Coordination Problems

A Simple Coordination Game: What Side of the Street?

Driver 1 \ Driver 2	L	R
ℓ	$5^{\checkmark}, 5^{\checkmark}$	$0, 0$
r	$0, 0$	$5^{\checkmark}, 5^{\checkmark}$

- Two equilibria: (ℓ, L) and (r, R)
- Pure coordination game—drivers care only about choosing the same side

Coordination with Distributional Concerns: Accounting Standards

		Britain: US	Britain: UK
America	us	$5^{\checkmark}, 1^{\checkmark}$	$0, 0$
	uk	$0, 0$	$1^{\checkmark}, 5^{\checkmark}$

- Two equilibria: (us, US) and (uk, UK)
- Coordination with distributional consequences—players want to coordinate, but disagree on preferred outcome

Coordination with Efficiency Concerns: Investing in a Developing Country

		Firm 2: Invest	Firm 2: Don't
Firm 1	invest	$20^{\checkmark}, 20^{\checkmark}$	$0, 5$
	don't	$5, 0$	$5^{\checkmark}, 5^{\checkmark}$

- Two equilibria: (invest, Invest) and (don't, Don't)
- (invest, Invest) Pareto dominates (don't, Don't)

Coordination Trap

Multiple equilibria

One equilibrium is more desirable than another

Players can become "trapped" in an undesirable equilibrium

How? — reinforcing expectations

Some Examples

Social Conventions

- Foot binding
- Honor killings
- Private vs public schools

Economic

- Underdevelopment
- Agglomeration economies
- Technology adoption

Political

- Failure of accountability
- Revolutions/Protests

Investment

2 investors who choose an investment level: $1 \geq e_i \geq 0$

Payoff to investing is

$$\pi_i(e_1, e_2) = e_1 \cdot e_2 - \frac{e_i^2}{2}$$

What is the best-response level of investment?

$$e_2 = e_1$$

Investor 1 wants to match investor 2's investment and vice-versa

Equilibrium Investment

Any strategy profile where $e_1 = e_2$ is an equilibrium!

Equilibrium payoffs: Let $e = e_1 = e_2$

$$e^2 - \frac{e^2}{2} = \frac{e^2}{2}$$

Increasing in e

Greater joint investments lead to Pareto improvements *and are equilibria*

The Coordination Trap

Each player investing 0 is an equilibrium: $u_i(0,0) = 0$

Each player investing $\frac{1}{2}$ is an equilibrium: $u_i(\frac{1}{2},\frac{1}{2}) = \frac{1}{8}$

Each player investing 1 is an equilibrium: $u_i(1,1) = \frac{1}{2}$

Self fulfilling expectations can create Pareto inefficient equilibrium outcomes

- Underdevelopment
- Underinvestment in education

Policy Responses to Coordination Traps

Insurance

- Suppose policy maker promises to "top up" other player's investment
- Never end up having to actually do so

FDIC

Banking Acts of 1933 and 1935 create Federal Deposit Insurance Corporation (FDIC) in response to bank runs of the Grat Depression

Guarantees depositors won't lose money, even if bank is insolvent

All but eliminates bank runs in the United States

But also creates a moral hazard problem—banks can take bigger investment risks

- Financial crisis of 2007
- There are *always* second best concerns

Policy Responses to Coordination Traps

Insurance

- Suppose policy maker promises to "top up" other player's investment
- Never end up having to actually do so

Communication and Leadership:

- Create a mutual expectation that others will invest

Footbinding

Footbinding appears in 11th century

Spreads gradually from royalty to all of society over 300 years

Becomes more extreme over time

Social Norm by Ming Dynasty (1368-1644)

In 1835, 50-80 percent of women (depending on locale)

Ending Footbinding

Foot binding is a coordination trap

- Coordination on bad outcome

Late 19th century societies

- Education
- Public relations
- Advocacy for "natural feet"

Tighsien (rural area south of Beijing)

