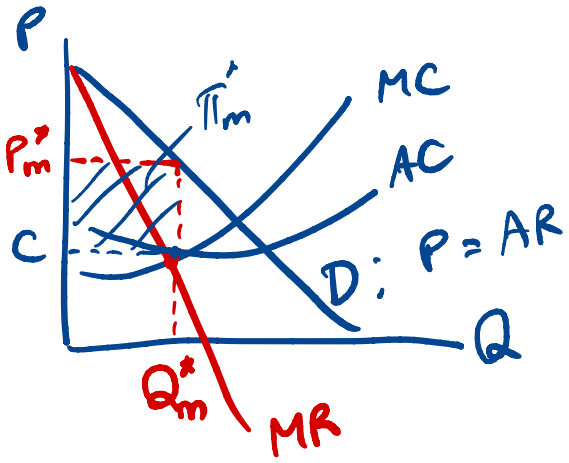
Assumptions

- There are many buyers and sellers in the factor market, but there is only seller in the output market.
- In factor markets, buyers and sellers are price takers.
- In output market, seller is the price setter.
  - Set price where MR = MC.

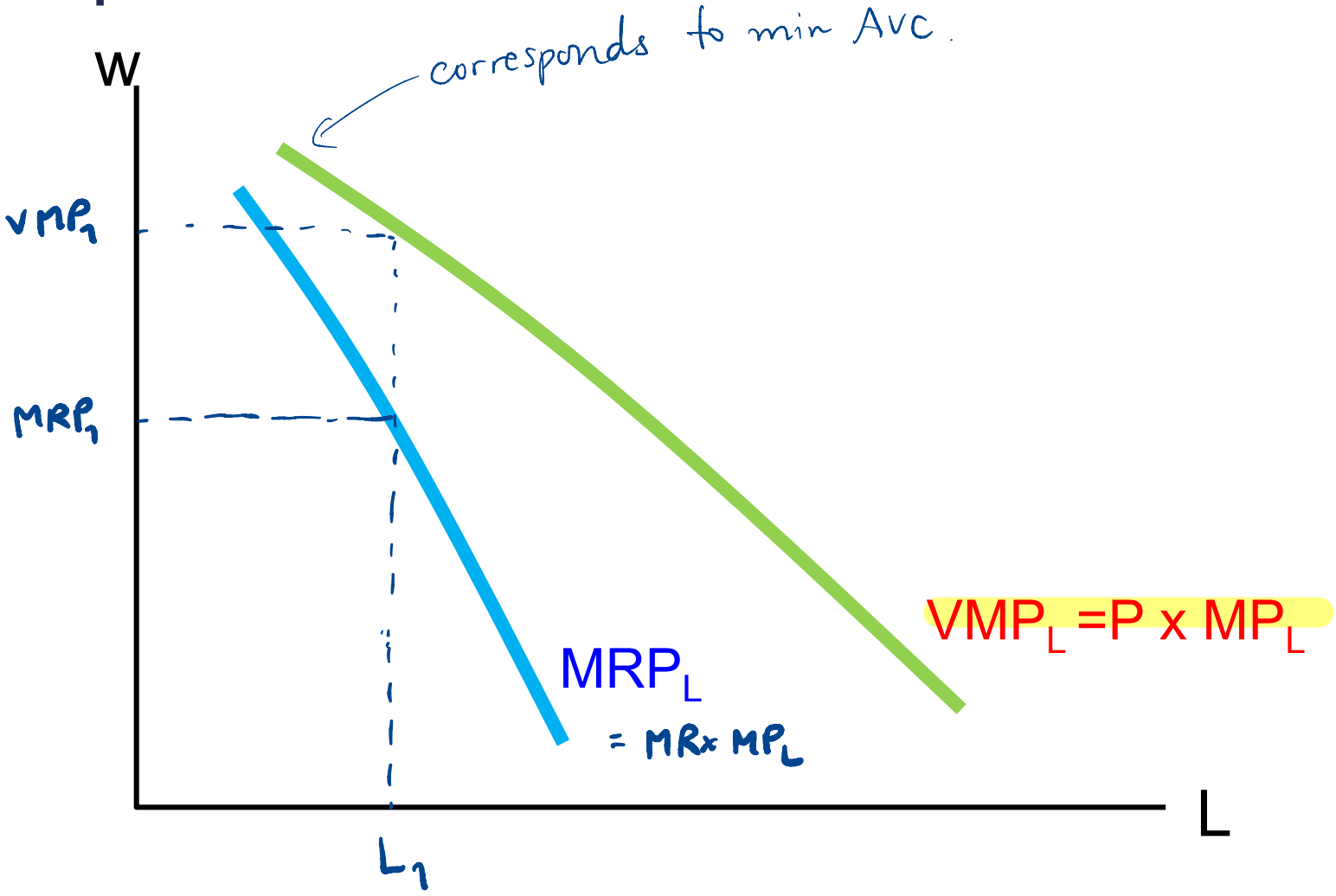
where MR < P

- In this case, $MRP_L = MR \times MP_L$.

