## J. Tax Incidence

1. Does a subsidy accrue more to consumers or more to firms as the demand curve becomes steeper? Explain why, using a graph.
2. Suppose the supply curve for a competitive industry has the form $P = Q$. Suppose the demand curve faced by this industry has the form $P = 2 - Q$.
   (a) Draw a graph of the supply and demand curves and show the equilibrium point. Indicate on the graph the exact numerical values for equilibrium price and quantity.
   (b) Redraw the graph from part (a). Then suppose a tax of \$1 per unit is imposed on the *firms*. Find the new consumer surplus on the graph and calculate the exact numerical amount of the consumer surplus.
   (c) Redraw the graph from part (a). Then suppose a tax of \$1 per unit is imposed on the *consumers*. Find the new consumer surplus on the graph and calculate the exact numerical amount of the consumer surplus.
3. A specific tax imposed on consumers who are buying a product produced by a competitive, increasing cost industry will, in the very long run, raise market price by less than the amount of the tax. Using graphs, explain why this is so.
4. Using a graph, prove the following statements: if a subsidy is imposed on a constant-cost industry, consumers benefit by exactly the amount of the subsidy in the very long run. In the short run, however, they benefit by less than the amount of the subsidy. Be sure to explain your graphs.

   Also, without using your graphs, explain in words why it makes sense that if a subsidy is imposed on a constant-cost industry, consumers benefit by exactly the amount of the subsidy in the very long run.
5. In the very long run, explain who gains, and by how much, when a subsidy is granted to a decreasing cost industry. What are the impacts on: (i) consumers; (ii) firms; (iii) input suppliers?
6. Via "preferential tax treatment," the US government gives a subsidy to consumers who buy homes. On p. 127 of your textbook, in an "Applying Economics" box entitled "Federal Tax Benefits for Homeowners," Nicholson writes the following (from paragraph 2):

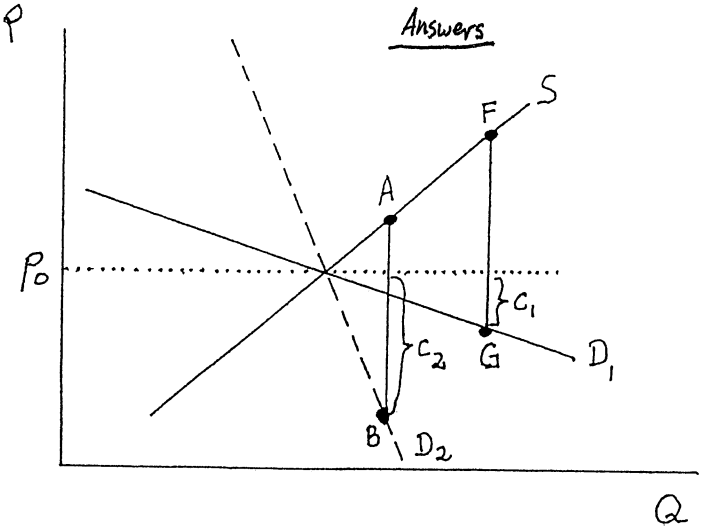
> "...the government essentially pays 21 percent of the true housing costs... The effective price of owner-occupied housing is 21 percent lower than it would be in the absence of preferential tax treatment."

Let "PEPDC" be an abbreviation for "Percent of Effective Price Drop to Consumers." Then Nicholson is saying that *a subsidy of 21% leads to a PEPDC of 21%.*

(a) By drawing a graph, show that this is false in the short run. Will PEPDC be more than 21% or less than 21% in the short run?

(b) By drawing three graphs, show that PEPDC might be less than 21%, exactly equal to 21% (as Nicholson claims), or more than 21% in the long run. House building must be what sort of industry in order for each of these cases to occur?

