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Research Statement

I am a microeconomic theorist with broad interests in information economics and dynamic games. My research focuses on two primary areas: the costs of information and the strategic use of information in dynamic environments. In this statement, I will summarize my four research papers on these topics and outline my future research trajectory.

1 Information Costs

In recent years, economic theorists have increasingly focused on how economic agents make decisions regarding information across different contexts. This inquiry has expanded to include situations where information is costly, raising critical questions about which cost functions are suitable for modeling these decisions.

A widely accepted minimum requirement for information costs is that information should become more costly as it becomes more informative in the sense of Blackwell [1951, 1953].[1] This principle is known as Blackwell monotonicity. **In my latest paper, "*Blackwell-Monotone Information Costs*" (with Xiaoyu Cheng), we provide simple necessary and sufficient conditions for a cost function to be Blackwell monotone over finite experiments.** This provides a tractable method to verify Blackwell monotonicity when an arbitrary information cost function is considered.

Since Blackwell monotonicity serves as a minimum requirement for information costs, our characterization represents the weakest form among all possible conditions. This allows for a broad class of information cost functions. However, we can extend this foundation by incorporating additional behavioral axioms or other conditions. For example, we show that when we focus on a class of information cost functions that are additively separable, an information cost function is Blackwell monotone if and only if it can be expressed as a sum of sublinear functions.

Another path for extension is to relax Blackwell informativeness. Due to the requirement that two experiments maintain the same order across every decision problem, Blackwell's condition is quite strong and often limits applicability. To address this issue, Lehmann [1988] introduced the *accuracy*

[1] Blackwell [1951, 1953] establishes several equivalent conditions under which a (statistical) experiment (f) is more informative than another experiment (g), that is, for any decision problem and prior belief about the states, the expected payoff under f is greater than or equal to that under g. One such conditions is the *garbling* condition, which states that g can be obtained by adding noise to f.

condition, which refines Blackwell's condition by focusing on monotone decision problems. Since many economic problems are monotone and already employ Lehmann's condition, it is important to understand information costs that preserve Lehmann's order. In our ongoing work, Xiaoyu and I are tackling this open problem.

As a groundwork for this, **I introduce a novel criterion for comparing information under monotone decision problems in my solo paper, "*Comparing Information in General Monotone Decision Problems*" (Journal of Economic Theory, July 2023)**. I develop a condition called *monotone quasi-garbling* meaning that an experiment is obtained by adding *reversely monotone noise* (more likely to return a higher signal in a lower state and a lower signal in a higher state) to another.

The contribution of this work to the literature is twofold. First, it relates the accuracy condition by Lehmann [1988] to Blackwell's garbling condition. Although the accuracy condition has been applied widely in economic settings, its precise meaning remains underexplored. I provide a simple interpretation for the accuracy condition showing that my monotone quasi-garbling condition is equivalent to accuracy under the monotone likelihood ratio property. Second, I extend the applicability of the accuracy condition to a larger class of monotone decision problems where the action spaces are potentially multidimensional. This result allows the application of the accuracy condition to multidimensional monotone decision problems such as nonlinear monopoly pricing and optimal insurance problems.

2 Dynamic Games

When economic agents work to complete a project, there can be multiple paths to completion, with each path potentially involving several rounds of success, namely progress. This raises the question of which path to take based on the information about the progress. In the following two papers, I explore this question in an agency setup and in an innovation race setup.

First, in "*Managing a Project by Splitting it into Pieces*," I study the role of intermediate progress as a monitoring device in managing projects. In project management, a work breakdown structure (WBS)—a step-by-step approach to completing projects—is widely used. Although there are many advantages of employing a WBS (e.g., clarifying the goals, communicating better, etc.), a fundamental benefit is monitoring progress. As a project is broken down into smaller chunks, a manager can better audit a subordinate's progress, which may reduce the moral hazard issue. Nevertheless, decomposing a project into many small pieces may make it rigid. It may lead the manager to micromanage the project which in turn slows down project progress, i.e., generates

inefficiencies. Thus, when a manager splits a project, she faces a tradeoff between better *monitoring* and worse *efficiency*. To study this tradeoff, I consider a dynamic principal-agent problem where there are two routes of completing a project: directly attacking it or splitting it into two subprojects. To mitigate moral hazard, the principal needs to commit to a deadline, which also affects her choice of project management strategy. I show that the optimal contract is determined by the interplay of these three factors: monitoring, efficiency, and an endogenous deadline.

Next, in "*Research or development in innovation races*" (with Francisco Poggi), we explore how firms' private acquisition of technology impacts R&D dynamics in innovation races. We introduce an innovation game where two firms strategically allocate resources across two R&D paths: (i) developing a product using currently available technology, and (ii) conducting research to discover a faster technology for posterior development. Success with current technologies requires only one breakthrough, while pursuing new technologies involves two steps—discovery, followed by product development.

The firms' optimal strategies heavily depend on the availability of information about their rivals' progress. When research progress is public, firms can adjust their actions based on competitors' discoveries. However, when progress is private, firms must form beliefs about their rivals' progress and base their R&D strategies on those beliefs. This incentivizes firms to conceal their progress to prevent competitors from adjusting their R&D paths, ultimately slowing the overall pace of innovation. Although patents can encourage disclosure by granting exclusive rights and licensing opportunities, firms may still prefer secrecy when the reward for winning the race is high and trade secret protection is strong.

These four papers are broadly emblematic of my research interests and plans for future work. I am motivated in my research to apply the powerful tools of economic theory to understand and resolve real-world problems. Incentives and information are ever more at the root of such problems, and the need for careful discerning analysis has never been more present.

References

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