The Dynamics of Bertrand Competition with Leapfrogging Investments

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Overview of results

- We extend the standard static textbook model of Bertrand price competition by allowing duopolists to undertake cost-reducing investments in discrete time
- Technological progress is exogenous and stochastic
- Each firm has a binary decision to acquire the state of the art production technology
- Even though this is a small extension of the classic static model of Bertrand price competition, surprisingly little is known about Bertrand competition in the presence of production cost uncetainty, especially in dynamic settings
- We show how to compute *all* equilibria of this game and show that this dynamic model of Bertrand price competition has surprisingly rich, complex, and counter-intuitive equilibrium outcomes.

Motivation: Collusion on the beach

Peter Brown: Amcor Managing Director

Harry Debney: Visy CEO

Russell Jones: Chairman of Amcor

Richard Pratt: Owner of Visy

Motivation: Australian collusion case

- The Australian market for *cardboard* (CFP) is essentially a duopoly
- Between 2000 and 2005 the two firms, *Visy* and *Amcor* colluded to raise the price of CFP
- I was hired to estimate the damage caused by the collusion, which requires predicting what CFP prices would have been in the absence of collusion
- My opinion was that the “but-for” CFP prices are those predicted by Bertrand price competition in the short run, with *leapfrogging investments* by the two firms over the longer run as they vie for low-cost leadership

Amcor's New B9 Paper Mill

Main Mill Site, Botany Bay Road, Botany Bay NSW

Source: Amcor

B9 is an example of leapfrogging

- Amcor's existing paper plant was over 50 years old
- "The B9 paper machine, so named as it is the ninth paper machine to operate at the company's Botany site, will produce more than 400,000 tonnes of paper annually when operating at full capacity and will deliver significant environmental benefits."
- Cost: $500 million, the largest single investment in Amcor's 144 year history. "Largest and most innovative recycled paper machine of its kind in Australasia"
- "The machine is 330 metres long, and 22 metres high, and produces 1.6 km of paper per minute and reduces water consumption by 26%, energy usage by 34% and the amount of waste sent to landfill by 75%" (Nigel Garrard, Amcor CEO)

But collusion caused B9 to be *delayed*

- Amcor had planned B9 back in 1999, and at that time internal studies estimated huge rate of return for this investment because it would enable it to leapfrog Visy to become the low-cost producer of CFP in Australia.
- Amcor and Visy were locked in a *price war* that started in 1999, around the time the Amcor Board authorized the B9 investment.
- However when Visy and Amcor started to collude in 2000, the B9 project was curiously scrapped. B9 was not actually started until 2011, well *after* the end of the collusion in 2005. B9 only came online in February 2013.

Justification for Bertrand pricing

- cardboard is a highly standardized product
- the consumers of cardboard are firms that are highly rational and interested in buying inputs at least possible cost
- further, firms acquire these inputs via *tenders* that create strong incentives for Bertrand-like price cutting
- In the case, we lacked good data on *aggregate demand* for cardboard facing Amcor and Visy before and after collusion
- but there was good data on their *costs of production*
- cardboard is made on production lines with machinery that is well-approximated as constant returns to scale with constant marginal costs

A cardboard corrugator

Technological progress via cost-reducing investments

- in this industry, Amcor and Visy do minimal amounts of R&D since there is limited scope for new product innovations to replace cardboard
- however the firms do spend considerable amounts on *cost reducing investments*
- these investments consist of building new plants or upgrading existing plants with the latest technology and machinery for producing cardboard
- rather than developing these machines themselves, Amcor and Visy purchase these machines from other companies that specialize in doing the R&D and product development to develop the machines that produce cardboard at the least possible cost

Leapfrogging by Amcor lead to a price war

- the proximate cause of the collusion between Amcor and Visy was a price war in cardboard
- a key input to cardboard is *paper* and Amcor had a severe cost disadvantage relative to Visy due to its outdated paper production plant, with machines that had not been replaced/upgraded in decades
- Visy on the other hand, has aggressively invested in the latest and most cost-efficient technology and maintained a persistent edge as the low cost leader
- however Amcor planned to invest in a new paper mill, B9, enabling it to produce CFP at substantially lower costs, thereby leapfrogging Visy to become the low cost leader in Australia

Are price wars evidence of tacit collusion?

- The economic experts defending Amcor and Visy dismissed theory of Bertrand competition and leap frogging investments as naive and out of touch with reality
- They claim that there is a huge body of research and empirical work in IO that supports a theory *tacit collusion* for repeatedly interacting duopolists
- In particular, they claimed that duopolists could achieve via tacit collusion the same discounted profits as they could via *explicit collusion.*
- This implies that the damage is *zero.*
- But if this is the case, and if tacit collusion is *legal,* why would Amcor and Visy have had any incentive to do illegal explicit collusion?

Paucity of empirical support for tacit collusion

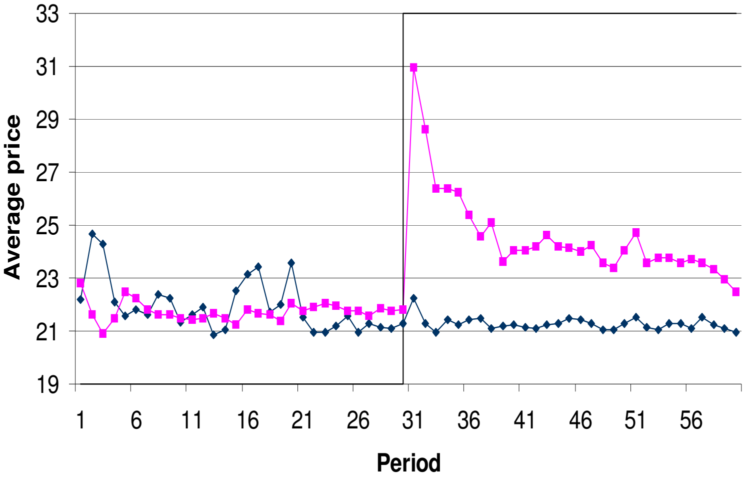
- Tacit collusion is hard to “observe” by the very fact that it is tacit
- We need good data on costs and demands to calculate what the cartel price would be
- Most of the empirical work on tacit collusion comes from laboratory experiments
- Hundreds of experiments done on tacit collusion have found that it is extremely difficult to “grow” tacit collusion in laboratory settings
- There are very few “field studies” that find evidence of tacit collusion outside of Breshnahan’s (1987) JIE paper, “Competition and Collusion in the American Automobile Industry: the 1955 Price War”

Conclusions of meta-study of over 500 experiments

- Christoph Engel (2007) “Tacit Collusion The Neglected Experimental Evidence”
- Econometric meta-analysis of 510 laboratory experiments finds no systematic evidence supporting tacit collusion
- D. Engelmann and W. Müller (2008) “Collusion through price ceilings? A search for a focal point effect”
- “Note that the Folk Theorem (see for example Tirole, 1988) predicts that infinitely many prices can occur as outcomes of collusive equilibria in infinitely repeated games if the discount factor is sufficiently high. This suggests a coordination problem when firms attempt to collude.” (p. 2)

Results of a laboratory duopoly

(Note: the Bertrand price is 21, the maximum cartel price is 48 and 28 is the price ceiling)



David Rapson's reanalysis of Breshnahan 1987

- David Rapson (2009) "Tacit Collusion in the 1950s Automobile Industry? Revisiting Bresnahan (1987)"
- "This paper reexamines the competitive landscape in the 1950s U.S. automobile industry, and tests the robustness of the famous result from Bresnahan (1987) that firms were engaged in tacit collusion."
- Rapson uses a random coefficients logit model allows for more realistic demand behavior, including a broad set of possible substitution patterns in characteristic space.
- This enables firms to engage in a more realistic set of potential actions, including intrabrand or intrafirm, multiproduct strategic pricing.

