

### I. Competitive Markets for Inputs

A. Another application of the net-benefit maximizing framework, allows one to make sharp predictions about a firm's demand for inputs.

B. To do so, we need to identify the marginal benefits that a firm gets from hiring persons, buying machines, or using raw materials.

- Since revenue is generally the “benefit” sought by firms, the marginal benefit that a firm obtains by employing an input is simply the increase in revenues generated by that input (unit of labor, etc.)
- This effect is partly determined by the productivity of the input (how much extra output is produced by or from that input) and partly by the price at which that output can be sold.
- Definition: the **marginal product** (mp) of an input is the change in total output produced by a unit increase in the input.
- Definition: the marginal revenue product (m<sub>rp</sub>) of an input is its marginal product times the price of the output; that is,

$$\text{MRP} = \text{MP} * \text{P}.$$

C. The following table illustrates how one can calculate marginal product from a production function and how to use marginal product and price to calculate marginal revenue product.

- The first column represents the quantity of some input, here labor hours.
- The second column represents the total output of each successive hour of labor.
- The third column is change in output generated by a one unit increase in labor, which is labor's marginal product..

- The fourth column multiplies marginal product (MP) by price to obtain marginal revenue product (MRP) . For the purposes of illustration the output price is assumed to be \$5.00.

Q Input	Q output	Marginal Product	Marginal product times Price = MRP
1	8	8	40
2	15	7	35
3	21	6	30
4	26	5	25
5	30	4	20
6	33	3	15
7	35	2	10
8	36	1	5
9	35	-1	-5

Note that if the price of labor is 10\$/hour, it is sensible to hire up to 7 hours of labor but not more. [\[Explain why.\]](#)

D. The firm's MRP curve is the basis of its demand for an input, just as a consumer's marginal benefit curve is the basis of his or her demand for (final) goods and services.

- The **marginal benefit of an input to a firm is the input's marginal revenue product** (since marginal revenue is the firm's marginal benefit).
- The MRP curve is downward sloping if production exhibits **diminishing marginal returns** over the entire range of interest.
- This, as we saw for ordinary consumer demand curves, implies that the **firm's demand curve** for such inputs also slopes downward, and runs through the same points as the MRP curve.
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E. Derivation of a firm's demand for an input:

- Given a firm's MRP curve for a particular input (say unskilled labor)
- Pick a price (wage)
- Find the profit (net benefit) maximizing quantity of the input to employ.
- Plot price and quantity.
- Repeat with another price.
- As with a consumer's demand curve, a firm's demand for an input tends to be downward sloping and go through (most) of the same points as its MRP curve.

F. Derivation of a market demand for an input such as labor.

- Given each firm's demand for the input of interest,
- Pick a price (wage rate, etc.)
- Find the amounts that each firm in the society or market of interest will purchase at that price.
- Add the quantities up.
- Plot price and the sum of those quantities.
- Repeat with another price.
- Note that the logic of net benefit maximization again implies that demand curves for inputs are downward sloping, and that the area

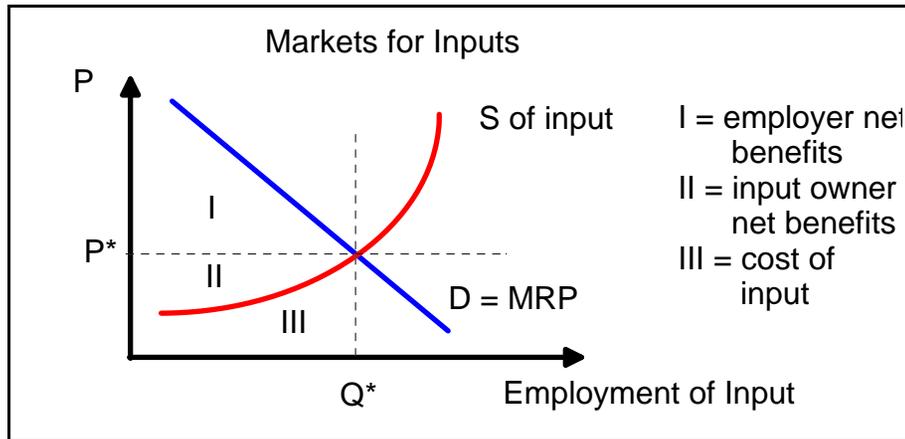
under the curve is the total revenue (or benefit) that firm's obtain from the input of interest.