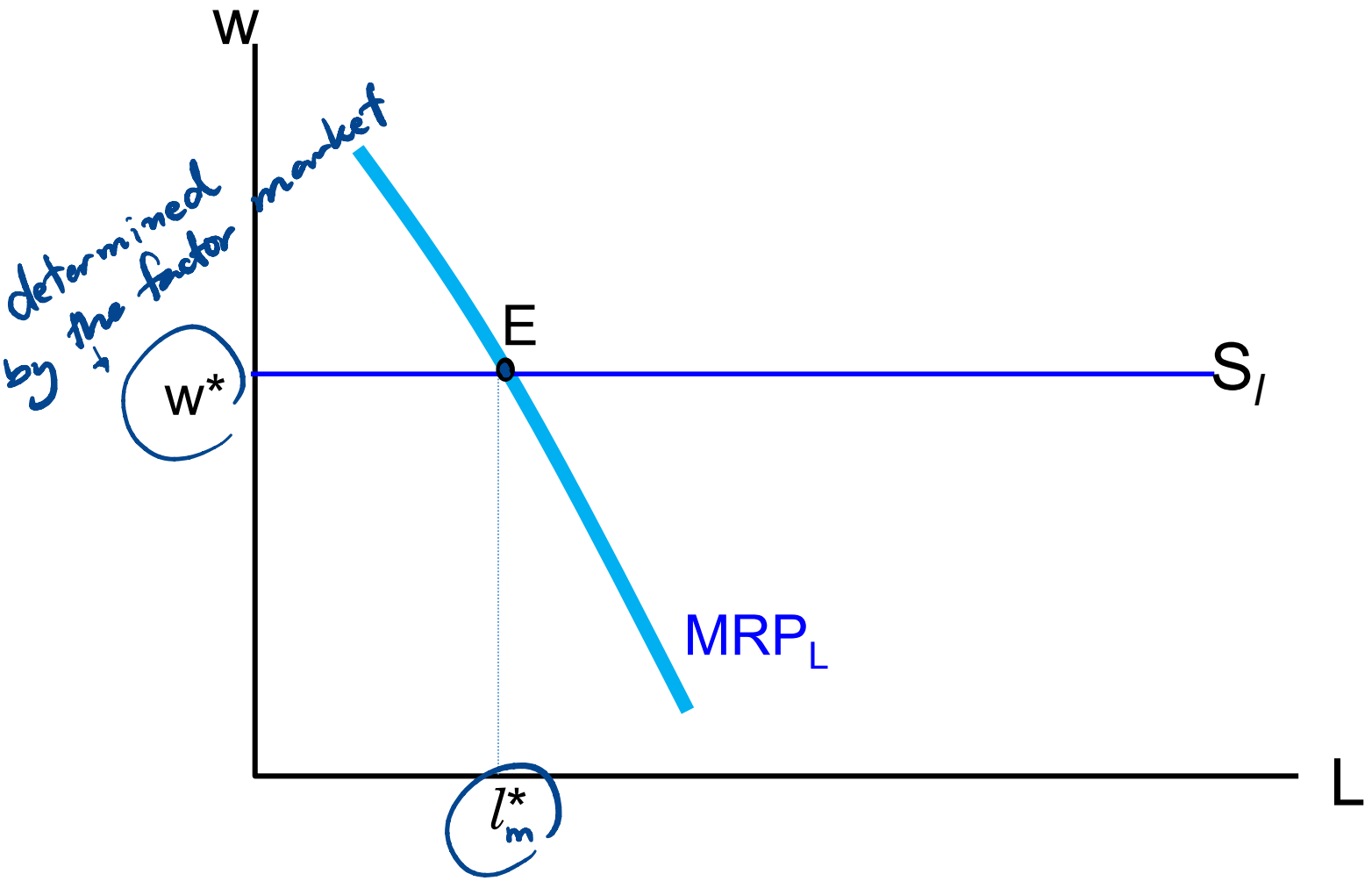
$MRP \neq VMP_L = P \times MP_L$



VMP and MRP in the Case of