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Trade, innovation, and integration into global value chains: evidence from Mercosur

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Abstract

Trade, Innovation, and Integration into Global Value Chains: Evidence from Mercosur Charlotte Jacobs, 1st year PhD Student, Temple University, Philadelphia (USA) Email: Charlotte.jacobs@temple.edu The link between international trade, or more specifically: imports, and economic growth has been established by Grossman & Helpman (1990) and confirmed in several empirical papers (e.g. Coe & Helpman, 1995; Eaton & Kortum, 1996; Coe, Helpman, & Hoffmaister, 2009). Imports from technologically advanced economies create opportunities for domestic firms to get in contact with and learn from foreign firms with more advanced technologies. They can also improve performance, by requiring domestic firms to compete effectively with imports in the domestic market (Schneider, 2005; Peuckert et al., 2016). Although the initial papers on this issue assumed an increase of innovation using the metric of Total Factor Productivity (TFP), Peuckert et al.'s (2016) study on the wind energy sector reinforces the existence of a direct link between imports and patent activity in the receiving country. Research on the relation between international trade and economic growth demonstrates two shortcomings we want to address in this paper. First, the models used are either on country-level (Coe, Helpman, & Hoffmaister, 2009) or industry specific (Peuckert et al., 2016). These models do not allow us to create concrete business or policy trade solutions as they do not explain the dynamics between imports and changes in local innovation patterns. Country-level research demonstrates the existence of a correlation between imports and

overall TPF improvement, but does not allow for a more detailed understanding of the link between these two variables. Industry specific studies (Peuckert et al., 2016) cannot yield generalized conclusions on how imports affect innovation, and in what industries. Further, domestic knowledge spillover effects cannot be addressed in such studies. Second, extant research has focused on how international trade affects economic growth (measured as TFP or GDP) or innovation in the importing country. The relation between imports, increased innovation, and the integration of the national industry into the global value chain is yet underexplored. Studies on technology catch-up (e.g. Awate et al., 2012; Kumaraswamy et al., 2012) demonstrate that foreign direct investment (FDI) can function as a trigger for increased innovation, and can lead to an upgrade of international trade activities. But the main focus of these studies still remains on the domestic effects of the inflow of knowledge. Considering the foregoing discussion, our paper proposes a cross-country and cross-industry study to analyze the relation between imports, innovation, and global value chain integration. Several specific questions arise in this regard: (a) Do imports stimulate innovation and where? (b) Does increased innovation result in increased global integration of the domestic industry? These research questions will be analyzed using international trade and patent data of four of the Mercosur economies. Argentina, Brazil, Paraguay, and Uruguay saw a steep increase in overall international trade as well as intra-Mercosur trade activities in the 1990s. Explorative patent analysis reveals a correlation between imports and local innovation activity. However, the USA seems to be the sole significant international partner for (measured through international innovation collaboration) A more detailed analysis of the relation between import and innovation will be conducted in the coming months. We also plan to analyze whether this innovation activity affected export activities (and if so, for what industries). In line with the findings of Awate et al. (2012) we expect that patenting from the Mercosur countries is principally related to an output-catch-up movement.

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Abstract

This project explores the relationship between international trade, import specifically, and innovation activity in emerging economies. Using the Mercosur countries (Argentina, Brazil, Paraguay and Uruguay) as empirical setting, our preliminary findings confirm extant literature and show that imports positively affect overall innovation activity of a country. It is our aim in this project to disentangle this relation and understand where imports had an effect on innovation and the international collaboration in innovation (interpreted as sign of integration into global value chains). Sequent, we analyze if these increases in innovation, present in only a few sectors, have positively affected export activities of these sectors. With this research we go beyond the traditionally studied FDIs and strategic alliances for innovation. Imports carries significantly less risk for economic growth traps than do FDIs, therefore their potential should be better understood.

