

Lecture 2 - Review of Supply and Demand in the Context of Minimum Wage Debate

14.03 Spring 2003

Agenda

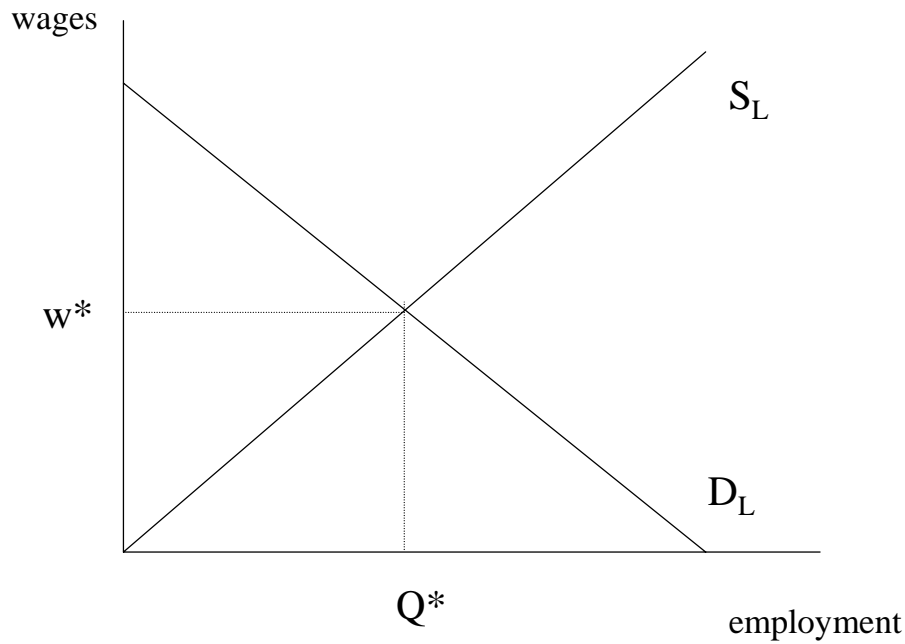
1. Textbook model of competitive labor market
2. Impact of minimum wage on textbook model
3. Assumptions behind this model
4. What happens when we relax an assumption - price taking?
5. Impact of minimum wage when employers have market power.
6. Testing the textbook model and alternatives
7. Natural experiments in economics
8. Card and Krueger article.

Minimum wages: A venerable topic in economics and area of ongoing controversy.

1 Textbook model of wages and employment

[Graph 4]

Graph 4



Labor Supply curve: all of the potential workers in the labor market, arranged according to their "reservation wage": minimum wage they will accept to take a job (from low to high)

Labor Demand curve: all potential employers in labor market, arranged according to their willingness to pay for a worker (from high to low)

Q: What is the key variable in this model? The wage or the number of employed workers?

A: Neither. They are both outcomes, endogenous variables.

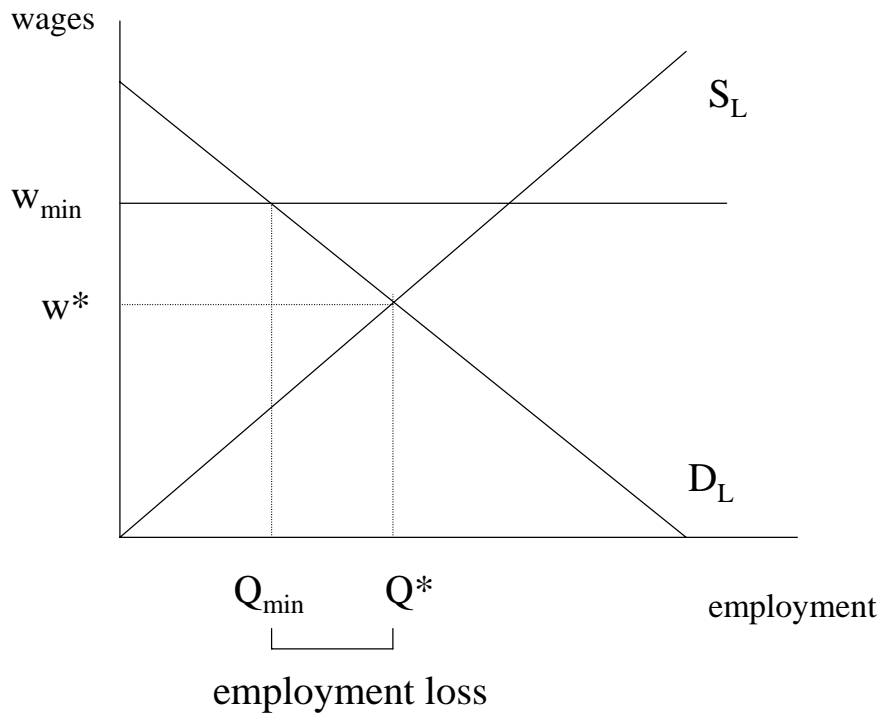
Definition: ENDOGENOUS: internally determined. An outcome as opposed to a cause.