(1)




Answers

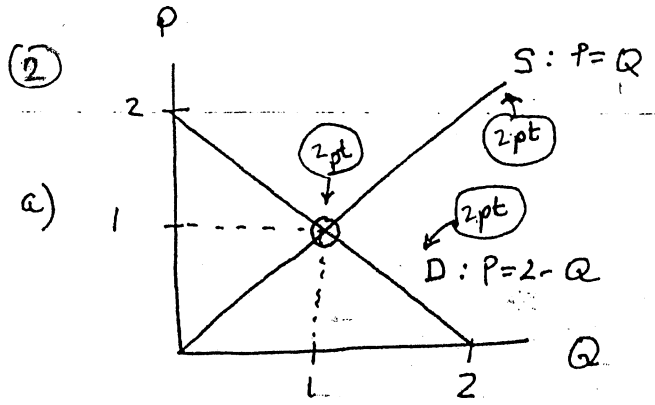
The distance from A to B is the same as the distance from F to G, and both are equal to the amount of the subsidy. The original equilibrium price is $P_0$. The amount of the subsidy that "truly" goes to consumers is given by the part of AB or FG which is below $P_0$. (This is the amount by which equilibrium price would fall if firms received the subsidy checks, and it is the amount by which the subsidy would exceed the price increase if the subsidy checks were received by consumers.)

Since $C_2 > C_1$, the subsidy accrues more to consumers as the demand curve becomes steeper. This is because the steeper the demand curve is, the less consumers are eager to absorb the extra output a subsidy causes (even large drops in price result in little increase in quantity demanded). So the steeper the demand curve, the more subsidy benefits have to go to the consumers.

| pts | |
|---|---|
| 10 | subsidy is between S and D, right of original equilibrium |
| 10 | consumers get below $p_0$ (-3 for no explanation but correct answer) |
| 11 | change as D gets steeper |

(2)

a)




For equilibrium, $S = D$

$Q = 2 - Q$

$2Q = 2$

$Q = 1$

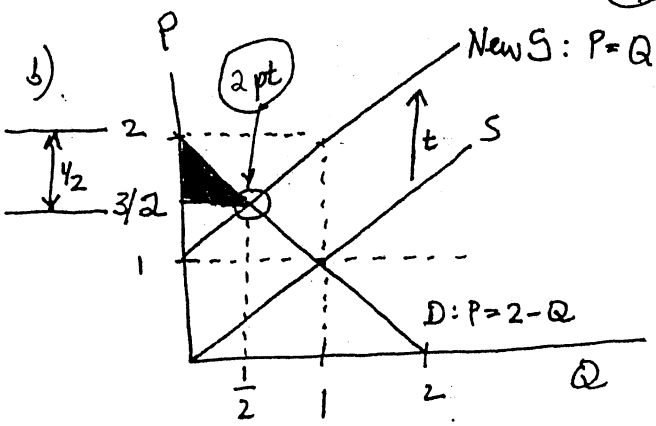
$P = Q = 1$ from supply

$P = 2 - Q = 2 - 1 = 1$ from dem

1pt combined

So $P = 1$.

b)




New $S = D$

$Q + 1 = 2 - Q$

$2Q = 1$

$Q = \frac{1}{2}$ ← 1 pt each

$P = Q + 1 = 1\frac{1}{2}$

or $P = 2 - Q = 2 - \frac{1}{2} = 1\frac{1}{2}$.

Consumer surplus: the area below the D curve and above the equilibrium price line.

