Word Count: 1100

I am applying to Harvard's doctoral program in economics in pursuit of a career in academic research. I entered economics research because I enjoy modeling real-world situations with math. This interest was confirmed by my research work, which included projects on mortgages, optimal surveys, and consumer savings. These research experiences also led me to discover that I enjoy theory work, especially theory fields that see wide use in empirical research, fields like game theory and mechanism design. My interest in game theory and behavioral economics recently led me to explore the subfield of learning in games, in which I have a few research ideas.

I entered economics research because I enjoy the process of modeling social situations, the process of looking at an economic phenomenon, thinking about the key empirical factors, and making the correct variable and structural choices to generate a tractable model that explains the situation. For example, one project I worked on for Professor John Jonson involved finding a formula that gave the best time to refinance mortgages. In this project, I enjoyed contemplating the various tradeoffs between simplicity and richness that went into the model design. Should we model interest rates as mean reverting, or is a simple random walk sufficiently approximate? Should we be precise and model mortgage amortization time, or should we avoid an extra state variable and instead just use a time-stationary hazard rate? These tradeoffs were interesting to think about, and existed in all projects: for example, my work on optimal surveys required careful consideration of response interaction complexity. Overall, my research work confirmed my interest in economic model building.

In doing research work, I also began to discover a new interest in economic theory, especially in theory work that is heavily used by empirical economics. For the mortgage-refinancing project, my major personal contribution was finding a closed-form solution for the refinancing formula. I discovered that I enjoy carefully thinking about the highly mathematical parts of the problem, like the existence conditions for the formula's solutions or the analytic details of the bellman equations. Similarly, I enjoyed the process of finding mathematical insights in my optimal survey project. One insight involved using a multidimensional envelope theorem; another insight involved pushing a standard delta-method technique in statistics to infinite cases. In both project, I was especially satisfied to know that these theoretical results advanced practical goals in empirical research. For mortgage research, a closed-form solution significantly advances the paper's goal of providing a simple formula homeowners can use. For optimal survey research, the math insights led to a method of construction of the best survey possible. The method was put to actual use for a separate journal article on empirical intertemporal discount rates. Through all these projects, I both enjoyed

generating mathematical insights and knowing that these theoretical advances have real empirical benefits.

My revealed interest in economic theory led me towards theoretical fields with wide applications, fields like game theory and mechanism design where advances in theory increase the power and scope of all of economics. For example, in game theory, sequential equilibrium in extensive form games allows richer dynamic models. In mechanism design, the revelation principle simplifies mechanism calculations. Implementation theory allows economists to design novel institutions to meet an objective that was previously untenable. The applicability of such theory work appeals greatly to me.

In addition to game theory and mechanism design, behavioural economics also interests me because of my recent exposure to the field in research assistance work. Behavioral economics is appealing because it question the basic assumptions of rationality in an attempt to generate more accurate predictions about human behavior. However, work in behavioural economics often lacks unity. Instead of a central model that explains a wide set of phenomena, oftentimes, there are numerous models that each explain a specific phenomenon without the ability to generalize further. For example in the subfield of learning in games, reinforcement models like Roth and Erev (1995) explain trends in learning, but predicts convergence much too slowly in coordination games (Boylan and El-Gamal 1992). In contrast, belief learning models like Fudenberg and Levine (1998) allow hypothetical reinforcement and hence faster learning, but performs slightly worse on zero-sum games (Battalio, Samuelson, and Van Huyck 1997; Mookerjee and Sopher 1997). Camerer (1999) synthesizes these two models in an Experience Weighted Attraction (EWA) model, but EWA has a high number of parameters that vary widely for different games, and still exhibits poor performance in zero-sum games. These models predict zero sum games poorly because they fail to consider a fraction of players who overpredict reinforcement learning in opponents. The missing component then is having players who are heterogeneous in level of sophistication, a structure in the style of Nagel (1995) or Stahl and Wilson (1995). However, instead of nth order reasoning, the correct concept seems to be nth order sophistication, an idea that Camerer (2007) broaches with the Cognitive Hierarchy (CH) model. CH is a static model however and needs to be extended to a dynamic setting, perhaps by allowing player sophistication to rise over time, or by basing the actions of level zero player on historic outcomes as in Stahl (1996). This model would explain quick convergence in median action games – sophisticates jump to the median very rapidly. This model also explains reinforcement overprediction in zero-sum games: level-one players number higher than level-zero players. If such a theory is confirmed through experiments, it would advance the goal of having more general models for behavioral economics.

In addition to giving me ideas, my past work has also given me the skills needed for graduate school. To build a technical toolbox, I have taken theoretical math, graduate statistics, and graduate economics classes, culminating in earning an A on the graduate micro generals last year. To experience working with real research, I have done research in behavioral economics and consumer finance with John Jonson and in auction theory work Barbara Babson. I have been exposed to many parts of the research process: I have solved mathematical models in mortgage refinancing work; I have advanced theoretical proofs in my optimal survey research; and I have analyzed large data sets including US Census for behavioral research. These experiences have given me skills for graduate work and have confirmed that research work is something I enjoy.

Overall, I am fascinated with economics and very much enjoy research. I especially enjoy building models and doing theory work with empirical impact. I am interested game theory, mechanism design, and behavioral economics, and would like to explore these and other economic fields in graduate school. My fascination with research will provide me with the necessary ambition to succeed in Harvard's program, while my extensive coursework and field preparation will provide me with the necessary skills to succeed in Harvard's program.

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