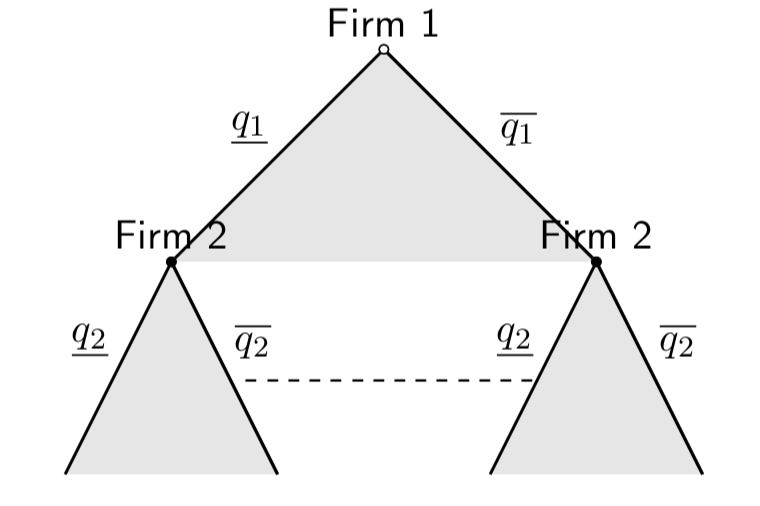
**4.4: Stackelberg Leader & Follower (Sequential)**

* The leader implements the first player’s Reaction Function intro their Payoff Function
* First mover advantage as leader gets higher payoff
* Recall from Sequential Games: Backward Induction
* **Linear Demand**:
* **Constant Marginal Costs**:
* **Profits**:
* Firm 1 moves, Firm 2 observes and moves
* Firm 1: Leader; Firm 2: Follower
* Recall Observation:
* Backward Induction:
  + Stage 2: Firm 2 maximises profits given

Firm 2 uses Best Response to whatever Firm 1 produces

* + Stage 1: Firm 1 anticipates reaction of Firm 2 to any decision made

Firm 1 maximises profits given response of Firm 2

Firm 1 chooses point on Firm 2’s Reaction Function which maximises profits

* **Stage 2:**
  + Given what’s the best for Firm 2 (follower) to do? – As Previously…
  + Recall: (Payoff Function)
  + Optimise and {=0}:
  + React: (Reaction Function)
* **Stage 1:** 
  + Firm 1 (Leader) will choose to max. profits taking into account the reaction of the follower
  + Recall: (Payoff)
  + It Knows: if they choose Firm 2 will respond with – account
  + Firm 1 (Leader):

* So Firm 1 Maximises:
* Therefore: (Reaction)
* So Firm 2 (Follower): (Reaction)
* Stackelberg Equilibrium \*\*
  + Idea Is: rather than equilibrium, there is an advantage
  + ; ;
* Stackelberg vs. Cournot:
  + Cournot: ; ; ;
  + Stackelberg: ;

;

; ;

* Hence, First Mover (Firm 1) Advantage!

**5: Applications of Prisoner’s Dilemma**

**5.1: Recalling The Cournot Game**

* An example of a continuous game
* Rather than using Reaction Functions, find Isoprofit Curves
* This is like indifference curves for firms
* Call Firms:
* Strategies:
* Payoff:

