

## Econ 302: Microeconomics II - Strategic Behavior

Midterm # 1 – June 16 2015,

**Answer Key**

1. **(5 points, Game Theory)** True/False/Uncertain? Explain your answer briefly (e.g., with an example)

In the following game,

		Column		
		Left	Center	Right
Row	Top			
	Bottom			

for player Column, if Left is a strictly dominated strategy, then either Center or Right must be a dominant strategy.

*False. The best way to explain this is to provide a counter example. For instance, the strategy Left can be dominated by the strategy Center but neither Center nor Right have to be dominant strategies, e.g., because Right is better than Center if Row plays Bottom but worse than Center if Row plays Top.*

		Column		
		Left	Center	Right
Row	Top	0, 1	1, 2	−3, −3
	Bottom	0, 0	−1, 2	−2, 3

2. **(8 points, Externalities)** The pipeline company Kinder Morgan currently plans to expand its Trans Mountain Pipeline, doubling the amount of oil and bitumen transported daily from Edmonton to the Burnaby Marine Terminal. Residents of Burnaby, Vancouver, and other Lower Mainland cities are worried about elevated chances of a major oil spill from increased tanker traffic in the Burrard Inlet. The mayors of those cities have unanimously declared their opposition to the plans. The project is projected to generate a revenue of \$18-billion at a cost of \$ 5-billion for Kinder Morgan. The expected collective (=aggregate) cost to the citizens from the increased spill potential is worth \$15-billion.

- a) Characterize the situation as one with externalities, and argue *carefully* why the pipeline expansion is not a Pareto optimal allocation.

*To show that building the pipeline is not Pareto optimal, we must find another allocation that makes at least one party better off without making anyone worse off. Here is such an allocation: the pipeline is not built and the citizens compensate Kinder Morgan by an amount of \$14-billion. The citizens are better off because paying \$ 14-billion is better than incurring \$ 15-billion disutility. Kinder Morgan is better off since being paid \$14-billion is better than the \$13 (=18-5)-billion profit it makes from the project.*

Show how the Coase theorem can help by proposing a Coasian solution (decision and transfers), assuming Kinder Morgan already has federal approval to go ahead with the project. *See above. Note that if Kinder Morgan does not have the right to go ahead with the project, no transfer is needed and the Pareto optimal allocation (no pipeline is being built) is already an equilibrium without any Coasian bargaining*

- b) Name at least 2 factors which could reasonably prevent the implementation of the Coasian solution above. Briefly explain.

*Generally speaking, transaction cost will prevent a Coasian solution. There are at least two obvious transaction cost here. First, the cost involved in getting the citizens organized to collectively be willing to pay the compensation (this includes things like raising the funds and dealign with legal issues of having Kinder Morgan sign a binding agreement with the citizens). Second, there is asymmetric information. If the citizen's willingness to pay for not having the pipeline being built is private information, the scheme is prone to free-rider problems (people claiming that they should contribute to the fund since their personal disutility is nil or small). Kinder Morgan also may try to get a larger share of the pie by claiming larger than actual projected profits from the project. Other potential issues include political economy considerations (if we need a vote to implement a tax scheme for the funding, will it pass?) as well as uncertainty regarding the federal decision on any agreement struck.*

- c) How would your solution in a) change if Kinder Morgan could alternatively build a new pipeline through an uncontroversial route at larger cost of 8-billion elsewhere?

*If Kinder Morgan can build a pipeline without any negative externalities elsewhere for \$8-billion, then this is a Pareto optimal allocation (there is no way to make Kinder Morgan or the citizens better off without making at least one of them worse off). But to implement this allocation, we **still need Coasian bargaining**. This*

is because in the absence of bargaining, Kinder Morgan will extend the Burnaby pipeline. Here is one possible deal that works: if the company chooses a different route, the citizens pay \$4-billion, and are better off by \$15 - 4 = 7-billion. The company's profit from building elsewhere is now \$18 - 8 + 4 = 14-billion, and so it is better off by \$1-billion compared to the \$13-billion profit it makes with the Burnaby route.

3. (12 points, Monopoly) A typical inhabitant of Smallville has a demand function for electricity  $q = 800 - 20p$ , where  $p$  price (in cents) per kw-hour and  $q$  is the kw-hours per week. Electricity is being provided by the monopoly Greed Industries., at a constant marginal cost of 10 cents per kw-hour.

- a) Determine the price  $p^m$  and the quantity  $q^m$  that maximize Greed Ind.'s profits under ordinary (linear) monopoly pricing.

The inverse demand function for each customer is  $p = 40 - \frac{1}{20}q$ , so the per-customer profit of Greed Inc. is

$$\Pi = \left(40 - \frac{1}{20}q\right)q - 10q$$

Maximizing with respect to  $q$  gives  $q^m = 300$  kw/hour and the corresponding price is  $p^m = 25$  cents/kw.

- b) The government of Smallville is concerned that the price of electricity is too high. It decides to pay Greed Ind. a *subsidy* of 5 cents per kw-hour supplied. Determine the new profit-maximizing quantity and price for Greed Ind.. Calculate the resulting *net* change in total welfare and give an intuition for your finding. You may illustrate your arguments graphically. Note: you can assume that the total cost of subsidy is a net transfer from consumers to producers (e.g. because the subsidy is paid for by a lump sum tax)

The subsidy will reduce the marginal cost of Greed by 5, so the new profit is

$$\Pi = \left(40 - \frac{1}{20}q\right)q - 10q - 5q = \left(40 - \frac{1}{20}q\right)q - 5q.$$

The new profit maximizing quantity per customer and price per kw are now  $q^m = 350$  kw/hour and  $p^m = 22.5$  cents/kw. To calculate the net change in welfare, let's look at consumers first. The net change in consumer surplus, taking into account that

each consumer has to pay  $5 \times 350$  additionally for the subsidy, is  $[\frac{1}{2}(40 - 22.5) - 5] \times 350 - \frac{1}{2}(40 - 25) \times 300 = 1312.5 - 2250 = -937.5$ , so consumers are worse off (due to having to pay the bill of the subsidy; otherwise, they would be better off). The monopolist must be better off since it could always have chosen to continue to produce 300 units, and got the subsidy in addition. Indeed, we have  $(22.5 + 5 - 10) \times 350 - (25 - 10) \times 300 = 6125 - 4500 = 1625$ . Note that  $1625 - 937.5 > 0$  so the net welfare gain is positive.

*Intuition:* The monopoly produced “too little”. The quantity increased with the subsidy, thereby moving ‘closer’ to the welfare maximizing (Pareto efficient) quantity of 600 kw/hour which is where demand equals marginal cost. Hence, efficiency increases with means a net gain in total welfare.

- c) The CEO of Greed Ind. lobbies the government to be allowed to charge a two-part tariff (weekly fee + per-kw-price) instead of a linear price. He even offers to forgo the subsidy. The government asks you for an opinion. Should it allow the new pricing scheme and save consumers the cost of the subsidy? Explain!

*If Greed is allowed to employ a two-part tariff, it will charge a per-unit price equal to marginal cost (so 10 cents/hour) and a weekly fee that extracts the entire consumer surplus. The resulting quantity is  $q = 600$  kw/hour with a total consumer surplus of  $\frac{1}{2}(40 - 10) \times 600 = 9000$ . So the fixed fee is \$90 per week. The resulting allocation is Pareto efficient. If you are an economist strictly interested in efficiency, you therefore would be in favour of allowing the two-part tariff. If you are concerned with consumer welfare, however, you may object since the utility of each consumer drops from 1312.5 to zero despite not having to pay the subsidy.*