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Research Statement

I am a microeconomic theorist with a particular interest in information and dynamic games. Specifically, my research agenda is to investigate how people or firms strategically use information about intermediate progress in various dynamic environments. In addition, I am also interested in theoretical foundations for comparing information structures. In this statement, I summarize my three research papers on these topics and briefly discuss my research plan.

My job market paper, "*Strategic concealment in innovation races*" (with Francisco Poggi), studies firms' strategic incentives to conceal intermediate progress in innovation races. In the course of research and development (R&D) for an innovative product (e.g., COVID-19 vaccines, Full Self-Driving (FSD) vehicles), firms often discover interim technology (e.g., mRNA technology for the vaccine, LIDAR technology for FSD vehicle) that brings them closer to ultimate success in development. Once a firm discovers such interim technology, it can choose either to *conceal* or *disclose* the breakthrough. When multiple firms race towards such innovation, a firm's optimal R&D strategy is likely to be influenced by the information about whether its rivals have made intermediate progress. Thus, a firm may want to conceal intermediate discoveries in order to increase the chance of winning the race by hindering its rivals from adjusting their R&D strategies. On the other hand, it may prefer to disclose an intermediate discovery because this can open the opportunity for monetization via licensing the technological breakthrough.

To study this tradeoff between disclosure and concealment, we introduce an innovation game where two firms dynamically allocate their resources between two distinct research and development (R&D) paths towards a final innovation: (i) developing it with currently available but slower technology; (ii) conducting research to discover a faster new technology for developing it. We fully characterize the equilibrium behavior of the firms in the cases where their research progress is public or private information. Then, we extend the private information setting by allowing firms to conceal or license their intermediate discoveries. We show that a firm's disclosure decision depends crucially on the magnitude of the reward from winning the race. Specifically, when the reward is high, firms sometimes conceal their interim discoveries to increase the chance of winning the race, which inefficiently retards the social pace of

making the final innovation. This result contrasts with the standard view absent the consideration of firms' strategic concealment: a higher reward would intensify the competition and increase the speed of innovation. Thus, it indicates that incentives for strategic concealment may be an important consideration for a policymaker who wishes to realize the innovation as soon as possible.

In my second paper, "*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.

I plan to explore a possible extension of the analysis in the above two papers. In those studies, I restricted attention to the case where the information about the intermediate progress is binary: whether a firm or an agent has made such progress or not. In practice, this kind of information is often more complicated, e.g., how much progress they have made so far. Thus, it is important to understand whether my results are robust to the extension to finer information about intermediate progress. I believe that there are numerous applications regarding information about intermediate progress in industrial organization, corporate finance, and management strategy, and my work can shed important light on the tradeoff between incentives and efficiency in these settings.

Last, I introduce a novel criterion for comparing information under monotone decision problems in my third paper, "*Comparing Information in General Mono-

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tone Decision Problems" (**R&R at the Journal of Economic Theory**). I develop a condition called *monotone quasi-garbling* meaning that an information structure 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. This condition is inspired by the garbling condition developed by Blackwell [1951]: an information structure is obtained by adding some noise to another. Though this condition is easy to interpret and provides a strong result (the rank is preserved in every decision problem), it is hard to satisfy the garbling order, so Blackwell's criterion typically has limited applicability. To resolve this issue, Lehmann [1988] introduced his *accuracy condition*, which refines Blackwell's garbling condition, and shows that the rank is preserved in a specific class of monotone decision problems.

The contribution of my work to this 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 as I illustrate.

These three 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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