David Rapson's reanalysis of Breshnahan 1987

- "Relative to Bresnahan's framework, these improvements increase the likelihood that high price-cost markups will be attributed properly to either strategic oligopoly behavior or collusion." (p. 21).
- "*For no year can either of the forms of Bertrand competition be rejected in favor of tacit collusion.* This stands in contrast to Bresnahan's finding that firms were colluding in 1954 and 1956, with a price war in 1955."
- "These results accentuate the paucity of empirical evidence in favor of tacit collusion.
- Bresnahan's (1987) famous paper is one of the only studies that claim evidence of its occurrence."

Nicolas de Roos' analysis of the US lysine cartel

- Theorists model collusion as an incentive-compatible, self-enforcing mechanism where price wars either do not exist in equilibrium, or if they exist, they are on the equilibrium path of a dynamic game of asymmetric information with cost or demand shocks.
- Papers such as "Cramton and Palfrey (1990) show that efficient collusion is attainable in which the lowest cost firm is allocated full production and the monopoly price is set."
- However de Roos argues that these theories may be out of touch with reality "Both price wars contain elements of a bargaining or negotiation problem. Disagreements persisted about the appropriate market shares for the participants as well as the fundamental issue of exactly what form the cartel should take."

de Roos' analysis of the US lysine cartel, cont.

- "A second such issue relates to the existence of cheating in the lysine market. It appears that cheating occurred or was at least heavily suspected by cartel participants." ... "where cheating is a problem for a cartel, this suggests the lack of an incentive compatible enforcement mechanism."
- A price war, prior to the cartel, was a result of ADM's leap-frogging: "In 1988, ADM acquired a fermentation technique for lysine and, observed by its incumbent rivals, began production of the world's largest lysine factory in 1989. ADM's plant began production in February 1991, precipitating a severe price war. "

The Bertrand Investment Paradox

Why should Bertrand competitors undertake cost-reducing investments?

- Suppose a pair of duopolists *simultaneously* invest in the state of the art low cost production technology with marginal cost c
- Bertrand price competition following these investments will lead to a price of $p = c$ and *zero profits for each firm*
- If each firm earns zero profits *ex post,* why would either have incentive to invest *ex ante*?

The investment stage game is an *anti-coordination game*.
Can the firms *dynamically coordinate* their investments in equilibrium, in order to avoid "bad" simultaneous investment outcomes?

The Riordan and Salant Conjecture

- In their 1994 *Journal of Industrial Economics* article, Riordan and Salant proved that in continuous time, if duopolists move alternately and technological progress is deterministic, then investment preemption is the only possible equilibrium outcome
- Further, they show this equilibrium is *completely inefficient* due to the excessively frequent investments of the preempting firm, a result they call rent dissipation
- They conjectured that their result does not depend on the alternating move assumption and that preemption (as opposed to leapfrogging) will be the generic equilibrium outcome in models of Bertrand price competition with cost-reducing investements.

Solution to the Bertrand Investment Paradox

We show:

- Endogenous coordination is possible in equilibrium
  - *leapfrogging* (alternating investments) is possible
  - We show that the Riordan and Salant conjecture is wrong: leapfrogging, not preemption, is the generic outcome
- Price paths are *piecewise flat* and *non-increasing*
  - *Price wars* occur when the high cost firm leapfrogs its rival to become the new low-cost leader
  - These price wars lead to *permanent* price declines, unlike the conventional interpretation of price wars as punishments for periodic breakdowns in tacit collusion
- Equilibria are generally *inefficient* due to *overinvestment*
  - duplicative investments
  - excessively frequent investments

Computing all equilibria

Our findings are based on the computation of *all* Markov perfect equilibria of this dynamic game

- New solution approach consisting of:
  1. *State recursion* algorithm for finding *stage equilibria*
  2. Recursive Lexicographic equilibrium Search (RLS) algorithm for finding all MPE paths
- Traditional solution approach (value function iterations, i.e. *time recursion*) fails in this model due to multiplicity of equilibria
  - Implementation of the Bellman operator induces an equilibrium selection rule
  - Not a contraction mapping, convergence is not guaranteed
- Danger of imposing symmetry
  - Most of MPE equilibria we find are *asymmetric*

Model setup: price competition

Basic Setup

- Discrete time, infinite horizon ($t = 1, 2, 3, \ldots$)
- Two firms, homogenous goods, no entry or exit
- Each firm maximizes expected discounted profits, common discount factor $\beta \in (0, 1)$
- Each firm has two choices in each period:
  1. Price for the product
  2. Whether to buy the state of the art production technology

Static Bertrand price competition in each period

- Continuum of consumers who make static choice each period
- No switching costs: buy from the lower price supplier

Model setup: investment decisions

State-of-the-art production cost c process

- Initial value c_0, lowest value 0: $0 \leq c \leq c_0$
- Discretized with n points
- Follows exogenous Markov process and only improves
- Markov transition probability $\pi(c_{t+1}|c_t)$
  $\pi(c_{t+1}|c_t) = 0$ if $c_{t+1} > c_t$

Investment choice: dichotomous

- Investment cost of $K(c)$ to obtain marginal cost c
- One period construction time: production with technology obtained at t starts at $t + 1$

State space and information structure

Common knowledge

- State of the game: cost structure (c_1, c_2, c)
- State space is $S = (c_1, c_2, c) \subset R^3$ such that $c_1 \geq c$, $c_2 \geq c$
- Actions are observable

Private information

- In each period each firm incurs additive costs (benefits) from not investing and investing $\eta\epsilon_{i,I}$ and $\eta\epsilon_{i,N}$
- $\epsilon_{i,I}$ and $\epsilon_{i,N}$ are extreme value distributed, independent across choice, time and firms
- $\eta \geq 0$ is a scaling parameter
- Investment choice probabilities will have logit form for $\eta > 0$

Model setup: timing of events

Pricing decisions are made simultaneously

Expected one period profit of firm i from Bertrand game ($j \neq i$)

$$r_i(c_1, c_2) = \begin{cases} 0 & \text{if } c_i \geq c_j \\ c_j - c_i & \text{if } c_i < c_j \end{cases}$$

Two versions regarding investment decisions

1. *Simultaneous moves*:
   - Investment decisions are made simultaneously
2. *Alternating moves*:
   - The “right to move” state variable $m \in \{1, 2\}$,
   - When $m = i$, only firm i can make a cost reducing investment
   - m follows an own Markov process (deterministic alternation as a special case).