2pt

Black triangle is new consumer surplus. Its area is

2pt

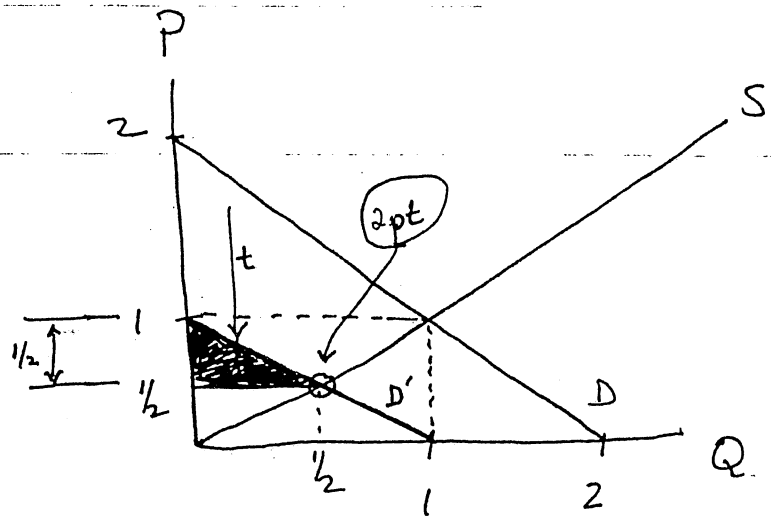
$\frac{1}{2}$ (base) (height) $= \frac{1}{2}\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) = \frac{1}{8}$.

2pt

2pt

Supply moves back because marginal cost moves up by the amount of the tax.

c)




2pt

D moves down by the amount of the tax, so the equation for D' is $P = 2 - Q - 1 = 1 - Q$. (2pt)

S = new D

$Q = 1 - Q$

$2Q = 1$

$\boxed{Q = \frac{1}{2}}$ (1 pt each)

$\boxed{P = Q = \frac{1}{2}}$ or

$P = 1 - Q = 1 - \frac{1}{2} = \frac{1}{2}$.

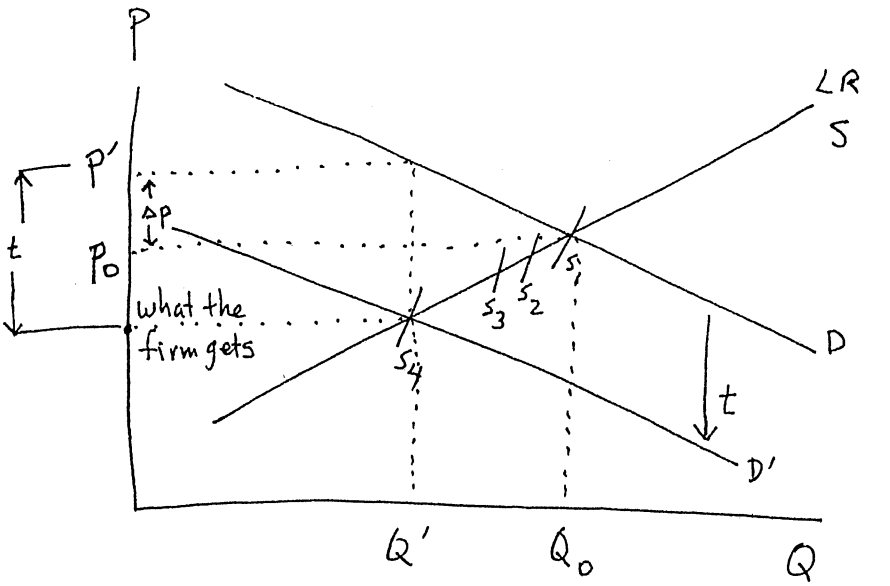
2pt

Consumer surplus is the black triangle. Its area is $\frac{1}{2}$ (base)(height) =

$\frac{1}{2}\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) = \frac{1}{8}$. ← (2pt)

So regardless of who sends the checks to the government, consumer surplus will be 1/8. It does not matter who sends the checks to the government.

(3)




initial equilibrium $Q_0$, $P_0$

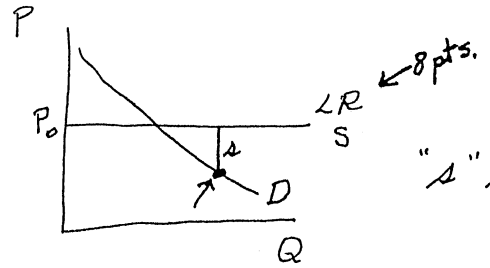
tax t imposed ⇒ after-tax D shifts to D'; price drops to where S hits D' (not shown). This causes $\pi < 0$, and firms start to exit.

