

AGSM 306
R. E. Marks

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STRATEGIC GAME THEORY FOR MANAGERS

Problem Set 1

*Note: Make any economic assumptions you think necessary, but make them explicitly. You may talk to fellow students about this, but **do not copy** others' work.*

1. (10) Imagine that there are three major television stations in a large city: RBC, CBC, and MBC. All three stations have the option of airing the evening news program live at 6:00 pm, or in a delayed broadcast at 7:00 pm. Each station's objective is to maximize its viewing audience in order to maximize its advertising revenue. The following normal-form representation describes the share of the population that is "captured" by each station as a function of the times at which the news programs are aired.
 - a. The stations make their choices simultaneously. The payoffs are list in the order RBC, CBC, MBC. Find the set of Nash equilibria. Explain.

MBC News @ 6:00 pm —

		C B C N e w s	
		6:00 pm	7:00 pm
RBC News	6:00 pm	(14%, 24%, 32%)	(8%, 30%, 27%)
	7:00 pm	(30%, 16%, 24%)	(13%, 12%, 50%)

MBC News @ 7:00 pm —

		C B C N e w s	
		6:00 pm	7:00 pm
RBC News	6:00 pm	(16%, 24%, 30%)	(30%, 16%, 24%)
	7:00 pm	(30%, 23%, 14%)	(14%, 24%, 32%)

Payoffs: (RBC, CBC, MBC)

- b. What is the definition of a dominated strategy?
- c. Suppose now that the stations interact sequentially. First, MBC chooses between 6:00 and 7:00. Then, after observing MBC's choice, RBC decides between 6:00 and

7:00. Finally, after observing the behaviour of both MBC and RBC, CBC chooses either 6:00 or 7:00. Payoffs are unchanged. Draw a game tree of this sequential interaction and identify the subgame perfect equilibrium. Is the outcome different from part a.? Explain.

2. (15) Bob and Mike both sell DVD playback machines, and both have per-unit costs of \$250. They compete on price: the low-price seller gets all the market, and they split the market if they have equal prices. Each prices without knowing the other's price.
- a. Using the tools of game theory, explain why the only Nash equilibrium has both firms charging \$250, splitting the market, and making zero profit.

Suppose the monopoly price for DVD players (the price that maximises the sum of the profits of both firms) is \$300. Now suppose Bob advertises that if a customer buys a DVD player from him for \$300 and discovers he or she can buy it more cheaply at Mike's, then Bob will sell the customer the DVD player with a rebate equal to twice the price difference between the two stores (e.g., if Mike charges \$275, then Bob will give the customer a rebate of $(\$300 - \$275) \times 2 = \$50$). Suppose Mike does the same thing.

- b. Using the tools of game theory, show that it is now Nash for both stores to charge \$300. (Conclusion: pricing strategies that seem to be super competitive can in fact be anticompetitive!)
3. (10) A debtor owes \$15,000 to each of two creditors, but he only has \$25,000. If he defaults on the debt, he will lose the whole amount, and the legal costs of filing for bankruptcy and litigating the liquidation of his assets will be \$15,000, so each of the debtors will collect \$5,000. The debtor has his solicitor draw up the following letter, which he sends to each of the creditors: "I hereby offer you \$5,001 if both you and my other creditor agree to cancel my debt. If one or both of you decline this offer, I will be legally in default."

Write a game tree for this situation. and show that it is a dominant strategy for each creditor to accept the offer, allowing the debtor to eradicate his debt and retain the amount \$14,998 for himself. (What does this tell you about bankruptcy law?)

Note: this simple example of a coordination problem is related to a proposal for debt forgiveness of shaky financial institutions in the current crisis, by Luigi Zingales (2008) "Why Paulson is Wrong," *The Economists' Voice*: Vol. 5: Iss. 5, Article 2. Available at: <http://www.bepress.com/ev/vol5/iss5/art2>

"During the Great Depression, many debt contracts were indexed to gold. So when the dollar convertibility into gold was suspended, the value of that debt soared, threatening the survival of many institutions. The Roosevelt Administration declared the clause invalid, de facto forcing debt forgiveness. The Supreme Court upheld this decision.

Current Fed Governor Randall Koszner studied this episode and showed that not only stock prices, but bond prices as well, soared after the Supreme Court upheld the decision. How is that possible? As corporate finance experts have been saying for the last thirty years, there are real costs from having too much debt and too little equity in the capital structure, and a reduction in the face value of debt can sometimes benefit not only the equityholders, but also the debtholders.

If debt forgiveness benefits both equity and debtholders, why do debtholders not voluntarily agree to it? First of all, there is a *coordination problem*. Even if each individual debtholder benefits from a reduction in the face value of debt, she will benefit even more if everybody else cuts the face value of their debt and she does not. Hence, everybody waits for the other to move first, creating obvious delay. Secondly, from a debtholder point of view, a government bailout is better. Even talk of a government bail-out reduces the debtholders' incentives to act, making the government bail-out more necessary.