G. Comparative statics

- Any change in technology that increases the marginal product of the input of interest will shift the demand for that input in the industry of interest.
- Any change in market conditions that affects the output price of products produced by the input of interest will affect the market (industry) demand for that input.
- If supply of the input is not affected, and increase in the MP of the input or Price of its output, will increase demand and tend to cause input prices to rise.
- (Draw a diagram or two to show this.)
- Note also that if input prices rise for reasons other than a change in technology, marginal costs throughout an industry are increased.
- (An example of such a change in input prices occurs if the supply of the input is reduced for some reason, such as bad weather.
- In such cases the supply curve for industries using that input will shift back to the left ("fall"), which will tend to cause output prices to rise.
- (Draw a diagram that shows how a reduction in the supply of an input will affect both input and output prices.)
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H. The technology of production has been assumed constant in the above diagrams.

- However, technological changes in production can also be modeled as changes in the marginal product of some or all inputs.
- Technological shifts increase the MP of at least some inputs or it would not be adopted..



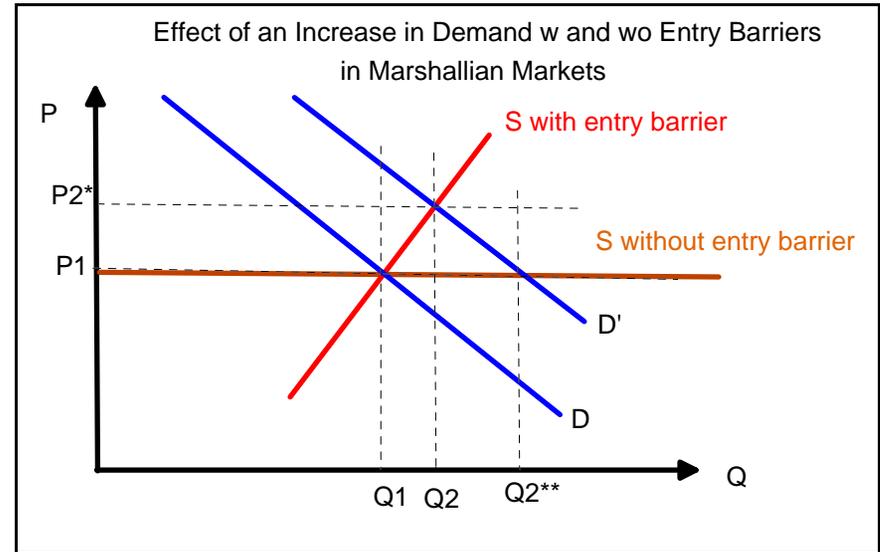
- Note that this increase in marginal product implies that the demand for some inputs always increases when technology increases.
- However, the demand for every input does increase as technology improves. For example, a technological innovation may increase the productivity (MP) of some inputs more than others.

## II. How Entry Barriers Affect Market Equilibria in the Long Run

Entry barriers prevent the Marshallian type of exit and entry from taking place, which tends to reduce supplies when demand is growing to levels

below competitive levels, or to increase supplies above competitive levels if exit is blocked.

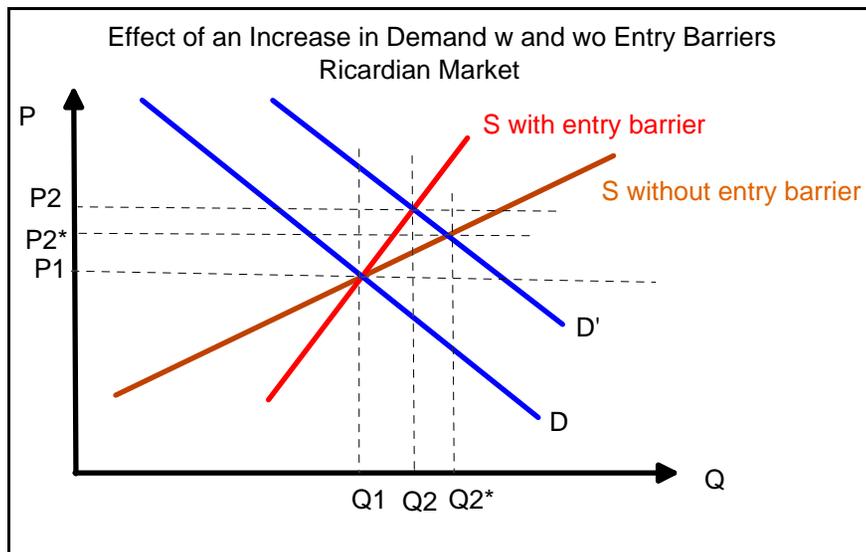
- An entry barrier allows profits to continue in the long run.
- Remember that in a Marshallian market, entry and exit are the main adjustment process toward LR equilibrium.



