Information Economics, Spring 2013
Homework 3

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Note 1. This homework is due **5:00 pm, October 11, 2013**. Please submit a hard copy into the instructor's mail box. As each team only needs to submit one copy, please indicate the names and student IDs of all team members on the first page.

Note 2. Each team must have **_exactly three_** students unless a special approval is obtained.

1. (10 points) Consider the channel structure game in McGuire and Staelin (1983) with pricing games D1, M1, and I1. When $\theta = \frac{1}{2}$, show that II is a unique Nash equilibrium.

2. (20 points) As we mentioned in class, while the Bertrand competition under pure integration makes the prices too low, switching to pure decentralization drives the prices up. A natural question is: Is it possible for the prices to go back to the efficient level? In this problem, we will address this issue.

   (a) (5 points) Find $p^*(\theta)$, the efficient price under complete integration for $\theta \in [0, 1]$. This can be found by assuming that the two manufacturer collude to choose a price to maximize industry profit;

   (b) (10 points) For $\theta \in [0, 1]$, draw the following three curves: (1) $p^*(\theta)$, (2) $p^I(\theta)$, the equilibrium price under pure integration (II), and (3) $p^D(\theta)$, the equilibrium price under pure decentralization (DD).[1] Compare $p^D(\theta)$ and $p^*(\theta)$. When is $p^D(\theta)$ higher and when is $p^*(\theta)$ higher?

   (c) (5 points) Does adding one level of intermediary drive the price back to the efficient level? If so, under what value(s) of θ?

3. (50 points) Consider the following dynamic game between the owner of a retail store and a worker in the store. We will call the owner "the retailer". Suppose the retailer only sells one product, whose production cost is normalized to 0. In each day, the retailer first chooses a retail price p and then the worker chooses a service level a. Given p and a, the demand of this product is $1 - p + a$. In other words, better services attract more consumers. However, better services do not come with no cost. Suppose the cost for offering service level a is $\frac{1}{2}a^2$. Both the retailer and the worker want to maximize their own profit. The retailer's profit is the sales revenue minus the worker's salary. The worker's profit is his salary minus his cost of services.

   (a) (5 points) Suppose the retailer offers the worker a fixed payment $t \geq 0$. Show that the worker will provide the minimum service, i.e., the equilibrium service level is 0. Then find the equilibrium price and the two players' equilibrium profits.

   (b) (10 points) Suppose the retailer shares the sales revenue with the worker by setting a commission rate $v \in [0, 1]$. If the total sales revenue is π, the retailer gets $(1 - v)\pi$ and the worker gets $v\pi$. Given the announced v and p, what is the equilibrium service level?

   (c) (10 points) Continue from Part (b), what are the equilibrium price and commission rate?[2] What are the equilibrium profits of the two players?

   (d) (5 points) Compare your answers in Part (a) and (c). Does the contract with a commission rate increase both players' profits? Does it decrease both players' profits? Does it make one player better off and the other worse off?

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[1]You should see that $p^*(\theta) > p^I(\theta)$ and $p^D(\theta) > p^I(\theta)$, which verify our intuitions that horizontal decentralization (from colluding to competition) drives down the price and vertical decentralization (from II to DD) drives up the price.

[2]To solve this two-dimensional optimization problem, you need to apply the FOC twice, once for v and once for p.

(e) (10 points) Now consider the first best case, in which the retailer "integrates" the worker.[3] What are the efficient price and service level? What is the system profit?

(f) (10 points) Compare your answers in Part (c) and (e). Is the contract with a commission rate efficient, i.e., making the two players together earn the system profit? Is the equilibrium price efficient? Is the equilibrium service level efficient? If no for either question, is it too high or too low? Given economic arguments (i.e., intuitions) to explain why.

4. (20 points) Recall that we introduced the principle of the second best in Lecture 4.3. The principle, which is also called the theory of the second best, has the following explanations on Wikipedia:[4]

> In welfare economics, the theory of the second best concerns what happens when one or more optimality conditions cannot be satisfied. Canadian economist Richard Lipsey and Australian economist Kelvin Lancaster showed in a 1956 paper that if one optimality condition in an economic model cannot be satisfied, it is possible that the next-best solution involves changing other variables away from the ones that are usually assumed to be optimal.
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> This means that in an economy with some uncorrectable market failure in one sector, actions to correct market failures in another related sector with the intent of increasing overall economic efficiency may actually decrease it. *In theory, at least, it may be better to let two market imperfections cancel each other out rather than making an effort to fix either one.* Thus, it may be optimal for the government to intervene in a way that is contrary to usual policy. This suggests that economists need to study the details of the situation before jumping to the theory-based conclusion that an improvement in market perfection in one area implies a global improvement in efficiency.
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> Even though the theory of the second best was developed for the Walrasian general equilibrium system, it also applies to partial equilibrium cases. For example, consider a mining monopoly that's also a polluter: mining leads to tailings being dumped in the river and deadly dust in the workers lungs. Suppose in addition that *there is nothing at all that can be done about the pollution. However, the government is able to break up the monopoly.*
>
> The problem here is that increasing competition in this market is likely to increase production (since competitors have such a hard time restricting production compared to a monopoly). Because pollution is highly associated with production, *pollution will most likely increase.* Thus, it is not clear that eliminating the monopoly increases efficiency. Gains from trade in coal will have been eliminated, but externalities from pollution will have increased.

Find an real-world example of the principle of the second best, i.e., "when you cannot control everything, it is better to give away of control of something." Your story may be about some firms in a business environment of your daily life. In either case, give some economic arguments about how the principle explains those happen in your story.

References

McGuire, T. W., R. Staelin. 1983. An industry equilibrium analysis of downstream vertical integration. *Marketing Science* **2**(1) 115–130.

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[3]You may imagine that the worker is the son of the retailer and they together determine the retail price and service level to maximize system profit.

[4]http://en.wikipedia.org/wiki/Theory_of_the_second_best.