Research Statement

Market failures in critical areas such as climate change mitigation, refugee distribution, and the integration of new technologies pose significant challenges to our global society. My research aims to address these challenges through the lens of market design, focusing on auctions, matching mechanisms, and strategy-proofness, with a particular interest in their application to real-world problems and the incorporation of artificial intelligence.

I am motivated by the urgent need for efficient and equitable mechanisms that can handle the complexities of modern economies. By investigating how to design markets that optimize resource allocation while remaining transparent and understandable to participants, I hope to contribute solutions with both practical and ethical significance.

In this statement, I outline my past work and future research plans in three interconnected areas: matching mechanisms for refugee distribution and ride-sharing services, the design of mechanisms for global challenges like climate change, and the role of obvious strategy-proofness in the context of AI-assisted decision-making.

Matching

Refugee Distribution Mechanisms

During my bachelor's degree, I conducted an analysis of the European Union's proposed mechanisms for asylum and migration laws. My research revealed that these mechanisms could lead to inefficient distributions of refugees across member countries. Given the ongoing conflicts, such as the war in Ukraine and unrest in the Middle East, coupled with the anticipated rise in climate-induced migration, optimizing refugee allocation is more critical than ever.

Building on the work of Delacrétaz et al. (2023) and Hagen (2022), who developed tools to enhance refugee distribution, I plan to investigate how allowing nations to express preferences over refugees affects allocation efficiency. Specifically, I aim to explore whether such preferences lead to assortative matching, where highly qualified refugees are concentrated in a few favored countries. To promote equitable and efficient outcomes, I intend to design reimbursement mechanisms that incentivize fair distribution among nations. Recognizing the ethical dimensions of this research, I will integrate considerations highlighted by Li (2017) regarding fairness and discrimination into the design of these matching mechanisms.

Ride-Sharing and Carpooling Services

Matching mechanisms also have significant applications in improving efficiency within ride-sharing platforms. In my undergraduate thesis, I explored dynamic matching models inspired by Akbarpour et al. (2020) and proposed enhancements for carpooling services like BlaBlaCar. Unlike real-time matching in platforms such as Uber, carpooling services face the unique challenge of coordinating drivers and riders who must have matching routes and mutually acceptable arrangements, often planned well in advance.

My research focused on developing algorithms that consider not only route matching and timing but also user preferences and acceptability criteria. By refining these matching algorithms and integrating dynamic pricing strategies, I aim to increase participation rates and overall efficiency in carpooling services. This approach has the potential to reduce traffic congestion and environmental impact by encouraging more efficient use of existing transportation resources.

Mechanism Design

Redistribution Mechanisms in Global Challenges

My fascination with mechanism design stems from my undergraduate coursework and my role as a student research assistant, where I explored how well-designed markets can achieve optimal redistribution of resources (Dworczak et al., 2021). In the context of global challenges like climate change, there is an urgent need for mechanisms that facilitate international cooperation and equitable resource allocation.

Recent proposals discussed by Clausing et al. (2024) highlight innovative strategies for combating climate change. However, the diversity of mechanisms adopted by different countries has led to fragmented markets that may not achieve global efficiency. My research aims to develop interconnected market mechanisms that account for significant inequalities between countries, ensuring that strategies for reducing emissions are both effective and fair.

I plan to investigate how existing mechanisms can be adapted and integrated to create a cohesive global market for carbon emissions. This includes designing auctions and trading systems that incentivize participation from both developed and developing countries while considering their varying economic capacities and environmental impacts.

Understanding Auction Mechanism Discrepancies

As a student research assistant, I assisted in developing a new theory that explain discrepancies between empirical results of different auction types and the theoretical predictions of the revenue equivalence theorem (Vickrey, 1961; Myerson, 1981; Bergemann et al., 2024).

This experience deepened my interest in auction theory and experimental economics. Moving forward, I intend to design and experimentally test new auction mechanisms that can improve allocations in various markets, including those related to environmental resources and technological innovations. By bridging the gap between theory and practice, my goal is to develop mechanisms that perform robustly in real-world settings.

