

## PS4, Ex. 2: Entry deterrence (backwards induction)

Consider the following dynamic game:  
firm 1 owns a shop in town A. Firm 2 decides whether to enter the market in town A. If firm 2 enters, firm 1 chooses whether to fight or accommodate the entrant. If firm 2 does not enter, firm 1 receives a profit of 2 and firm 2 gets 0. If firm 2 enters and firm 1 accommodates, they share the market and each of them receives a profit of 1. If firm 2 enters and firm 1 decides to fight, firm 2 suffers a loss of 1 (so that the payoff is -1), but fighting is costly for firm 1, lowering its payoff to 0.

- (a) Draw the game tree.
- (b) Solve the game by backwards induction.

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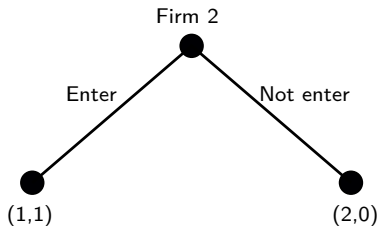
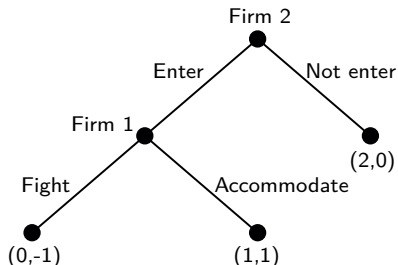
**Starting from the bottom:** If Firm 2 has entered the market in the 1<sup>st</sup> round, then Firm 1 can choose to either fight or accommodate in the 2<sup>nd</sup> round.

**Firm 1** will always accommodate, as it is more costly to fight ( $1 > 0$ ).

Knowing that Firm 1 is rational and will accommodate in the 2<sup>nd</sup> round, **Firm 2** (first mover), will always choose to enter in the 1<sup>st</sup> round ( $1 > 0$ ), i.e. the backwards induction solution is the strategy profile:

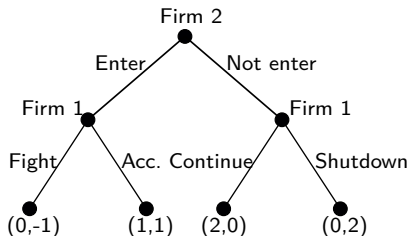
$$(s_1, s_2) = (\text{Accommodate}, \text{Enter})$$

**Intuition:** Firm 2 has *first mover advantage*, thus, to "Fight" would not be a credible threat given Firm 1 is rational. I.e. Firm 2's decision can be reduced to the upper part of the game tree.



(c) What is the solution now?

**Looking at the new choices:** If Firm 2 chooses to not enter in the 1<sup>st</sup> round, then Firm 1 can choose to either continue as normal or shut down in the 2<sup>nd</sup> round, effectively handing over the whole market to Firm 2 instead.



## PS4, Ex. 2 extra: Choices off the equilibrium path

(a) What is the solution now?

**Looking at the new choices:** If Firm 2 chooses to not enter in the 1<sup>st</sup> round, then Firm 1 can choose to either continue as normal or shut down in the 2<sup>nd</sup> round.

**Firm 1** will always continue, as it will gain nothing in a shutdown ( $2 > 0$ ).

Knowing that Firm 1 is rational and will choose to continue in the 2<sup>nd</sup> round, **Firm 2** (first mover), would get 0 by not entering in the 1<sup>st</sup> round, so to enter in the 1<sup>st</sup> round will be the best response ( $1 > 0$ ), i.e. the backwards induction solution is the strategy profile:

$(s_1, s_2) = (\text{"Accommodate"} \text{"Continue"}, \text{"Enter"})$

**Off the equilibrium path:** The strategy profile now reflect choices off the equilibrium path, this is done because firm 1's choices off the equilibrium path might be relevant to the equilibrium path.

