Fairness and Social Preferences

<u>Pure Self-Interest:</u> Standard economics often assume that agents make decisions out of pure self-interest

<u>Social Preferences:</u> In many scenarios, however, people exhibit **social preferences** or **other-regarding preferences**:

- Individuals who exhibit social preferences behave as if they value the payoffs of relevant reference agents
- Others' payoffs can be valued positively or negatively, depending on our perceptions of their beliefs and intentions

We would in general divide social preferences into two types:

Distributive preferences	Preferences over the final distribution eg. Equity, efficiency, altruism • Related to **consequences or outcomes**
Reciprocal preferences	Desire to reward or punish others beyond mere consequences eg. Being "more than fair" to someone who has been fair to you • Related to **intentions of agents**

Fairness

- These social preferences often represent what is considered to be "fair" by the decision maker
- The concept of fairness is central to understanding people's beliefs regarding important issues such as market mechanisms and outcomes, prices and wages etc

Kahneman, Knetsch, Thaler (1986) use phone surveys to identify community standards of fairness in various scenarios, and consider its implication for market outcomes.

Example: Football Tickets

A football team normally sells tickets on the day of their games. Recently, interest in the next game has increased greatly, and tickets are in great demand. The team owners can distribute the tickets in one of three ways:

1. By auction: the tickets are sold to the highest bidders
2. By lottery: the tickets are sold to the people who names are drawn
3. By queue: the tickets are sold on a first-come first-served basis

Subjects are asked to rank the three options from the most fair to the least fair according to their perceptions:

Allocation Method	Most fair (%)	Least fair (%)
Auction	4	75
Lottery	28	18
Queue	68	7

Therefore in this case, people's fairness judgement is not consistent with the economic efficiency rankings.

- We know that auctions will give the highest efficiency
- Highest WTP will receive the object and lowest WTP will miss out

Example: Wage

Indicate whether you think the following scenarios are acceptable or unfair.

1) A small photocopying shop has one employee who has worked in the sop for 6 months and earns $9 an hour. Business continues to be satisfactory, but unemployment has increased in the area. Other firms have now hired similar workers at $7. The owner of the photo shop reduces the employee's wage to $7

2) A small photocopying shop… The current employee leaves, and the owner decides to pay a replacement $7 an hour

Results:

1) Acceptable 17%; Unfair 83%
2) Acceptable 73%; Unfair 27%

Game Theory Primer

Game Theory: is the study of how agents behave in strategic situations

- In a **strategic situation**, each person, in deciding what actions to take, must consider how others might respond to that action
- A **Game** is defined by players, their available actions, resulting payoffs, and structure (timing of moves, whether Nature moves)

Prisoner's Dilemma

Prisoner's Dilemma

- Two suspects are arrested, but the police do not have enough information for a conviction
- The police separate the two suspects, and offer both the same deal:
  - If one confesses, and the other denies, the "betrayer" goes free and the one that denies gets a 20 year sentence
  - If both deny, each receives a one year sentence
  - If both confesses, each receives a 5 year sentence
- Each suspect must choose either to confess or deny; the decision of each is kept secret from his partner until the sentence is announced

	Prisoner B		
Prisoner A		Confess	Deny
	Confess	-5,-5	0,-20
	Deny	-20,0	-1,-1

Best Response: The strategy in a single period that creates the most favourable immediate outcome for the current player, taking other players' strategies into account. For example:

- Given Prisoner A confesses, Prisoner B's best response would be to confess
- Given Prisoner A denies, Prisoner B's best response would be be to confess
- Given Prisoner B confesses, Prisoner A's best response would be to confess
- Given Prisoner B denies, Prisoner A's best response would be to confess

Nash Equilibrium: an outcome from which neither player would want to deviate, taking the other player's behaviour as given

- Nash equilibrium occurs whenever each player is best responding to the other player's best response
- A game may have zero, one, or more pure strategy Nash equilibrium
- **Dominant strategy:** a strategy that is best for a player in a game regardless of the strategies chosen by the other players
- In the game of Prisoner's Dilemma (Confess, Confess) is the Nash Equilibrium and both players have a Dominant Strategy: Confess

