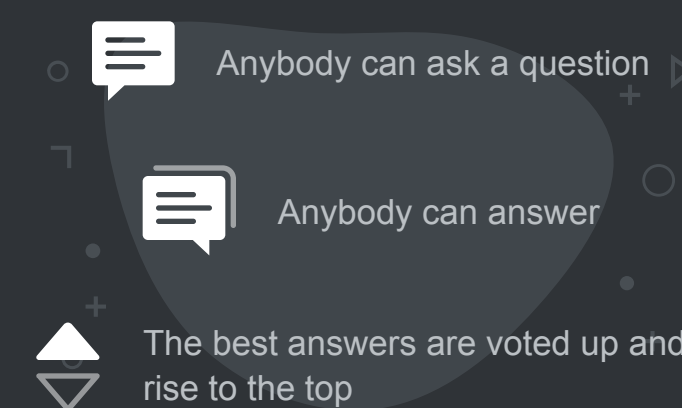


Economics Stack Exchange is a question and answer site for those who study, teach, research and apply economics and econometrics. It only takes a minute to sign up.

Sign up to join this community



Economics Beta

- Home
- Questions
- Tags
- Users
- Unanswered

Divinity for Dummies

Asked 4 years, 2 months ago Active 1 year ago Viewed 576 times

Ask Question

I understood the general idea of divinity: that it helps to rule out "unreasonable" equilibria. However, can someone explain it in more details with simple examples so that a senior undergrad student understands it?

game-theory bayesian-game signaling equilibrium-selection

share improve this question follow

edited May 19 '19 at 16:59 Bayesian 1,708 1 8 31

asked Mar 6 '16 at 19:16 Beck 151 3

add a comment

1 Answer

Active Oldest Votes

Signaling games (games in which an informed "sender" moves first and an uninformed "receiver" second) typically have a plethora of Perfect Bayesian Equilibria which is not really appealing in terms of predictive power. However, as you already said, some equilibria may be "unreasonable". Refinements serve the purpose to formalize which of these equilibria are unreasonable.

Sequential Equilibrium is not really helpful in eliminating the equilibrium multiplicity, because the multiplicity of equilibria stems from the fact that PBE allows off-path beliefs to be "crazy". That is, we can support many equilibria by assigning "crazy" beliefs when a signal is sent that was not supposed to be sent on equilibrium path.

I take the fact that you ask about divinity as a signal that you dug deeper into signaling so that you know the Spence model and the Beer-Quiche game. Otherwise, look up these examples as they are helpful to illustrate the issue. I provide references below. Back to said issue: For example, we can support a no-education pooling equilibrium in a standard two-type unproductive-costly-education Spence model by imposing that a receiver does not update her beliefs when she observes education - we can even say that education signals a low type, because positive education is an off-path message. As another example, in the Beer-Quiche game, you can support a quiche pooling (sequential) equilibrium where the off-path message (drinking beer) is interpreted as wimpy.

To understand why divinity is helpful, you should understand another refinement first. Perhaps the most widely used refinement is Cho & Kreps (1987) "Intuitive Criterion"(IC). In a standard two-type Spence signaling model, IC eliminates all but one equilibrium, the least-cost separating one (Riley outcome). Very sloppily saying, IC labels off-path beliefs as "unreasonable" if one type can say:

"I am going to send this out-of equilibrium message  $mm$  for which you may have a weird belief. I do this to signal that my type is  $xx$  although you may believe I am some type  $yy$ . However, notice that if I were such a type  $yy$ , I would be better off by staying on equilibrium path **regardless of what you infer from  $mm$** . Also notice that as a type  $xx$  I am better off by sending  $mm$  **IF this speech convinces you** that I am really  $xx$ ."

Now this is a relatively simple idea to eliminate weird beliefs. Thing is that it does not always work. For example, we can add a third type to the standard Spence model. Now IC does not solve our multiplicity problem. You can verify (or read in one of the references) that IC does not eliminate hybrid equilibria in which the high types send a separating signal while for some education levels low types and medium types are pooled. The issue here is that possibly more than just one type may benefit from credibly announcing a speech as above. A belief that all such types are equally likely to do this deviation satisfies the IC. However, it might be that some types are more likely to deviate to this off-path message. Now, enter divinity, an even more powerful refinement.