Solution concept

Markov perfect equilibrium (MPE)

- Pair of strategies (σ_1, σ_2), where
  $\sigma_i = \big(p_i(c_1, c_2, c), P_i^I(c_1, c_2, c)\big)$,
  and pair of value functions (V_1, V_2) such that:
- The system of Bellman equations given below is satisfied for each firm, and
- $p_i(c_1, c_2, c) = max(c_1, c_2)$,
- Probalities of investment $\big(P_1^I(c_1, c_2, c), P_2^I(c_1, c_2, c)\big)$ constitute mutual best responses for all states and in every time period.

Bellman equations for firm *i* (simultaneous moves)

$$V_i(c_1, c_2, c, \epsilon_{i,I}, \epsilon_{i,N}) = \max\left[v_i^I(c_1, c_2, c) + \eta\epsilon_{i,I}, v_i^N(c_1, c_2, c) + \eta\epsilon_{i,N}\right]$$

$$\begin{aligned} v_i^N(c_1, c_2, c) &= r^i(c_1, c_2) + \beta EV_i(c_1, c_2, c|N) \\ v_i^I(c_1, c_2, c) &= r^i(c_1, c_2) - K(c) + \beta EV_i(c_1, c_2, c|I) \end{aligned}$$

Using extreme value shocks, the investment probability is

$$P_i^I(c_1, c_2, c) = \frac{\exp\{v_I^I(c_1, c_2, c)/\eta\}}{\exp\{v_i^I(c_1, c_2, c)/\eta\} + \exp\{v_i^N(c_1, c_2, c)/\eta\}}$$

Bellman equations for firm i (simultaneous moves)

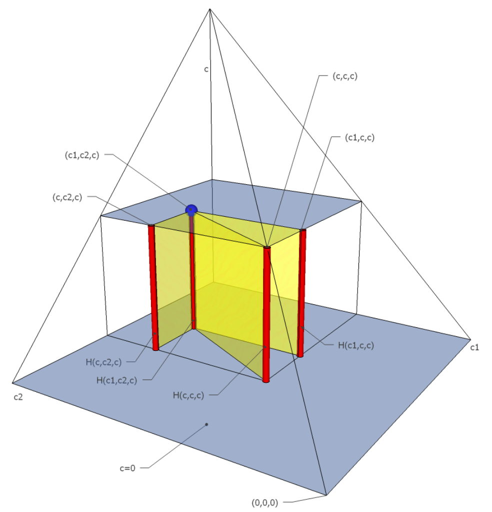
The expected values are given by

$$
\begin{aligned}
EV_i(c_1, c_2, c|N) &= \int_0^c \Big[P_j^I(c_1, c_2, c) H_i(c_1, c, c') + \\
&\qquad P_j^N(c_1, c_2, c) H_i(c_1, c_2, c') \Big] \pi(dc'|c) \\
EV_i(c_1, c_2, c|I) &= \int_0^c \Big[P_j^I(c_1, c_2, c) H_i(c, c, c') + \\
&\qquad P_j^N(c_1, c_2, c) H_i(c, c_2, c') \Big] \pi(dc'|c)
\end{aligned}
$$

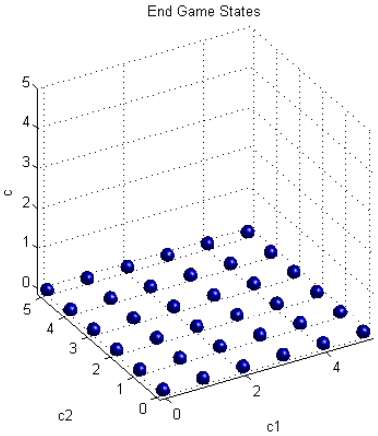
where $H_i(c_1, c_2, c) =$
$\eta \log \big[\exp \big(v_i^N(c_1, c_2, c)/\eta \big) + \exp \big(v_i^I(c_1, c_2, c)/\eta \big) \big]$
is the “smoothed max” or logsum function

State space of the game: a "quarter pyramid"

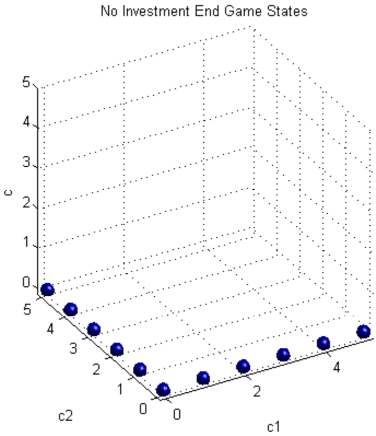
$S = \{(c_1, c_2, c) | c_1 \geq c,\, c_2 \geq c,\, c \in [0, \overline{c}]\}$



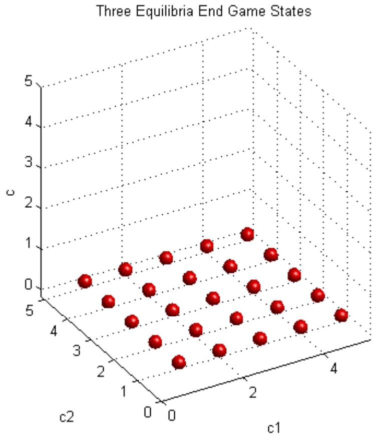
End Games States



No Investment End Games States



Multiple Equilibria End Games States

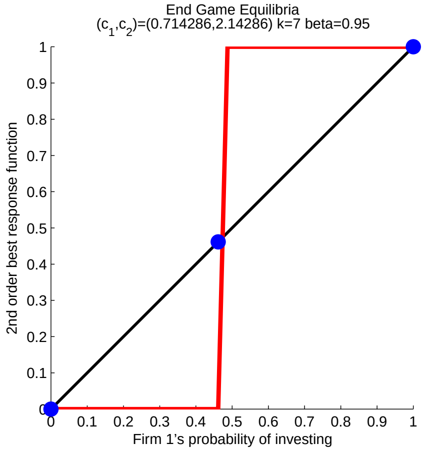


End Game Payoff Matrix $\eta = 0$

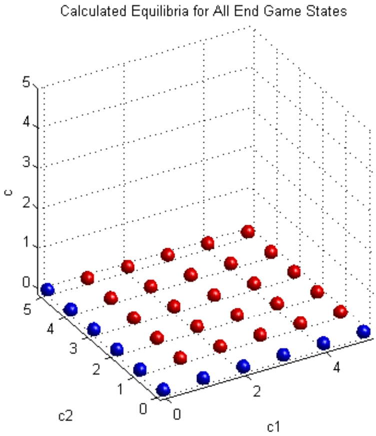
Table 1: End Game Payoff Matrix in state $(c_1, c_2, 0)$ with $c_1 > c_2$