As during the Great Depression and in many debt restructurings, it makes sense in the current contingency to mandate a partial debt forgiveness or a debt-for-equity swap in the financial sector. It has the benefit of being a well-tested strategy in the private sector and it leaves the taxpayers out of the picture. But if it is so simple, why has no expert mentioned it?

The major players in the financial sector do not like it. It is much more appealing for the financial industry to be bailed out at taxpayers' expense than to bear their share of

pain. Forcing a debt-for-equity swap or a debt forgiveness would be no greater a violation of private property rights than a massive bailout, but it faces much stronger political opposition.”

Luigi Zingales is the Robert C. McCormack Professor of Entrepreneurship and Finance, University of Chicago Graduate School of Business, has won the 2003 Bernacer Prize for the best European young financial economist, the 2002 Nasdaq award for best paper in capital formation, and is author of *Saving Capitalism from the Capitalists* (Princeton U. P.), together with Raghuram G. Rajan.

4. (14) Suppose the Intel Corporation and the Microsoft Corporation are considered engaging in a joint venture. Each will have to invest \$10 million in assets that will then be of no use or value outside this project. If both firms act in accord with their promises, the annual economic profit to each firm is \$2.5 million. If one or both do not act in this way, the annual economic profit to each is as shown below (Intel, Microsoft, in millions):

Possible strategies for Intel	Possible strategies for Microsoft	
	Act in accord with promises	Don't act in accord with promises
Act in accord with promises	\$2.5, \$2.5	-\$1, \$5
Don't act in accord with promises	\$5, -\$1	\$0, \$0

- In the absence of a contract, would the joint venture generally be a good idea? Explain.
- Suppose a contract can be formulated that will ensure that both firms will act in accord with their promises. Will either firm enter into the joint venture (assuming their lawyers' fees are nominal)? Why or why not?
- Explain why might it be very difficult to formulate an effective contract of this sort.
- Is this an ordinary Prisoner's Dilemma game? If not, why not?

5. (16) What is the definition of a strategic interaction? Consider a strategic situation that you are personally familiar with from work, uni, or through social contacts.
- a. Describe it, briefly. Who are the players?
 - b. What are the possible actions of each of them? Does one (or more) move first (and be seen to move first)? Who?
 - c. Plot an outcomes matrix or game tree (if the number of players is not too many, and the number of possible actions is not too many) with the outcomes for each. If the matrix is a cube or worse, discuss a few of the possible combinations of actions and the payoffs for each player.
 - d. Can you reduce the numbers of possible actions? If so, do so.
 - e. Are there one or more players who are peripheral (whose actions have only a marginal impact on the other players)? If so, remove them.
 - f. Can the outcomes be easily ranked for each remaining player? If so, do so.
 - g. Can you solve for the equilibrium of the interaction (perhaps using a game tree, if appropriate)? Do so. If not, why not? (What additional information would allow solution?)

(See an example below.)

(Names have been changed to protect the innocent.)

A student reports:

I have a girlfriend, Justine, who was privy to a delicate situation involving her sister, Brenda. Brenda had recently married and so it was both distressing and startling for Justine to receive a phone call from Brenda to confide that she was having a secret affair with another man. This had been going on for only a couple of weeks, and she was by all accounts “deeply in ♥” with this particular person. Justine on the other hand was terribly upset as she knew Brenda’s husband from their long period of dating and engagement, and believed him to be a genuine, sincere, loving and trusting man. Justine felt that in no way did he deserve this treatment from her sister and told Brenda her thoughts on this in no uncertain terms. She also told Brenda that she felt she, Justine, had a moral obligation to tell Brenda’s husband, since Brenda was not going to divulge her indiscretion,

and that Brenda should terminate the affair immediately.

Brenda and Justine were separated geographically, with Brenda living in Adelaide and Justine in Sydney. They had ended their conversation heatedly, and both had to decide what to do: essentially, Justine had to decide whether or not to ring Brenda's husband and tell him his wife was having an affair, whilst Brenda had decided whether to terminate the affair or not. Given that the conversation had ended so badly, with no chance of further dialogue (at least in the short term) between them, their decisions had to be made independently.

If Brenda terminates the affair, probably the best thing that Justine can do is to maintain the secret. This is because if Justine told the husband and Brenda had terminated the affair, it would lead to considerable domestic strife, and Brenda would probably estrange Justine. The salve to Justine's conscience would be the fact that Brenda had ceased the affair. If Brenda were to continue the affair, then Justine's best course of action would probably be to maintain the secret. This was reasoned to me by Justine, who indicated Brenda would irrevocably estrange her, and it would probably precipitate Brenda leaving her husband immediately, precluding any chance for Brenda to see her foolishness and terminate the affair herself.

From Brenda's point of view, if Justine told her husband, her best course of action would probably be to continue the affair, since, in the telling, Brenda would be forced to separate from her husband. If Justine maintained her silence, the best course of action for Brenda could be to continue the affair, since Brenda was gaining considerable satisfaction from her tryst.