S shifts in to $S_2$, $S_3$, and finally $S_4$.

Price changes from $P_0$ to P' (a change of "$\Delta p$"); this is less than the tax t.

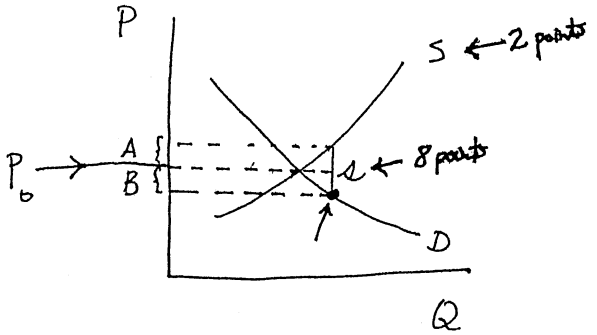
LR S curve — 5 pts.
D shift — 5 pts.
SR S shifts — 2 pts.
P', Q' — 5 pts.
$\Delta p$ vs. t — 8 pts.

(4)




← 8 pts.

"s" represents the amount of the subsidy ← 8 points




← 2 points

← 8 points

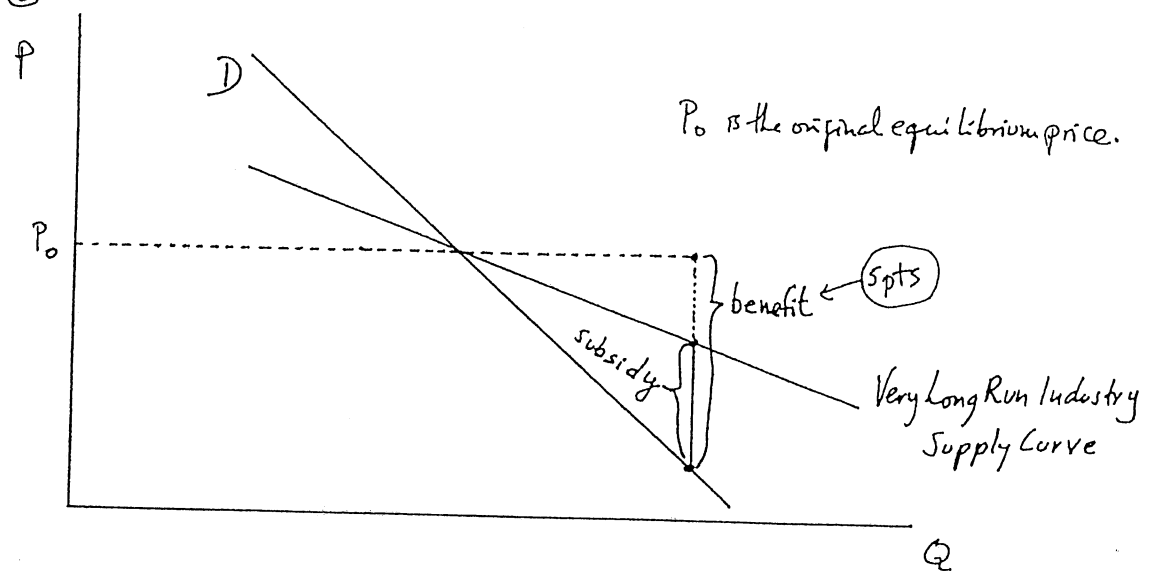
In both these graphs, consumers benefit to the extent that the dot indicated by the arrows lies below the original price. This was shown in our class discussion, where we proved this conclusion regardless of whether the firm or the consumers were the direct recipients of the subsidy.

The first graph illustrates the long-run situation. Since we have a constant-cost industry, the long-run supply curve is flat. Hence all of "s" falls below the original price $P_0$, and therefore all the subsidy goes to consumers. The second graph illustrates the short-run. It is evident that "B" represents the portion of s falling below $P_0$; since B is less than s, only part of the subsidy goes to consumers.

