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Do Imports Spur Incremental Innovation in the South?

Yi LU [a], Travis NG [b,*]

[a] Department of Economics, The National University of Singapore, Singapore
[b] Department of Economics, The Chinese University of Hong Kong, Hong Kong

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ABSTRACT

We estimate that a one-standard-deviation increase in a firm's import penetration ratio raises its likelihood of having engaged in an incremental innovation by 4.48% using a random-sampled firm survey in China. The estimate is close to those in Gorodnichenko, Svejnar and Terrell (2010). A number of empirical strategies rule out alternative explanations as sufficient drivers of our result. Competitive pressure from imports is shown to be an underlying mechanism through which imports spur incremental innovation. We discuss how the link between imports and innovation in the South differ from that in the North.

1. Introduction

This paper estimates that a one-standard-deviation increase in the import penetration ratio a firm faces raises its likelihood of having engaged in an incremental innovation by 4.48%. We use a random-sample of firms surveyed by the World Bank in 2002 in China. A firm is referred to as having engaged in incremental innovation if it has introduced either new products/services, business lines, management practices, quality controls, or production processes in the past three years.[1] Unlike the traditional use of industry-level import penetration ratio, our firm-level import penetration measure equals the share of imports of a firm's major market. Our 4.48% estimate is in the neighborhood of those reported in Gorodnichenko, Svejnar, and Terrell (2010); using firms surveyed in European developing countries, their estimates are 7% and 4% for new product and new technology, respectively.

Our result is important in three aspects. First, developing countries have been increasingly innovative; investigating its underlying drivers is important. Second, developing countries have become significantly more globalized. Linking their globalization trend with their innovation may draw potentially important policy implications. Third, Leamer (2007) argues that the unintended transfer of innovative processes in manufacturing, alongside the outsourcing of production, tops all other concerns of "the world is flat." The developed world should thus examine the causes and consequences of these conditions.

* Corresponding author.
E-mail addresses: ecsluyi@nus.edu.sg (Y. Lu), TravisNg@cuhk.edu.hk (T. Ng).

[1] The literature refers "process innovations" as small-step cost-cutting innovations. In contrast, "incremental innovations" embody more than just innovations on processes; such innovations include product innovations, new quality controls, new management practices, and so on. Tailoring existing technology to niche markets at a large volume is an example: Haier gains a 60% share of the world's wine-storage fridges, a niche market in fridge manufacturing.

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Indeed, developing countries are not only *exporting* more to the rest of the world, they are also *importing* more from the rest of the world. Do their exports to the developing countries also spur innovativeness there?

The strong association between import penetration and incremental innovation can be due to the possibility that more innovative firms are also more globally-connected through foreign ownership and international trade. The strong association may just reflect such connections. We rule out this alternative explanation by directly controlling for foreign ownership, fraction of sales aboard, and fraction of imported inputs.

Another alternative explanation is that more capable firms innovate more and are more likely to compete in markets with intense import competition. We use four strategies to show that this alternative explanation is unlikely to drive our results.

Our first strategy is to directly control for firm and CEO characteristics, most notably, lagged labor productivity, levels of capital, and employment size. We also include CEOs' education level and political capital.

Our second strategy is to address omitted variable bias by instrumenting our regressor of interest, firm-level import penetration ratio, with an instrumental variable (IV) that is unlikely to correlate with any omitted firm-level variables. Our IV is the average of the import penetration ratios faced by firms belonging to the same industry but located in different cities. Section 4.1 details the relevance of this IV and why it is unlikely to fail the exclusion restriction.

Our third strategy is the use of the imperfect IV method developed in Nevo and Rosen (forthcoming). The idea is to relax the IV's identifying assumption by assuming it to be endogenous, but less so than our regressor of interest. Relaxing the identifying assumption does not remove the significant association between import penetration ratio and incremental innovation.

Our fourth strategy is to address a plausible explanation that technologically capable firms may self-select to locate at markets with intense import competition. We fail to document compelling evidence supporting this plausible explanation.

The four strategies, along with a battery of other robustness checks using alternative measures and alternative specifications, and controlling for sample attrition bias, suggest that the alternative explanations and other econometric issues are unlikely to drive the strong association between import penetration ratio and incremental innovation.

Section 5 examines indirectly whether competition effect (i.e., foreign imports force domestic firms to improve their production) is a channel through which imports affect firms' incremental innovation. If such is the case, the firms that havepre-innovation rents less affected by imports should have a weaker correlation between their innovation and imports. Section 5.1 uses the heterogeneous response estimation à la Rajan and Zingales (1998) to document such a pattern. Firms with a larger fraction of sales to governmental agencies, which implies that their pre-innovation rents are less affected by imports, have their innovation correlated significantly less with imports.

We also show evidence consistent with the discouragement effect (i.e., domestic firms give up competing with imports because foreign rivals are significantly more superior) in Aghion, Bloom, Blundell, Griffith, and Howitt (2005). Firms in mature manufacturing industries with products relatively closer to global technological frontiers respond to imports to innovate, but not firms in high-tech manufacturing industries with products relatively far away from global technological frontiers.

Our paper echoes Gorodnichenko et al. (2010). They document that firms in European developing countries also respond to imports by engaging in more small-step innovations. We supplement their results by identifying a similar response among Chinese firms. China is important in examining the link between imports and innovation in the South. First, China's innovation is significant. Between the period from 1990 to 1992 and 2000 to 2002, China's share of innovative new goods in US imports increased from 17% to 48% or from 0% to 5% in terms of trade value. Second, it spends the most in R&D among developing countries. China's expenditure on R&D reached USD 86.8 billion in 2006 after an impressive growth of approximately 19% annually in real terms from 2001 to 2006 (OECD, 2008). China claimed 2% of the global share of total R&D expenditure in 1996, dramatically increasing to 7.5% in 2005, just behind the US (35%), the EU27 (24%), and Japan (14%). Third, while a world exporter, China is also a gigantic importer. The WTO (2005) ranks China as the world's third largest importer of merchandises in 2004 (USD 561.4 billion or 5.0% of the world's total) and eighth largest importers of services (USD 69.7 billion or 3.3% of the world's total).

Teshima (2009) measures import competition faced by Mexican firms based on firm-specific import tariff reduction. He shows that tariff reduction raises spending on both process R&D and product R&D. While his main focus is R&D spending, ours is on innovation output rather than input. His import competition measure is also different from ours. To the extent that more R&D spending produces more innovation, our result is closely in-line with his.

2. Linking imports with incremental innovation in the South

Aghion et al. (2005) show competition can either promote or discourage innovation. If increased competition reduces pre-innovation rents more than post-innovation rents, firms "escape competition" by innovating (the competitive effect). On the other hand, if pre-innovation rents are low to begin with, increased competition primarily reduces post-innovation rents. Firms are thus discouraged from innovating (the discouraging effect). The competitive effect likely dominates if a firm has technology on par with that of its competitors. In contrast, the discouraging effect likely dominates if a firm is laggard with low pre-innovation rents to begin with.

Unlike firms in the North, firms in the South are more likely to lag behind their import competitors because North-North trade and North–south trade dominates South-South trade (OECD, 2006; UNCTAD, 2005). The OECD (2006) estimates merchandise exports and trade in services among countries in the South in 2002 to be only 6% and 10%, respectively, of the corresponding world figures. The discouraging effect is therefore likely to dominate in the South.

The effect of increased competition on innovation also depends on the beginning level of competition. If the degree of competition is low to begin with, the competition effect dominates, and vice versa. Although the South does import from the rest