

Research Statement

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My research interests span the areas of international trade, urban economics and industrial organization. A common thread in my research is in understanding firms' decisions in an intra- or inter-national spatial setting and how they interact with market equilibrium. Three main questions I focus on answering are where firms produce, from whom they source, and how they organize firm boundaries. Since the distribution of economic activities in space are largely shaped by the way in which firms respond, a good understanding of firms' internal workings is essential for the welfare evaluation of a wide variety of policies. In three of my papers, I explore such interdependency among firms, markets and government policies by developing multinational firm models based on trade and industrial organization theory and leveraging computational methods to empirically quantify the equilibria in different contexts.

In my job market-paper, *“Location Choices of Multi-plant Oligopolists: Theory and Evidence from the Cement Industry”*, I study heterogeneous spatial oligopolists with multiple plants. Considering competition with others and cannibalization within itself, the multi-plant firm makes interdependent entry decisions to a set of heterogeneous production locations. Existing trade models achieve tractability either by assuming away the endogenous interdependent location choices or by ignoring the oligopolistic nature of firm competition. I relax those assumptions by incorporating strategic pricing and variable markups, while tackling the hard combinatorial location problem in a computationally efficient way. Built upon the head-to-head oligopoly trade model introduced by Bernard et al. (2003), the theoretical framework recognizes the granularity of oligopolists and the prevalent multi-plant feature, and thus, yields more generalized and closed-form results that nest single-plant firm models. The framework highlights the role of the spatial distribution of plants in determining prices and trade. More plants owned by a firm are a source of market power and raise markups. The geographic configuration of plants reinforces differences in comparative advantage promoting trade. Therefore, shocks at one plant spill globally to market outcomes and welfare.

Despite having a higher-dimensional discrete choice model, I provide a toolkit to estimate the model in a three-step procedure leveraging a gravity-type regression, the analytical expression for market price derived from the model, and the solution algorithm for a combinatorial problem. To quantify implications of firms having multiple plants and demonstrate the generality of this framework in answering various policy-related questions, I apply the multi-plant firm framework to the cement industry in the US and Canada and perform counterfactual exercises on environmental, trade and competition policies. Not only can I measure impacts on welfare of different carbon pricing schemes, tariff increases, firm merger and acquisition, but also the effects can be decomposed to channels regarding plant relocation, market structure, prices, production, and trade. Overall, this paper establishes an estimable micro foundation of multi-plant production and promotes theoretical and methodological cohesion in analyzing a wide variety of issue.

The other aspect of firm-level trade decisions contrary to export, is firms' imports of intermediate inputs, in accordance with the growing importance of global production sharing. My second paper in this line of research, *“Rules of Origin and Automobile Parts Trade”*, explores the firm-level sourcing decisions in a multi-country world. I use a policy instrument, preferential rules of origin (RoOs) employed by free trade agreements (FTAs) to investigate firms' selections on which inputs to offshore and the countries from which to purchase them. There are two ways

in which FTAs can distort sourcing decisions. One is through preferential tariffs so that inputs imported from FTA partners enjoy lower tariffs than those from third countries. The other indirect channel is by requiring a minimum share of inputs originated from member countries for the final good to be granted preferential tariff treatment when exporting within the FTA, despite the fact that there are more efficient suppliers outside the region. Hence, a firm minimizes the costs of intermediates considering tariff and input prices subject to the regional value content (RVC) constraint and exporting decisions. I develop a multi-country sourcing model using the gravity trade framework where firms decide imports based on supplier-intermediate characteristics, destination-intermediate characteristics, and bilateral accessibility. Elasticities are then recovered using aggregated trade data. Focusing on the car industry, I survey rules of origin restrictiveness for a nearly exhaustive set of FTAs since 2000. The paper unpacks the effects of FTAs and finds that a 60% and greater RVC diverts intermediate trade more than a direct tariff reduction, but the rule is nonbinding below 60%. The impacts of RoOs are heterogeneous. If car exports are more intensive within the FTA region, the effect of RVC on imported car parts is larger implying higher degree of compliance. However, the sourcing allocation across different types and value of car parts is ambiguous with different countervailing forces. With more detailed firm-level data about the car parts suppliers, my future research will be focused on the marginal firms' decisions on whether to comply with RoOs or opt out voluntarily.

So far the two papers illustrate considerations and effects associated with firms locating production and sourcing intermediates under complete contracts. Understanding of firms, especially multinational firms, however, cannot be complete without discussing the boundaries of the firm. In *"Licensing versus Internalization of Branded Beer"*, I analyse whether firms choose to internalize or engage in arms length licensing when entering a foreign market, specifically for firms that carry more than one brand and multiple stages of operation before reaching consumers. As reviewed by Antràs and Yeaple (2013), there are two approaches in the literature concerning firm boundaries, the transaction-cost theory and property-rights theory. The former determines the optimal organization by comparing exogenous costs associated with each form, whereas the latter endogenizes these costs through ownership of assets and incomplete contracts even for integrated relationships. Opposite predictions from the two models open the door for empirical evaluations that I test using a unique brand-market level data in the beer industry. Empirically, I develop an innovative way to infer contractual relationship by combining brands ownership information at the national and global level. Results show that beer brands with better formula and quality reflecting higher headquarter intensity tend to be produced through foreign direct investment. Firms also prefer to internalize when facing better contractual enforcement at the host country. Both results support the property-right approach of modelling multinational firms in the beer industry. The empirical section goes beyond in characterizing allocation of ownership rights by market size and competition structure, licensor and licensee brand portfolio along the production and distribution stage.

All three preceding papers are in line with the rise in importance of global value chains (GVC). My research interest in this topic continues to some of my joint work with the Asian Development Bank in their flagship reports on measuring GVC participation of selected Asian economies, as well as ongoing country-specific projects to provide insights for policymakers.

In the course of my research, despite the focus on the supply side and multinational firms. I have also given consideration to the demand side of the story by exploring how consumer preference is dictated by their demographics. One work in progress with Keith Head, *"Who*

Likes Foreign Beer? An Exploration of Home Bias within the Chicago Metro Area”, studies consumer taste towards beer brands originated from countries where the ancestors of consumers came. The empirical analysis works with a single Chicago-area grocery store chain, Dominick’s, having stores located at census tracts with different ethnic background composition. With the store-UPC level data across a large number of beer brands, we find significant home bias in consumption that may shed light on why this grocery chain has its market share plummeted after it was taken over by Safeway and replaced with house branded products.

Looking forward, I plan to pursue several research avenues related to my job-market paper. On the empirical front, I intend to use more plant-level data to estimate a richer version of the multi-plant firm model so that more aspects of firms and plants can be considered. I am also going to explore the possibility of estimating a game with more than two players by adapting Hu and Shi (2019) to the multi-plant firm framework. As for applications, I am in the process of developing another paper focusing on the distributional effects of a specific carbon pricing policy, output-based pricing system, where cleaner firms can sell carbon credits to others that produce excessive amount of carbon. Broadly, I also intend to look at issues such as two-sided heterogeneity and sorting of consumers and firms using the matched US home and store scanner data, and multi-product firms as a variant of multi-plant firms but in the product space.

My research will involve a good mix of theoretical models and cutting-edge techniques in understanding the interplay of firms, markets and governments at the intersection of trade, urban, and industrial organization, while taking advantage of the growing accessibility of micro-level big data. I am excited at the prospect of learning, contributing, and making an impact in these fields.