

My research explores the economics of innovation, focusing on how firms make strategic decisions about research and development (R&D) activities, entry into innovation areas, and the impacts of mergers and subsidy on innovation scope and direction. I combine theoretical modeling, structural estimation, and empirical analysis using large-scale datasets such as surveys, admin data, patents, merger records, and other structured and unstructured data to understand these dynamics. My work contributes to industrial organization and innovation economics by providing insights into firm behavior, policy implications, and the role of competition in shaping innovation outcomes.

In my first solo paper, "Internal and External R&D: An Analysis of Costs and Benefits," I examine the costs and benefits associated with internal and external R&D activities. Drawing on Dutch production and innovation surveys from 2000 to 2020, with a focus on the IT industry, I document a rising trend in R&D activities across industries and provide evidence that internal and external R&D serve as complements. To explain these patterns, I develop and estimate a dynamic discrete choice model that incorporates specific investment costs for each type of R&D. The results indicate that external R&D costs are approximately four times higher than internal R&D costs, which accounts for the relatively small proportion of firms engaging in external R&D. I then simulate the effects of R&D subsidization programs similar to the Dutch Tax Incentives for Innovation scheme. The findings show that neutral subsidies, without preference for internal or external R&D, maximize the increase in R&D-active firms and enhance firm valuation. In contrast, subsidies favoring only internal R&D yield minimal changes in participation and lower valuation gains.

Building on this, my second solo paper, "Entry into Innovation Areas," investigates how firms choose to enter specific innovation domains, treating innovation direction as an outcome of entry decisions. Using Latent Dirichlet Allocation, a topic modeling technique from natural language processing, I analyze 631,000 U.S. electronics patents filed between 1990 and 2019. This approach optimally classifies patents and firm innovation portfolios into 20 distinct areas, revealing key stylized facts: firms persistently engage in multiple domains, with average patents covering 2.86 topics and firms spanning 4.68 topics; entry rises in software-intensive fields like user interfaces and content services, while declining in capital-intensive areas such as memory architecture; and valuation varies across domains amid shifting competitive landscapes. To rationalize these observations, I construct an entry model estimated through moment inequalities, yielding bounds on key parameters. Notably, a 1 percent increase in competitors reduces innovation profits by 18.44 to 56.85 million USD, while an increase of one standard deviation in portfolio diversification boosts profits by 0.57 to 36.81 million USD, with average entry costs bounded at 75.93 million USD.

In collaboration with my supervisors, Sabien Dobbelaere and Jose Luis Moraga-Gonzalez, my third paper, "Mergers and Innovation: An Exploration of Firms' Direction and Scope of Innovation," extends this line of inquiry by studying how mergers influence innovation strategies. We develop a theoretical model of mergers and innovation across multiple projects, structured in two stages: firms first invest in projects, then compete. Empirically, we identify treated merging firms and construct control groups using a matching estimator with calipers for one-to-one pairing. We create joint units by combining acquirers and targets for both treated and control groups, addressing a common flaw in prior studies that often compare post-merger combined entities against standalone controls, especially given data gaps in sources like Compustat and SDC. Our results demonstrate that mergers reduce the scope of innovation, measured by the Euclidean norm of the firm's innovation portfolio vector, under specific conditions: when the merger involves overlapping portfolios and the acquirer is less active while the target is more active. Similarly, mergers alter the direction of innovation, assessed by the similarity of the firm's portfolio to a synthetic reference firm based on the top 10 percent of cited patents.

In ongoing joint work with Costanza Cincotta, titled "The Impact of Subsidy on the Firm's Direction and Scope of Innovation," we build upon the notions of innovation scope and direction from my third paper to investigate the effects of subsidies on these dimensions. Leveraging webscrapped firm-level data on subsidies and grants on publicly-listed firms from Compustat for U.S. firms, which offers superior granularity over prior studies that relied on state-level corporate tax variations, we categorize subsidies into R&D-specific types and non-R&D types, such as loans, employment grants, or decreased corporate tax rates. We plan to construct a theoretical model similar in structure to the mergers framework, but centered on categorizing subsidy on direct R&D costs, reduced corporate tax rates, or loan. We are also planning to accompany our study with reduced-form evidence, and that our estimated parameters from our empirical exercise can then be used as a sufficient statistics for a welfare analysis.

These papers collectively advance our understanding of firm-level innovation decisions, highlighting the interplay between costs, entry barriers, competition, and external shocks like mergers or subsidies. Looking ahead, I plan to expand this research by integrating more techniques, such as reinforcement learning, more deeply into structural models, exploring cross-industry spillovers in innovation, and evaluating the long-term effects of policy interventions on technological progress. My goal is to inform policymakers and firms on fostering efficient innovation ecosystems in an increasingly competitive global landscape.