THEORY AND APPLICATIONS OF GAMES WITH SHARED CONSTRAINTS UNDER UNCERTAINTY

THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DOCTORAL PROGRAMME IN MANAGEMENT

INDIAN INSTITUTE OF MANAGEMENT INDORE

BY

KISHAN SUTHAR

February 2026

Thesis Advisory Committee

Prof. Nagarajan Krishnamurthy (Chairman, IIM Indore)

Prof. Omkar D. Palsule-Desai (Member, IIT Bombay)

Prof. Sutirtha Bandyopadhyay (Member, IIM Indore)

Prof. Yadati Narahari (Member, IISc Bangalore)

Acknowledgments

This thesis would not have been possible without the support and guidance of many people. My quest for learning led me onto an unplanned path that eventually shaped my life and gave me the opportunity to pursue my doctoral studies at the Indian Institute of Management Indore. Although *game theory* was not my original focus when I began my doctoral journey, everything changed after I enrolled in a course taught by Prof. Nagarajan Krishnamurthy. From that point onward, the subject became one of my strongest academic interests. This transformation was possible only because of his exceptional ability to make the subject engaging and intellectually stimulating. He consistently encouraged my ideas and never once discouraged my efforts, which gave me the confidence to complete this degree in a timely manner. I am deeply grateful to him for being a patient, kind, and supportive advisor. If there is anyone I aspire to emulate in life, it is him.

I am sincerely grateful to Prof. Omkar D. Palsule Desai for his immense contribution to this thesis. His ability to simplify complex problems and structure rigorous arguments inspired me to develop my analytical skills. The work on the sericulture land-allocation scheme was initiated through his guidance. He also helped introduce me to professionals in the sericulture sector, which enabled me to begin modeling a real-world problem. I would also like to thank the sericulture personnel of the Madhya Pradesh Government who provided practical insights essential to this study.

I would like to thank Prof. Sutirtha Bandyopadhyay for his valuable suggestions, which helped me approach this work from an economic perspective. His feedback at each stage of the thesis provided fresh insights, strengthening the overall quality of the research. Beyond academics, his empathetic nature continually motivated

me and helped shape my academic character.

I am grateful to Prof. Yadati Narahari for being part of this thesis. While reading his book *Game Theory and Mechanism Design*, I never imagined that I would have the opportunity to interact with him personally or receive feedback on my work. His precise and insightful comments greatly improved the structure and clarity of this thesis. I am deeply thankful to him for agreeing to be associated with this study. I would like to thank the Thesis Evaluation Committee (TEC) for their constructive feedback, which helped improve the quality of this thesis.

My time at 306, DPM Residence at IIM Indore will always remain special. I made lifelong friends, colleagues, and collaborators there. I thoroughly enjoyed my coursework days with my batchmates Manu, Deepesh, Pankesh, and Abhinay. I also shared many memorable moments with Mahesh, Rohit, Ankit, Minali, Krati, Puloma, and many other friends. I learned greatly from my seniors Umang, Priyam, Manish, Arvind, Sachin, Ankur, Abhinay JPS, and Vignesh. The list is long, and I am thankful to everyone who contributed to making my journey enriching.

I sincerely thank all the faculty members at IIM Indore who taught and motivated me to pursue challenging academic goals. I am also deeply appreciative of the DPM Office for providing continuous academic support, the administrative staff for their assistance, the housekeeping staff for maintaining a positive environment, and all non-academic staff members who were always willing to help.

I also thank Prof. Deeptesh Ghosh, Prof. Sachin Jayaswal, Prof. Ankur Sinha, Prof. Prahalad Venkateshan, Prof. Gautam Dutta, Prof. Tathagatha Bandyopadhyay, and Prof. Karthik Sriram (IIM Ahmedabad) for inspiring me to pursue my PhD.

