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RESEARCH NEWS STORY

November 14, 2023
Chiba University

Boosting Profits for Technology Holders and Licensees through Game Theory

A new study shows that licensing schemes that maximize profits for technology holders and boost licensees' own surplus can be determined via game theory

Patents and licenses protect the technology holder's inventions from being stolen or copied without approval. However, determining a licensing scheme that boosts the technology holder's profit through bargaining is tricky. A new study using game theory found the scenarios in which fee and royalty licenses could be utilized successfully to achieve such an outcome.

Image title: Business partners shaking hands at a meeting
Image caption: A new study shows that licensing schemes that maximize profits for technology holders and boost licensees' own surplus can be determined via game theory, providing new insights to regulators and stakeholders in the field
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Patents and licenses safeguard the intellectual property of the rights holder from being copied or sold without their permission. Companies and individuals who want to make use of the patented or licensed invention must make a formal request to do so. In industries where oligopolies operate—a small number of producers who control the supply of a good or commodity and can determine prices—the profitability of licensing a patent depends on two critical factors: the chosen method of payment for license access and the relative number of firms granted the license as opposed to those left without. Previous studies on technology transfer within oligopolistic markets predominantly revolved around non-cooperative licensing methods, including take-it-or-leave-it offers and auction-based systems. However, negotiations play a key role in granting and obtaining licenses between the technology holder and licensee companies. The bargaining aspect of cooperative game theory has been under-researched.

Published on September 12, 2023, in the *Journal of Public Economic Theory*, a new study by Associate Professor Shin Kishimoto from the Graduate School of Social Sciences at Chiba University, Japan, examined which stable licensing schemes could maximize profits for the technology holder based on a combination of fees and royalty licenses. His mathematical model revealed a number of interesting results.

First, if a licensing scheme is rejection-proof—when a group of licensee applicants doesn't have the incentive to reject the licensing scheme being offered—and not dominated—when there is no better licensing scheme for the technology holder and licensee applicants than the offered licensing scheme— (i.e., stable), then the royalty rate does not necessarily maximize the total profit of the technology holder and licensees. In this scenario, fee licensing is not achieved through bargaining, except when the royalty rate maximizing the total profit of the technology holder and licensees is equal to zero.

Second, a stable licensing scheme always exists for the group of licensees who maximize the sum of the technology holder's profit and their own total surplus.

Third, a comparison of the technology holder's profits under the stable licensing schemes shows that it is always beneficial for the technology holder to grant the license to the applicants, which maximizes the sum of the technology holder's profit and the licensees' total surplus.

These findings build on Prof. Kishimoto's previous research on cooperative game theory in technology transfer. "*In my previous study, I separately analyzed two payment methods, lump-sum fees, and per-unit royalty, for technology licensing through bargaining*. *In practice, however, their combinations are also used as a payment method. This paper provides a perspective on the question of which licensing contracts are desirable for technology holders,*" he says. "*In addition, by comparing these results with those of the non-cooperative previous study, I found that the number of licensees might be fewer in the licensing-through-bargaining approach than through auction. If technology holders aim at a wide diffusion of their technologies, my paper suggests that they should license through auction*."

Prof. Kishimoto's research offers valuable insights for technology holders seeking optimal licensing strategies to boost profits. Policymakers can leverage this knowledge to inform intellectual property and antitrust regulations. Moreover, the study underscores the significance of cooperative game theory in technology transfer, which can enhance the outcomes of licensing agreements for businesses.

While the paper employs simplified mathematical models and assumptions, like the rejection-proof concept and specific mathematical conditions, which may not fully represent the complexities of real-

world technology transfer scenarios, Prof. Kishimoto is hopeful that more papers will focus their lens on game theory that is predicated on cooperation and bargaining outcomes. "*There are not many papers that study technology licensing through bargaining from the viewpoint of cooperative game theory. Thus, I hope that subsequent studies will be done based on this research,*" he concludes.

About Professor Shin Kishimoto

Shin Kishimoto is an associate professor in the Graduate School of Social Sciences at Chiba University. His research interests are game theory and industrial organization, with a focus on the application of cooperative game theory to technology transfer. Prior to joining Chiba University in 2014, he was an Assistant Professor in the Graduate School of Decision Science and Technology at the Tokyo Institute of Technology. He received his PhD from the Tokyo Institute of Technology in 2011.

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Reference

Title of original paper: Stable licensing schemes in technology transfer
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Journal: Journal of Public Economic Theory
DOI: 10.1111/jpet.12664

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