Public Good Game

Public Good Game

A community is trying to collectively build a public good such as a park:

- N players
- Each player i has an initial endowment e_i
- Each player i chooses an amount c_i to contribute to the public good
- The total contribution is multiplied and shared by everyone

Player $i's$ payoff:

$$e_i - c_i + \frac{m \times (c_1 + c_2 + \cdots + c_N)}{N}$$

- m denotes how much contributes are multiplied by
- $m < N$: a player does not benefit enough personally to contribute for private gain
- $m > 1$: some everyone contributing would be Pareto improving

❖ Suppose there are 4 players, each has an initial endowment $10
❖ The total contribution is tripled $(m = 3)$ and shared equally among all players

Suppose everyone gives all $10:

$$10 - 10 + \frac{3 \times (10 + 10 + 10 + 10)}{4} = 30$$

Suppose the other 3 all contribute $10 but you did not contribute:

$$10 - 0 + \frac{3 \times (10 + 10 + 10 + 0)}{4} = 32.5$$

All players have a **dominant strategy:** contributing nothing (free-riding)
Regardless of other player's contributions, it is always better to contribute 0 than to contribute $c_i > 0$

$$\left[e_i - 0 + \frac{m \times (c_1 + c_2 + \cdots + c_N) - m \times c_i}{N}\right] - \left[e_i - c_i + \frac{m \times (c_1 + c_2 + \cdots + c_N)}{N}\right]$$
$$= \left(1 - \frac{m}{N}\right) \times c_i > 0$$

Since $\frac{m}{N} < 1$

❖ The game is essentially a multi-person Prisoner's Dilemma
❖ **The Nash Equilibrium** is that everyone is contributes nothing

The Game of Chicken

The Game of Chicken

- Two drivers, both headed for a single-lane bridge from opposite directions
- The first to swerve away yields the bridge to the other
- If neither player swerves, the result is a costly deadlock or head-on collision

	Driver B		
Driver A		Swerve	Straight
	Swerve	0,0	-1,+1
	Straight	+1,-1	+100,-100

❖ Given Driver A swerves, Driver B will go straight
❖ Given Driver A goes straight, Driver B will swerve

- Given Driver B swerves, Driver A will go straight
- Given Driver B goes straight, Driver A will go straight

The game has **two pure-strategy Nash equilibria**: (Swerve, Straight) and (Straight, Swerve)

There is **no dominant strategy** in this game

Simultaneous or Sequential Games

- One important feature is whether the players move simultaneously or sequentially, in other words, whether a player observes other's actions before making his/her own decisions
- Both prisoner's dilemma and the game of chicken are **Simultaneous Games:** players choose their moves without being sure of the other's
- Some other games are called **Sequential Games:** one player moves first, the other player observes the action, and then decides his/her actions

Ultimatum Game

Ultimatum Game

- One player, the Proposer, decides how to split a sum of money with another player, the Responder
- **Stage 1:** the Proposer decides what share s of the "pie" P to offer to the Responder
- **Stage 2:** after observing the Proposer's decision, the Responder may accept it or reject it
    - If the Responder accepts the money is split per the proposal
        - Proposer keeps $(1 - s) \times P$
        - Responder receives $s \times P$

If the Responder rejects, bother players receive 0

Backward Induction

- We usually use <u>**backward induction**</u> to solve sequential games
- Stage 2: the Responder should accept ANY $s > 0$ since she gets 0 by rejecting the offer
- Stage 1: anticipating the Responder's decision, the Proposer should choose the minimum positive share to offer, say $s = 1\%$
- This is called a **subgame perfect Nash equilibrium;** as a result:
    - Proposer keeps $99\% \times P$
    - Responder receives $1\% \times P$

Behavioural Deviations – Social Preferences

- Experimental results often show that people exhibit social preferences or limitations in cognitive abilities
- Therefore, they tend to deviate from the predictions of standard game theory, which assumes that agents make decisions out of pure self-interest and complete rationality