Finally, I would like to express my deepest gratitude to my parents, who have supported me unconditionally throughout every stage of my life. Their faith in me gave me the strength to pursue my doctoral journey. This thesis is dedicated to their hard work, sacrifices, and unwavering belief. I would also like to thank my partner, Mansi, for standing by me during the final stages of this journey. She has been a wonderful friend and a thoughtful critic. I am also grateful to my extended family members for their continued support.

Abstract

This thesis studies games with shared constraints under uncertainty. Individuals sharing common resources often face interdependent strategy sets, a structural property absent in standard Nash equilibrium problems. Such games are known as Generalized Nash Equilibrium Problems (GNEP). While existence and uniqueness in deterministic GNEPs are well established, their counterparts with stochastic payoffs and strategy sets remain relatively unexplored; we refer to this formulation as the Generalized Nash Equilibrium Problem under Uncertainty (GNEPU). In Chapter 1, we present the motivation and the problem statement, and in Chapter 2, we review the relevant literature.

In Chapter 3, we establish the existence of an equilibrium using measurable selection and random fixed-point theorems and prove uniqueness via (i) contraction properties of best-response mappings and (ii) a risk-adjusted formulation with strict monotonicity. We demonstrate the practical relevance of our theoretical findings through an application to a Tragedy of the Commons (TOC) setting in sugarcane farming in India.

In Chapter 4, we extend the non-cooperative GNEPU framework to a cooperative setting in which players are allowed to form coalitions. Such situations arise in applications where players organize into groups while facing a common public resource. We refer to these problems as shared-constraint cooperative games under uncertainty (SCGU) and show that the core of such games is non-empty under certain conditions. We further extend the sugarcane farming example developed in the previous chapter to the case in which farmers form FPOs, and we identify the conditions under which these FPOs are stable.

In Chapter 5, we examine a real-world application of GNEPU in the sericulture

sector. Sericulture involves rearing silkworms and producing silk from their cocoons. Different types of silk vary substantially in terms of input requirements, skill needs, production costs, and market prices. Focusing on two silk types—mulberry and tussar—we analyze (i) farmers' crop choices and production quantity decisions and (ii) the firm's optimal procurement prices when farmers face a shared water-resource constraint. Cultivation of mulberry requires a certain level of skill; therefore, only high-skill farmers can produce it, whereas tussar can be produced by both high- and low-skill farmers. Consequently, low-skill farmers must decide whether to upgrade their skills to cultivate mulberry. Equilibrium outcomes are established using the results developed in Chapter 3 for GNEPU. Our main findings indicate that farmers prefer selling to the firm when water resources are scarce, whereas they sell directly in the open market when resources are abundant. Interestingly, skill upgrading is beneficial only when resources are limited; under high resource availability, increasing skill does not affect equilibrium outcomes.

Our modeling framework is not limited to the agriculture and sericulture sectors. Generalized Nash equilibrium problems under uncertainty (GNEPU) and shared-constraint cooperative games under uncertainty (SCGU) arise in a variety of real-world settings. For instance, fishermen may decide harvest levels without precise knowledge of fish stock, while fishing cooperatives determine collective catch decisions. Another important application is in pollution control, where industries or countries choose production levels while facing shared environmental constraints. Many other applications can be studied within this framework. We believe that our results can assist practitioners and policymakers dealing with similar resource-sharing and uncertainty-driven decision environments.

Keywords: Shared constraint games, generalized Nash equilibrium, tragedy of the commons, cooperative games with shared resources, sericulture.

Contents

List of Figures

yield parameters and their skill levels. Second, the skill differential between high- and low-skill farmers affects equilibrium profits only when water is scarce; when water is abundant, skill differences do not influence equilibrium outcomes. We also find that social welfare—defined as the sum of farmers' profits, the firm's profit, and consumer surplus—initially increases with water availability but declines beyond a threshold level, primarily because the firm's profit decreases as water availability rises. Finally, when water resources are scarce, farmers prefer selling directly in the open market at higher prices, whereas when water availability is sufficient, selling to the firm becomes more beneficial.

