

Innovation and the Patterns of Trade: A Firm-Level Analysis

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February 13, 2018

1 EXTENDED ABSTRACT

What are the effects of trade liberalizations on firms' innovation incentives? What types of a firm's innovations are more affected by these liberalizations: product or process innovation, basic or fundamental innovation? How do changes in a firm's innovation activities after trade liberalizations affect a country's patterns of trade? We examine these questions both empirically and theoretically, through the lenses of a quantifiable model of trade and innovation.

Recent empirical studies have found that trade liberalizations substantially affect firms' innovation activities (see Bloom, Draca, and Van Reenen (2015), Autor et al (2016), Coelli, Moxnes and Ulltveit-Moe (2016)). However, there is no consensus on the direction of the effect on innovation. Bloom, Draca, and Van Reenen (2015) and Coelli, Moxnes and Ulltveit-Moe (2016) find that declines in trade frictions increase innovation, whereas Autor et al. (2016) find that trade liberalization reduces firms' patents and R&D expenses. The ambiguity of these results shows the need of structural models to understand the channels through which trade affects firms' incentives to innovate. These models can quantify the importance of the market size and foreign competition channels embedded in trade liberalizations, and rationalize the ambiguity of the empirical findings. Moreover, these models can shed light on the effect that changes in firms' innovation incentives has on a country's patterns of trade.

Our first contribution is empirical. We provide empirical evidence on the effect that the accession of China to the WTO in the early 2000s had on the innovation activities of French firms. In particular, we break down innovation activities by categories and study what activities were more affected by changes in trade frictions. We merge three datasets reporting information on firms' R&D and innovation activities, trade and balance sheets over the period 1993-2016. Our R&D data comes from the national survey on firms' R&D and innovation activities and reports information on R&D expenditures, patents, product and process innovation, basic and fundamental innovation, area of research, among others. The custom and balance sheet data provide information on all firms'

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exports and imports by country destination and origin, sales, capital, and employment. These extensive datasets allow us to build detailed measures of the different activities involved in the innovation process over a long panel, and to measure firms' exposure to the Chinese trade shock.

Our second contribution is theoretical. We develop and quantify a model of trade, innovation and firms' dynamics to explain our empirical findings. From a theoretical perspective, the effect of a decline in trade frictions depends on two forces: (i) a market size effect, and ii) a foreign competition effect. The first effect increases investment in innovation, as firms benefit from serving a larger market. The second effect decreases the incentives to innovate, as firms face larger competition from abroad. In this case, the direction of the evolution of comparative advantage determines whether a firm finds it or not profitable to invest in innovation. Which force dominates determines whether the net effect on innovation after a trade liberalization is positive, negative or neutral. One sector-sector models of Ricardian trade without knowledge spillovers predict that decreases in trade frictions have negligible effects on innovation since the market effect cancels out the foreign competition effect (see Atkeson and Burstein (2010) and Buera and Oberfield (2017)). A recent attempt to model these channels has been done by Sampson (2016), Somale (2016), and Cai, Li and Santacreu (2017), among others, by introducing sectoral linkages in production and knowledge spillovers to previous models of trade and innovation. These papers do not model explicitly the role of the firm in taking innovation, export, entry and exit decisions.

Our model builds on Atkeson and Burstein (2010) and Atkeson and Burstein (2017). Atkeson and Burstein (2010) develop a model of trade and innovation without knowledge spillovers, in which innovation is modeled as the introduction of new products in the economy. We augment their model by adding knowledge spillovers and process and product innovations of incumbent firms as in Atkeson and Burstein (2017), who study the effect of innovation policies in a closed economy. In the model, the dynamics of productivity are driven endogenously by innovation of entering firms and product and process innovation of incumbent firms. Changes in trade costs have a direct effect on both product and process innovation in the economy. Our model allows us to disentangle the role of the market size effect and the foreign competition effect on these results. Furthermore, changes in innovation translate into changes in productivity, which in turn has an effect on the patterns of trade of the economy.

We calibrate the model to data on innovation and trade for French firms during the period 1996-2016. We then perform a counterfactual exercise that consists of a reduction in trade frictions between China and France, and analyze quantitatively the effect that such trade reform has on innovation and the patterns of trade.

Our paper provides a unified framework of trade and innovation at the firm level that allows us to obtain aggregate implications of trade liberalizations.