Final

Wednesday, April 28, 2021 6:00 PM

1) Optimal Production and Pricing and Valuation

Inverse demand is p=10-0.1q with probability 0.75 and otherwise is p=10-0.2q. Cost is $2 per unit. Unsold output is disposed of at a cost of $1 per unit. The profit function is:

$$\pi = 0.25(10-0.2q_L)q_L + 0.75(10-0.1q_H)q_H - 2q_H - 0.25(q_H - q_L),$$

with the constraint that $q_H \geq q_L$. Profit is maximized by producing 35 units, selling them all at a price of $6.50 if demand is high, and selling 27.5 units at a price of $4.50 if demand is low.

a) Show that if the firm could instead store unsold output at a cost of $1 per unit, to sell in the next period, they would produce 38.33 units, sell them all at a price of $6.17 if demand were high, and sell 22.5 at a price of $5.50 if demand were low. If you set up and explain the new profit function correctly and explain the intuition for the solution well, but mess up the math, you will get significant credit.

$\pi = .25(10-.2q_L)q_L + .75(10-.1q_H)q_H - 2q_H - 1\cdot.25\cdot(q_H-q_L) - (q_H-q_L)(10-.1q_H)$

Probability + Price

Cost per 1 unit

Cost of saving $q_H - q_L$ times Prob of low

Cost savings of storing + not producing more

$\frac{d\pi}{dq_H} = \frac{q_H - 2q_L - 95}{20} = 0$

$\to q_H = 2q_L + 95$

Plug back in and $\frac{d\pi}{dq_L} = \frac{-6q_L - 65}{20} = 0$

$\to q_L = \frac{65}{6}$

I definitely messed up somewhere. Most likely with my profit function. It should be the regular probability and price combination. Subtract the cost of production of qH because you're storing the leftovers (qH-qL) and you'll want to subtract the storage costs for qH-qL too, but only with a probability .25 because that's the likelihood of low demand. The last part is the one I'm stuck on. You need to add back in the profits for the next period. I thought it was the leftover stock

maybe $+ .25(q_H-q_L)(10-.2q_L) + .4(q_H-q_L)(10-.1q_H)$?

$\frac{d\pi}{dq_H} = -12q_H - q_L - 610/40 = 0 \to q_H = \frac{q_L+610}{12}$

Plug in... :(

$\frac{d\pi}{dq_L} = \frac{-479q_L + 61250}{14400} = 0$

Dang. Still not quite there. But like I said, my problem's most likely with my last term.

b) What is the value, per period, of obtaining the ability to store output, ignoring discounting? Explain how valuation problems like this are approached generally.

The value per period is the amount of extra revenue generated by storing product like this.

$\pi_{no\ save} = .25(10-.2(27.5))(27.5) + .75(10-.1(35))(35) - 2(35) - .25(35-27.5) = 129.6875$

$\pi_{save} = .25(10-.2(22.5))(22.5) + .75(10-.1(38.33))(38.33) - (38.33-22.5)$

cost of saving?

I'm sure my second profit function is wrong, but if it was right, I would then subtract my profit from not saving from the profit with saving.

2) Risk Aversion and Insurance

Consider an individual with preferences over uncertain monetary outcomes (m) represented by $u(m)=m^{0.5}$. Initial wealth is $81,000 but they face a 0.1 probability of a $45,000 loss.

a) Show that the most the individual would pay for full insurance is $5,310.

$\sqrt{CE} = .9\sqrt{81k} + .1\sqrt{36k} = 275.118 \to$ square it to get CE

$\to 275.118^2 = 75690$

$81000 - 75690 = 5310$

b) If the administrative cost of insurance averages $100 per policy, the insurance market is highly competitive, and there are many insured facing independent risks, the approximate market price of full insurance is $4,600. Why? EV - transaction

$81000 - 4600 = 76400 \to \sqrt{76400} = 276.405$

Costs are $.1(100)$ per person $= \$10$

I know we did an example like this but for the life of me I can't find it. There was a function we used that acted like there were infinite people in it. I found it. It was homework problem 19 but in that we did not calculate the cost of insurance which I know we did somewhere else. Edit: can't believe my notes were helpful

OMG. I kinda have it

Insurance Pays EV - transaction $= (.9\cdot 81k) + (.1\cdot 36k) - 100 = 76400$

$81000 - 4600 = 76400$

Because insurance pays expected value and nothing to do with certainty equivalents and transaction costs, their total expected costs are $76400. When you take wealth and subtract the benefits of insurance and the admin costs, you are left with $4600

c) What is the approximate value added by the insurance industry, per individual insured, in (b)? Explain, intuitively, how the insurance industry adds value while creating no tangible output. How would a lack of independence change value added, and why?