We believe that the theoretical and applied results on shared-constraint games developed in this thesis will open several avenues for further research and find applications across multiple fields.

Bibliography

Aflaki, S. (2013). The Effect of Environmental Uncertainty on the Tragedy of the Commons. *Games and Economic Behavior*, *82*, 240–253.

Aliprantis, C. D., & Border, K. C. (2006). *Infinite Dimensional Analysis*. Springer.

Alizamir, S., Iravani, F., & Mamani, H. (2019). An Analysis of Price Vs. Revenue Protection: Government Subsidies in the Agriculture Industry. *Management Science*, *65*(1), 32–49.

Alshamrani, A. M., Alrasheedi, A. F., & Alnowibet, K. A. (2022). A Game-theoretic Model for Wind Farm Planning Problem: A Bi-level Stochastic Optimization Approach. *Sustainable Energy Technologies and Assessments*, *53*, 102539.

Arrow, K. J., & Debreu, G. (1954). Existence of an Equilibrium for a Competitive Economy. *Econometrica*, *22*(3), 265–290.

Aruga, H. (1994). *Principles of Sericulture*. CRC Press.

Aumann, R. J. (1961). The Core of a Cooperative Game Without Side Payments. *Transactions of the American Mathematical Society*, *98*(3), 539–552.

Aumann, R. J. (1967). *Measurable Utility and the Measurable Choice Theorem* (tech. rep.). Hebrew University of Jerusalem. Institute of Mathematics.

Aumann, R. J. (1989). *Lectures on Game Theory*. Westview Press.

Ba, Q., & Pang, J.-S. (2022). Exact Penalization of Generalized Nash Equilibrium Problems. *Operations Research*, *70*(3), 1448–1464.

Berge, C. (1963). *Topological Spaces: Including a Treatment of Multi-valued Functions, Vector Spaces and Convexity*. Oliver & Boyd.

Birge, J. R., & Louveaux, F. (2011). *Introduction to Stochastic Programming*. Springer Science & Business Media.

Bochet, O., Laurent-Lucchetti, J., Leroux, J., & Sinclair-Desgagné, B. (2019). Collective Risk-taking in the Commons. *Journal of Economic Behavior & Organization*, *163*, 277–296.

Bondareva, O. (1963). Some Applications of Linear Programming Methods to the Theory of Cooperative Games. *Problemy Kibernetiki*, *10*, 119–139.

Braouezec, Y., & Kiani, K. (2023). Economic Foundations of Generalized Games With Shared Constraint: Do Binding Agreements Lead to Less Nash Equilibria? *European Journal of Operational Research*, *308*(1), 467–479.

Browder, F. E. (1968). The Fixed Point Theory of Multi-valued Mappings in Topological Vector Spaces. *Mathematische Annalen*, *177*(4), 283–301.

Castaing, C. (1967). Sur Les Multi-applications Mesurables. *Revue française d'informatique et de recherche opérationnelle*, *1*(1), 91–126.

Central Silk Board. (2023). Export Value of Silk Fabrics From India From Financial Year 2013 to 2023 (in Billion Indian Rupees) [https://www.statista.com/statistics/1025673/india-export-value-silk-fabrics/]. *In Statista. Retrieved June 26, 2023.*

Charnes, A., & Granot, D. (1977). Coalitional and Chance-constrained Solutions to N-person Games, II: Two-stage Solutions. *Operations Research*, *25*(6), 1013–1019.

Chen, X., Wang, L., Jiang, Y., & Wang, J. (2024). A Peer-to-peer Joint Energy and Reserve Market Considering Renewable Generation Uncertainty: A Generalized Nash Equilibrium Approach. *Energy Conversion and Economics*, *5*(3), 179–192.

Chen, Y.-J., & Tang, C. S. (2015). The Economic Value of Market Information for Farmers in Developing Economies. *Production and Operations Management*, *24*(9), 1441–1452.

Chick, S. E., Hasija, S., & Nasiry, J. (2017). Information Elicitation and Influenza Vaccine Production. *Operations Research*, *65*(1), 75–96.

