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I. Measuring the impact of government policies

Our main task today is to learn how price ceilings, price floors, and limits on quantities affect the marketplace. It is not too hard to come up with predictions about what happens to prices, production, and consumption. For instance, the minimum wage reduces employment, increases unemployment and raises wages for those who still have jobs. But we can actually measure these impacts and put the information together to get a fuller understanding. In particular, we need to know how much producers and consumers each may *gain* or *lose* from a particular policy. This will require a small dose of economic theory:

A. Consumer surplus

Ideally we would like to measure value of a particular mix of goods to an individual consumer. To make things simple, let's focus on a single good: air travel to Toronto. Let the following individual demand schedule illustrate the preferences of Nancy Nortel (P in \$100, Q = flights per year):

| P | Q | Value | |
|----|---|-------|--------------------------------------|
| 15 | 1 | 15 | We teleconference at higher prices |
| 10 | 2 | 25 | More trips will help our team |
| 6 | 3 | 31 | Our team is really getting close now |
| 3 | 4 | 34 | Is our team meeting too much? |
| 1 | 5 | 35 | Our family likes Toronto on weekends |

(Aside: by summing up the individual demand schedules for all consumers, we could get the market demand curve for RDU-Toronto air travel. This point is made in the text on pp. 122-123.)

Our goal is to measure the value of these flights to Nancy, keeping in mind that as prices drop she flies more. Let's suppose that the airlines that fly to Toronto all charge the same price for a seat all year long to all customers. (Wouldn't that be a switch?) At

$P > 15$, she does not fly at all. At $P = 15$ (called the *reservation price*), she enters the market and consumes 1 unit which has a value of 15. She is not willing to take more than 1 trip until P drops to 10. At that point the total value of the 2 trips is $25 = 15 + 10$, which represents the most she would have paid for them if they had been auctioned off separately. But she only has to pay 20 ($= 2 * 10$) to get two tickets. So she has gotten a "deal" on the 1st one, which was worth 15, but now costs her only 10. The name for this "deal" is *consumer surplus*:

Consumer surplus = difference between the maximum a customer is willing to pay for a good and what the customer actually pays

In practice, consumer surplus is inversely related to price. (Exercise: what is consumer surplus for Nancy if $P = 3$? $P = 2$?) Also in practice, it is calculated off market demand curves instead of individual demand curves. We will turn to a graphical treatment shortly.

Consumer surplus is a very central concept in this course. We know that consumers vary drastically in terms of their willingness to pay for the same good. Companies will want to try to segment the market so that they can target groups of consumers with a product that fully matches their willingness to pay. Auto dealers try to do this by negotiating every sale. More often, firms achieve this by tweaking the design of the product, or the terms under which it is sold, delivered, and serviced. (Examples?) Ironically, we will learn later on this semester that the various forms of price discrimination can actually make consumers better off!

Question: how does the concept of consumer surplus help us understand ticket scalping at entertainment and sports events? Who benefits from scalping? Who loses?

One final definition:

Consumer welfare = consumer surplus + total expenditure ($P * Q$)

Applications: pricing policy, cost-benefit analysis of government policy, evaluation of nonmarket goods (especially environmental quality)

B. Producer surplus

This is the same basic idea; text provides details in chs. 8 and 9. Production levels of individual firms and the market increase with price. As the price rises and the firm moves along its supply curve, it gets extra revenue on the units it was previously willing to produce at a lower price. (We will get into this in more detail later, for right now just keep in mind that rising prices are necessary to cover rising costs of production as output expands.)

Producer surplus = difference between amount received by producer and minimum amount necessary to get him to produce at a given level

C. Graphical representation

As noted above, consumer welfare, or total value, is sum of consumer surplus and actual spending. Demand curve represents willingness to pay on behalf of all

consumers for a particular good. Actual spending is shown by rectangle corresponding to actual P, Q combination. Entire area under demand curve (including P*Q rectangle) is consumer welfare. Consumer surplus is triangle under demand curve but above P*Q rectangle. (See slide 12)

Producers receive P*Q in revenue from consumers, but cost of resources used in production is area under supply curve (take this on faith for now). Producer surplus is the difference between revenue and cost of resources. Graphically, producer surplus equals the area between market price and supply curve (see slide 13).

Area under supply curve represents cost of resources used in production. This is not considered in policy analysis; we assume they will simply flow to other sectors and be used effectively there. (For instance this is equivalent to saying Michael Dell would add as much value to HP or General Motors as he does to Dell. This assumption probably works pretty well for most employees, but may be iffy for those with company-specific skills.) Another way of thinking about this is that the area under the supply curve equals the value of scarce resources (labor, capital, land) that have alternative uses. So their value will be the same if allocated elsewhere (of course this hinges on their being reallocated to a situation where their training and expertise are equal, is MJ as golfer = MJ as NBA owner = MJ as NBA player).