Definition: EXOGENOUS: externally determined. A causing or forcing variable.

What happens when we impose a minimum wage in this labor market?

[Graph 5]

Graph 5



Wages:

$$w_{\min} > w^*$$

Employment:

$$Q_{\min} < Q^*$$

Q: if this model is right why would you ever want to impose a minimum wage?

One answer: Total earnings

$$w_{\min} Q_{\min} \geq w^* Q^*$$

Total worker earnings may increase even if employment falls.

Q: What does this depend on?

A: Elasticity of demand:

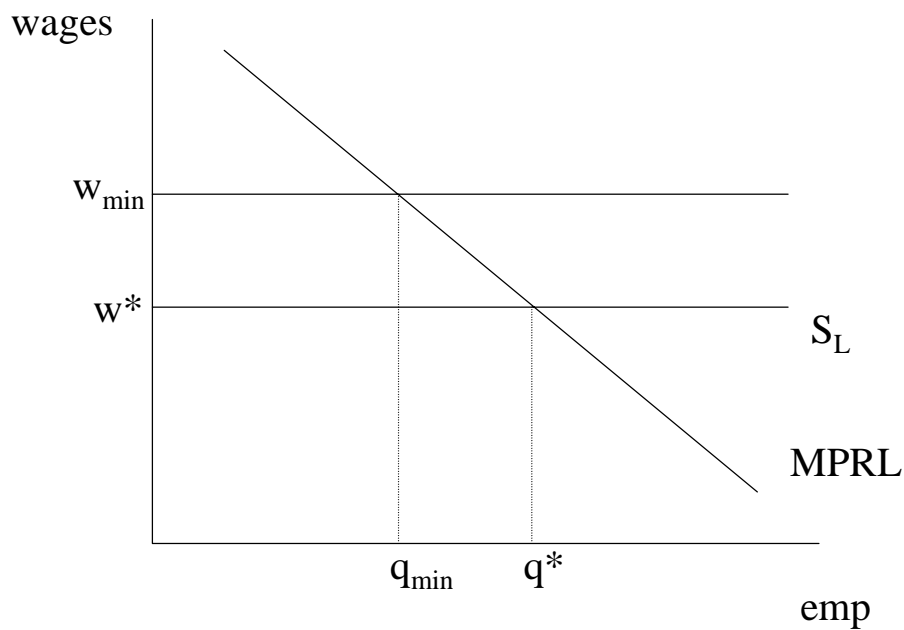
$$\eta = \frac{\partial Q}{Q} \frac{w}{\partial w} \geq -1$$

If proportional increase in wages larger than (induced) proportional decline in employment \implies wagebill increases

What is the primary assumption behind the textbook model?

Individual "price-taking firm"
[graph 6]

Graph 6



$MRPL =$ Marginal Revenue Product of Labor \implies "what the marginal worker produces". It is decreasing in employment due to decreasing returns in the production function.