Chintapalli, P., & Tang, C. S. (2021). The Value and Cost of Crop Minimum Support Price: Farmer and Consumer Welfare and Implementation Cost. *Management Science*, *67*(11), 6839–6861.

Chintapalli, P., & Tang, C. S. (2022). Crop Minimum Support Price Versus Cost Subsidy: Farmer and Consumer Welfare. *Production and Operations Management*, *31*(4), 1753–1769.

Cornes, R., & Hartley, R. (2012). Fully Aggregative Games. *Economics Letters*, *116*(3), 631–633.

Cornes, R., & Sandler, T. (1983). On Commons and Tragedies. *The American Economic Review*, *73*(4), 787–792.

CSB. (2018). *Sericulture* [https://csb.gov.in/silk-sericulture/sericulture/ [Accessed: 2025-01-11]].

CSB. (2023). Share of Silk Production Across India in Financial Year 2023, By Type [https://shorturl.at/3Hj98]. *In Statista. Retrieved June 26, 2023.*

Deo, S., & Corbett, C. J. (2009). Cournot Competition Under Yield Uncertainty: The Case of the US Influenza Vaccine Market. *Manufacturing & Service Operations Management*, *11*(4), 563–576.

Devi, K. L., Yellamma, K., et al. (2013). Cocoon Parameters in the Silkworm, Bombyx Mori on Exposure to Trace Element and Nutrients. *J Bio. Innov*, *2*(5), 260–284.

Dutta, P. K., & Sundaram, R. K. (1993). The Tragedy of the Commons? *Economic Theory*, *3*(3), 413–426.

Eswaran, M., & Kotwal, A. (1985). A Theory of Contractual Structure in Agriculture. *The American Economic Review*, *75*(3), 352–367.

Facchinei, F., Fischer, A., & Piccialli, V. (2007). On Generalized Nash Games and Variational Inequalities. *Operations Research Letters*, *35*(2), 159–164.

Facchinei, F., & Kanzow, C. (2010). Generalized Nash Equilibrium Problems. *Annals of Operations Research*, *175*(1), 177–211.

Facchinei, F., Kanzow, C., & Sagratella, S. (2014). Solving Quasi-variational Inequalities via Their KKT Conditions. *Mathematical Programming*, *144*, 369–412.

Fan, K. (1969). Extensions of Two Fixed Point Theorems of FE Browder. *Mathematische Zeitschrift*, *112*(3), 234–240.

Fan, T., Feng, Q., Li, Y., Shanthikumar, J. G., & Wu, Y. (2024). Output-oriented Agricultural Subsidy Design. *Management Science*, *70*(3), 1448–1464.

Faysse, N. (2005). Coping With the Tragedy of the Commons: Game Structure and Design of Rules. *Journal of Economic Surveys*, *19*(2), 239–261.

Federgruen, A., Lall, U., & Şimşek, A. S. (2019). Supply Chain Analysis of Contract Farming. *Manufacturing & Service Operations Management*, *21*(2), 361–378.

Filippov, A. (1959). O Nekatorych Voprosach Teorii Optimalnovo Regulirovania. *vestnik moskovskogo universiteta*, (2), 25–32.

Franci, B., & Grammatico, S. (2021). Stochastic Generalized Nash Equilibrium-seeking in Merely Monotone Games. *IEEE Transactions on Automatic Control*, *67*(8), 3905–3919.

Gardiner, S. M. (2001). The Real Tragedy of the Commons. *Philosophy & public affairs*, *30*(4), 387–416.

Garret, H. (1968). The Tragedy of the Commons. *Science*, *162*, 1243–1248.

Gillies, D. B. (1959). Solutions to General Non-zero-sum Games. *Contributions to the Theory of Games*, *4*(40), 47–85.

Glover, B. M. (1982). A Generalized Farkas Lemma With Applications to Quasidifferentiable Programming. *Zeitschrift für Operations Research*, *26*(1), 125–141.