- [Label the area in the figure above that corresponds to profit in the setting with entry barriers. Recall that with a fixed number of firms, the LR supply in a Marshallian market is the Industry MC Curve, just as it is in Ricardian Markets.]

The effects of entry barriers on Ricardian markets tend to be smaller, because entry and exit play a smaller role in such markets.

Nonetheless, entry barriers block the entry of higher cost firms in Ricardian markets, which also tends to reduce long run supply and drive up prices, when demand increases.



Note that in both the Marshallian and Ricardian cases, demand increases, **prices rise more in the market with entry barriers** than without the barrier to trade. This causes profits to be higher and consumer surplus to be lower. It also tends to reduce social net benefits to levels below those associated with the “open” market.

[As an exercise, redraw the above diagram and shade in and label the effects of this barrier to entry on consumer surplus and profits in the long run. Note that profits rise, if demand is increasing through time.]

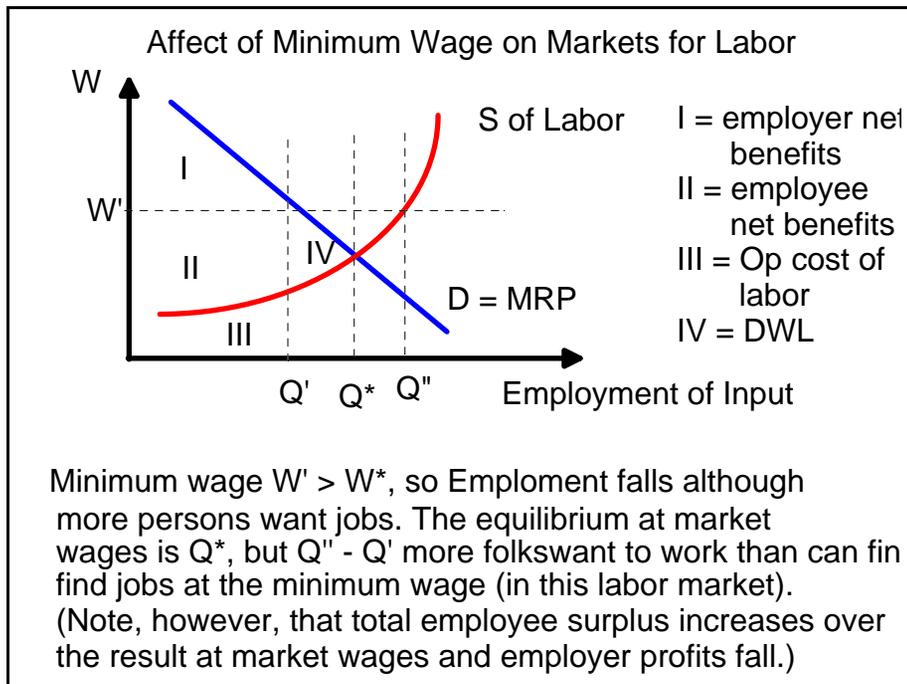
- Regulations, for example, may reduce the number of firms (number of suppliers) to levels below the Marshallian equilibrium.
- For example, doctor salaries (an other income) remains very high, well above other that of other graduate degrees) because there are limits on the number of doctors that can be “produced” (e.g. Graduate from medical schools) every year. [The US has about 20% fewer doctors per capita than other Western countries.]