Monopoly Output Market



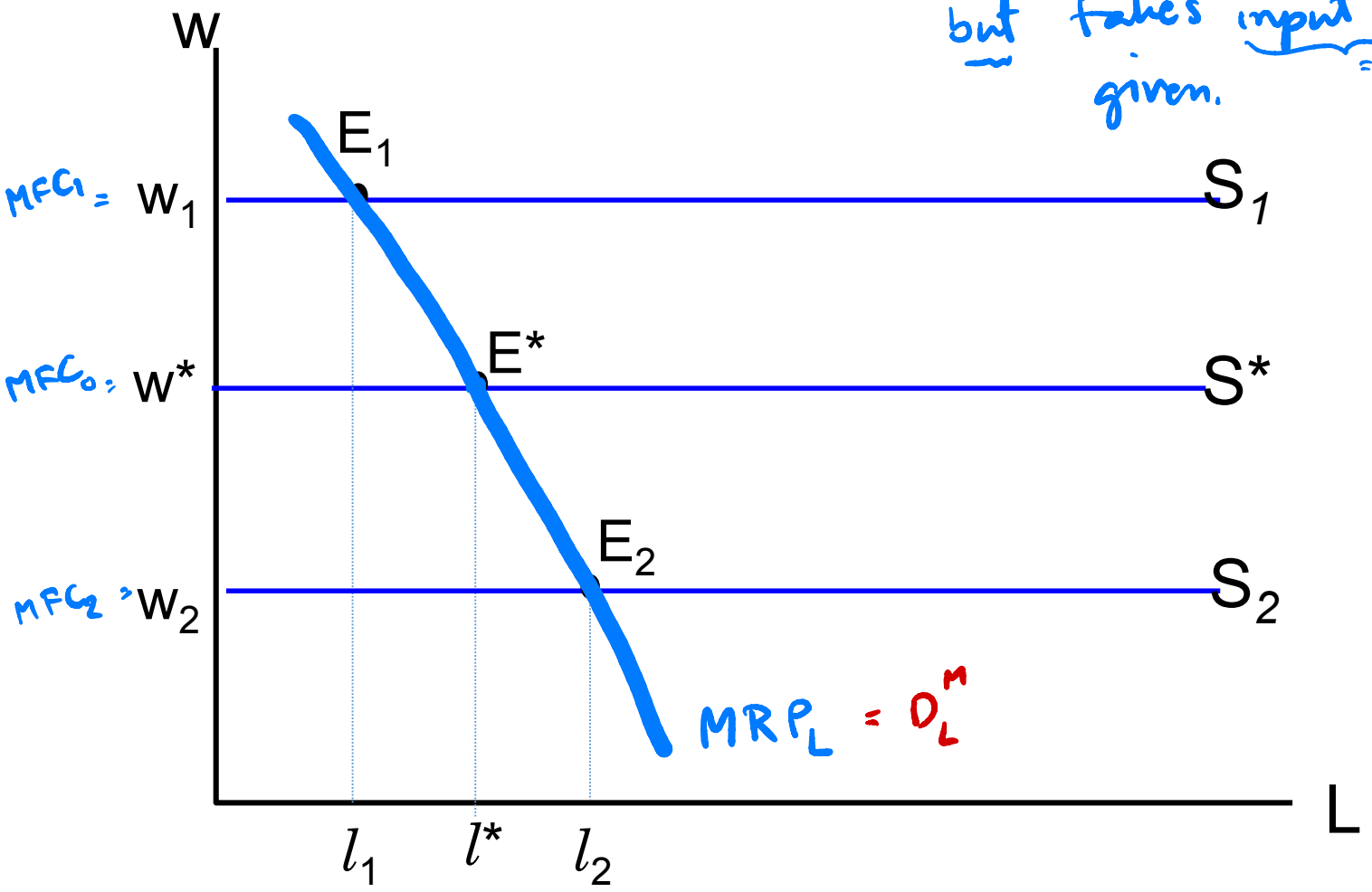
Equilibrium (Monopoly Output Market)