Grammatico, S. (2017). Dynamic Control of Agents Playing Aggregative Games With Coupling Constraints. *IEEE Transactions on Automatic Control*, *62*(9), 4537–4548.

Grewal, V., & Srinivasan, V. (2024). Why Do Parts of Maharashtra Experience Different Water Stress Levels? [Accessed: March 10, 2024.].

Halmos, P. R. (2013). *Measure Theory* (Vol. 18). Springer.

Harker, P. T. (1991). Generalized Nash Games and Quasi-variational Inequalities. *European Journal of Operational Research*, *54*(1), 81–94.

Harsanyi, J. C. (1967). Games With Incomplete Information Played by "Bayesian" Players, Part I. The Basic Model. *Management science*, *14*(3), 159–182.

Haveman, R. H. (1973). Common Property, Congestion, and Environmental Pollution. *The Quarterly Journal of Economics*, *87*(2), 278–287.

He, S., Wang, X., & Zhang, S. (2013). On a Generalized Cournot Oligopolistic Competition Game. *Journal of Global Optimization*, *56*(4), 1335–1345.

Ichiishi, T. (1981). A Social Coalitional Equilibrium Existence Lemma. *Econometrica: Journal of the Econometric Society*, 369–377.

ISC. (2023). *Silk Industry Statistics* [https://inserco.org/en/statistics [Accessed: 2025-01-11]].

Ito, M., Saijo, T., & Une, M. (1995). The Tragedy of the Commons Revisited Identifying Behavioral Principles. *Journal of Economic Behavior & Organization*, *28*(3), 311–335.

Itoh, S. (1977). A Random Fixed Point Theorem for a Multivalued Contraction Mapping. *Pacific Journal of Mathematics*, *68*(1), 85–90.

Jadamba, B., & Raciti, F. (2015). On the Modeling of Some Environmental Games With Uncertain Data. *Journal of Optimization Theory and Applications*, *167*(3), 959–968.

Jeyakumar, V., & Glover, B. M. (1995). Nonlinear Extensions of Farkas' Lemma With Applications to Global Optimization and Least Squares. *Mathematics of Operations Research*, *20*(4), 818–837.

Kalita, T., & Dutta, K. (2020). Characterisation of Cocoon of Different Population of Antheraea Assamensis (lepidoptera: Saturniidae). *Oriental Insects*, *54*(4), 574–590.

Kazaz, B., & Webster, S. (2011). The Impact of Yield-dependent Trading Costs on Pricing and Production Planning Under Supply Uncertainty. *Manufacturing & Service Operations Management*, *13*(3), 404–417.

Kim, T., Prikry, K., & Yannelis, N. C. (1988). On a Carathéodory-type Selection Theorem. *Journal of Mathematical Analysis and Applications*, *135*(2), 664–670.

Kim, T., Prikry, K., & Yannelis, N. C. (1989). Equilibria in Abstract Economies With a Measure Space of Agents and With an Infinite Dimensional Strategy Space. *Journal of Approximation Theory*, *56*(3), 256–266.

Knaster, B., Kuratowski, K., & Mazurkiewicz, S. (1929). Ein Beweis Des Fixpunktsatzes Für N-dimensionale Simplexe. *Fundamenta Mathematicae*, *14*(1), 132–137.

Kouvelis, P., Xiao, G., & Yang, N. (2021). Role of Risk Aversion in Price Postponement Under Supply Random Yield. *Management Science*, *67*(8), 4826–4844.

Kulkarni, A. A. (2017). Games and Teams With Shared Constraints. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *375*(2100), 20160302.

Kuratowski, K., & Ryll-Nardzewski, C. (1965). A General Theory on Selectors. *Bull. Acad. Polon. Sci. Sér. Sci. Math. Astron. Phys.*, *13*(6), 397–400.