"More powerful" refinement means that it has even stricter restrictions on off-path beliefs. The D1-criterion restricts the off-path belief upon observing an out-of-equilibrium message to be a point belief with all mass on the type who is most likely to make this deviation: Intuitively, after receiving message  $mm$ , there are more best responses of the receiver that improve the equilibrium utility of type  $x_1x_1$  compared to  $x_2x_2$ . D1 says Receiver should infer that she deals with a type  $x_1x_1$  and put weight zero on type  $x_2x_2$ . Note that in the two-types Spence model, both criteria coincide. In contrast, in the three-types model D1 eliminates all but the least-cost-separating equilibrium.

D2 is even stricter than D1: It requires the posterior to put weight zero on a type  $xx$  upon observing  $mm$  if for every best response of the Receiver that causes type  $xx$  to deviate there is some other type  $x'x'$  that strictly benefits from the deviation. Divinity and Universal divinity (after Banks&Sobel 1988) are based on D1 and D2. Divinity weakens D1: Receiver does not have to put belief mass zero on type  $x_2x_2$ , but his posterior must not increase the likelihood ratio of  $x_2x_2$  to  $x_1x_1$ . Universal divinity is stronger than D2 in that it applies D2 iteratively.

For a more formal treatment, read the original papers. [A good summary is provided by Peter Camton](#). He also discusses the Beer-Quiche-game and in addition covers cheap talk games and the corresponding refinement, neologism-proofness. [This](#) guide on refinements may also help (they discuss the 3-types Spence model I refer to). To stay within the community, see the answers to [this well-received question](#).

share improve this answer follow

edited Apr 13 '17 at 12:51 Community 1

answered Jan 17 '17 at 12:45 Bayesian 1,708 1 8 31

add a comment

Your Answer

Rich text editor area with formatting tools (bold, italic, link, image, list, etc.) and a large text input area.

Sign up or log in

Sign up using Google, Sign up using Facebook, Sign up using Email and Password

Post Your Answer

By clicking "Post Your Answer", you agree to our terms of service, privacy policy and cookie policy

Post as a guest

Name, Email fields

Not the answer you're looking for? Browse other questions tagged game-theory bayesian-game signaling equilibrium-selection or ask your own question.

Featured on Meta

- Meta escalation/response process update (March-April 2020 test results, next...
- Creative Commons Licensing UI and Data Updates

Linked

26 How to intuitively understand the 'Intuitive criterion'?

Related

26 How to intuitively understand the 'Intuitive criterion'?

4 Dominated Strategies in an Infinitely vs Finitely Repeated Game

5 Checking incentive compatibility of a mechanism

4 Equilibria in Signaling and Screening

2 Beliefs about equilibrium paths with overlapping strategies

5 Example of a game with no Nash equilibria but at least one correlated equilibrium

2 Signaling in zero-sum games?

0 Refinements in signaling games with three sender types

Hot Network Questions

- Are there names for the different types of adjacency in a square grid?
- How can I show time passing with no way to measure time?
- Boss often wants me to screen share (and record) from my personal computer
- Security differences in going online by WiFi vs by Ethernet lan cable
- Is it bad etiquette to try to make an opponent lose on time when a position is clearly drawn?
- How can my PCs discover an NPC's class if they are trying to hide it?
- Basic readings and references: where to start
- MolView is unable to generate correct 3D structure for hydroxypropadiene
- Why would anyone contribute to Android?
- Current status of axiomatic quantum field theory research
- Where does Trump's authority to cut funding to WHO come from, if Congress controls spending?
- Do propellers layered on top of each other have twice the thrust of one propeller?
- Is "open software" the same as "open source" software?
- Can I slim this UTF8-encoding program?
- How can I improve Commonwealth load time in Fallout 4 (PC)?
- Why is this "the first elliptic curve in nature"?
- Is it common practice to validate responses from 3rd party APIs?
- How did the Bolsheviks fund their government?
- Grammaticality: 'Wise men speak because they have something to say; Fools because they have to say something'
- How to store refusal of cookie consent
- Are there native tongue-twisters in Latin?
- Steel welding options for a remote property?
- Is it possible to "push" a leaning concrete wall upright?
- Does reduction of maximum hit points stick to the form it is applied to?

Question feed

ECONOMICS

- Tour
- Help
- Chat
- Contact
- Feedback
- Mobile
- Disable Responsiveness
- Disable Responsiveness

COMPANY

- Stack Overflow
- Stack Overflow Business
- Developer Jobs
- About
- Press
- Legal
- Privacy Policy

STACK EXCHANGE NETWORK

- Technology
- Life / Arts
- Culture / Recreation
- Science
- Other

Blog Facebook Twitter LinkedIn Instagram