		Firm 2	
		Invest	Don't invest
Firm 1	Invest	$-K,\ c_1 - c_2 - K$	$\frac{\beta c_2}{1-\beta} - K,\ c_1 - c_2$
	Don't invest	$0,\ c_1 - c_2 + \frac{\beta c_1}{1-\beta} - K$	$\beta V_1,\ c_1 - c_2 + \beta V_2$

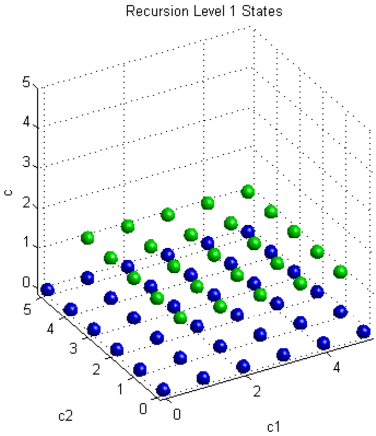
Second order best response function, $\eta = 0$



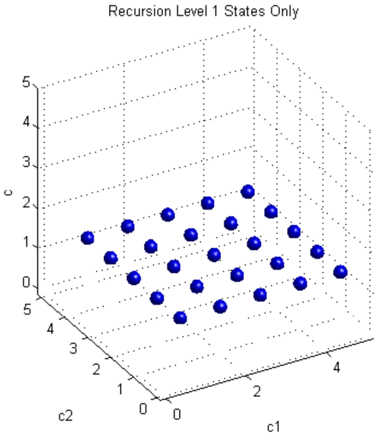
Calculated Equilibria for End Games States



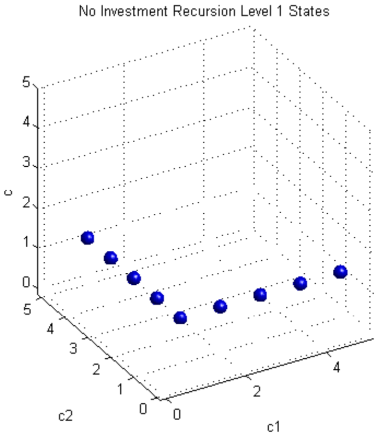
Recursion Level 1 States



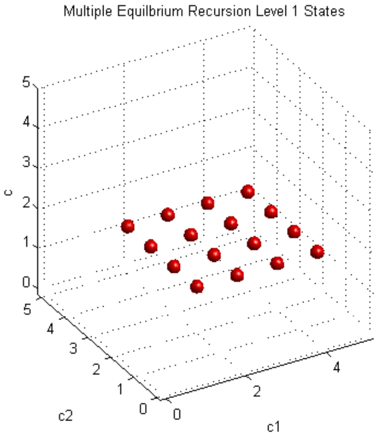
Recursion Level 1 States, isolated



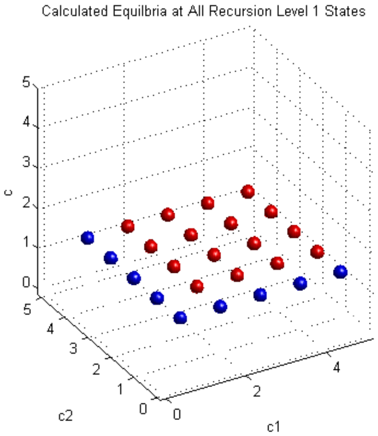
No Investment Recursion Level 1 States



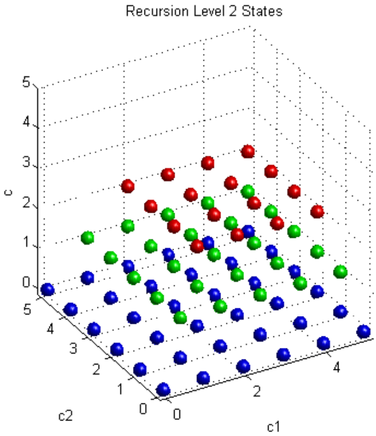
Multiple Equilibria Recursion Level 1 States



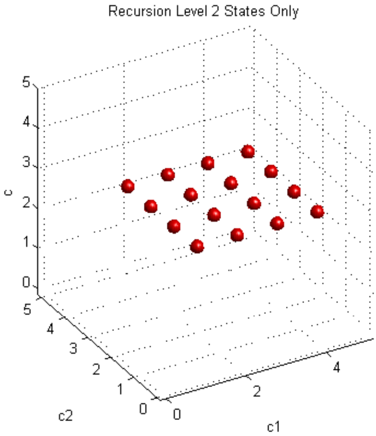
Calculated Equilibria Recursion Level 1 States



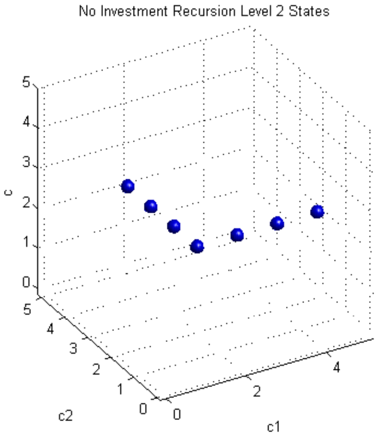
Recursion Level 2 States



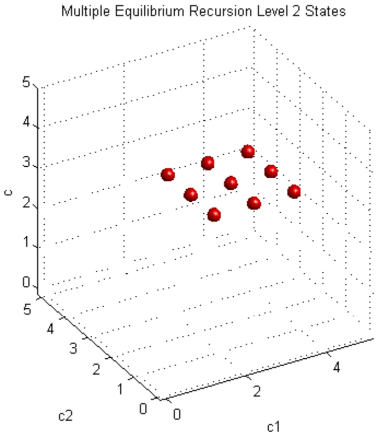
Recursion Level 2 States, isolated



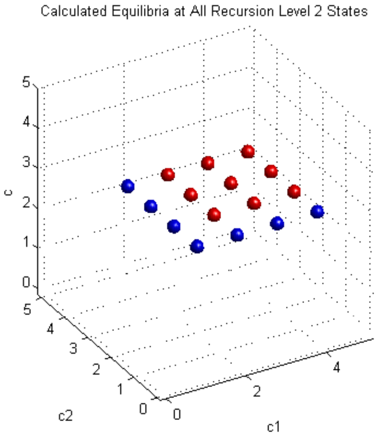
No Investment Recursion Level 2 States



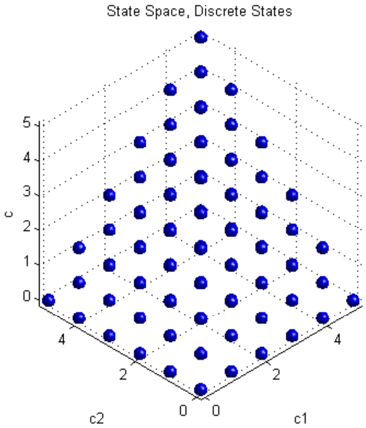
Multiple Equilibria Recursion Level 2 States