Ultimatum Game

Ultimatum Game

- In the ultimatum game, while the subgame perfect Nash equilibrium predicts
    - Proposer keeps $99\% \times P$
    - Responder receives $1\% \times P$

- In experiments, Proposers:
  - Rarely choose $s < 10\%$
  - Virtually never choose $s > 50\%$
  - The mode and median offers are $40\% - 50\%$ and means are $30\% - 40\$$
- In experiments, Responders:
  - Rarely reject offers with $s > 40\%$
  - Reject offers with $s < 20\%$ about half the time
  - The probability of rejection increases as s gets smaller
- **Note that the true deviating behaviours mainly come from the Responders instead of the Proposers**
- Proposers' decision to offer larger shares can be justified by the fact that Responders tend to reject offers they consider unfair
- In fact, if the Responder rejects all offers with $s < s^*$, then Proposer offerings s^* is a Nash equilibrium (just not subgame perfect)
- Given the distribution of rejection rates, Proposers' actions are in general **only slightly more generously** than payoff maximising
- Therefore, the result that Proposers offer a larger share could be due to:
  - Social preferences
  - Fear of rejection

Dictator Game

- To disentangle different motives in the ultimatum game, we could use the dictator game as a "control"
- Different from the ultimatum game, the dictator game **eliminates the possibility for the Responder to reject**
- **Stage 1:** the Proposer decides what share s of the "pie" P to offer to the Responder
- ~~**Stage 2:** after observing the Proposer's decision, the Responder may accept it or reject it~~
- This allows us to see how much of the offer was due to fear of rejection and how much due to social preference

- The experimental results show that the mean share allocated to the Responder is about 20% in dictator games
- This means that both motives play a role in Proposers' behaviours in ultimatum game:

Fear of Rejection	The fact that dictator fame offers are lower means that Proposers are being strategic, that is, they offer more to avoid being rejected by Responders
Social Preferences	The fact that dictator game offers are still positive shows that people do have fairness or altruistic concerns

Behavioural Deviations - Cooperation

- Behavioural deviations are also observed in simultaneous games such as prisoner's dilemma and the public good game
- Typically, agents exhibit behavioural patterns that are more cooperative than the predictions of standard game theory

Prisoner's Dilemma

Prisoner's Dilemma

- (Deny, Deny) maximises total payoff
- (Confess, Confess) is both the Nash Equilibrium and the individually rational dominant strategy
- In experiments, around 30% of people choose Deny

	Prisoner B		
Prisoner A		Confess	Deny
	Confess	-5,-5	0,-20
	Deny	-20,0	-1,-1

Public Good

Similarly, in public good game, contributing nothing is both the Nash Equilibrium and the individually rational dominant strategy.

- In experiments,
  - Mean contributions are about **half** of endowments
  - There is wide dispersion: most contribute either all or nothing
  - There is positive correlation between amount contributed and how much a subject expects other to contribute
  - Players who contribute say they expect others to contribute

Behavioural Alternatives

- It is important to note that deviations from the pure self-interest assumption is **not a fundamental** violation of game theory or decision theory
- It simply means that we should have a more accurate characterisation of people's **utility functions**, which allows us to explain social preferences

Altruism

Let x_1 be Player 1's material payoff, x_2 be Player 2's material payoffs.

- **Pure self-interest:** Player 1's utility/preferences are: $u_1(x_1)$
- **Social preferences:** Player 1's utility/preferences are: $u_1(x_1, x_2)$

A person exhibits **simple altruism** if her utility is increasing in other people's material payoffs. For example, a simple formulation: $u_1(x_1, x_2) = x_1 + \varphi \times x_2$, where $\varphi > 0$.