- Similar regulations (zoning) tend to reduce supplies of low cost (small) housing units in many cities, making prices higher than it would otherwise have been.
- Similar barriers often exist in various foreign trade markets, which often limit imports of goods and services (as in Japan with respect to rice and beef, and in the US with respect to sugar).
- [Who benefits from such regulations?]
- [Draw (i) a Marshallian and (ii) a Ricardian market with a barrier to entry and analyze the effects of the barrier on profits and consumer surplus.]
- [Is the AACSB an organization that creates artificial barriers to entry? Why or why not?]

### III. Effects of Price Controls

- A. Another type of regulation can also reduce a market’s ability to reach both short run and long run equilibria, namely price regulations of various kinds.
- There are a wide range of price controls that are still used to affect prices in competitive markets, although many of these have been eliminated over the past fifty years.
  - Examples include rent controls, minimum wage laws, and interest rate regulations.
  - Price controls may limit price adjustments in either the upward or downward direction
- B. A price control that limits downward movements tends to generate a “surplus.” A price control that limits upward movements tends to generate a “shortage.”
- One of the most common price controls is a minimum wage.

- Minimum wage legislation holds prices above their market clearing level, which has effects on the level of employment, wage rates and the supply curves of goods and services produced via low or unskilled labor.
- In general, employment falls, social surplus falls, total wages increases, and profits from employing unskilled and low skilled labor falls.
- These effects are illustrated below

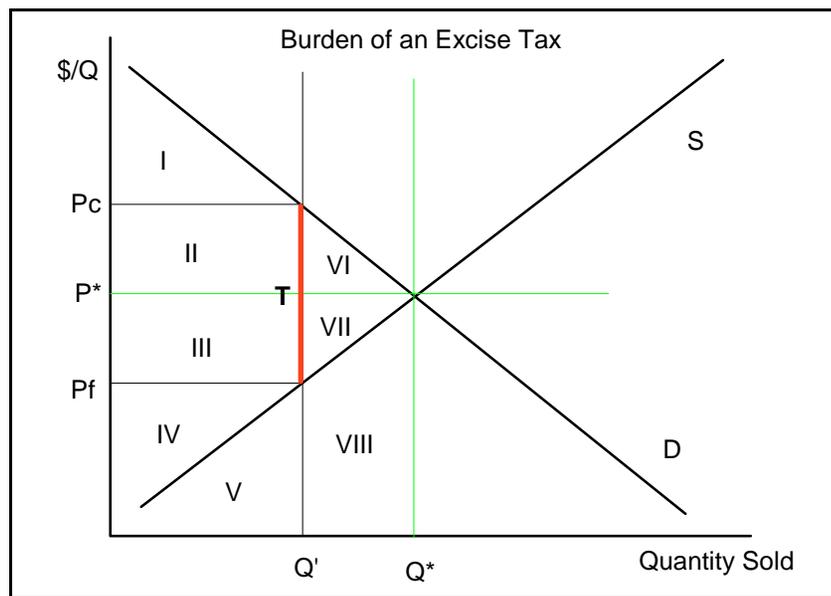


#### IV. The Burden of Excise Taxes in Competitive Markets

The burden of taxes often falls on persons or firms who do not write checks to the treasury, and who may not be "obviously" affected by a particular tax law..

- For example, sales taxes are paid by firms in the sense that firms (or firm owners) actually write the checks deposited in the government's treasury. Thus, calculated as cash payments, one could say that the burden of a sales tax falls entirely on firms.
  - However, if firms simply increase their prices to pay for the tax, which is what they appear to do at the cash register, then the tax burden has really been "shifted" forward onto their customers, even though consumers never actually write checks for sales taxes and send them into the treasury.
  - In many cases, the persons most affected by a tax are **not** the persons who "directly" pay the taxes by writing out a check to the treasury or IRS!
- A. Our usual net benefit methods can be used to see how an excise tax affects the consumer surplus and profits of a tax that "paid" in a particular market, as with excise taxes
- B. Suppose that a market is initially in an equilibrium without taxes, so that demand equals supply at  $P^*$ . In this case, there is no "tax wedge" between the price paid by consumers,  $P_c$ , is the same as that received by firms,  $P_f$ ; so  $P_f = P_c = P^*$ . Firms receive exactly the same amount that consumers pay.
- Now, suppose that an excise tax of  $T$  is imposed on each unit of the good sold in this market, as for example is done with tire sales in the US.
  - After the tax is imposed,  $P^*$  is no longer the market clearing price:
  - If  $T$  is simply added to  $P^*$  by firms, consumers will purchase too little at their new price ( $P_c = P^* + T$ ) to match supply, which would remain at  $Q^*$ .

