MICROECONOMICS AND POLICY ANALYSIS - U8213
Professor Rajeev H. Dehejia
Class Notes - Spring 2001

Input Markets - The Demand for Labor
Monday, Feb 5th, Wednesday, Feb 7th, and Monday, Feb 12th
Reading: PR Chapter 14.1-14.2, Ehrenberg & Smith, Chapters 3-5

Demand for Labor
Previously we were looking at conditional factor demands, the level of input required to produce a given level of output given that a firm wants to minimize costs. Now, we are looking at the level of input desired given that a firm is profit-maximizing.

Recall from last semester that for a profit-maximizing firm:

$\Pi = pQ - \underbrace{wL - rK}$ where p (price) is given, w is the wage rate and r is the rental rate of capital.

        Cost Function C(q)

or

$\Pi = \underbrace{pf(L,K)} - wL - rK$

Production
Function - how
much output the
firm is producing

Firms will maximize profit where MR=MC or where p=MC.

Now, how does a firm choose the amount of labor and capital used to maximize profits?
To maximize, set the derivative of profit with respect to labor and capital equal to zero:

$\text{Max}_{L,K} \Pi = pf(K,L) - wL - rK$

$\dfrac{\delta\Pi}{\delta L} = \dfrac{p\delta f(K,L)}{\delta L} - w = 0$

or

$\dfrac{\delta\Pi}{\delta L} = p*MP_L - w = 0$

$\underbrace{p*MPL} = w$ ← Marginal Revenue Product of Labor (MRP_L)

Likewise,

$$\frac{\delta\Pi}{\delta K} = \frac{p\delta f(K,L)}{\delta K} - r = 0$$

p*MP$_K$ = r

Marginal Revenue Product of
Capital (MRP$_K$)

p*MP$_L$ = w
p*MP$_K$ = r

Determines how much
labor and capital
should be used.

Does this make sense? Are these two conditions compatible with what we have learned before?

$$MRTS = \frac{w}{r} \quad so$$

$$\frac{p*MP_L}{p*MP_K} = \frac{w}{r} \quad or \quad \frac{MRP_L}{MRP_K} = \frac{w}{r}$$

If the MRP$_L$ > w then you would want to add more workers because the added revenue from hiring an extra worker is higher than what you would have to pay that worker. If the MRP$_L$ < w then the worker is costing the firm more than he/she is creating in revenue.

The marginal revenue product of labor is the **Demand for Labor**.

w

w = MRP$_L$
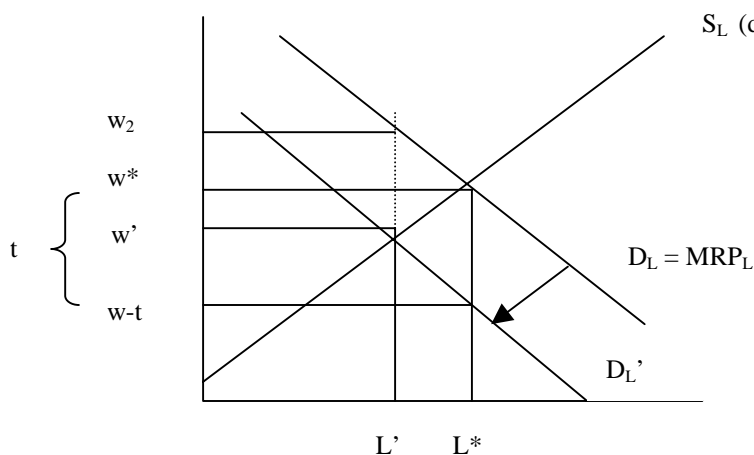
W$_1$

MRP$_L$ = p*MP$_L$ = D$_L$

MP$_L$

L$_1$

L
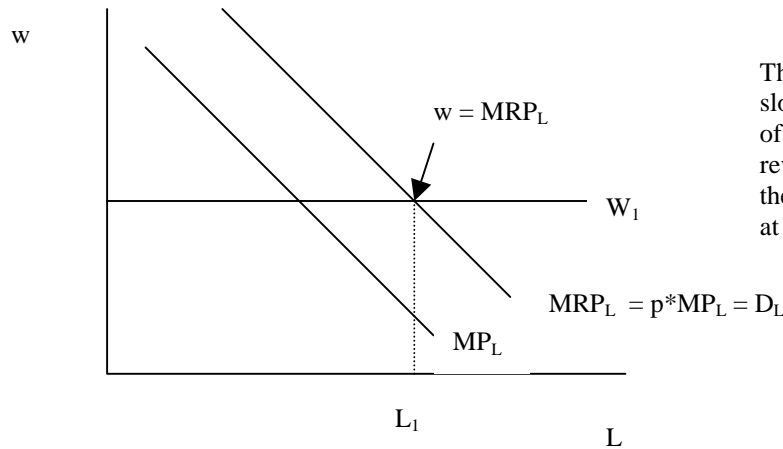
The marginal product of labor is downward sloping. When it is multiplied by the price of labor (wage rate) you get the marginal revenue product of labor which is equal to the demand for labor. The demand for labor at w$_1$ is L$_1$ for a single firm.