INTRODUCTION

Imports create opportunities for domestic firms to get in contact with and learn from foreign products and producers with more advanced technologies. The presence of foreign products can also enhance competition on the domestic market, forcing firms to seek more efficiency or higher quality in order to compete effectively with imports in their home market (Connolly, 2000 & 2003; Peuckert et al., 2016; Schneider, 2005). The link between international trade, or more specifically: imports, and innovation has first been explored by Grossman & Helpman (1990). Later, several empirical papers (e.g., Coe & Helpman, 1995; Coe, Helpman, & Hoffmaister, 2009; Connolly, 2000 & 2003; Eaton & Kortum, 1996) confirmed the positive effect of imports on innovation performance at the national (Connolly, 2000 & 2003; Liu & Buck, 2007; Schneider, 2005) as well as at the industry level (Peuckert et al., 2016). These studies used Total Factor Productivity (TPF) (Grossman & Helpman, 1990) or patent counts (Connolly, 2000 & 2003; Peuckert et al., 2016) as measure for innovation performance.

Extant research on the relation between international trade, innovation, and integration into global value chains demonstrates two shortcomings we wish to address in this paper. First, the models used are either at the country level (Connolly, 2000 & 2003; Coe, Helpman, & Hoffmaister, 2009; Liu & Buck, 2007) or are industry specific (Peuckert et al., 2016). These models do not allow us to create concrete business strategy or trade policy solutions as they do not explain the dynamics between imports and changes in local innovation patterns. Country-level research demonstrates the existence of a correlation between imports and overall increased innovation performance, but does not allow for a more detailed understanding of the link between these two variables. Industry specific studies (Peuckert et al., 2016) cannot yield generalized conclusions on how imports affect innovation, and what industries are affected. Further, domestic knowledge spillover effects cannot be addressed in such studies.

Second, extant research has focused on how international trade affects economic growth (measured as TFP or GDP) or innovation in the importing country. The relation between imports, increased innovation, and the integration of the national industry into the global value chain is yet underexplored. Studies on technology catch-up (e.g. Awate et al., 2012; Kumaraswamy et al., 2012) demonstrate that foreign direct investment (FDI) or strategic alliances can function as triggers for increased innovation allowing the country to achieve the innovation frontier in certain fields of technology. What remains unexplored, however, is the degree to which this improved innovation performance allows the developing economy to export its innovative products or to become a partner in the global innovation chains. The main focus of studies on effects of international trade or technology catch-up remains on the domestic effects of the inflow of knowledge.

Considering the foregoing discussion, our paper proposes a longitudinal cross-country and cross-industry study to analyze the relation between imports, innovation, and global value chain integration. Specific questions arise in this regard: (a) Do imports stimulate innovation and where? (b) Does increased innovation result in increased global integration of the domestic industry?

These research questions will be analyzed using international trade and patent data of four of the Mercosur economies. Argentina, Brazil, Paraguay, and Uruguay saw a steep increase in overall international trade as well as intra-Mercosur trade activities in the 1990s. In line with former research, explorative patent analysis reveals a correlation between imports and domestic innovation activity. Contrary to former research, we try to link patent and trade data in a systematic way to get a more detailed understanding of the relation between imports and innovation. Using the NBER classification of patents (Hall et al., 1991) we observe in which industries innovation took place during the observed period (1980-2014). Grouping the trade

data using the NBER classification, import and innovation activities can be jointly analyzed. This working method allows us to obtain cross-industry results permitting conclusions on where imports make a difference for innovation enhancement.

