

Problem Set 4

Due Saturday, February 28th at 6pm

Problem 1

For each of the following statements, argue if it is TRUE, FALSE, or UNCERTAIN.

1. There is always deadweight welfare loss in monopolistic markets.
2. Analogously to the general equilibrium in the Robinson-Crusoe economy, Nash equilibria are always Pareto-efficient.

Problem 2: Utilities pricing

There are two types of consumers in the market for domestic electricity: one is a work-from-home consumer who uses electricity throughout the day, and the other is a non-work-from-home consumer who uses electricity only at night. In other words, the work-from-home consumer derives higher utility from electricity than the non-work-from-home consumer. In this framework, consumers choose how much electricity C to consume and how much income to allocate to the numeraire good C_0 .

Thus, the utility functions for these two types of consumers are:

$$U_1(C, C_0) = 18 \ln(1 + C) + C_0,$$

$$U_2(C, C_0) = 8 \ln(1 + C) + C_0.$$

The electricity provider is a monopolist in the local market with a constant marginal cost of production of \$2 per unit of electricity.

1. Consider a world in which the electricity provider asks consumers about their employer, from which it can credibly infer whether they are work-from-home consumers or not. It decides to offer an individually tailored package (q units of electricity for T dollars) to each consumer. What packages will it offer to each type of consumer?
2. Now, consider what happens when the provider decides to charge per unit of electricity, rather than sell packages of electricity (p dollars per unit of electricity). It can still infer the type of consumer and thus charge different prices based on that. What prices will it charge to each type of consumer? How much electricity will each type of consumer consume?
3. Now, after some time, consumers realize they can lie about their employer to the electricity provider to get a lower price. The provider learns about this and decides to offer everyone two types of electricity packages, hoping that different types of consumers will self-select into different packages. Which packages will the provider design?
4. Compare total production quantities and consumer welfare across the three scenarios above. Which scenario maximizes aggregate consumer welfare?

Problem 3

Consider a game that is captured by the following table:

		Player 2	
		A	B
Player 1	A	0, 0	3, 1
	B	1, 3	2, 2

1. Write down the full analytical description of the game captured by this table. That is, define the players, their available actions, and their payoffs.
2. Find Nash equilibria of this game in pure strategies.
3. Are there profiles of actions that Pareto-dominate at least one of the Nash equilibria? Do the Nash equilibria Pareto-dominate any of the possible profiles of actions?
4. Based on your answers to the above, which type of game is this (among “Prisoner’s Dilemma”, “An Arms Race”, “Bach or Stravinsky”, “Hawks & Doves”, and “Competitive game”)?
5. Find Nash equilibria of this game in mixed strategies.
6. What are the expected payoffs of both players in this Nash equilibrium?
7. Is the mixed-strategy Nash equilibrium Pareto-dominated by any of the pure-strategy Nash equilibria?

Problem 4: Why does antitrust sue a monopolist over minor cases?

There is a monopolist in the market, considering abusing its market power by preventing entry of potential competitors, which is illegal. If it does so, it receives a payoff of 1.

The antitrust authorities are concerned about the monopolist’s behavior. They believe they have a strong case and can convince the judge to strike down the monopolist’s anti-competitive behavior. If they do not take action, the harm to social welfare from the monopolist’s anti-competitive behavior is (-2) . If the antitrust authorities bring a case against the monopolist, they incur a cost of (-1) to prepare evidence and analysis for court. At the same time, the monopolist hires a top-tier but expensive team of economic consultants and lawyers to fight the case. This team charges the monopolist (-3) , but ensures the court rules in favor of the monopolist. In this scenario, the authorities end up with a payoff of (-3) , including the welfare harm and preparation costs, while the monopolist ends up with (-2) due to consulting and litigation costs.

If the antitrust authorities do not bring a case and the monopolist hires a team of economic consultants and lawyers, the monopolist still incurs a cost of (-3) . If the monopolist does not violate competition laws, the antitrust authorities do not incur any costs.

1. Set up a strategic game between the monopolist and the antitrust authorities, assuming both parties make decisions simultaneously.
 - 1.a. Write down the players, their available actions, and their payoffs from profiles of actions.
 - 1.b. Write down a payoff table that captures this game.
2. What are the Nash equilibria of this game?
3. Now, consider a dynamic set-up where both the monopolist and the antitrust authorities know that after the current case is resolved, there will be another opportunity for the monopolist to abuse its market power. The game consists of 4 periods:

Period 1: Monopolist decides whether to abuse its market power.