Summary: total expenditure on good (if no price controls) = producer surplus + value of resources used in production

II. Price controls

We will now use the concepts of consumer surplus and producer surplus to examine the effect of various government policies. In each case we want to compare consumer surplus and producer surplus before and after the policy is imposed. We also need to take into account the absolute waste of resources, which we will call the *deadweight loss*.

A. Price ceilings (e.g., rent controls, gas price controls, etc.)

Consumers now go from (P_0, Q_0) to (P_{\max}, Q_1) . Their consumer surplus changes from area xyz to area uvwx.

Effects on consumers mixed: some can consume good at lower price so their consumer surplus goes up (area A in slide 16), but others are unable to consume so their consumer surplus goes down (area B in slide). Net effect = A-B

Producer surplus goes from area def to area dgh.

Effect on producers: get lower price for goods than before (area A in slide 17) and have reduction in producer surplus because of reduction in output (area C). Net loss = $-(A+C)$

Total effect = $(A-B) - (A+C) = -(B+C) = \text{deadweight loss of price controls}$

This can be calculated if you know old (P, Q), new (P,Q), and what D, S are.

Sample exercise: problem 10, p. 335.

B. Price floors

Case 1: quantity produced determined by demand (e.g., airfares before deregulation, minimum wage)

Effect on consumers: fewer seats sold meaning loss of consumer surplus (area B in slide) plus pay higher price for remaining seats (area A in slide 20). Net loss = $-(A+B)$

Effect on producers: fewer seats sold meaning loss of producer surplus (area C in slide) but remaining seats sold at higher price (area A). Net effect = $A-C$

Deadweight loss = $-(A+B) + (A-C) = -(B + C)$

Case 2: quantity produced determined by supply (e.g., agricultural price supports in slide 22)

Consumers same as before; net loss = $-(A+B)$

Producers are quite happy (thus explaining motivation behind policy); producer surplus increases by $A+B+D$

Government is stuck with surplus, represented by the shaded area $(Q_2-Q_1)*P_s$

Deadweight loss = $-(A+B) + (A+B+D) - (Q_2-Q_1)*P_s = D - (Q_2-Q_1)*P_s$

III. Trade

A. Which goods get traded

Exports: world price $>$ price where domestic D equals domestic S

Mechanics (slide 24): domestic consumption where world price intersects D, domestic production where world price intersects S, exports = difference between production and consumption

Imports: world price $<$ price where domestic D equals domestic S

Mechanics (slide 25): domestic consumption where world price intersects D, domestic production where world price intersects S, imports = difference between production and consumption

B. Quotas and tariffs

Whatever your political target, you can get there with either a tariff (tax on imports) or quota (limit on imports). Only difference is where the \$ go: government pockets the tariff, whereas under a quota foreign producers benefit by ability to receive higher price.

Loss to consumers = $-(A+B+C+D)$ (in slide 27)

Gain to domestic producers = A

Gain to government (tariff) or foreign producers (quota) = D

Deadweight loss = $-(B + C)$

Sample exercise: problem 6, p. 334, parts b-d

Ex. See text pp. 604-606 for real life examples.

Steel producers (even Nucor) pressuring for tariffs after fall in value of many foreign currencies made imports more price competitive in U.S. Political claim: need protection to keep U.S. jobs from going abroad. Issue: consequences for rest of economy?

Sugar tariffs and quotas – what are consequences here? Discuss *WSJ* articles

IV. Taxes and subsidies

A. Impact

Taxes drive a wedge between what customers pay and what producers receive. General practice is to make D a function of price including tax (in the text this is P_b = buyer's price) and S a function of price excluding tax (P_s = seller's price). In equilibrium, we must have two conditions now:

$$\begin{aligned}Q^D &= Q^S \\P_b - P_s &= t,\end{aligned}$$

where t = tax paid.

Net result is lower price received by producer and higher price paid by consumer. Using the notation on the slides,

Loss to consumers = $-(A + B)$

Loss to producers = $-(C + D)$

Gain to government = $A + D$

Deadweight loss = $-(B + C)$

Analysis of subsidies very similar, except have $P_b + s = P_s$, where s is amount of subsidy.

Sample exercise: problem 2, p. 333

B. Pass-through function

Useful to know how much prices paid by consumers (received by producers) will rise (fall) in response to a tax. If S perfectly (or infinitely) elastic, then consumer pays entire tax. (Why?) Ditto if D totally inelastic (zero). (Why?) These extreme cases illustrate that we have to look at both S and D elasticities.

% of tax paid by consumers = $E_S / (E_S - E_D)$

This would allow you to forecast impact of a tax on price you would have to charge.

C. A primer on taxes

1. All taxes involve some deadweight loss. Distortions smallest if taxes are imposed on goods where production after tax will not change. Goods with highly inelastic demand usually fall into this category.
2. Specific taxes to consider:
 - sales taxes on retail merchandise
 - sin taxes (tobacco, alcohol)
 - income taxes (rates, deductions)
 - development fees on new homes in Cary
3. Taxation on the internet (discussion if time permits)