INTERNATIONAL TRADE & INNOVATION PERFORMANCE

In the debate on the link between international trade and innovation performance, FDI, strategic alliances, and imports are positively related to domestic innovation performance (Blomström & Kokko, 1998; Govindarajan & Ramamurti, 2011; Liu & Buck, 2007; Peuckert et al, 2016). For FDI and imports the benefits are parallel. Both permit the receiving country to learn from new products and technologies what can result in 'reverse engineering'. The contact with foreign suppliers gives further insights in these new technologies and skills that the country not yet possesses. In addition, FDI can result in turnover of skilled professionals moving to local firms together with their technological knowledge. Besides the possibility for 'reverse engineering' FDI and import create more competition in the domestic market through the introduction of cheaper products or products of higher quality. This forces local businesses to search for more efficient ways to use existing technologies or to look for new, more efficient technologies. The introduction of foreign products or the presence of a foreign player can have the adverse effect however, when the new product or producer outcompetes domestic players and monopolizes the market. FDI also bears the potential of the foreign MNC bringing its foreign suppliers with it, therefore limiting potential knowledge transfers significantly. Considering the goal is technology transfer, FDI seems to come with more risk than do imports. Connolly did not found a significant spillover effect for FDI in her model that takes imports into account. The big majority of studies however, conclude that there exists a significant positive relation between the presence of foreign subsidiaries and innovation performance in the receiving country. While literature on FDI is extensive, the interaction between imports and innovation is less understood.

The economic model of Grossman & Helpman (1990) explores the relation between international trade, innovation, and economic growth at the country-level. These authors find a positive relationship between imports and innovation through an increase in total factor productivity. The import of more advanced technologies and machineries functions as an enabler that allows a country's productivity to go up. Other authors found an increase in innovation activity wherever TPF went up (Coe & Helpman, 1995; Coe, Helpman, & Hoffmaister, 2009; Eaton & Kortum, 1996). A more direct measure of innovative performance, patent counts, has been also used. Connolly's research focuses on the role of trade in the diffusion of technology and found that imports play a significant role in this process (2000, 2003). One of her findings is that high-technology imports make a difference, while low- tech imports don't have a significant effect. These results are consistent with the idea that economic growth and development correlated with the development of technology-rich industries. In their analysis of the effect of FDI, imports, and exports on domestic innovation, Liu & Buck (2007) adopted sales of new products as a proxy for innovation activity of firms in high-technology sectors and found that, for firms in those sectors, imports of selected high-technology goods have a positive effect on innovation performance. Exports and FDI also had positive effects. While Liu & Buck (2007) provide a more fine-grained view on the relationship between imports and the development of high-technology industries, they do not disentangle the interaction between innovation performance and imports.

Furthermore, focus on a single industry does not provide an overall understanding of the effect of import on the national system of innovation. Recently, Peuckert et al. (2016)

studied the wind energy industry in developing countries and concluded that imports from technological advanced players positively affected the knowledge base of the importing economy, what highlights the importance of trade partner selection during the process of technology acquisition. Learning takes place through imports of more technologically advanced partners, what does not restricts this process to high-technology imports.

From extant literature on the topic it can be concluded that imports from technologically more advanced products positively affect innovation performance at the national level. The dynamics of this relationship, however, are not yet clear. Our intention is to tap into this uncharted territory to explore the influence of imports on innovation and consequent integration in global value chains, using the Mercosur countries as an empirical setting.

SAMPLE AND DATA

Sample

With the rise of new economic powers, academic interest in the so called catch-up movement of emerging economies increased rapidly. Japan and South Korea were clear examples of how the classic models of path-dependent growth following product life-cycles (Utterback, 1994) did no longer fit the new reality. India, Taiwan, and China also made evident that catch-up processes could be incredibly fast, allowing these countries to become exporters of high-technology products in a relatively short period of time. The North-South division of technology diffusion became outdated. This story, however, seems different for the Mercosur countries.

Mercosur is a regional trading bloc created in 1991 by Argentina, Brazil, Paraguay and Uruguay. More recently, Venezuela (in 2012) and Bolivia (in 2015) were added as full members, while, Chile, Peru, Colombia, Ecuador and Suriname are associate members, with more limited participation. The full members comprise a market of nearly 290 million people with a combined GDP of 4 trillion dollars. While the four founding members of the bloc have experienced a steady and steep increase of their export/import exchanges since they liberalized their markets and signed the Mercosur agreement in 1991 (see figures 1 and 2), none of these countries have shown much progress on the innovation front. Argentina, Brazil, Uruguay, and Paraguay are not innovative countries, but they still produce a certain volume of innovations. In particular, Brazil and Argentina are first and third largest innovators in Latin America by USPTO patent volume (Mexico is number two). Our study explores the patterns of innovation in these countries, with a particular focus on disaggregating each sector, in order to assess whether intra-bloc trade has had an influence on the way these countries innovate.

For example, observing innovative trends in by sector in Argentina (figure 3) we note that Surgery and Medical instruments, as well as drugs have been present but become dominant from the mid-90's on. Linking these numbers with import activities will be our main objective for the first phase of this research.

Data

For detailed data on imports and exports, we have used the database constructed by Feenstra & Lipsey. Overall import and export data by country were collected from the online database of UN COMTRADE. Considering that patent data only become available from 1976 on, we focus on the trade data covering the period 1976-2016.

Innovation performance is measured through patent counts in the USPTO database. Although US filed patents are somewhat controversial as proxy for innovation activity in foreign countries, we consider it a more accurate tool than other available proxies (e.g. sales of new products, or R&D expenditures). U.S. patents also tend to underestimate and not

overestimate innovative activity. If we find any positive results, they are more likely to hold than be an exaggeration of the real effect.

Other variables that will be considered in our regression model: local knowledge stock (cumulative number), R&D expenditures (intensity), patent intensity per capita per year, income per capita per year (to capture economic growth), GDP (captures economic growth and size of the economy), country size. Because we work with a longitudinal dataset, year and industry dummies will be introduced as well. We will also add interactions between import and country size, and between imports and GDP to the model. We are exploring other theoretically plausible interactions as well as different lag-intervals for R&D expenditures and knowledge stock.

Data collection is ongoing at this moment and is expected to be concluded early 2017.

METHOD

Considering that the trade and patent data form a longitudinal dataset and that our dependent variable (patents) is a positive count variable, a negative binominal model will be adopted. Because we work with cross-country data, we will run a fixed effects regression to take individual country characteristics into account. Currently, the empirical model looks as follows:

$$pat_{i,t} = \alpha_i + \beta_1 \ln imp_{i,t-?} + \beta_{1a} \ln imp_{i,t-?} + \ldots\ldots + \beta_2 LKS_{i,t} + \beta_3 \ln R\&D + \beta_4 \text{patent/capita}_{t} + \beta_5 \text{income/capita}_{t-?} + \beta_6 \ln GDP_{t-?} + \beta_7 \text{country size x imports} + \beta_8 \text{GDP x imports} + \beta_9 \text{year} + \beta_{10} \text{industry}_{i} + \varepsilon_{i,t}$$

The number of import industry categories will depend on the further classification of the trade data. A GMM model is also considered, together with its robustness checks to control for possible reverse causality between imports and innovation. It is plausible that the most innovative industries are more open to receive imports.

DISCUSSION

This early stage project hopes to contribute to the ongoing debate on the importance of an open economy for economic growth and integration into global value chains. Our study sheds light on the link between imports and innovativeness as well as the integration processes of developing economies. We go beyond the highly explored phenomena of foreign direct investment (FDI) and strategic alliances (Blomström & Kokko, 1998; Liu & Buck, 2007), to explore the specific effect of imports on both innovation output and the degree of international collaboration in this innovation process. The success of integration is measured through export activity of these economies. In addition, with our focus on the Mercosur, an economically significant trading bloc, we pay attention to an economically significant trading bloc that has received scant attention to date.

