Research Statement

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I am an applied microeconomist who uses both structural models and reduced-form approach to answer questions in Industrial Organization and Labor Economics. Topics related to airline industry, price discrimination and informed vs. uninformed consumers are of particular interests. I have also done some work on mathematical and quantitative methods, especially developing innovative methodology for collecting, estimating and organizing data. My work employs different theoretical frameworks and programming languages to collect data, develop algorithm, and solve research questions.

My job market paper, "*Paying More for a Shorter Flight? - Hidden City Ticketing*" focuses on an interesting pricing phenomenon called hidden city ticketing. It occurs when an indirect flight from city A to city C, using city B as the connection node, turns out to be cheaper than the direct flight from city A to city B. Passengers who wish to fly from A to B have an incentive to purchase the indirect flight ticket, pretend to fly to city C, while disembark at the connection node B, and discard the remaining segment B to C. This research question came up to my mind when I experienced this phenomenon myself in my second year. To the best of my knowledge, this is the first paper to quantitatively study the cause and impact of hidden city ticketing on welfare outcomes using real empirical data. In this paper, I have built a structural model in which airlines can choose both airfare and network structures as strategic variables. I collected daily flights data by scraping the webpage using a Python package. Then I apply MLE to estimate the model and conduct counterfactual analysis based on the estimation results to shed some light on policy implications (using MATLAB). I find that in the short run, hidden city ticketing does not necessarily decrease airlines' expected profits, and consumer welfare and total surplus always increase. In the long run, the welfare outcomes become ambiguous. For some routes, airlines have the incentive to switch from hub-and-spoke network to a fully connected one when there are more and more passengers informed of hidden city ticketing. During this process, firms always result in lower expected revenue, while consumer surplus and total social welfare are not necessarily better off.

Implementing the maximum likelihood estimation of my job market paper is challenging. This is because the MLE is implicit with a random sampling in the first step, and the gradient is also difficult to evaluate with respect to my parameter of interest. Normally, economists solve this problem using global optimization techniques including Genetic Algorithm, Simulated Annealing, Pattern Search, etc. And I have also applied those techniques in my job market paper. But in my second paper, "*Maximum Likelihood Optimization via Parallel Estimating Gradient Ascent*", co-authored with Yining Wang, we develop a new maximum likelihood optimization algorithm that may solve this task more efficiently. Specifically, we study the problem of coordination between the multiple "threads" of estimating gradient descent in order to pause or terminate unpromising threads early. The high-level idea is to make predictions, either conservative or aggressive, on the potential progress of each estimating gradient descent threads and to compare them with the progress on other threads. The algorithm consists of three major components: Thread Coordination, Gradient Estimation and Thread Stopping. The pseudo-code description of the proposed algorithm framework has been provided and we have demonstrated that under certain local concavity assumptions, our proposed stopping rules are conservative in the sense that, with high probability,

they will not remove a promising computing thread by mistake. In the final section we test our proposed methodology on both synthetic data and real airline pricing data, and compare with competitive methods including the genetic algorithm and the pattern search algorithm. The numerical results show both the effectiveness and efficiency of our proposed approach.

My third paper is inspired by the active reforms of H-1B visa program in recent years. As foreign-born graduates, the H-1B visa program governs the admissions of us with a bachelor's degree or above for employment in United States. Previous literatures normally focus on the labor market outcomes of this program. But immigrant scientists and engineers may affect how the U.S. economy operates over longer horizons through adjusting college major choices for natives. To the best of my knowledge, my paper, "*Does H-1B Visa Reforms Affect Whether US Natives Major in STEM Fields*", is the first paper directly examining the relationship between H-1B visa reforms and US natives' college major choices in STEM fields. To bring identification to the research question, I use data on college majors from the 2009-17 American Community Survey and exploit large changes in the H-1B population over the 1992-2017 period. To overcome the data limitation of H-1B visa program, I have applied a novel approach by utilizing the micro-level data in the first step of H-1B visa application. And I have also constructed an instrumental variable based on the historic settlement pattern of foreign-born STEM workers to deal with the endogeneity problem of immigrants' self-location choices. I find some evidence that H-1B population adversely affect natives' choices in STEM fields when they enter the college and graduate from it. Both male and White subgroups have been negatively affected, and the native Asian subgroup suffer from the most dramatic crowding-out effect. Since foreign-born Asian account for a large proportion of H-1B visa holders, there might be an interesting "Asian crowd out Asian" story. In future works related to this paper, I am looking for the possibility of combining the different major choices I have found when students enter the college and graduate from it, with a structural model of college major choice paying special attention to the shifting behavior.

Moving forward, myself and Yining Wang just obtain access to the database of Yamibuy, which is a US-based, Asian-centric international e-commerce corporation. This innovative dataset provides details of each order consumers have made along the time, with the COVID-19 pandemic period also being covered. We believe the study of this data could contribute to the application of decision theory, or more specifically, the discrete choice models, and we are working hard on this possibility now. I always believe that economics research should provide policy implications and shed some light on controversial issues. Being well-equipped with both theoretical frameworks and empirical tools, besides topics in empirical industrial organization and labor economics, I am also open to new topics and research questions in the future.