Calculated Equilibria Recursion Level 2 States



Continue recursion to calculate equilibria in all states



Road Map for the rest of Talk

Results and Simulations

1. Resolution to the Bertrand investment paradox
2. Sufficient conditions for uniqueness of equilibria
3. Characterization of the set of equilibrium payoffs
4. Efficiency of equilibria
5. Leap-frogging or preemption and rent-dissipation

Resolution to the Bertrand investment paradox

Theorem (Solution to Bertrand investment paradox)

If investment is socially optimal at a state point $(c_1, c_2, c) \in S$, then

- *no investment by both firms cannot be an MPE outcome in the subgame starting from (c_1, c_2, c) in either the simultaneous or alternating move versions of the dynamic game.*

Multiplicity of equilibria

Theorem (Sufficient conditions for uniqueness)

In the dynamic Bertrand investment and pricing game a sufficient condition for the MPE to be unique is that

1. *firms move in alternating fashion (i.e. $m \neq 0$), and,*
2. *for each $c > 0$ in the support of π we have $\pi(c|c) = 0$.*

1. Corollary: If firms move simultaneously, equilibrium is generally *not unique*.
2. Corollary: If the probability of technological improvement is sufficiently below 1, equilibrium is generally *not unique*.

Multiplicity of equilibria

Theorem (Number of equilibria in simultaneous move game)

If investment is socially optimal, and the support of the Markov process $\{c_t\}$ for the state of the art marginal costs is the full interval $[0, c_0]$ (i.e. continuous state version),

- *the simultaneous move Bertrand investment and pricing game has a continuum of MPE.*

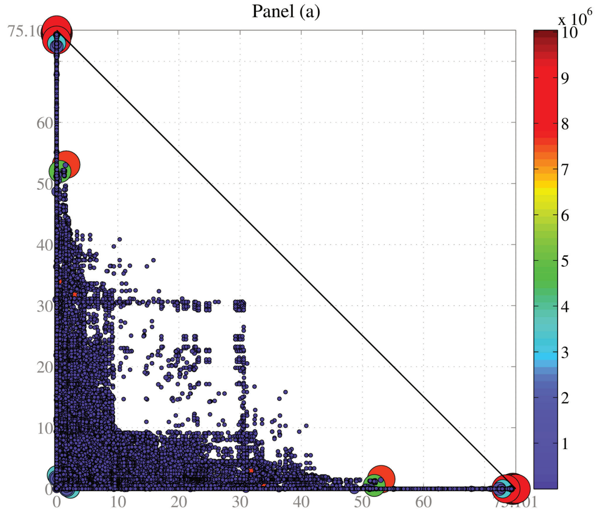
Pay-offs in the simultaneous move game

Theorem (Triangular payoffs in the simultaneous move game)

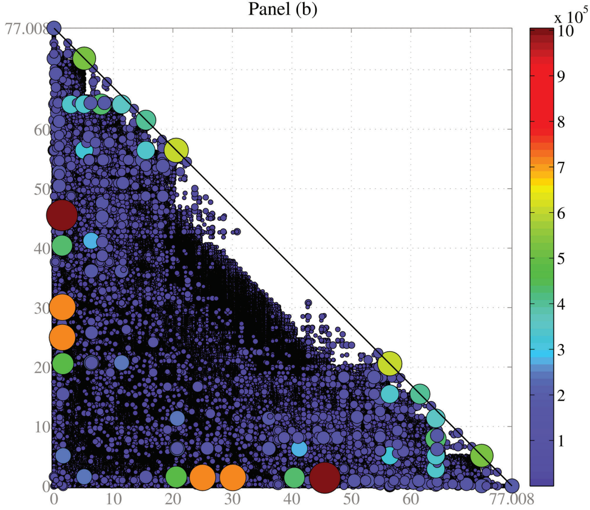
Suppose that the $\{c_t\}$ process has finite support, that there are no idiosyncratic shocks to investment (i.e. $\eta = 0$) and that firms move simultaneously

- *The (convex hull of the) set of the expected discounted equilibrium payoffs at the apex state $(c_0, c_0, c_0) \in S$ is a triangle*
- *The vertices of this triangle are at the points $(0, 0)$, $(0, V_M)$ and $(V_M, 0)$ where $V_M = v_{N,i}(c_0, c_0, c_0)$ is the expected discounted payoff to firm i in the monopoly equilibrium where firm i is the monopolist investor.*

Pay-off map – deterministic technological progress



Pay-off map – stochastic technological progress

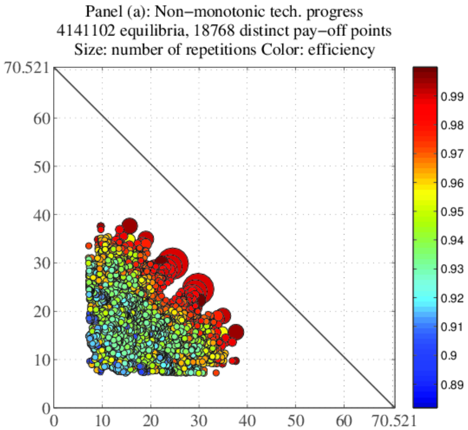


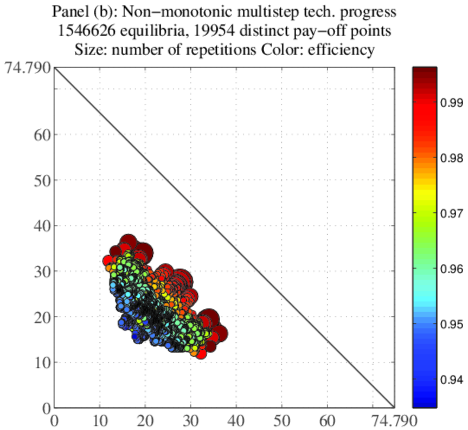
Pay-offs in the alternating move game

Theorem (Equilibrium payoffs in the alternating move game)

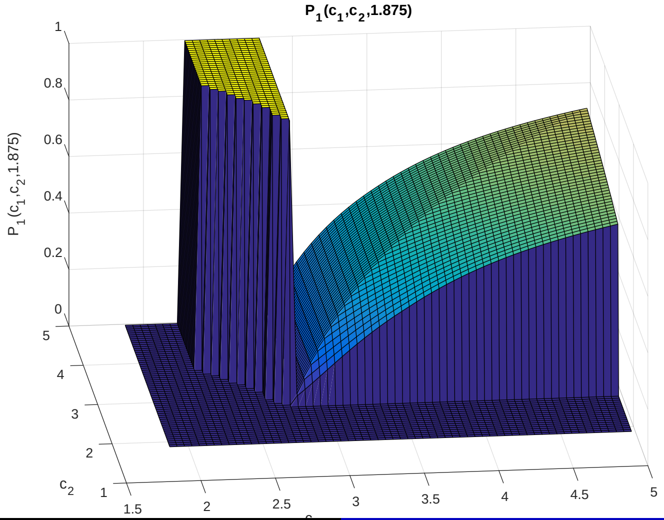
The (convex hull of the) set of expected discounted equilibrium payoffs at the apex state $(c_0, c_0, c_0) \in S$ of the alternating game is a strict subset of the triangle with the vertices $(0, 0)$, $(0, V_M)$ and $(V_M, 0)$