Period 2: Antitrust authorities decide whether to sue the monopolist.

Period 3: A new opportunity arises for the monopolist to abuse its market power.

Period 4: Antitrust authorities decide whether to sue the monopolist for the violation in Period 3.

In this multi-period context, the benefits and costs of litigation in periods 3 and 4 for both players depend on the previous history. If the antitrust brought a case to court in Period 2, both parties spend fewer resources on litigation preparations due to prior experience or established relationships with consultants. As a result, the net benefit to litigation for the antitrust becomes $(-.5)$ and for the monopolist: $(+.5)$. Formally, this means the history (Violate, Pursue, Violate, Pursue) yields (-1.5) to the monopolist and (-3.5) to the antitrust authorities.

If the parties did not litigate in period 2, the benefit/cost structure remains the same as in the simultaneous setup.

- 3.a. Figure 1 shows an incomplete game tree for this game. Fill out the remaining payoffs.
- 3.b. Derive the best responses for the antitrust in the last period for every possible history. *Hint:* This involves comparing the payoffs for the antitrust between the neighboring lowest offshoots of the game tree.
- 3.c. Move one period back and choose the best response for the monopolist to every possible previous history, given the best response of the antitrust in the last period. *Hint:* The answer should have the following form for all 2-period-long histories: $s_M((\text{Violate}, \text{Pursue})) = \text{Not Violate}$.
- 3.d. Move one period back and find the best response for the antitrust to every possible previous history, given that it knows how the events would evolve under any choice. *Hint:* The answer should have the following form: $s_A((\text{Violate})) = \text{Pursue}$.
- 3.e. Finally, what would the monopolist prefer to do in the first period?

- 3.f. Put together the answers to the previous questions and write down the equilibrium of this game.
- 3.g. Write down the history that takes place in the equilibrium. Did the antitrust improve social welfare by credibly threatening to fight the monopolist in period 2 despite the waste of resources from the contemporaneous perspective?

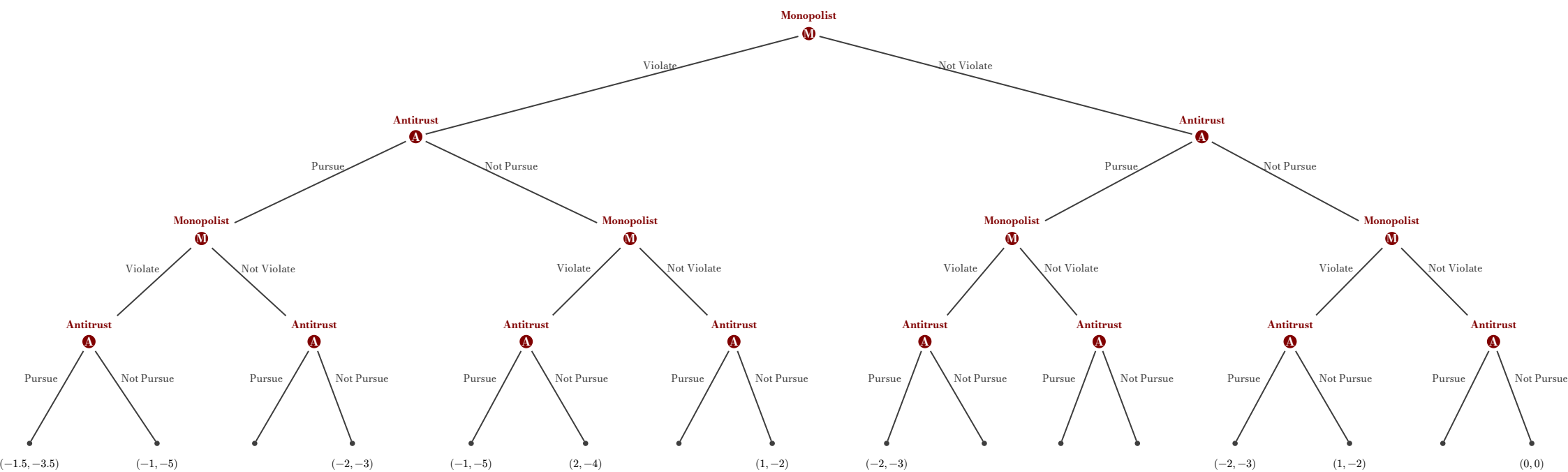


Figure 1: Game tree for the interaction between the monopolist and antitrust authorities