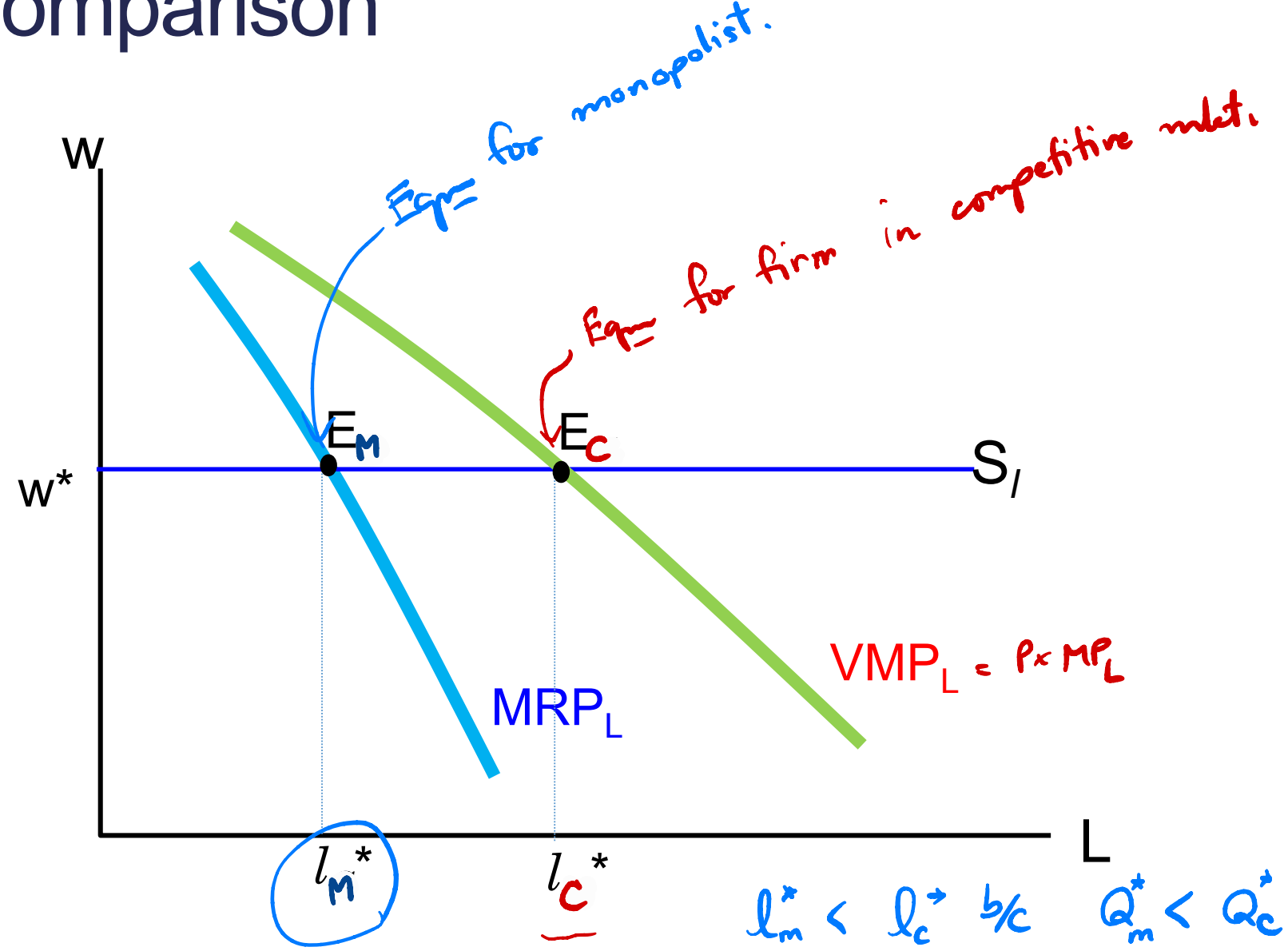
Monopolist

Firm's Derived Demand for Labor

Monopolist sets output price, but takes input price as given. (=w)



Comparison


W
w*
E_M
E_C
S_l
MRP_L
$VMP_L = P \times MP_L$
L
l_M^*
l_C^*
Eqm for monopolist.
Eqm for firm in competitive mkt.
$l_m^* < l_c^*$ b/c $Q_m^* < Q_c^*$