- 1889: 99%
- 1899: 94%
- 1919: 0%

Policy Responses to Coordination Traps

Insurance

- Suppose policy maker promises to "top up" other player's investment
- Never end up having to actually do so

Communication and Leadership:

- Create a mutual expectation that others will invest

Short-run interventions

- Fundamentally different than externalities because new behavior is also an equilibrium
- This tells us about the scope of leadership

The Tennessee Valley Authority

Starting in 1930s, TVA is a massive federal investment to modernize the economy of one of the poorest and least developed areas of the country

- Hydroelectric dams
- Canals
- Road networks
- Schools

1940s and 1950s, spent over $14 billion (2000 dollars)

1930: Tennessee Valley is almost entirely agricultural

1945: Largest supplier of electricity in the country

Long Run Effects

TVA subsidies decline starting in 1960s

Gains in agricultural sector disappears

- After 1960, TVA counties have a 13-16 percentage point decrease in ten-year agricultural employment growth

Manufacturing gains persist

- After 1960, TVA counties continue to have a growth rate that is 3 percentage points higher than non-TVA counties

In sectors with agglomeration economies (and, so, coordination traps), a short run intervention creates a new equilibrium that persists after the intervention

Summing Up Coordination Traps

Multiple equilibria with one Pareto dominated by another

Communication and leadership

Insurance

Short-run rather than long-run policy interventions

Coordination Failure

Primary motive is for individuals to coordinate

Players have uncertainty about each other

Uncertainty creates a friction when trying to coordinate

Some Examples

Social Conventions

- Private vs public schools
- Fashion

Economic

- Bank runs
- Underdevelopment

Political

- Revolutions/Protests
- Voting

A Simple Model of Rebellion

2 citizens

Each can rebel or not; rebelling costs $c = 1$

If both rebel the regime is defeated

Each citizen gets 5 if regime falls and 0 otherwise

Equilibrium

Citizen 1 \ Citizen 2	R	NR
r	$4^{\checkmark}, 4^{\checkmark}$	$-1, 0$
nr	$0, -1$	$0^{\checkmark}, 0^{\checkmark}$

There's a coordination trap here as well

Introducing some uncertainty

Suppose citizens don't know each other that well

Two types of citizens:

1. Low cost: $c_L = 1$ with probability p
2. High cost: $c_H = 6$ with probability $1 - p$

Citizens know their own cost but not the other citizens

Citizen strategies depend on their cost

High cost best response

For a high cost citizen rebelling is dominated

So high cost types will never rebel

Low cost best response

Suppose a low cost player believes that both high and low cost players will not rebel

- Her best response is to not rebel
- There is an equilibrium where all types do not rebel

Suppose a low cost player believes high cost players will not rebel but low cost players will rebel?

Expected utility of rebelling is

$$4p + (-1)(1 - p)$$

It is a best response to rebel if this is greater than 0

$$p \geq \frac{1}{5}$$

Equilibria

If $p < \frac{1}{5}$ all players don't rebel

If $p \geq \frac{1}{5}$ there are two equilibria

- All players don't rebel
- High cost players don't rebel, low cost players do rebel

This latter equilibrium creates the possibility of coordination failure

- One player rebels, the other player does not

Coordination Failure

How often does a coordination failure occur?

If no one rebels, there is never coordination failure

- But with probability p^2 there are two low types in a coordination trap

If high types do not rebel and low types do rebel, there is coordination failure when there is one of each type

- This happens with probability $2p(1-p)$

Policy Interventions

Same ideas as coordination traps, but perhaps a bit trickier

Individuals need to know things about each other to reassure risky actions

Leadership may be insufficient because mutual expectations are harder to establish

Take-Aways

Coordination Traps

- Reinforcing expectations can lead to bad outcomes
- One-shot policy interventions can get things on track

Coordination Failures

- Result from strategic uncertainty about others
- Different types of policy interventions are needed