Liu, J., Dietz, T., Carpenter, S. R., Alberti, M., Folke, C., Moran, E., Pell, A. N., Deadman, P., Kratz, T., Lubchenco, J., et al. (2007). Complexity of Coupled Human and Natural Systems. *science*, *317*(5844), 1513–1516.

Marcus, M., & Mizel, V. J. (1977). Measurability of Partial Derivatives. *Proceedings of the American Mathematical Society*, *63*(2), 236–238.

Maschler, M., Zamir, S., & Solan, E. (2020). *Game Theory*. Cambridge University Press.

Mignoni, N., Scarabaggio, P., Caselli, S. M., Carli, R., & Dotoli, M. (2024). Generalized Nash Equilibrium Seeking for Crop Mix Selection in Sustainable Agriculture. *2024 Ieee International Humanitarian Technologies Conference*, 1–6.

Ministry of Textiles, GOI. (2022). *Silk Samagra-2 Sop & Guidelines for Implementation* (Technical Report) (Accessed June 10, 2024). Ministry of Textiles, Government of India. https://texmin.nic.in/sites/default/files/SILK_SAMAGRA.pdf

Ministry of Textiles, GOI. (2025). *Sericulture Statistics in India-a Glance* (Technical Report) (Accessed June 10, 2025). Ministry of Textiles, Government of India. https://www.texmin.gov.in/sites/default/files/Table-1%20Sericulture%20Statistics%20of%20India-A%20Glance.pdf

MOSPI. (2023). Production Volume of Raw Silk in India in Financial Year 2023, By State [https://www.statista.com/statistics/622953/raw-silk-production-by-state-india/]. *In Statista. Retrieved June 26, 2023*.

Munkres, J. R. (1974). *Topology; A First Course*. Prentice-hall.

Narahari.Y. (2014). *Game Theory and Mechanism Design*. IISc Press and World Scientific.

Nash, J. (1951). Non-cooperative Games. *Annals of Mathematics*, *54*(2), 286–295.

Oggioni, G., Smeers, Y., Allevi, E., & Schaible, S. (2012). A Generalized Nash Equilibrium Model of Market Coupling in the European Power System. *Networks and Spatial Economics*, *12*(4), 503–560.

Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press.

Özen, U., Slikker, M., & Norde, H. (2009). A General Framework for Cooperation Under Uncertainty. *Operations Research Letters*, *37*(3), 148–154.

Papageorgiou, N. S. (1986). Random Fixed Point Theorems for Measurable Multifunctions in Banach Spaces. *Proceedings of the American Mathematical Society*, *97*(3), 507–514.

Parthasarathy, T. (2006). General Theorems on Selectors. *Selection Theorems and Their Applications*, 49–57.

Pawar, U. V. (2022). Rainfall Distribution and Trends Over the Semi-arid Marathwada Region of Maharashtra, India. *Arabian Journal of Geosciences*, *15*(23), 1738.

Ponthiere, G. (2025). Stoicism and the Tragedy of the Commons. *Environmental and Resource Economics*, 1–26.

Press Information Bureau. (2021). Farmer Producer Organisations (FPOs) [Accessed: 16 February 2026].

Qian, X., & Olsen, T. L. (2022). Contractual Coordination of Agricultural Marketing Cooperatives With Quality Provisions. *Manufacturing & Service Operations Management*, *24*(6), 3269–3282.

Rajan, R. (1989). Endogenous Coalition Formation in Cooperative Oligopolies. *International Economic Review*, 863–876.

Ravat, U., & Shanbhag, U. V. (2011). On the Characterization of Solution Sets of Smooth and Nonsmooth Convex Stochastic Nash Games. *SIAM Journal on Optimization*, *21*(3), 1168–1199.

Ravat, U., & Shanbhag, U. V. (2017). On The Existence of Solutions to Stochastic Quasi-variational Inequality and Complementarity Problems. *Mathematical Programming*, *165*, 291–330.

Riley, M., Sangster, H., Smith, H., Chiverrell, R., & Boyle, J. (2018). Will Farmers Work Together for Conservation? The Potential Limits of Farmers' Cooperation in Agri-environment Measures. *Land Use Policy*, *70*, 635–646.