The **Market Demand for Labor** is the horizontal summation of the individual demands:

w
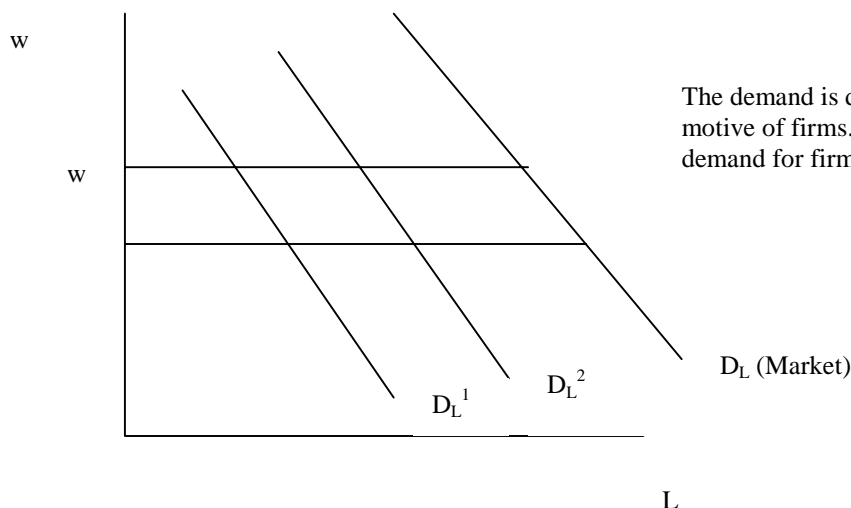
The demand is derived from the profit-maximizing motive of firms. In this case it is the summation of the demand for firms one and two.

D_L^1 D_L^2 D_L (Market)

L

Example: Impact of minimum wage - Classical Analysis

S_L (derived from Demand for Leisure)

$D_L = MRP_L$

D_L'

w_2
w^*
w'
t
$w-t$

L'   L*

At equilibrium, the supply of labor is L* and the wage is w*. Now, suppose a payroll tax is implemented that is paid by the firm, who is responsible for paying the tax? With the tax the firm pays w*+t so it will only pay workers w-t (The demand curve shifts down). At L' the wage received by workers is w' and the wage paid by the firm is w_2 ($w_2 > w^*$ and w'<w*). The difference between the two is the amount of the tax. Therefore, the burden of the tax is shared between workers and the firm. It doesn't matter who must pay the tax because it will ultimately be shared by both sides of the transaction.

What if market power exists? (i.e. Perfect competition is no longer present)

Monopsony = Only one buyer   (Monopoly = only one seller)

If a firm has monopsony power in the input market (it is the only buyer of labor) then how will it behave?

L_S: $w = a + bL$ (Linear supply of Labor)

$\Pi = pQ - wL - rK$ or

$\Pi = pf(K,L) - wL - rK$

Now the wage rate is a function of the amount of labor supplied. Therefore, -wL actually equals $-w(L) * L$.

When maximizing,

$$\text{Max}_{L,K} \ \Pi =$$

$$\frac{\delta\Pi}{\delta L} = \frac{pMP_L}{\delta L} - \frac{\delta(wL)}{\delta L} = 0$$

$$= pMP_L - w - \frac{\delta w}{\delta L} * L = 0$$

$$MRP_L = \underbrace{w}_{\text{Demand for Labor}} + \underbrace{\frac{\delta w}{\delta L} * L}_{\text{Supply of Labor}}$$

Demand for Labor   Supply of Labor

Competitive firms take w as given and work from that, but a monopsonist exploits the wage rate as it hires more workers. Now, Price * MPL = wage rate plus an extra term. If you are the only person buying labor then if you demand one more worker you need to offer a slightly higher wage. As the wage rate increases you change the amount of labor. When you offer a higher wage to one worker you must offer it to all workers (that is why you multiply the expression by L).
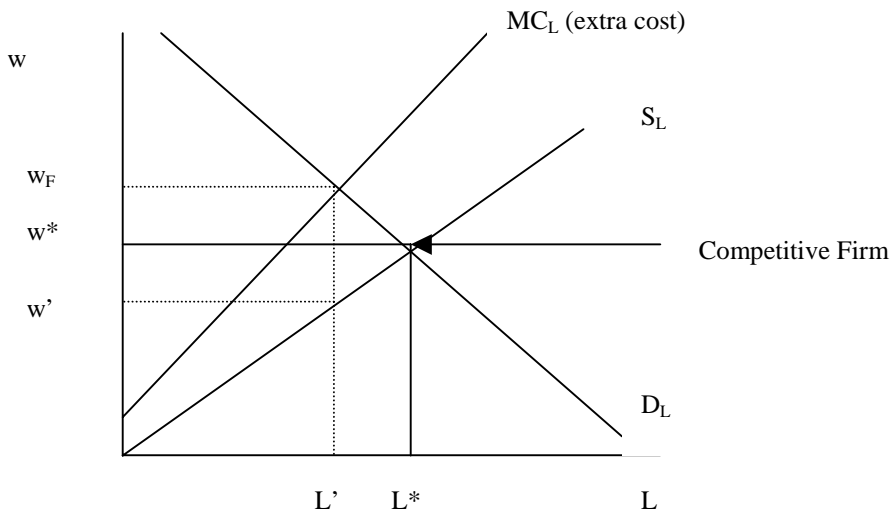
The demand for labor equals the supply of labor plus an extra amount. At this point the value of a marginal worker to the firm is w_F but the firm is only paying workers w'. The firm is also hiring less workers at L'. Because of market power the monopsonist pays workers a lower wage then their marginal value. Regulation is probably needed.