Figure 1: Trade between Argentina and other Mercosur countries

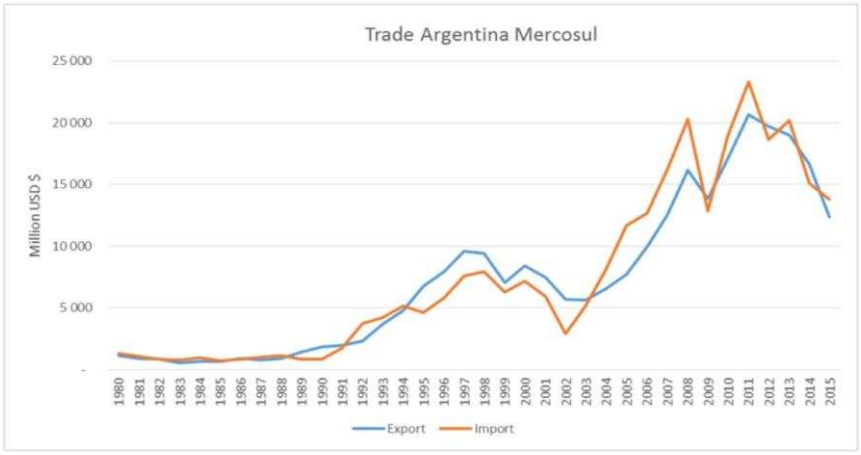


Figure 2: Trade between Brazil and other Mercosur countries

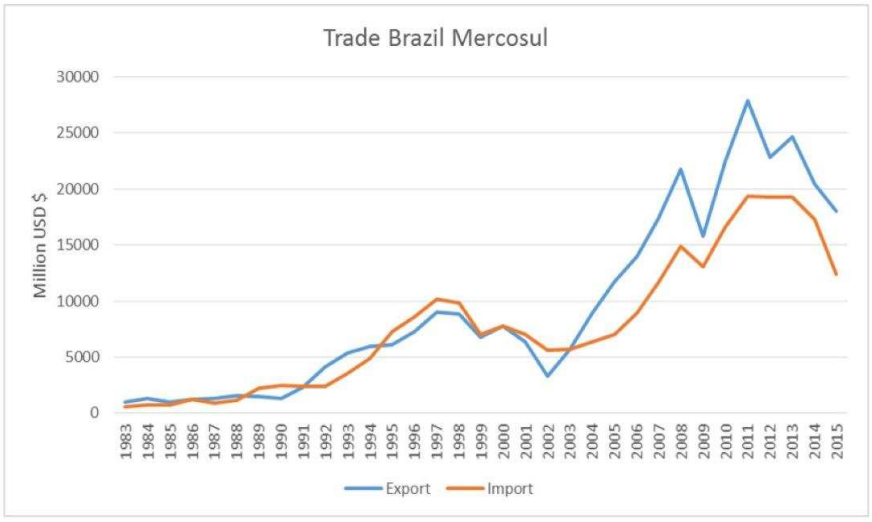
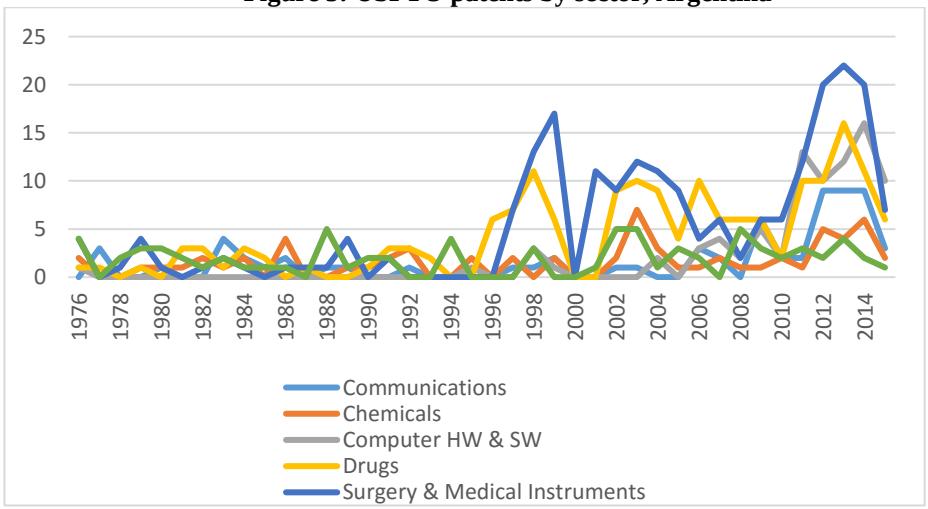


Figure 3: USPTO patents by sector, Argentina



Total patents granted per industry sector (NBER classification of first USPTO patent class), based on their application year. NOTE: the data for 2014 and beyond are not complete as many applications for these years have not yet been concluded.

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