Obvious Strategy-Proofness and AI in Mechanism Design

My interest in the concept of obvious strategy-proofness was sparked early in my studies when I realized that traditional assumptions about rational behavior often do not hold in practice (Li, 2017). Even when mechanisms are designed to be strategy-proof, participants may fail to follow optimal strategies due to complexity or misunderstanding. Obvious strategy-proofness addresses this by ensuring that the best strategy is apparent to participants, reducing cognitive burden and potential for errors.

Building on the work of Gonczarowski et al. (2022), who developed mechanisms that are more transparent and tested them experimentally, I am interested in exploring how these concepts interact with the increasing role of artificial intelligence in decision-making processes. As AI systems, particularly large language models (LLMs), become more integrated into economic activities, understanding how they interpret and interact with economic mechanisms is crucial.

Research by Engel et al. (2024) has begun to examine scenarios where both humans and AI agents participate in games, revealing insights into AI behavior and its impact on outcomes. I aim to investigate how AI assistance affects human decision-making in mechanisms designed to be obviously strategy-proof. Specifically, I plan to study whether AI can enhance participant understanding of complex mechanisms or if reliance on AI might introduce new biases or strategic considerations.

By examining the interplay between AI and mechanism design, my research seeks to adapt traditional economic theories to an evolving landscape where AI agents are both tools and participants in markets. This includes developing mechanisms that are robust to AI-assisted

decision-making and ensuring that strategy-proofness remains effective in an AI-influenced environment.

Conclusion

Through my research in market design, matching mechanisms, and the integration of AI in economic systems, I aim to contribute to the development of markets that are efficient, equitable, and adaptable to the complexities of modern challenges. By addressing issues such as refugee distribution, climate change, and the incorporation of AI, my work seeks to have a meaningful impact on both theory and practice.

References

Akbarpour, Mohammad, Shengwu Li, and Shayan Oveis Gharan. 2020. "Thickness and Information in Dynamic Matching Markets." Journal of Political Economy 128 (3): 783–815.

Bergemann, Dirk, Kevin Breuer, Peter Cramton, Jack Hirsch, Yero Ndiaye, and Axel Ockenfels. 2024. "A Soft Floor Auction Improves Efficiency and Revenues by Exploiting Bidder Regret." University of Cologne Working Paper.

Clausing, Kimberly, Peter Cramton, Axel Ockenfels, and Catherine Wolfram. 2024. "Strategic Climate Cooperation and Greenhouse Gas Price Coordination." Intereconomics 59 (1): 55–56.

Delacrétaz, David, Scott D. Kominers, and Alexander Teytelboym. 2023. "Matching Mechanisms for Refugee Resettlement." American Economic Review 113 (10): 2689–2717.

Dworczak, Piotr, Scott D. Kominers, and Mohammad Akbarpour. 2021. "Redistribution through Markets." Econometrica 89 (4): 1815–1847.

Engel, Christoph, Max R.P. Grossmann, and Axel Ockenfels. 2024. "Integrating Machine Behavior into Human Subject Experiments: A User-Friendly Toolkit and Illustrations." MPI Collective Goods Discussion Paper No. 2024/1.

Gonczarowski, Yannai A., Ori Heffetz, and Clayton Thomas. 2022. "Strategyproofness-Exposing Mechanism Descriptions." arXiv preprint arXiv:2209.13148.

Hagen, Martin. 2022. "Tradable immigration quotas revisited." Journal of Public Economics 208 (2022): 104619.

Li, Shengwu. 2017. "Obviously Strategy-Proof Mechanisms." American Economic Review 107 (11): 3257–3287.

Li, Shengwu. 2017. "Ethics and market design." Oxford Review of Economic Policy 33.4: 705-720.

Myerson, Roger B. 1981. "Optimal Auction Design." Mathematics of Operations Research 6 (1): 58–73.

Vickrey, William. 1961. "Counterspeculation, Auctions, and Competitive Sealed Tenders." Journal of Finance 16 (1): 8–37.