The insurance industry adds value while creating no tangible output by acting in a risk neutral manner and pooling risk among policy holders. This allows them to only pay out on negative outcomes and for the cost of administration. "Since expected wealth is greater than the certainty equivalent, for risk adverse individuals, this creates value." -- 2010 Exam key

3. Game Theory

An incumbent and a potential entrant engage in one shot competition. Each can compete aggressively or passively. The entrant can also stay out. The incumbent moves first. Payoffs are shown in the table to the right.

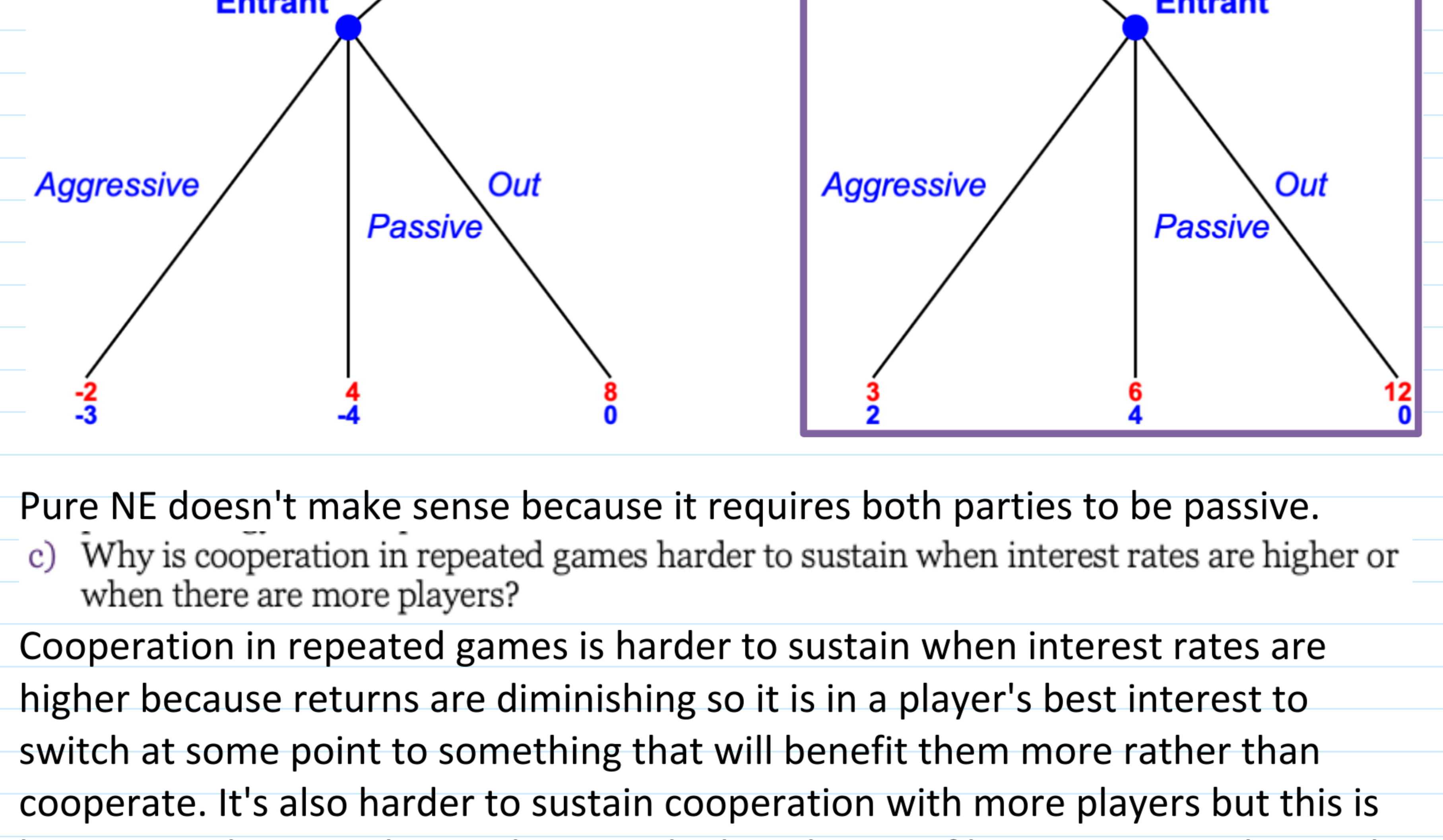
Decisions		Payoffs Incumbent	Payoffs Entrant
Incumbent aggressive			
Entrant	Aggressive	-2	-3
	Passive	4	-4
	Out	8	0
Incumbent passive			
Entrant	Aggressive	3	2
	Passive	6	4
	Out	12	0

a) Represent the game in normal form and find all pure strategy Nash equilibria.

Entrant\Incumbent	Aggressive	Passive
Aggressive	-3, -2	2, 3
Passive	-4, 4	4, 6
Out	0, 8	0, 12

NE

b) Represent the game in extensive form and find the subgame perfect Nash equilibrium. Explain why the non-subgame perfect pure strategy Nash equilibrium is nonsensical.