- d. On the other hand, if firms simply "absorb" the tax, they would provide too little of the good to meet demand.
- Their after tax price is  $P_f = P^* - T$ .
  - The quantity supplied would fall, but demand would remain at  $Q^*$  if  $P_c = P^*$  and  $P_s = P^* - T$ .
  - e. To clear the market, thus, firms have to receive less than  $P^*$  per item sold, and consumers have to pay more than  $P^*$ .



C. At the new equilibrium output, the demand curve will be exactly  $T$  dollars above the supply curve, and  $Q_d(P_f + T) = Q_s(P_f)$ .

Such an equilibrium output is shown in the diagram. Note that at  $Q'$ , supply equals demand.

- $Q'$  units of the good are sold, with  $Q' < Q^*$ , given the two prices, the quantity supplied equals the quantity demanded.

- At this equilibrium, there is a sense in which the tax has simply been passed onto consumers, because  $P_c = P_f + T$
- However, that is not true if one considers the original price.  $P_c$  is less than  $P^*$  plus  $T$ .

D. There is also another sense in which the **burden of taxation is shared** by firms and consumers, because both consumer surplus and profits have been diminished by the tax!

- **Consumer Surplus falls** from area I + II + VI (before the tax at  $Q^*$ ) to just area I after the tax is imposed and output falls to  $Q'$ .
- Similarly, **Profit falls** from III + IV + VII (before the tax at  $Q^*$ ) to area IV (after the tax at  $Q'$ ).

The **burden on consumers** is II + VI, and that **on firms** is III + VII.

E. Note that **this distribution of the loss of consumer and firm net benefits occurs regardless of who actually writes the check to the state or federal treasury.**

- Price movements ultimately determine the actual division of burden between firms and consumers.
- If firms send in the check, their effective "payment" is reduced by the increase in price paid by consumers.
- If consumers write out the checks, their effective "payment" is reduced by the price decrease absorbed by firms.

F. The amount of revenue raised by the tax is  $T \cdot Q'$ .

- $Q'$  units are sold and each pays a tax of  $T$  dollars.

- The total tax revenue,  $TQ'$ , can be represented in the diagram area II + III in the diagram.

- (Note that II + III is the area of a rectangle  $T$  tall and  $Q'$  wide.)

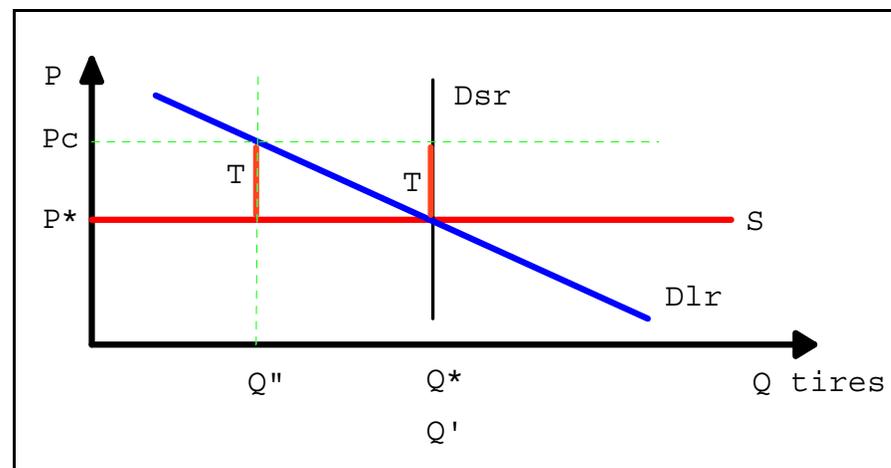
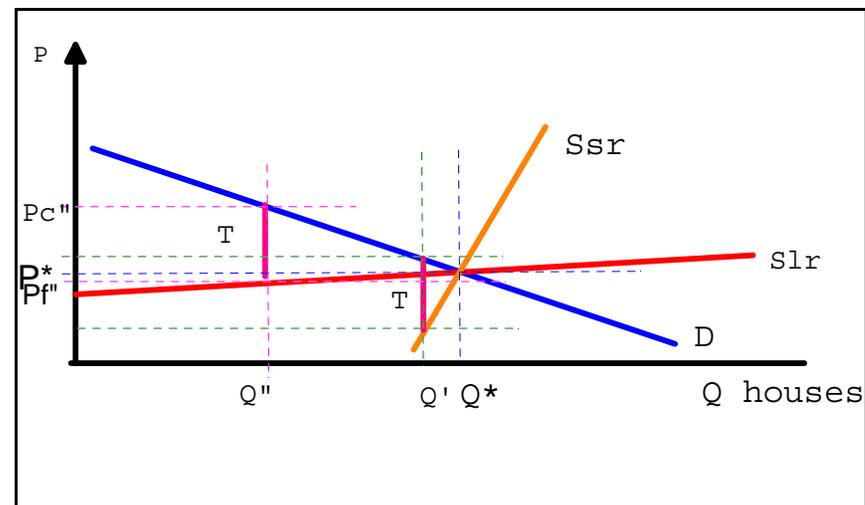
G. Notice that the tax revenue is smaller than the "surplus" lost by taxpayers (firms and consumers in the affected market).

- The reduced profit plus the reduced consumer surplus equals  $\{II + VI\} + \{III + VII\}$ .
- The total burden of this tax is  $VI + VII$  larger than the tax revenue.
- This area of "excess burden" is sometimes referred to as the **deadweight loss of an excise tax**.

H. Both the extent of the deadweight loss and the distribution of the tax burden vary with the slopes of the supply and demand curves.

- Generally, more of the burden falls on the side of the market with the least price sensitive curves.
- If the demand curve is flatter (less elastic) than the supply curve, more of the burden falls on consumers than on firms.
- In the extreme case in which market demand is vertical or the industry supply curve is horizontal, all of the burden falls on consumers!
- On the other hand if the demand curve is essentially horizontal, because good substitutes exist, or the supply curve is vertical (perfectly inelastic) then more of the burden tends to fall on the firm.
- In the extreme case in which the market supply of the product of interest is completely inelastic or consumer demand is perfectly elastic, all of the burden falls on suppliers.
- Note also that, the excess burden of a tax tends to increase with the price sensitivity (slope or elasticity) of the demand and supply curves.

I. Both supply and demand tend to be **more elastic in the long run than in the short run**, consequently, the excess burden of taxation tends to be larger in the long run than in the short run. However, in most cases, economists focus on differences in long and short run supply as we have earlier in this handout.



J. Note that in the first case, supply is more price sensitive (elastic) in the long run than in the short run, so the initial effect of the tax is

largely on firms, but in the long run the burden is shifted mostly to consumers.

- The after tax price falls at first for firms, but rises back to  $P^*$ .
- The price to consumers rises just a bit at first, but rises to  $P^*+P_c$  in the long run.

K. The second case is an unusual case where demand is more price sensitive (elastic) in the long run than in the short run, but because supply is completely elastic in both the long and short run, the burden falls entirely on consumers in both the short and long run.

- As an exercise, construct a case in which the burden falls entirely on firms in both the long and short run.
- Repeat, showing a case in which the burden falls entirely on consumers in the long run in a Ricardian market

L. In cases in which long run and short run demand are the same, the fact that long run supply is relatively more price sensitive (elastic) than short run supply implies that the burden of a new tax or increase in tax tends to be gradually shifted from firms to consumer in the long run.

- Marshallian competitive markets have perfectly elastic supply curves in the long run, which implies that narrow taxes on such products are shifted entirely to consumers in the long run.

M. There are, however, also cases in which consumer demand is more price elastic in the long run than in the short run (as when demand for a good is determined in part by consumer capital goods, like automobiles).

- In such cases, a tax such as a gasoline tax may be gradually shifted from consumers to firms (owners of capital and natural resources) in the long run.