Pay-offs: alternating vs simultaneous move games

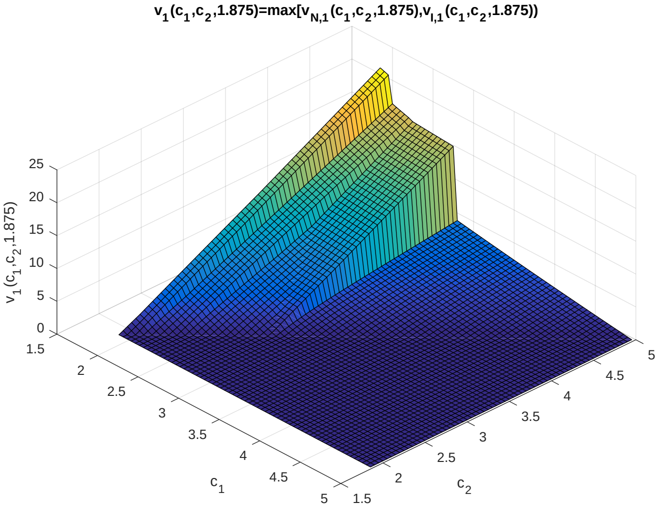




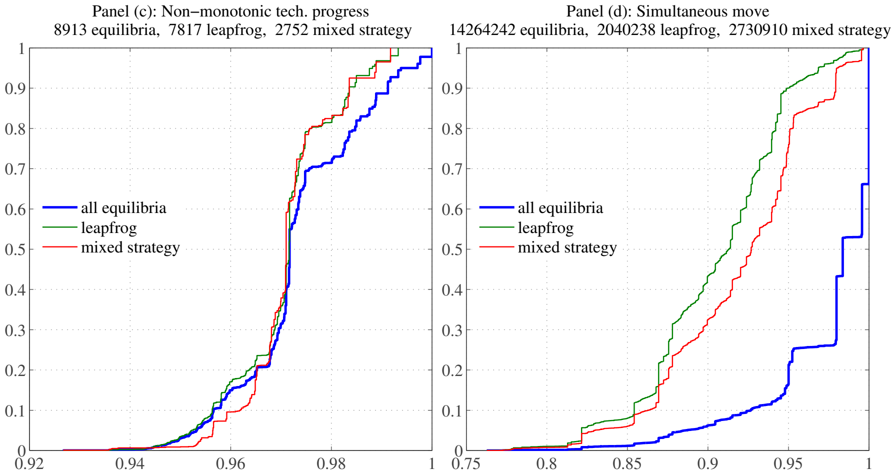
Symmetric mixed strategy equilibrium



Payoff to firm 1 in mixed strategy equilibrium



Efficiency: alternating vs simultaneous move games



Efficient equilibria — simultaneous moves

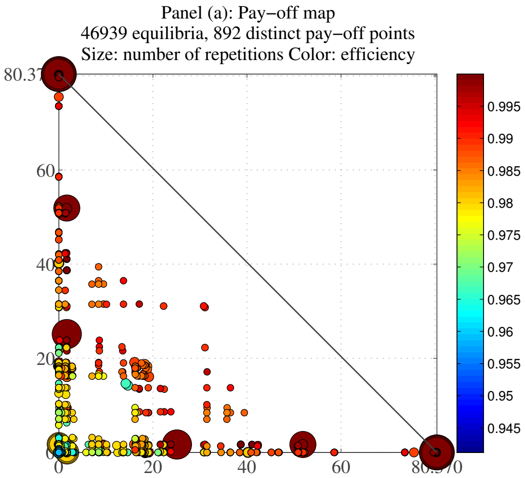
Theorem (Monopoly outcome in simultaneous move game)

If investment is optimal for the social planner, in the sense that investment costs are not prohibitively high, then there exist two symmetric "monopoly" MPE in the simultaneous move game.

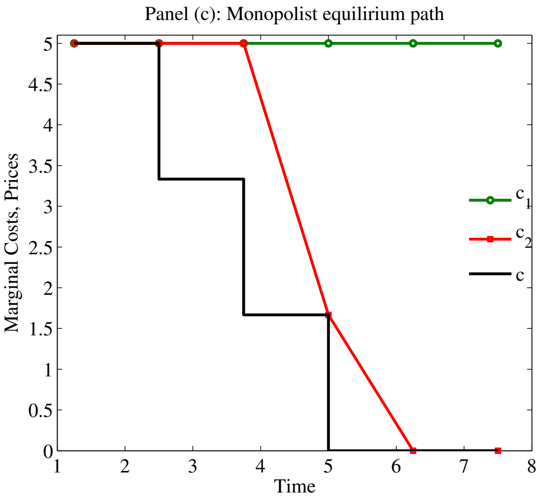
Theorem (Existence of efficient non-monopoly equilibria)

In both the simultaneous and alternating move investment games, there exist fully efficient non-monopoly equilibria.

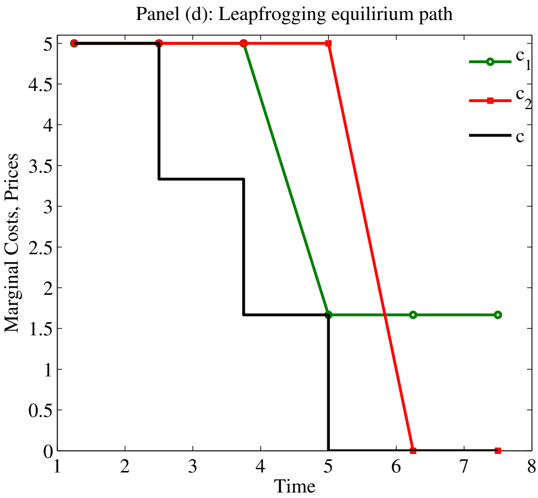
Efficiency of equilibria — simultaneous moves



Monopoly outcome — simultaneous moves



Efficient leapfrogging — simultaneous moves

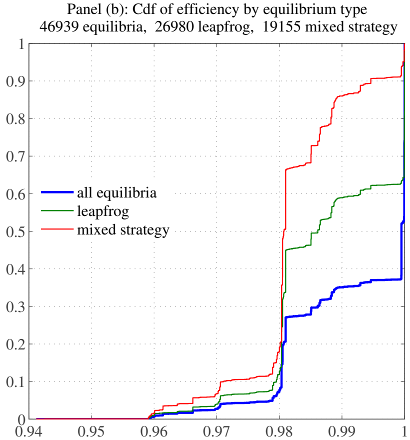


Efficiency of equilibria — simultaneous moves

Theorem (Inefficiency of mixed strategy equilibria)

A necessary condition for efficiency in the dynamic Bertrand investment and pricing game is that along MPE path only pure strategy stage equilibria are played.

Distribution of efficiency — simultaneous moves



NB: Red line jumps up at .99998, so there are no mixed strategy efficient equilibria

Riordan and Salant: Preemption equilibrium

Theorem (**Riordan and Salant, 1994**)

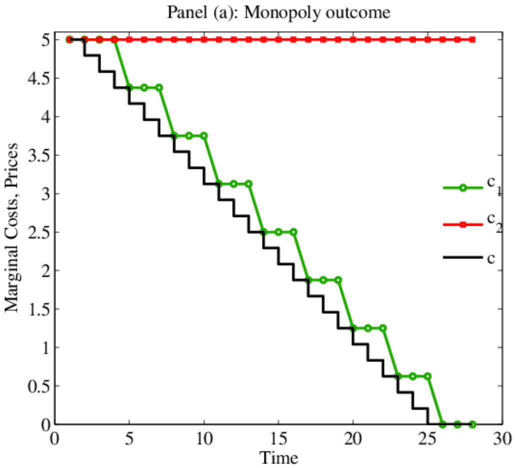
Consider the continuous time investment game where

1. *right to move alternates deterministically.*
2. $K(c) = K$ *and is not prohibitively high.*
3. *technological progress is deterministic:* $c(t)$ *is a continuous, non-increasing function*

Then there is a unique MPE with

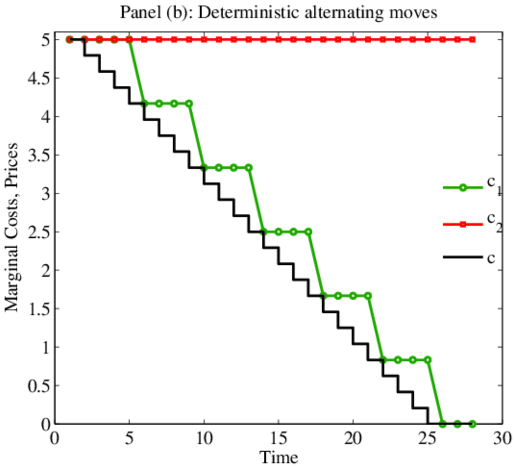
- *investment preemption: only one firm invests in equilibrium*
- *rent dissipation: discounted payoffs of both firms is* 0*, so the entire surplus is wasted on excessively frequent investments by the preempting firm*

Riordan and Salant: preemption and rent dissipation



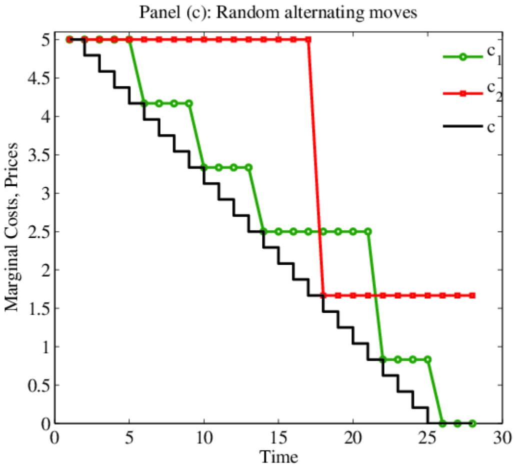
Underinvestment

Rent-dissipation disappears when *K* is low relative *dt*



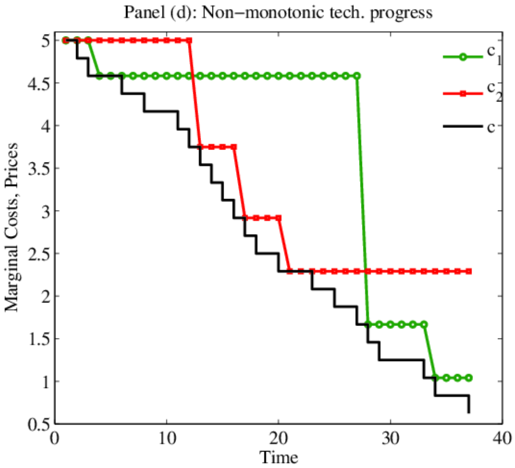
Leap-frogging

Preemption disappears under moves alternate randomly



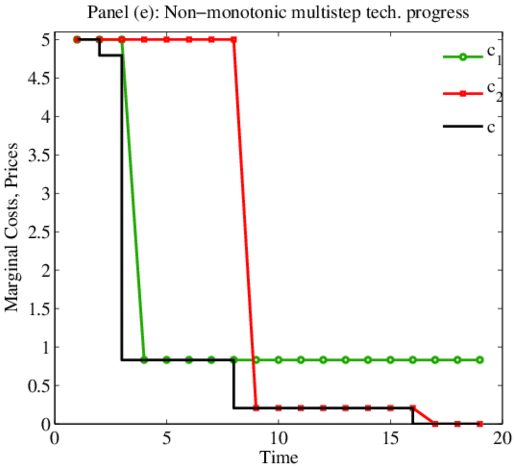
Stochastic technological progress → Leapfrogging

Riordan and Salant's result is not robust



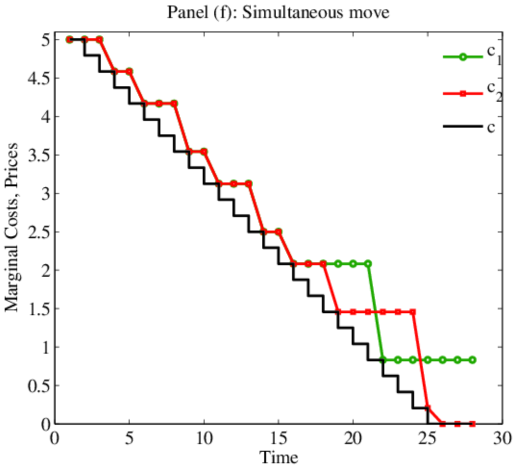
Random multistep technology → Leapfrogging

Riordan and Salant's result is not robust



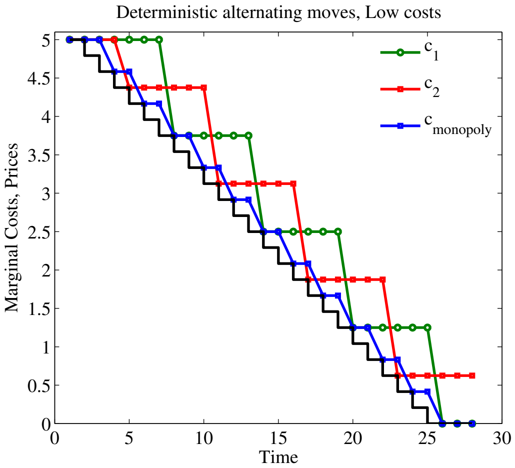
Simultaneous moves → Leapfrogging

Riordan and Salant's result is not robust

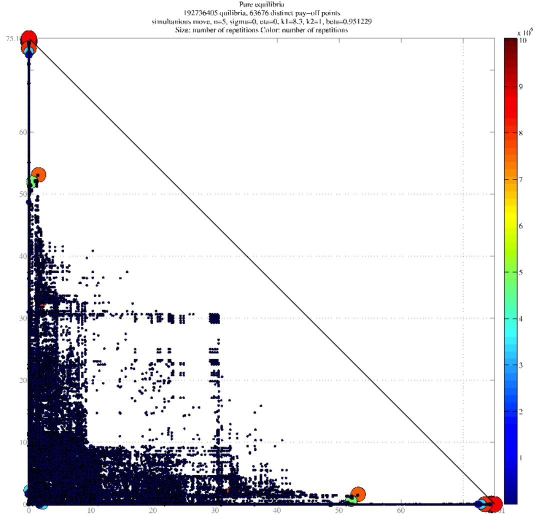


Determinsitic alternating moves: Leapfrogging

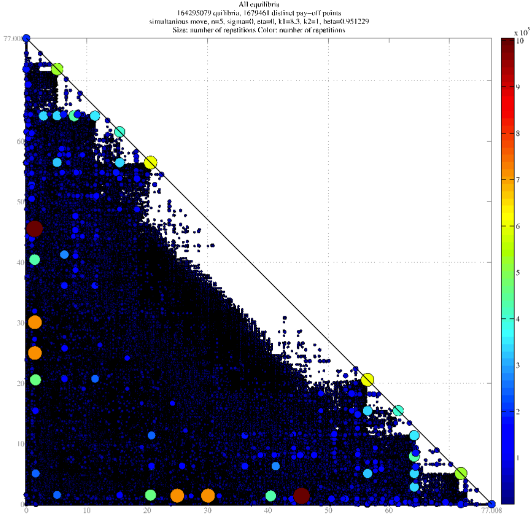
Riordan and Salant's conjecture is wrong



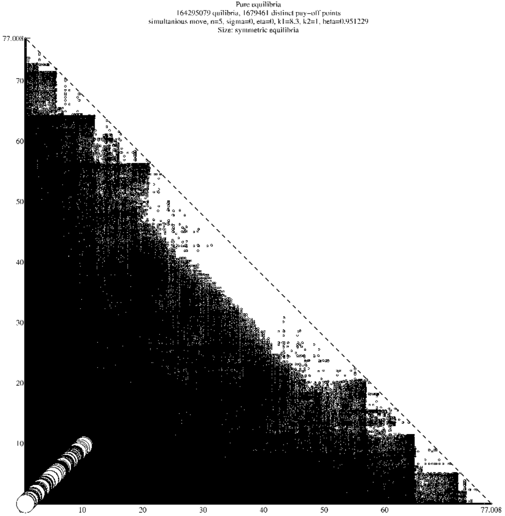
Step-by-step deterministic technology



Random technology



Symmetric equilibria: $V_1(c_1, c_2, c) = V_2(c_2, c_1, c)$



Idiosyncratic shocks in investment decisions

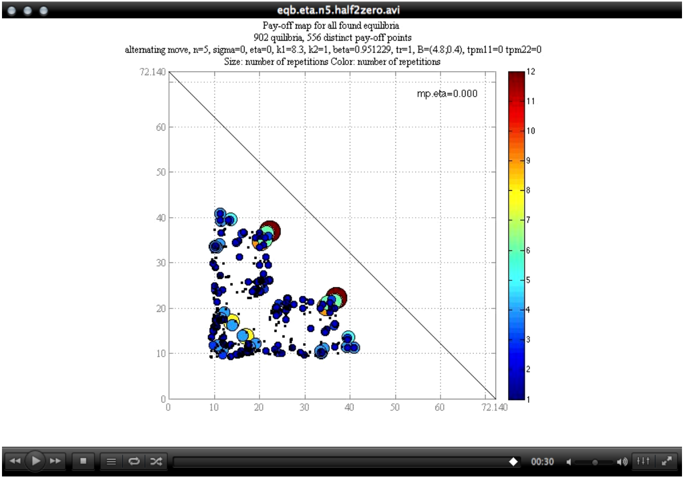
Private shocks to investment decisions

- In each period each firm incurs additive random costs/benefit from not investing and investing
- η is a scaling parameter
- game of incomplete information when $\eta > 0$

Doraszelski Escobar (2008 *Theoretical Economics*)

- Equilibria in our game are subject to their theory of regular MPE in dynamic stochastic games
- η is the homotopy parameter in the path-following methods
- **Problem:** multiplicity of equilibria $\rightarrow$ too many bifurcations along the path

Idiosyncratic shocks in investment decisions



Conclusions

Theoretical conclusions

- Endogenous coordination (e.g. leapfrogging) is possible in equilibrium of dynamic Bertrand investment game
- Leapfrogging investments: a new interpretation for price wars
- Numerous MPE equilibria and "Folk theorem"-like result
- Most equilibria are inefficient due to overinvestment

Methodological conclusions

- When equilibrium is not unique the computation algorithm inadvertently acts as an *equilibrium selection mechanism*
- State recursion algorithm is preferred to time iterations
- Imposing symmetry restriction on equilibria knocks out most equilibria in the model

In light of all this theory, what to tell the judge?

- In retrospect, what light does this theory of leapfrogging shed on the "but for" price of CFP in Australia?
- Clearly, the predictions are *sensitive* to assumptions about the timing of firms' moves and the nature of technological progress
- There are disturbingly many equilibria when we model firms as moving simultaneously, with Folk-Theorem like multiplicity of equilibria
- So is the theory vacuous? Does it predict that "anything could have happened"?

Limits to theory – Ariel Rubinstein, *Economic Fables*

- "I believe every academic . . . when in appearing in public [and] speaking about political and controversial issues — to clarify the extent to which he is incorporating his professional knowledge in his remarks, whether he is expressing views with the authority supported by academic findings, and what part of of his comments are nothing more than his personal thoughts and opinions."
- "And so, I would like to declare unequivocally, without hesitation and even with a bit of pride, that my words here have *absolutely nothing to do with my academic knowledge.*" "Everything I say here is personal, based upon the entire range of my life experience, which also includes the fact that professionally I engage in economic theory."

Collusion and the culture of executive immunity

- The Amcor-Visy collusion case was the first big, successful prosecution by the ACCC under the 1974 Australian *Trade Practices Act*
- Similar to the way the lysine cartel was the first big, successful collusion prosecution by the DOJ under the Sherman Antitrust Act
- However when we look at the Australian case, we see there is no real threat of jail time for executives who collude
- Instead it is the *Amcor shareholders* who are the chumps who have to foot the bill for the misbehavior of the corporate leadership — the executives walked away with substantial bonuses and were *indemnified* and thus insulated from any substantial penalties from colluding

Deep thought

- How to set the "rules of the game" to select the "good equilibria" and avoid the "bad equilibria" and the culture of *crony capitalism* that is so prevalent around the world?
- Leapfrogging: a metaphor for "good competition" — winning by making a better product at lower price
- Billions of people around the world are dismayed and harmed by corruption — in firms and in government.
- We have to recognize the lazy, greedy nature of human beings: we will seek the easy way out and cheat and collude rather than to compete — if we can get away with it. Though we try to devise rules to encourage virtuous behavior, humans have endless creativity in bending the rules to find an easier way to get what they want — especially to find easy ways to take advantage of others.