Pure NE doesn't make sense because it requires both parties to be passive.

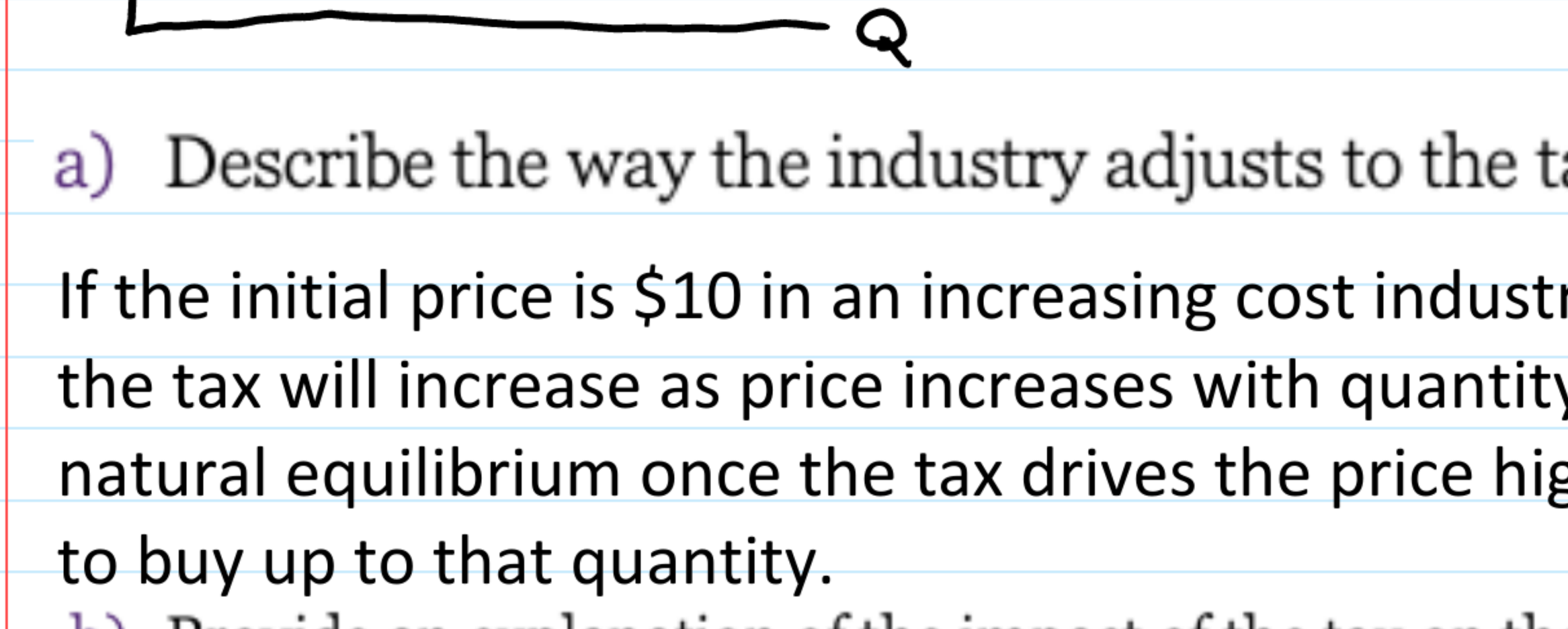
c) Why is cooperation in repeated games harder to sustain when interest rates are higher or when there are more players?

Cooperation in repeated games is harder to sustain when interest rates are higher because returns are diminishing so it is in a player's best interest to switch at some point to something that will benefit them more rather than cooperate. It's also harder to sustain cooperation with more players but this is because with more players there is a higher chance of having a crazy player who will deviate for no particular reason other than to cause havoc. Or a player may believe that another is going to deviate first and so they try and do it before the other one does to try and minimize losses.

4) Supply and Demand Models for Highly Competitive Markets

Consider a highly competitive increasing cost industry beginning in long run equilibrium at an initial price of $10 with no taxes, upon which a 10% sales tax is levied.

c) Illustrate with an appropriate diagram.



a) Describe the way the industry adjusts to the tax over time.

If the initial price is $10 in an increasing cost industry, then the dollar amount of the tax will increase as price increases with quantity. The industry should reach a natural equilibrium once the tax drives the price high enough that no one is willing to buy up to that quantity.

b) Provide an explanation of the impact of the tax on the price paid by consumer including the tax, the price received by suppliers net of the tax, and social surplus.

The producers will pass the entire cost of the tax on to the consumer and price the product so that after tax is taken out, their income is what they would have wanted to price the product at. Because the cost is increasing due to the tax, the social surplus is decreasing as the price moves along and up the long run cost curve.