Collaboration, Innovation and Performance in Production Networks

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The project examines the determinants and extent of research collaboration across firms, the role of network linkages across firms and how they relate to firm performance. The paper will consider three types of linkages, collaboration in innovation activities related to patenting, production linkages between suppliers and customers of goods and services, and ownership crossholding between firms.

Data

The project combines data from three sources. The first is a comprehensive panel data set on (granted) patents in Japan from 1985 to 2010. Each record contains the publication date, application date, technology code and the authors (inventors), their affiliations and addresses. From the affliation and address information, it is possible to link inventors to individual establishments within firms and to assign a precise geocode to each inventor. The second data set consists of the 2006 and 2011 waves of the TSR data on firms and their supplier and customer connections in Japan. The TSR data contains detailed supplier, customer, and ownership links for more than 900,000 firms in Japan and gives a unique and comprehensive picture of the production network in Japan. The combination of these two datasets results in information on supplier-customer relationships, innovation collaboration activities, and ownership links for any pair of firms over time.

The funds from the grant will be used to purchase detailed road and rail distance and travel time data from Navitime, a Japanese firm that collects and maintain historical station-to-station travel times as well as driving distance and driving time information (similar to Google Maps but containing historical information). Japan is a collection of islands that have mountain ranges in the interior thus making great circle distances a poor proxy for actual travel times between locations. The rail and road data from Navitime will allow for a substantially improved measure of distance between locations. This detailed connection time and distance data will be used to identify changes in travel costs between locations and the resulting changes in innovation collaboration as well as supplier relationships.

Research Agenda

The project has two related parts. First, using the long panel nature of the patent data and the detailed geographic information of the investors, we will test whether there are agglomeration externalities in innovation activity and whether collaboration patterns change when travel times are reduced between firms. As a next step, we would like to explore the consequences of more (or less) research collaboration on important firm outcomes, such as productivity. Hence, we can estimate the aggregate productivity impact of research

collaboration induced by large infrastructure projects in Japan (see next Section).

The second focus of the project is the evolution of collaboration in innovation activities between firms and the interaction with the production and ownership networks of the firms. The TSR data gives us a detailed picture of all the buyer-supplier connections between firms in Japan at two points in time in addition to their ownership connections. Linking that data to the patent panel, we can ask whether firms in a production network are more likely to collaborate on innovation activities and conversely whether innovation relationships increase the likelihood of a production connection between the firms. These are largely unexplored questions in the literature. Related questions include whether the existence of innovation collaboration increases the survival chance of a supplier relationship and improves the performance, i.e. productivity, of the partners.

Geography and Identification

Several substantial (exogenous) changes in the transport structure in Japan occured during this time period, including the expansion of the high-speed (Shinkansen) rail network at various points during the sample period, the opening of the Seikan railway tunnel linking the islands of Hokkaido and Honshu in 1988, the completion of all three stages of the Honshu-Shikoku bridges linking those two islands, and a sizable increase in direct air connections between cities as a result of airline deregulation. These changes in transport connectivity provide useful natural experients as they effectively shorten the distance between sets of firms and innovators. The primary research focus of the project is to identify the importance of geography, production and ownership connections in determining research collaboration efforts between firms.

Additional researchers on the project include Professor Andrew B. Bernard, Tuck School of Business at Dartmouth and NBER, and Dr. Yukiko U. Saito, RIETI Tokyo Japan.