Minimum Wage - Price Floor

Competitive Labor Market

Excess supply of labor S_L

W

w^{min}

w^*

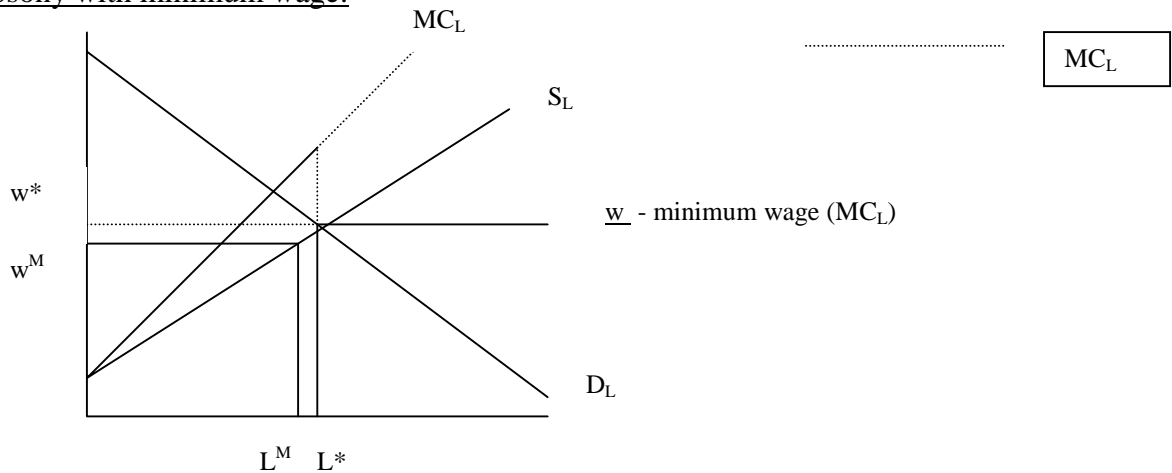D_L

L^D L^* L^S L
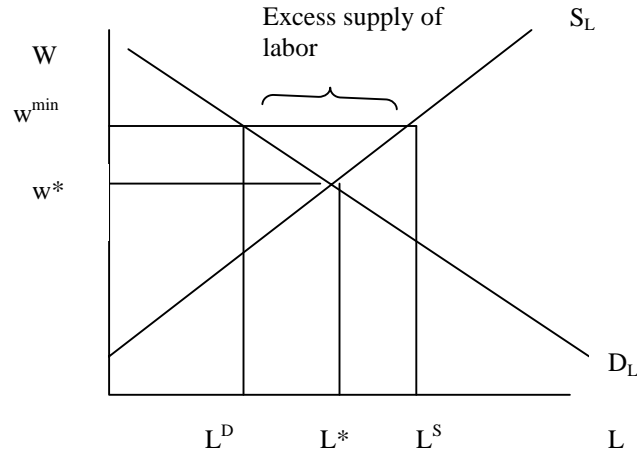
Assumption: The minimum wage is higher than the equilibrium wage.

Some people are made better off - those who find jobs and retain jobs.
Some people are made worse off - Those who find labor at w* but can't at W^{min}

W is real wage. Legislated minimum wage is nominal.

Monopsony with minimum wage:

MC_L

MC_L

S_L

w^*

$\underline{w}$ - minimum wage (MC_L)

w^M

D_L

L^M L^*

Set $w^M = w^*$

The dashed line is the new marginal cost curve. The monopsonist sets the marginal cost of labor equal to the demand for labor.

The monopsonist pays $\underline{w}$ (minimum wage) which is the same level of employment and wage rate under a competitive market.

<u>Elasticity of Demand for Labor</u> (Chapter 4)
Hicks-Marshall Laws of Derived Demand

Under what circumstances would demand for an input be responsive? In other words, what determines elasticity for the demand of an input?

The elasticity of demand for labor will be higher when…

1) Price elasticity of demand for the final good is high.
2) Other factors of production can be easily substituted for labor.
3) The supply of other factors of production is highly elastic (when usage of other factors can be increased without a substantial increase in their price).
4) The cost of employing category of labor is a small share of the total cost of production.

When would we expect labor unions to raise its members' wages by a significant amount?
        -The above four rules apply
Unions have incentive to reduce elasticity of demand for labor. There are provisions in union contracts that disallow substitutability.