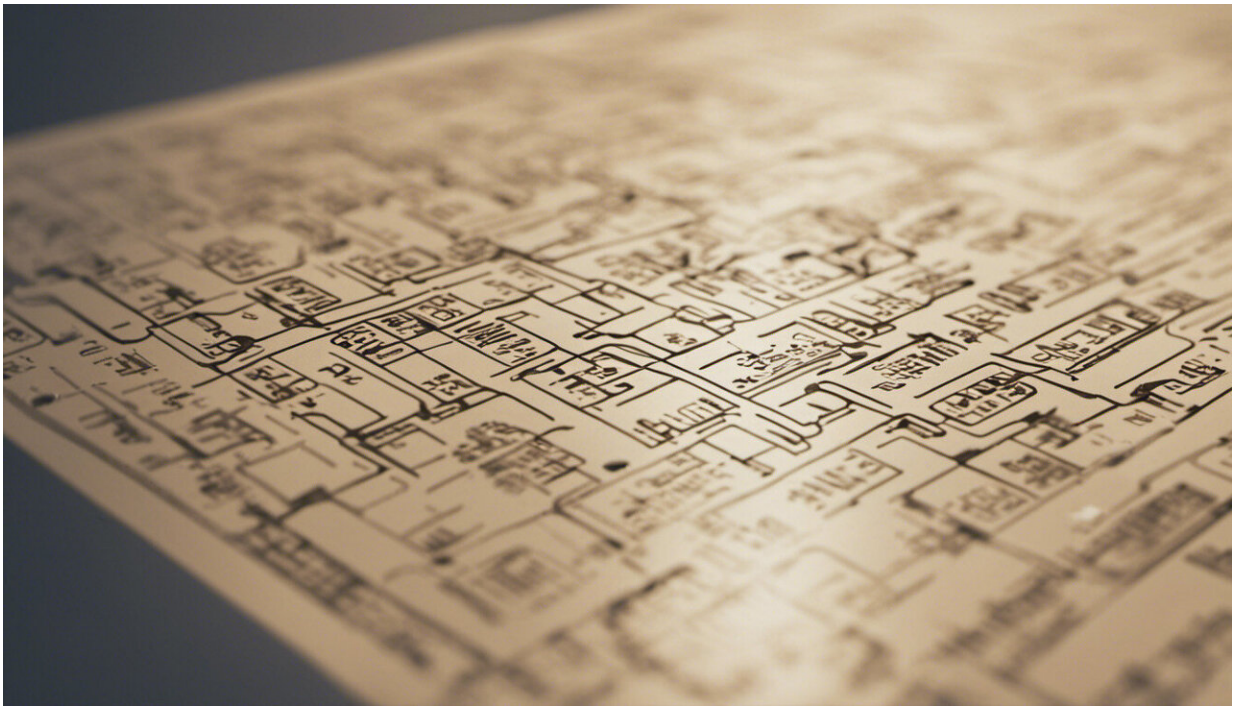
Game theory expert expands method to incorporate new categories

December 23 2019, by Jon Niccum



Credit: AI-generated image (disclaimer)

If economics is a game, Tarun Sabarwal would make a worthy opponent.

An expert in "game theory," the professor of economics at the University of Kansas creates and studies mathematical models designed to predict behavior.

"Game theory can be explained as everyone is doing what they want to do, but what each person does affects the well-being of others through what we call 'payoffs.' For firms, that means profits. Or for countries, that means social welfare," he said.

Those are among the concepts explored in Sabarwal's "Global Games with Strategic Complements and Substitutes." Co-authored with Eric J. Hoffmann, the article is published in the current issue of *Games and Economic Behavior*, the leading journal of game theory.

"We went in understanding the benefit of the global games method," Sabarwal said. "Our goal was to see if we can expand this tool to allow for analysis of additional classes which it can't cover presently. And we have managed to do that."

Attempting to explain the byzantine strategies of game theory proves impractical in a short article. But an abridged version appears graspable with the help of a few Sabarwal analogies.

Consider a "base coordination game and its natural equilibrium."

"A basic metaphor is that in a group of individuals, if we coordinate with each other, we can get to a better outcome. Let's say we have two technologies, but one technology is worse than the other. Maybe Microsoft Windows is worse than Apple iOS—or conversely. In any organization, there is a benefit from coordinating on one technology. Let's just select one because if we have both, it won't be as good as even going with the worse one," he said.

Game theorists deem both outcomes perfectly acceptable, even though one is inherently weaker than the other. This is a fundamental observation of coordination games, which are frequently applied to things ranging from speculative attacks in the stock market to a nation

waging warfare.

As alluded to in the title of his article, coordination games are those with strategic complements. Others are termed strategic substitutes. As a base example, he introduces a dove/hawk game.

"Think of a situation in which you can take a less-aggressive action or a more-intense action. I can do the same thing, but our payoffs are going to be governed by our joint actions," he said.

As an illustration, he offers two firms competing for dominance in the marketplace.

He said, "If both firms compete aggressively, then there will be oversupply, and both will end up with lower prices and therefore low profits. If both produce less, that's fine. But if you produce less and I produce a bit more, I am not really flooding the market. I get the higher market share and my profits go up. Same situation in terms of strategic interactions."

Sabarwal indicates game theory is applicable to a myriad of subjects, even to the authoring of his own article. In this case, the professor co-wrote it with a former student. Hoffman, a KU alumnus, is now a faculty member in the department of accounting, economics and finance at West Texas A&M University.

"It's very satisfying collaborating with someone who was once in my classroom," he said.

"Eric started working on it as a student. We discussed what the topics would be and would have a lot of back and forth. I try to develop deeper foundations in students, even though it takes longer to reach this level."

Now in his 12th year at KU, Sabarwal studies decentralized decision making, its collective impact and the welfare implications of such collective impact.

"What I'm trying to convey more and more to the general audience is that the method of game theory is very flexible," said Sabarwal, a native of Patiala in northwestern India.

He explains the only thing required is a set of indexes.

These indexes (or players) could be programs that are playing with each other. They could even be robots. They need defined actions, and payoffs, or what the index gets from joint interaction.

"That's why game theory is very foundational and fundamental, because the model itself can be applied without regard to people," Sabarwal said. "The people part is not necessary."

More information: Eric J. Hoffmann et al. Global games with strategic complements and substitutes, *Games and Economic Behavior* (2019). DOI: 10.1016/j.geb.2019.08.007

Provided by University of Kansas