N. In cases where both sides of the market (firms and consumers) are more price elastic in the long run than in the short run, the shift of burden will reflect their relative ability to adjust.

O. All such long run adjustments imply that **deadweight losses** to narrow taxes, such as an excise tax, are **larger in the long run than in the short run**.

[For more on the effects of taxation and other policies on markets, enroll in a Public Economics course.]

#### V. Effects of transactions costs (imperfect information and search costs)

The usual assumptions of perfectly competitive markets include low (zero) transactions costs and very good (or perfect) information about prices and alternative technologies.

However, if significant transactions occur, some of the predictions of the competitive model will not be realized. For example, the “law of one price” will not apply perfectly.

Transactions and information costs imply that firms will not all be forced to sell at the same price, because (a) consumers may not know where the lowest priced source of a good or service is, and (b) because consumers will take account of the cost of waiting in line at the lowest cost sources of the goods. [In effect their true price is the “posted price” plus their search and transactions costs.]

Positive search costs imply that prices may vary somewhat (within a fairly narrow band) according to the degree of information and waiting costs.

Consider the example of two firms selling at two different prices:

- Suppose two firms sell identical products and firm A sets a price that is 10% higher than firm B. What happens?
- Now, as customers go to firm B, lines form, which increases the effective price of shopping at B. Some will return to A and pay a higher money price in order to save time.
- (It could be argued that A and B now sell different products. Explain why.)
- Firm A no longer has to its price or go out of business, but if its price were really high, it is still the case the consumers might go to B even given its waiting costs.
- Waiting costs thus imply that some price variation will exist, but that prices will stay within relatively narrow bands--based on waiting and other transactions costs.
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- [Puzzle: what effect on the distribution of prices do you think that internet shopping has had? Does the same effect occur in Marshallian and Ricardian Markets?]

#### VI. Further Applications, Puzzles, on Barriers to Entry and Exit:

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- Contrast the effects of a regulation that creates a barrier to entry (or exit) with one that imposes a cost increasing production technology (as often are associated with environmental regulations).
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- Many professions have licensing requirements of various kinds. All of these tend to create entry costs. Do they all have the same effects on supplier net income (profits) in the long run? Why or why not?
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- Countries often have rules and regulation that make it more difficult for foreign providers of goods and services to enter a nation's markets. Show how such regulations affect long run supply in Ricardian and Marshallian markets. It can be argued that this "supply" effect is often greater in Ricardian than in Marshallian markets--explain why.
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- To what extent are college education requirements simply an entry barrier?
- Are college degrees simply a form of information that reduces search costs?
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- In addition to barriers to entry, regulations often reduce the range of prices and price adjustments that can take place in a particular market.
- How do price controls (ceilings and floors) affect market equilibria in the short and long run?
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#### VII. How Price Controls Can Prevent Markets from Reaching Equilibrium

- A. Another form of regulation that can reduce the efficiency of markets (in terms of social net benefits) are regulations that restrict pricing in various ways.
- These regulations are often called price controls
  - If such regulations prevent market prices from reaching market clearing levels, the result tends to be "permanent" surpluses or shortages.
- B. A variety of price controls have been imposed on otherwise competitive markets.
- Examples include rent-controls and minimum wages,
  - Examine the effects of a minimum wage law on the market for unskilled labor in the figure below. What is the "surplus" called?

#### VIII. Effects of small numbers of firms or consumers

As the number of firms or consumers falls from dozens or hundreds to just a handful, it become more likely that a single firm's output decision or a single consumer's purchase decision will have a clear, observable, effect

on market supply or demand. In those cases, it is not likely that firms or consumers will behave as price takers. They will understand that their supply or purchase decisions will affect market prices, and they will take those effects into account when making output or purchase decisions.

When the number of firms or consumers becomes so small that pricing taking behavior becomes implausible, then we shift from “competitive” market models to other models of market behavior such as the monopoly (single firm), duopoly (two firms), and monopolistic competition (lots of firms selling similar but not identical products) models. [

In those cases, markets still tend to clear, but by conscious decisions by firms, rather than as an unintended consequence of inventory adjustments.

We analyze other “market structures” in lecture 6.

- How do such laws affect prices of products produced by such labor? Does anyone benefit from such laws?
-