Prisoner's Dilemma

Prisoner's Dilemma

- Suppose Player 1 is altruistic

	Prisoner B		
Prisoner A		Confess	Deny
	Confess	1+ φ,1	5,0
	Deny	0+5φ,5	3+3 φ,3

- Choosing Deny hurts oneself but helps the other player. Because an altruist get utility from own payoff as well as the other player's payoff, if the gain to the other from choosing Deny outweighs the diminished own payoff, the altruist will cooperate
- Here, for $\varphi > \frac{2}{3}$, it is optimal for Player 1 to choose Deny

$$\mathbf{3} + \mathbf{3}\varphi > 5$$
$$\mathbf{0} + \mathbf{5}\varphi > 1 + \varphi$$

Dictator Game

Dictator Game

- In the dictator game, the Proposer decides what share s of the "pie" P to offer to the Responder
- Choosing $s > 0$ increases the Responder's payoff
- A higher level of simple altruism works **in favour of choosing a larger share for the Responder**
- For certain formulations and parameters of the simple altruism model, it becomes optimal for the Dictator to choose $s > 0$, thus explaining the experimental result

Ultimatum Game

Ultimatum Game

- Proposer: Similar to the Dictator fame, choosing $s > 0$ increases the Respondent's payoff; simple altruism works in favour of choosing $s > 0$
- However, for the Responder,
  - Rejecting an offer $s > 0$ **decreases** both the Responder's own payoff **AND** the Proposer's payoff
  - Altruism implies that the Responder should be even **more likely to accept offers** than the pure self-interest case
- Altruism cannot explain Responder's rejections
- Thus, the model of simple altruism can explain some experimental findings, but it can't explain everything

Inequity Aversion

- Fehr and Schmidt (1999) introduce the model of **Inequality Aversion:** people don't just care about their own payoff, they care about how much they make relative to others
- A simple model: $u_1(x_1, x_2) = x_1 - g(x_1 x_2)$ where,

$$g(x_1, x_2) = \begin{cases} 0, if\ x_1 = x_2 \\ \alpha(x_2 - x_1), if\ x_1 < x_2 \\ \beta(x_1 - x_2), if\ x_1 > x_2 \end{cases}$$

  With $0 \leq \beta < 1$ and $\alpha \geq \beta$
- According to the model of inequality aversion: $u_1(x_1, x_2) = x_1 - \beta(x_1 - x_2), if\ x_1 > x_2$
  Where $0 \leq \beta < 1$
  - ❖ β captures how averse a person is to being better off than other people

- ❖ $\beta > 0$ implies that the player is willing to give some money to player 2 to help reduce the inequality between them
- ❖ $\beta < 0$ would imply that a person enjoys being better off than others. Although this is certainly true for some people in the real world, for the games we're considering here, they would have no impact on equilibrium behaviour

Suppose Player 1 has $10 and player 2 has $2

- $\beta = \frac{1}{4}$ implies that Player 1 is willing to pay $1 to increase Player 2's payoff by $3:

$$u_1(x_1, x_2) = 10 - \frac{1}{4}(10 - 2) = 8$$

$$u_1(x_1 - 1, x_2 + 3) = 9 - \frac{1}{4}(9 - 5) = 8$$

- $\beta = \frac{1}{2}$ implies that Player 1 is just indifferent between keeping $1 for himself and giving it to player 2:

$$u_1(x_1, x_2) = 10 - \frac{1}{2}(10 - 2) = 6$$

$$u_1(x_1 - 1, x_2 + 1) = 9 - \frac{1}{4}(9 - 3) = 6$$

- More generally, Player 1 is willing to pay $1 to increase Player 2's payoff by $\frac{1-\beta}{\beta}$
- $\beta > \frac{1}{2}$ implies that Player 1 is willing to give up $1 even if it means Player 2 would only receive less than $1
- That is, $\beta > \frac{1}{2}$ implies that the player cares about equality so much that he/she is willing to support "inefficient transfers" or "leaky buckets" to reduce inequality
- $\beta > \frac{1}{2}$ implies that Player 1 is willing to give up $1 even if it means Player 2 would get $\frac{1}{3}$:

$$u_1(x_1, x_2) = 10 - \frac{3}{4}(10 - 2) = 4$$

$$u_1\left(x_1 - 1, x_2 + \frac{1}{3}\right) = 9 - \frac{3}{4}\left(9 - \frac{7}{3}\right) = 4$$

- Why assuming $\beta < 1$? If $\beta \geq 1$, a person is willing to just throw money away for the purpose of reducing inequality → this is unrealistic.