How did we conclude that the firm sets:

$$MRPL = w^*$$

Recall firm's optimization problem:

$$\max \pi = pf(L) - w(L)L$$

where p is the product price, $w(L)$ is the wage necessary to "call forth" L workers.

$$\begin{aligned}\frac{\partial \pi}{\partial L} &= p \frac{\partial f(L)}{\partial L} - w(L) - \frac{\partial w(L)}{\partial L} L = \\ &= pf'(L) - w(L) - w'(L)L = 0\end{aligned}$$

The FOC can be rewritten as:

$$pf'(L) = w(L) + w'(L)L$$

where:

- $pf'(L)$ = the marginal revenue product of labor
- $w(L)$ = wage
- $w'(L)L$ = variation in the wage per additional worker \times *total* workforce

Q: What is the key assumption of a competitive model?

$$\frac{\partial w}{\partial L} = 0 \iff \text{price taking firms}$$

How does firm choose employment when it is not price taker?

It chooses employment according to the above FOC:

$$pf'(L) = w(L) + w'(L)L$$

If $w'(L)L \neq 0$ then firms must pay all workers more for each additional worker it hires.

Q: How do we know this means lower employment?

Optional:

$$\begin{aligned}pf'(L) &= w(L) + w'(L)L \\ w &= MRPL - \frac{\partial w}{\partial L} L \\ 1 &= \frac{MRPL}{w} - \frac{\partial w}{\partial L} \frac{L}{w} \\ 1 &= \frac{MRPL}{w} - \frac{1}{\eta}\end{aligned}$$

where η is the elasticity of labor supply, $\frac{1}{\eta}$ is the elasticity of wages w.r.t. employment perceived by the single firm. In the case of a competitive labor market the elasticity of wages w.r.t. employment is perceived by the single firm as zero.

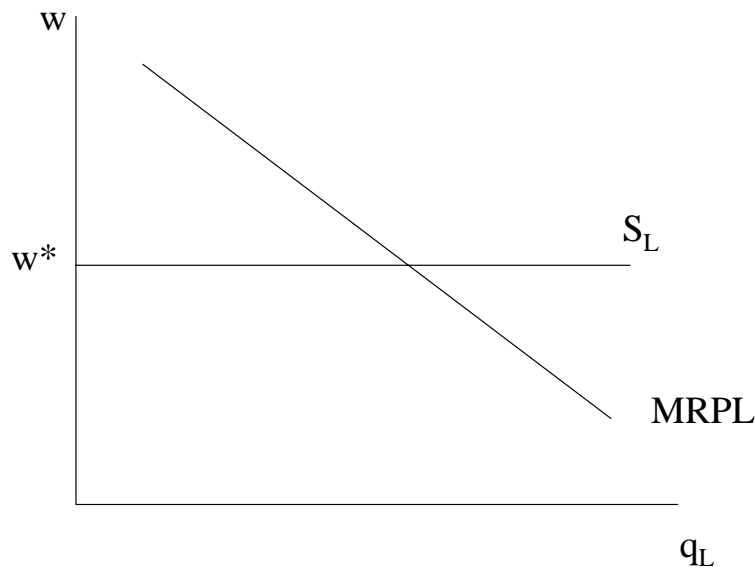
$$w = \frac{MRPL}{1 + \frac{1}{\eta}}$$

The more elastic is labor supply the lower the wage relative to marginal product of labor.

1.1 Conventional case: Individual Price Taking Firm

[Graph 7]

Graph 7



Notice that the labor supply curve is upward-sloping at the market level, but it is flat as perceived by the single firm.

1.2 Monopsonistic employer

Q: How do we want to draw the labor supply curve for a monopolist?

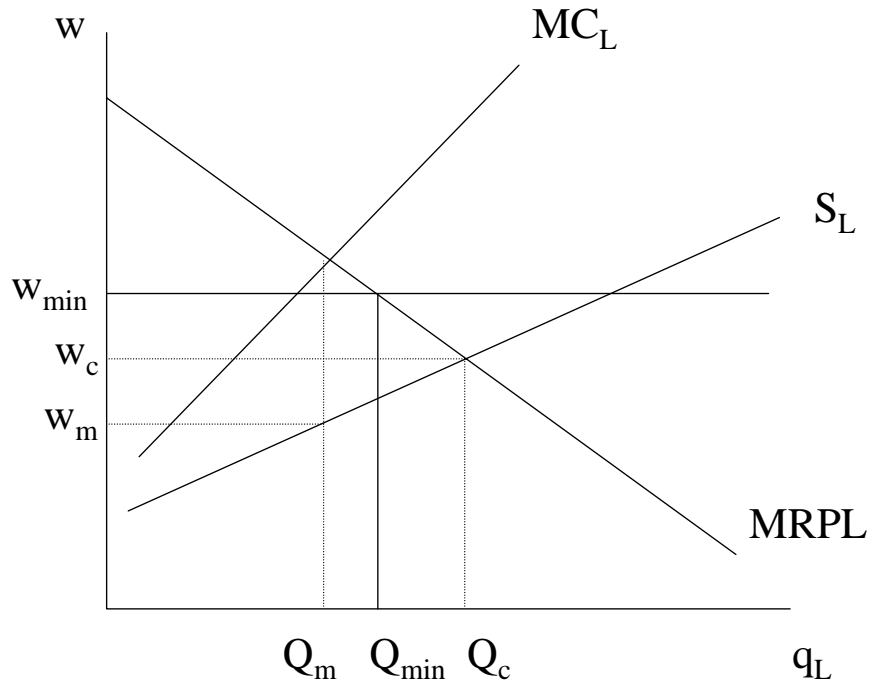
A: Upward sloping

Q: How should we draw the marginal labor cost curve for this firm?

A: Even more upward sloping: by hiring an extra worker the additional cost is given by the higher wage of this worker and by the increase in wage given to the entire pool of workers.

[Graph 8]

Graph 8



- Implementation of a binding minimum wage raises wages and employment!

$$w_{\min} > w_m$$

$$Q_{\min} > Q_m$$

- How does this work?

Firm is now a price-taker for labor at w_{\min} , hence labor supply is "perfectly elastic". Therefore the monopsonist sets:

$$w = MRPL$$

since the choice of the quantity of labor has no impact on the level of wages.

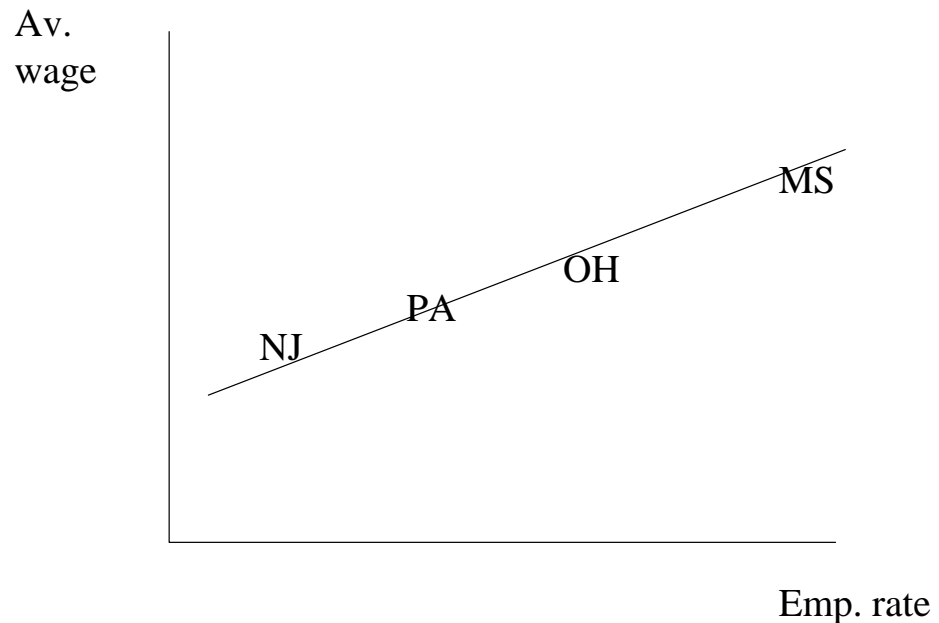
Q: Does raising minimum wage to monopsonists always increase wages and employment?

- If skills are very specific, e.g. IBM mainframe repair technicians
- ‘Captive’ labor markets, spouses of soldiers based away from home.
- Fast food restaurants located in nearby towns in NJ and PA?

2.1 Testing for monopsonistic labor market

- How do we go about testing the monopsony vs competitive model of the labor market?
- Q: What’s the key empirical implication that distinguishes these models?
 A: In the competitive model: $w \uparrow$ and employment \downarrow
 In the monopsonistic model: $w \uparrow$ and employment \uparrow
- So how do you test this implication?
 - We can look across different states and ask ourselves the following question: is employment higher where wages are higher?
 Let’s suppose you find the following pattern:
 [Graph 10]

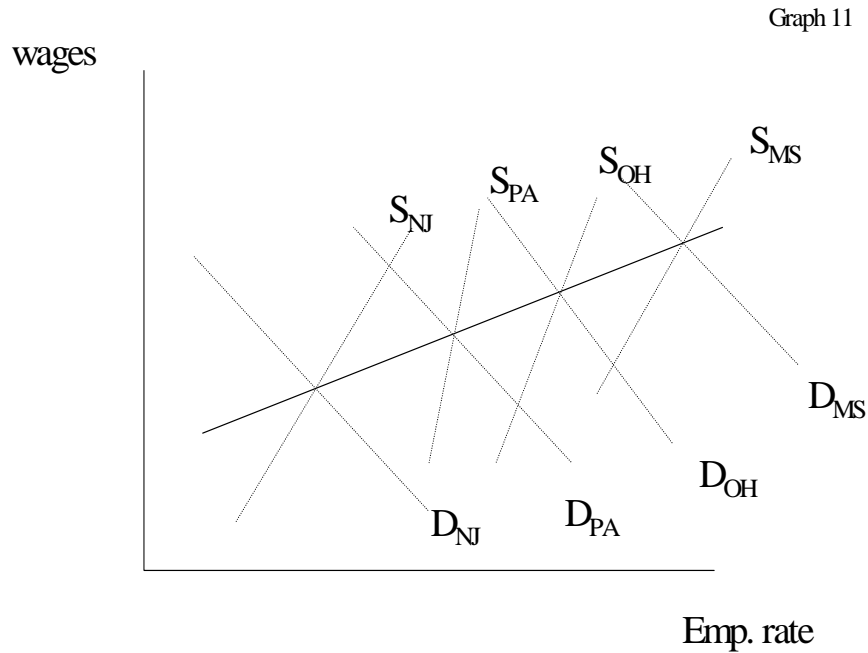
Graph 10



Q: Would this convince you? What's the problem with the wage here?

A: We don't know why it is different across states. There could be different demand and supply schedules.

[Graph 11]



Since both employment and wages are endogenous outcomes - determined by both supply and demand - this picture tells us nothing about the impact of minimum wages on employment.

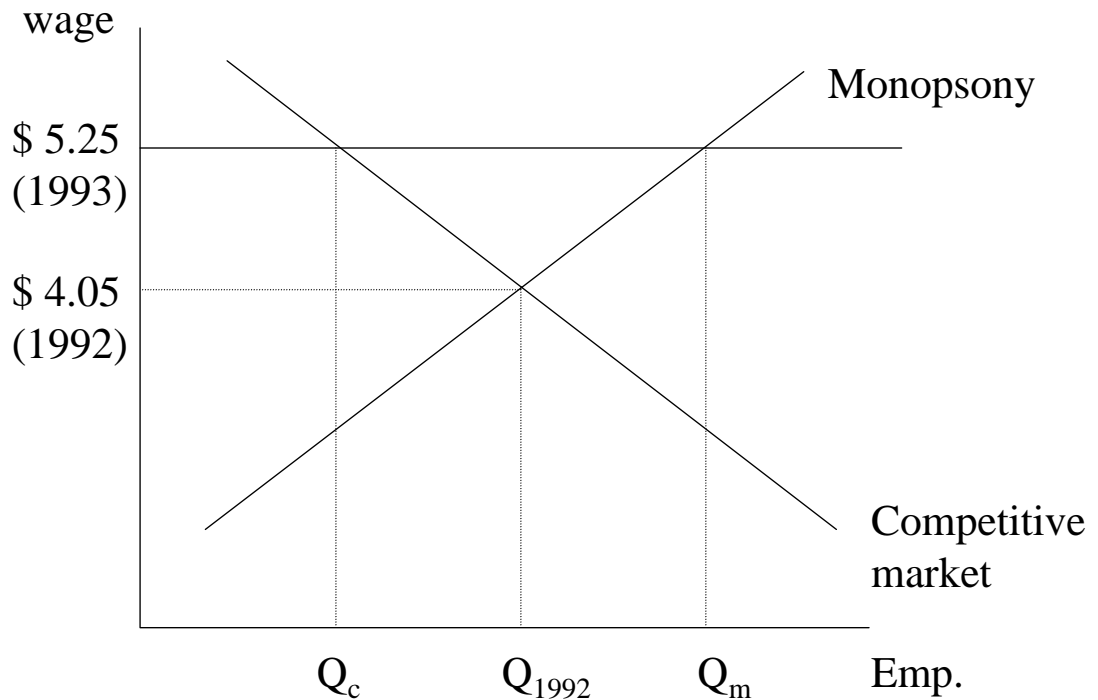
- How do we overcome this problem? We need an experiment. But what type of experiment? One in which wages go up. What about something that shifts supply out? No.