Rockafellar, R. T. (2007). Coherent Approaches to Risk in Optimization Under Uncertainty. In *Or Tools And Applications: Glimpses of Future Technologies* (pp. 38–61). Informs.

Rockafellar, R. T., Uryasev, S., et al. (2000). Optimization of Conditional Value-at-risk. *Journal of Risk*, *2*, 21–42.

Rockafellar, R., & Wets, R. (1976). Stochastic Convex Programming: Basic Duality. *Pacific Journal of Mathematics*, *62*(1), 173–195.

Rockafellar, R. T., & Wets, R.-B. (1977). Measures as Lagrange Multipliers in Multistage Stochastic Programming. *Journal of Mathematical Analysis and Applications*, *60*(2), 301–313.

Rosen, J. B. (1965). Existence and Uniqueness of Equilibrium Points For Concave N-person Games. *Econometrica*, 520–534.

Sandler, T., & Sternbenz, F. P. (1990). Harvest Uncertainty and the Tragedy of the Commons. *Journal of Environmental Economics and Management*, *18*(2), 155–167.

Scarf, H. E. (1967). The Core of an N Person Game. *Econometrica: Journal of the Econometric Society*, 50–69.

Schlager, E. (2002). Rationality, Cooperation, and Common Pool Resources. *American Behavioral Scientist*, *45*(5), 801–819.

SFAC. (2026). List Of Farmer Producer Organisations (FPOs) – Statewise [Small Farmers' Agri-Business Consortium. Accessed: 16 February 2026].

Shapley, L. S. (1953). Stochastic Games. *Proc. Natl. Acad. Sci. USA*, *39*(10), 1095–1100.

Shapley, L. S. (1965). *On Balanced Sets and Cores* (tech. rep.).

Shapley, L. S. (1973). On Balanced Games Without Side Payments. In *Mathematical Programming* (pp. 261–290). Elsevier.

Stoop, J., Noussair, C. N., & Van Soest, D. (2012). From the Lab to the Field: Cooperation Among Fishermen. *Journal of Political Economy*, *120*(6), 1027–1056.

Suijs, J., Borm, P., De Waegenaere, A., & Tijs, S. (1999). Cooperative Games With Stochastic Payoffs. *European Journal of Operational Research*, *113*(1), 193–205.

Tang, C. S., Sodhi, M. S., & Formentini, M. (2016). An Analysis of Partially Guaranteed Price Contracts Between Farmers and Agri-food Companies. *European Journal of Operational Research*, *254*(3), 1063–1073.

Tang, C. S., Wang, Y., & Zhao, M. (2024). The Impact of Input and Output Farm Subsidies on Farmer Welfare, Income Disparity, and Consumer Surplus. *Management Science*, *70*(5), 3144–3161.

Tao, Y., & Xu, H. (2025). Generalized Bayesian Nash Equilibrium with Continuous Type and Action Spaces. *SIAM Journal on Optimization*, *35*(2), 789–817.

Tushar, W., Saad, W., Poor, H. V., & Smith, D. B. (2012). Economics of Electric Vehicle Charging: A Game Theoretic Approach. *IEEE Transactions on Smart Grid*, *3*(4), 1767–1778.

Ui, T. (2016). Bayesian Nash Equilibrium and Variational Inequalities. *Journal of Mathematical Economics*, *63*, 139–146.

Wagner, D. H. (1977). Survey of Measurable Selection Theorems. *SIAM J. Control Optim.*, *15*(5), 859–903.

Wirl, F. (2008). Tragedy of the Commons in a Stochastic Game of a Stock Externality. *Journal of Public Economic Theory*, *10*(1), 99–124.

Wiszniewska-Matyszkiel, A., & Singh, R. (2024). Counteracting "The Tragedy of the Commons" In An Imperfect World. *Journal of Public Economic Theory*, *26*(5), e12713.