7 points → The explanation of the long-run situation in words is the following. Since we have a constant-cost industry, each firm's average cost curve is

fixed, regardless of the number of firms. Long-run profits are fixed by definition at zero, both before and after the subsidy. Hence neither costs nor profits of firms change with the imposition of the subsidy. The only effect of the subsidy is therefore to help consumers.

(5)

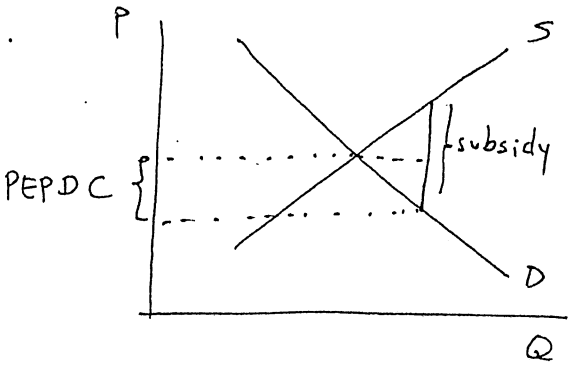



5pts

In a decreasing cost industry the Very Long Run Supply Curve is downward-sloping. The subsidy is measured by the vertical distance between the demand curve and the VLR Ind. S curve. The subsidy causes firms to enter, and therefore costs decline. Consumers get the whole "benefit" amount indicated on the graph. Firms get no benefit because in very long run equilibrium they make zero profit both before and after the subsidy. Input suppliers get a lower price for their products, since costs to output firms have declined. (If firms get no benefit and input suppliers get hurt, the only agents left to gain are consumers, so they get all the benefits.)

5pts 5pts 5pts 5pts

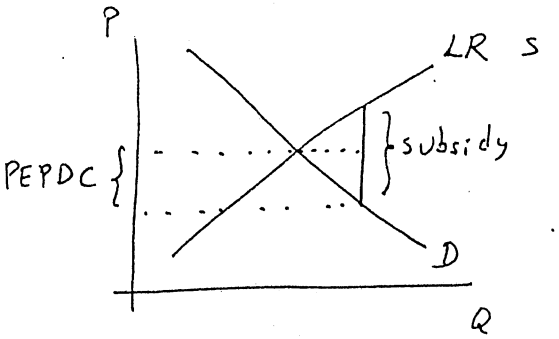
(6) a.




PEPDC < subsidy in the short run

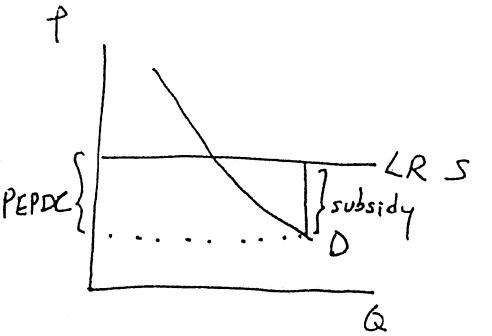
10 points

b.



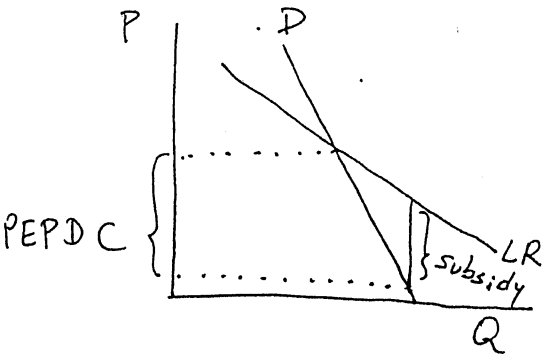

PEPDC < subsidy in the long run

Increasing Cost Industry




PEPDC = subsidy in the long run: constant cost industry.

8 points each for graphs; 2 points each for type of industry




PEPDC > subsidy in the long run: decreasing cost industry