According to the model of inequality aversion:

$$u_1(x_1, x_2) = x_1 - \alpha(x_2 - x_1), if\ x_2 > x_1$$

Where $\alpha \geq \beta$

- α measures how averse a person is to being worse off than other people

Suppose Player 1 has $6 and player 2 has $10

- $\alpha = 4$ implies that Player 1 is willing to give up $1 if it would reduce Player 2's payoff by $1.25:

$$u_1(x_1, x_2) = 6 - 4(10 - 6) = -10$$

$$u_1(x_1 - 1, x_2 - 1.25) = 5 - 4(8.75 - 5) = -10$$

- More generally, Player 1 is willing to pay $1 to decrease Player 2's payoff by $\frac{1+\alpha}{\alpha}$

- $\alpha \geq \beta$ indicates that if there's going to be inequity, people would rather it be in favor of themselves

Prisoner's Dilemma

Prisoner's Dilemma

- Suppose Player 1 exhibits inequity aversion:

	Prisoner B		
Prisoner A		Confess	Deny
	Confess	1,1	5-5β,0
	Deny	0-5α,5	3,3

Given that Player 2 plays Deny,

- Player 1 will experience guilt over the advantageous inequality by playing Confess
- Thus, it is optimal for Player 1 to play Deny if β is large enough

$$5 - 5\beta < 3 \rightarrow \beta > 0.4$$

If both players have such inequity aversion, this game will now have TWO Nash equilibria: (Confess, Confess) and (Deny, Deny).

Public Good Game

Public Good Game

- Suppose as a player in the public good game, you exhibit inequity aversion
- If no one else is contributing, disadvantageous inequality would prevent you from contributing
- If everyone else is contributing, advantageous inequality would prevent you from not contributing
- When β is large enough, it becomes optimal to contribute as well

Dictator Game

Dictator Game

- Keeping all the money would create advantageous inequality, so a high enough β implies that a Dictator should give a positive share.
- The current formulation: $u_1(x_1, x_2) = x_1 - \beta(x_1 - x_2)$ if $x_1 > x_2$
  Predicts that $s = 0.5$ if $\beta > 0.5$ and $s = 0$ if $\beta < 0.5$
- That is, it predicts **only very fair or very unfair outcomes**
- A different formulation where utility is concave in the amount of advantageous inequality would allow for interior solutions in [0,0.5]

Ultimatum Game

Ultimatum Game

- Again, keeping all the money would create advantageous inequality, so a high enough β implies that a Dictator should give a positive share to the Responder
- Suppose the Responder is evaluating an unfair offer $s < 0.5$. Accepting it yields the material payoff but creates disadvantageous inequality:
  - Accept: $s - \alpha[(1-s) - s]$
  - Reject: 0
- Therefore, the Responder would only accept if:

$$s - \alpha[(1-s) - s] > 0$$

  That is,

$$s > \frac{\alpha}{2\alpha + 1}$$

- Inequity aversion results in an acceptance threshold $\frac{\alpha}{2\alpha+1}$ for the Responder
- The Responder will only accept an offer that is higher than the threshold:
  - $\alpha = 0$ → accept only if $s > 0$
  - $\alpha = 0.5$ → accept only if $s > 0.25$
  - $\alpha = 1$ → accept only if $s > 0.33$
  - $\alpha = 4$ → accept only if $s > 0.44$
- Now re-consider the decision of the Proposer
  - Suppose he does not know the Responder's α, but knows the distribution of α across the population
  - Now his optimal offer is both a function of his own inequality aversion β and the population distribution α
  - For example, even a Proposer with $\beta = 0$ might maximise expected utility by offering $s > 0$ if he knows a substantial fraction of the population has high α and would thus reject unfair offers