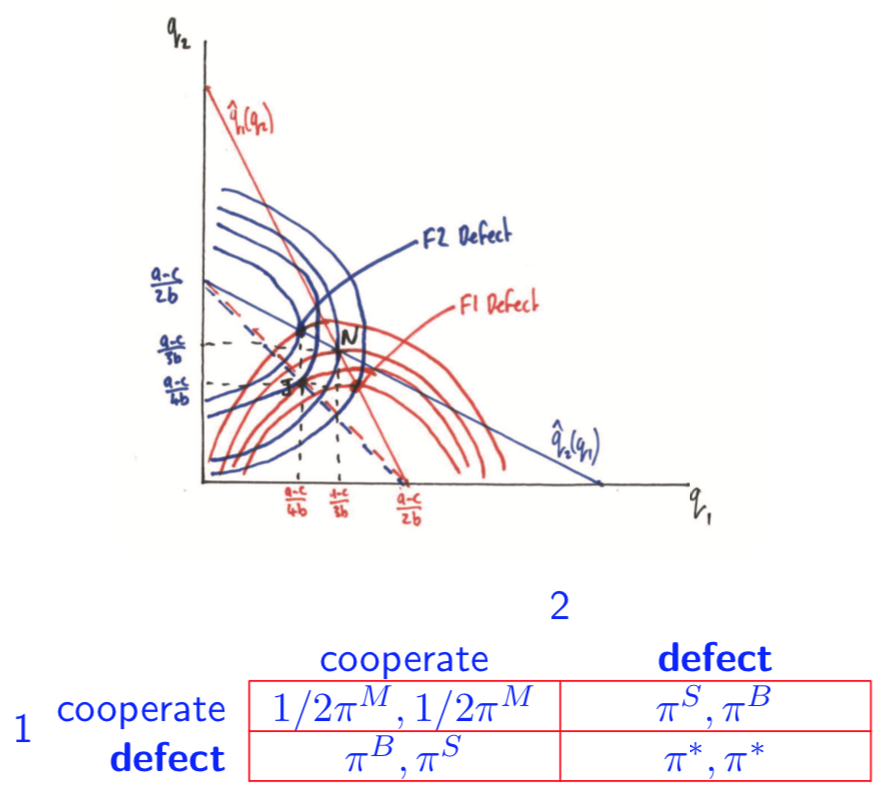
***5.1.1: Typical Reaction Function***

* + From Isoprofit contours
  + Equilibrium at intersection:

***5.1.2: Maximising Joint Profit***

* Hence: assuming ;
  + Makes sense as:

***5.1.3: Will Firms Agree?***

* Will firms agree to produce at half the monopoly output?
* **No**: if firms expect you to produce more than ;
  + Best possible: 🡪 must expand output in excess of Cournot Output
  + Defecting firm: **Bonanza** Payoff
  + Cooperating firm: **Sucker** Payoff
* Hence: Prisoner’s Dilemma

**5.2: Externalities & Strategic Nature**

***5.2.1: Externalities***

* **Negative**:
  + You do more, you lower my payoff (Cournot Game)
  + (Slope of Payoff Function)
* **Positive**:
  + You do more, you lower my payoff
  + (Slope of Payoff Function)

***5.2.2: Strategic Nature***

* **Strategic Substitutes**:
  + Opponent does more of their action: you optimally do less (Reaction Function downward)
  + “with a higher *xj* the optimum is with a lower *xi*”
* **Strategic Compliments**:
  + Opponent does more of their action: you optimally do more (Reaction Function upward)
  + “with a higher *xj* the optimum is with a higher *xi*”

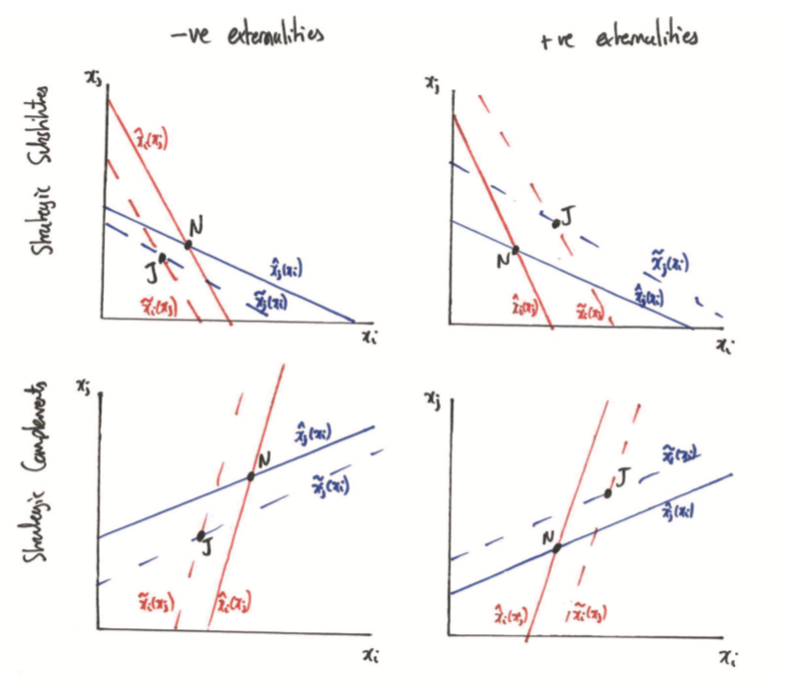
**5.3: Nash Equilibrium in Games**

* When non-cooperative, players optimise self-interest
* Marginal Payoff = 0: &
  + *Note that hat implies function*
* Nash Equilibrium at: Equilibrium
  + Thus Nash Equilibrium actions:

**5.4: Social Planner**

* What happens when they ‘internalise’ the externality?
* Social Planner maximises joint payoff
  + - Chooses to maximise
    - 🡪 these are both Social Optimums

**5.5: Nash Equilibrium vs. Optimum**

* w/ **Positive Externalities**
  + {}
  + So for Social Planner {}
  + So:
* w/ **Negative Externalities**
  + {}
  + So for Social Planner {}
  + So: