Beauty Contests and Contagious Adverse Selection

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Introduction

- Conference Title: 75th Anniversary of the General Theory
- Session Title: Expectations and Beliefs
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- Session Title: Expectations and Beliefs
- Chapter 12: The State of Long-Term Expectation
"It would be foolish, in forming our expectations, to attach great weight to matters which are very uncertain."

"In practice we have tacitly agreed, as a rule, to fall back on what is, in truth, a convention.... assuming that the existing state of affairs will continue indefinitely, except insofar as we have specific reasons to expect a change.... (This) conventional method of calculation will be compatible with a considerable measure of continuity and stability in our affairs, so long as we can rely on the maintenance of the convention."

This convention is precarious because of The Beauty Contest
The Beauty Contest

"...professional investment may be likened to those newspaper competitions in which the competitors have to pick out the six prettiest faces from a hundred photographs, the price being awarded to the competitor whose choice most nearly corresponds to the average preferences of the competitors as a whole; so that each competitor has to pick, not those faces which he himself thinks likeliest to catch the fancy of the other competitors, all of whom are looking at the problem from the same point of view. It is not a case of choosing those which, to the best of one's judgment, are really the prettiest. We have reached the third degree where we devote our intelligences to anticipating what average opinion expects the average opinion to be. And there are some, I believe, who practise the fourth, fifth and higher degrees."
An Interpretation

- Ordinary times...
  - "Convention"
  - Common understanding ("common knowledge") of rules of the game supporting equilibrium
- In extraordinary times....
  - Common understanding may break down
  - Higher order beliefs may become important
An Interpretation

- Ordinary times (thru’ summer 07)...
  - "Conventional" that all AAA rated assets are near perfect substitutes
  - Common understanding ("common knowledge") of rules of the game supporting equilibrium

- In extraordinary times....
  - Common understanding breaks down (somewhere between summer 07 and autumn 08)
  - Higher order beliefs may become important
A Quibble about the Beauty Contest Metaphor

- Very Suggestive
- Pure Coordination Game with Framing / "Focal Point" (Tom Schelling)
  - Multiple Equilibria (with either complete or incomplete information)
  - Fundamentals versus Sunspots
  - False Dichotomy?
  - Higher Level Reasoning a little redundant
A Quibble about the Beauty Contest Metaphor

- Very suggestive
- Pure Coordination Game with Framing / Focal Point
- But there are - Keynes concedes - a few long run traders who care about "fundamentals"
- Implicit assumption to make it interesting: one or more contestant who chose "sincerely" (don't care about winning / used a computer algorithm to identify the prettiest?)
- Unique equilibrium with complete and maybe with incomplete information
- Higher Order Beliefs play an essential role
- Neither fundamentals nor sunspots determine the winner, but an interesting mixture
This Talk

- Taking the beauty contest ("higher order beliefs") seriously in applied economic analysis
- Convention and Common Knowledge
- Contagious Adverse Selection (with Hyun Song Shin)
  - Market Confidence \( \equiv \) Approximate Common Knowledge of Bounded Potential Losses
  - Market Freeze if and only if Failure of Market Confidence
Convention and Common Knowledge

- David Hume (1739): *A Treatise on Human Nature*
- David Lewis (1969): *Convention: A Philosophical Study*
- How does language work?
- It is a convention that we use the word "cat" to refer to a cat, and "dog" to refer to a dog
- We might just as well call the cat "dog" and call the dog "cat"
Language

- For you and I to have a successful conversation, it is not enough that we both use the word "cat" to refer to a cat.
- We must also both know that the other is using the word "cat" to refer to a cat.
- Not enough: suppose I use the word "cat" to refer to a cat, and I think that you use the word "cat" to refer to a cat, but I think that you think that I use the word "cat" to refer to a dog. I would not expect to be understood if I said "The cat is on the mat".
- To have a successful conversation, must have common knowledge of meaning, i.e.,
  1. We both use "cat" to refer to a cat
  2. We both know that we both use "cat" to refer to a cat
Language

- To have a successful conversation, must have common knowledge of meaning, i.e.,
  1. We both use "cat" to refer to a cat
  2. We both know that we both use "cat" to refer to a cat
  3. We both know that (2) is true
  4. We both know (3) is true
  5. and so on....

- Coordination Problem

- Tom Schelling ⇒ David Lewis ⇒ Bob Aumann ⇒......
Coordination and Common Knowledge

- Suppose that I would like to accept a certain AAA security as collateral if and only if (1) the security will not default; and (2) everyone else will accept it as collateral.

- The security can be used as collateral if and only if
  1. Everyone knows that the security will not default
  2. Everyone knows that everyone knows that the security will not default
  3. Everyone knows that (2) is true
  4. Everyone knows that (3) is true
  5. and so on....

- i.e., it is common knowledge that the security will not default
Some Lessons from a Theoretical Literature on Coordination and Common Knowledge

1. Common knowledge is generated by "public" events (Aumann 76); public events are necessary for common knowledge.

2. "Approximate common knowledge" = "common $p$-belief" (Monderer and Samet 89):
   
   2.1 everyone believes with probability at least $p$ that the security will not default
   
   2.2 everyone believes with probability at least $p$ that (a) is true
   
   2.3 everyone believes with probability at least $p$ that (b) is true
   
   2.4 ....
Some Lessons from a Theoretical Literature on Coordination and Common Knowledge

1. Common knowledge is generated by "public" events (Aumann 76); public events are necessary for common knowledge.
2. "Approximate common knowledge" = "common $p$-belief" (Monderer and Samet 89).
3. Approximate common knowledge generated by almost public events.
4. Bayesian coordination requires approximate common knowledge (where $p$ depends on how risky the risky action is).
5. Approximate common knowledge in this sense is surprisingly hard to obtain (Rubinstein 89, Carlsson and van Damme 93, Morris and Shin 98).
Applying Lessons to Economic Settings

1. "Obvious" coordination problems (bank runs, currency attacks,....)
   - how adverse selection leads to coordination problem with higher order belief sensitivity
Contagious Adverse Selection

- There is always adverse selection (broadly defined) in financial markets
- In ordinary times, there is a convention to act as if not there
- Coordination problem among uninformed traders on both sides of the market
- Requires "market confidence" = "approximate common knowledge that losses are bounded"
- News that breaks approximate common knowledge (without significantly impacting anyone’s view of about adverse selection) shuts down market
Model

- \( N \) risk neutral sellers
- \( N \) risk neutral buyers

<table>
<thead>
<tr>
<th></th>
<th>probability</th>
<th>value to sellers</th>
<th>value to buyers</th>
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<tbody>
<tr>
<td>lemon</td>
<td>( \delta )</td>
<td>( \bar{v} - M - c )</td>
<td>( \bar{v} - M + c )</td>
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<tr>
<td>normal</td>
<td>( 1 - 2\delta )</td>
<td>( \bar{v} - c )</td>
<td>( \bar{v} + c )</td>
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<tr>
<td>peach</td>
<td>( \delta )</td>
<td>( \bar{v} + M - c )</td>
<td>( \bar{v} + M + c )</td>
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- common knowledge of gains from trade \( 2c \)
- small probability \( \delta \) of high gains or losses \( M \)
Model

- Welfare = Gains from Trade = $2c \times$ Probability of Trade
- But adverse selection: proportion $q$ of buyers and sellers know true value
- Buyers and Sellers randomly matched and say yes or no to trade at price $\bar{v}$
Key Parameter: Loss Ratio

- Suppose you are a uninformed seller matched with a random buyer who will buy UNLESS (1) he is informed; AND (2) the object is a lemon.
- When faced with an informed buyer (a probability $q$ event), expected losses are: $\delta (M + c) - c$
- When faced with an uninformed buyer (a probability $1 - q$ event), expected gains are: $c$
- The "Loss Ratio" is

$$\text{Loss Ratio} = \frac{q(\delta (M + c) - c)}{(1 - q) c}$$

- If $\delta M$ is large compared with $c$, then

$$\text{Loss Ratio} \approx \frac{q \delta M}{(1 - q) c}$$

- Symmetric calculations apply to buyers....
Complete Information among Uninformed = Common Knowledge of Loss Ratio

- Suppose common knowledge of parameters and thus $\psi$
- If $\psi < 1$, there is a unique equilibrium where no one trades
- If $\psi \geq 1$, there is also an equilibrium where everyone trades
Best Responses without Common Knowledge

- Suppose a seller is uncertain about the proportion of uninformed buyers who will sell and is uncertain of $M$.
- Uninformed seller will accept trade if and only if his expectation of the proportion of uninformed buyers who will trade is greater than his expectation of the loss ratio.
- Symmetric analysis for buyer.
Necessary Conditions for Trade

1. An agent's expectation of the loss ratio is less than 1...

2. (1) is true and his expectation of the proportion of agents on other side of market for whom (1) is true is greater than his expectation of the loss ratio...

3. (2) is true and his expectation of the proportion of agents on other side of market for whom (2) is true is greater than his expectation of the loss ratio...

4. etc....

There is *market confidence* for agent $i$ if and only if all the above statements are true.

We have argued market confidence is necessary for trade.
Fixed Point Characterization of Market Confidence

- Agent $i$ has market confidence if and only if his expectation of the proportion of agents on the other side with market confidence is greater than his expectation of the loss ratio.
- This self-referential, fixed point, definition is equivalent to iterated definition above.
- Analogous to / generalization of Aumann 76 and Monderer and Samet 89 characterizations of common knowledge and common $p$-belief respectively
- Fixed point definition can be used to show sufficiency of market confidence for trade.
Global Game Example

- At date 0, loss ratio is $\frac{1}{2} < \theta_0 < 1$ (common knowledge)
- At date 1, loss ratio $\theta_1 = \theta_0 + \eta$, where $\eta$ is drawn according to density $g(\cdot)$
- Each buyer and each seller observes a signal $x_i = \theta + \sigma \varepsilon_i$, where $\varepsilon_i$ is drawn according to $f(\cdot)$
- Trading game played at each of dates 0 and 1
Losing Market Confidence

- There is an equilibrium where all uninformed agents trade at date 0.
- For small $\sigma > 0$, the unique equilibrium has uninformed agents trading at date 1 only if expected loss ratio ($\approx x_i$) is less than $\frac{1}{2}$.
- Thus market freeze even if $\theta_1 < \theta_0$. 
Argument

- For small $\sigma$ and for any expected loss ratio, an agent’s expectation of the proportion of agents on the other side of the market with higher expected loss ratios is (approximately) $\frac{1}{2}$.
- Let $\bar{\theta}$ be the highest loss ratio at which any agent has market confidence.
- That agent’s expectation of the proportion of agents on the other side of the market with market confidence is at most $\frac{1}{2}$.
- So $\bar{\theta} \leq \frac{1}{2}$. 
Extensions

- General Asset Returns
- General Trading Mechanisms
Implications?

- Importance of Information Channels
- Common Understanding, not Accurate Measurement, is Key
- Implications for Accounting Standards (Recognition versus Disclosure)
- Implications for Stress Tests
Conclusion: Chapter 12 and Beauty Contests

- Chapter 12 holds up well
- Static expectations of bastard Keynesianism will not and should not make a comeback in economic modelling
- But insight that convention / expectational coordination is important, as is failure of common knowledge / higher order beliefs / beauty contests, is robust
- Can and should look for these phenomena within richer modelling of expectations and beliefs
- Benchmark model of adverse selection driven coordination problems
- Framework to analyze role of information
Conclusion: Contagious Adverse Selection

- "Market Confidence" well interpreted as approximate common knowledge that expected losses from participation are bounded
- Benchmark model of adverse selection driven coordination problems
- Framework to analyze role of information