By exogenously manipulating wages we can study impact on employment to infer the slope of the relationship between wages and employment (downward sloping \rightarrow competitive market, upward sloping \rightarrow monopsony)

- An idea: New Jersey Minimum Wage Law.

[Graph 12]

Graph 12



Notice that the conditions under which the introduction of a minimum wage raises employment in a monopsonistic market are only locally satisfied.

By looking at the change in employment after the adoption of the minimum wage, we can see if employment has gone up (monopsony) or down (competitive market).

Q: Why do we need Pennsylvania?

A: We need Pennsylvania as a control group.

2.2 Controlled groups

Ronald Aymler Fisher is the inventor of modern experimental methods which were initially used for agricultural experiments.

Example

Let's say you wanted to test the efficacy of a new fertilizer on a crop, so you take a plot of land A that hasn't been fertilized in August and you use fertilizer on this land in September so that you can observe the before and after treatment results.

Plot A yields the following:

- in August the crop grows by 6 inches
- in September the crop grows by 6 inches

You are tempted to conclude that the fertilizer has no effect, but a control group is needed to assess the net effect of the fertilizer.

Say you take a second plot B and you don't treat it with the fertilizer. Plot B yields the following:

- in August the crop grows by 6 inches
- in September the crop grows by 2 inches

Now you are forced to reconsider your previous conclusion and you can use the following method to determine what the effect of the fertilizer is.

2.3 Difference in difference

[Table 13]

Table 13

	Before	After	Δ
Treat	6	6	0
Control	6	2	-4

$$\Delta_{Treat} - \Delta_{Control} = 0 - (-4) = 4$$

Q: What is the counterfactual assumption?

A: If the treatment plot hadn't received the fertilizer, it would have behaved like the control group.

Q: How plausible is this?

2.4 Experiments in economics

We don't generally get to choose treatment and control groups in economics, perhaps because the stakes are too high for the variables we want to manipulate.

So we often look for "quasi-experiments" or "natural experiments" where policy, nature or freak accidents create treatment and control groups for us.

One such accident is the one used in Card and Krueger's article. This paper is a very famous study of the impact of the introduction of minimum wage.

This paper:

- created huge controversy among economists
- Arguably caused millions of workers to get a raise from the Clinton's administration in 1995.

2.4.1 Card & Krueger experiment

April 1, 1992: in New Jersey the minimum wage rose from \$4.25 to \$5.05 per hour (this is a sizable increase)

Eastern Pennsylvania (bordering NJ) didn't raise the minimum wage.

Card & Krueger surveyed 410 fast food restaurants.

In this experiment the timing of the experiment is the following:

Before: Feb-Mar 1992

After: Nov-Dec 1992

Table 3 in the paper shows "Per store employment"

[Table 14]

Table 14

	Before	After	Δ
NJ	20.44	21.03	0.59
PA	23.33	21.17	-2.16

$$\Delta_{NJ} - \Delta_{PA} = 0.59 - (-2.16) = 2.75$$

The paper contains many more tests, but this is the basic result: $2.76 \approx 13.5\%$ increase in employment

Interpretations:

1. Monopsony
Other interpretations:
2. Hungry teens
3. Motivational effects
4. Confounding variables (shocks to PA that are not accounted for in the test)
5. Wrong venue (why did they study fast food?)