Global Games

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From multiple to unique equilibria

- Diamond and Dybvig exhibit multiple equilibria
  - Very difficult to apply economic recommendations
  - No probabilities and in (general) not dependant on economic fundamentals
  - Quick solution: Sunspot equilibria - exogenous probability of each equilibria
- Solution: Global Games
  - Rochet and Vives (2004) and Goldstein and Pauzner (2005)
  - From multiple equilibria to unique equilibria
  - Based on investors signals

From multiple to unique equilibria

- Global games methods to have unique equilibria in bank run setups
  - Rochet and Vives (2004) and Goldstein and Pauzner (2005)
  - Morris and Shin (2003) -currency attacks-
  - Based on Carlsson and Van Damme (1993)
- Model ingredients
  - Each individual receives a private signal of bank returns R
    - Individuals can not put all the signals together (info friction)
  - Such signal is different for each investor $s_i = R + \varepsilon_i$
  - Where ε_i iid error term with distribution $f(\mu, \sigma)$
  - Each individual's withdrawal decision depends only on her private signal

From multiple to unique equilibria

- Equlibrium
  - Existence of 3 regions in general - depends on fundamentals (Return)
  - Fundamental default region - banks always default
  - Fundamental safe region - banks always survive
  - Coordination problem region - withdrawals happen in equlibrium
- Aspects of the equilibrium
  - Threshold strategy equilibria run IFF $s_i < \bar{S}$
  - Bank withdrawals are function $w(R)$ $w'(R) < 0$
  - Bank defaults if $R < \bar{R}$
  - Bank fundamentals drive the run
  - You can have unique equlibria

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Brief on Carlsson Van Damme (1993)

- Assume two agents with strategic complementarities
- Following payoff structure

	NW	W
NW	(θ, θ)	$(0, \theta - 1)$
W	$(\theta - 1, 0)$	$(0, 0)$

- With $1 > \theta > 0$
- Payoff of a given agent doing NW

$$\theta - 1(W_j)$$

- Given strategic complementarities - multiple equilibria
- We would want to coordinate on NW no withdrawal

Brief on Carlsson Van Damme (1993)

- Let us introduce randomness in θ
- Noone knows θ but each player has a signal

$$s_i = \theta + \varepsilon_i$$

- Where $\varepsilon_i \sim N(0, \sigma^2)$ and is iid
- Bayesian updating. For simplicity, say the prior of θ is "improper prior" or noninformative prior (equally likely over real line)
- Given s_i the posterior of θ is $N(s_i, \sigma^2)$
- Given s_i the posterior of s_j is $N(s_i, 2\sigma^2)$
- Agent's i conditional payoff

$$E(\theta - 1(W_j)|\, s_i) = s_i - \Pr(\, W_j|\, s_i)$$

- Two different roles played by the signal *si*
  - First term: *si* tells me something about fundamental
  - Second term: *si* tells me something about the distribution of agent *j* signal *sj* and thus his strategy

Brief on Carlsson Van Damme (1993)

- Lets focus on the second term
- The second term captures the idea of "guessing" each otherís strategy, in a simple but powerful way
- Suppose that everybody follows a cutoff rule with threshold k
  - NW if $s_i > k$
  - W otherwise
- As $s_j \sim N(s_i, 2\sigma^2)$ the probabilty of j doing W is

$$\Phi\left(\frac{k - s_i}{\sqrt{2\sigma^2}}\right)$$

- So agent i will do NW IFF

$$s_i - \Phi\left(\frac{k - s_i}{\sqrt{2\sigma^2}}\right) > 0$$

Brief on Carlsson Van Damme (1993)

- The equlibrium cutoff k
- When $s_i = k$ the agent is indifferent between NW and W

$$k - \Phi\left(\frac{k-k}{\sqrt{2\sigma^2}}\right) = 0 \rightarrow k = \frac{1}{2}$$

- So, the unique equilibrium is that every agent invest if his/her signal $s_i > 1/2$.
- Intuition:
  - Symmetry: when receiving $s_i = k$, the probability of j getting signal s_j below k is 0.5
  - Strategic uncertainty (guessing each other) implies the second term to be 0.5
  - The first fundamental term have to be 0.5 for equilibrium threshold

Brief on Carlsson Van Damme (1993)

- The assumption of threshold strategy can be relaxed
  - Unique equilibrium surviving iterated deletion of strictly dominatedstrategies
- Magically, it does not depends on how noisy the private signal σ is!
- Say $\sigma \rightarrow 0$ so that the game seems to converge to the full information case, the equilibrium is still unique
- Although fundamental uncertainty shrinks, the strategic uncertainty effect remains at 0.5
- As a result, the agent invests only when the fundamental is above 0.5