

# China's Import Competition and Innovation: the Role of Unions

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## Abstract

This paper provides a deeper understanding of the role of unions in the firm innovation response to the China's import competition shock. By using Italian firm level data for period 2005-2010 and applying IV fixed effects estimation techniques, we investigate the impact of China's import competition on product and process innovations. Results show that this impact depends: i) on the kind of goods imported (intermediates vs finals goods) and ii) on the kind of innovation (process vs product innovation). When exploring the relevance of unions in this relationship, we provide evidence that in firms characterized by union presence the likelihood of engaging in product innovation activities increases, while the opposite happens for process innovation. Further, the effects of imports on innovation activities turn out to be generally reduced. In particular, unions reduce the increase in process innovation in response to China's final good competition, while attenuating the negative impact entailed by imports of intermediate goods on product innovation. These findings highlight the relevance of taking into account the role of unions when analyzing the consequences of globalization on firms' strategies and performances.

JEL Classification: C33, L25, F14, F60, O30, J50.

Keywords: China's Import Competition, Final and Intermediate Inputs, Product and Process Innovation, Unions, IV Fixed effects estimations.

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## 1. Introduction

The relation between unions and firm performance have been object of a wide range of studies, with findings showing in general a negative impact of unions on productivity and profitability (.....). Other papers have paid attention to the impact of unions on specific firms' strategies, such as the innovation activity of unionized firms. This relationship is ambiguous from a theoretical point of view since, on the one hand, unions may discourage innovation because of the fear of job losses, change or work intensification following new technology; on the other hand, they might foster it, especially in response to other job losses shocks, because of the increase in productivity derived by some kind of innovation that might in turn boost demand and jobs (Menezes-Filho and Van Reenen, 2003).

The empirical evidence has not reached a consensus since the outcomes of the studies change according to the countries analyzed, in line with institutional differences between nations in unions' attitude and ability to bargain (Menezes-Filho and Van Reenen, 2003). SOME Papers....

In this paper we conduct a rather different exercise, because we aim at investigating whether and how unions interfere with the adjustment mechanism caused by globalization in terms of innovation. More specifically, we exploit the China's import competition exogenous shock to analyze the firms' innovative response and we disentangle the role of unions within this relationship. The interest in analyzing the shock coming from China is based on the striking surge of China's (low price) exports during the last decades, which has stimulated a strong firms' adjustment process analyzed especially in terms of employment and wages (Autor et al.2014, Acemoglu et al. 2016, Pierce and Schott, 2015). A few studies have recently investigated the impact on innovation activities, with results far from conclusive. Bloom et al. (2015), using different measures of innovation (TFP, R&D, patenting) have shown an increase of technical change within firms and reallocation of employment toward more technologically advanced firms in response to China's import competition. On the opposite, Autor et al. (2016), focusing on the US for a larger time period, show a negative impact on patenting of US firms.

Therefore in this paper, we first analyze the impact of China's import competition, distinguished by imports of intermediates or final goods, on the technological change within survival **(incumbent)** firms. Secondly, we investigate whether and, if so, how

this relationship is affected by the presence of unions at the firm level, in order to see how labour market institutions interfere with these impacts. To the best of our knowledge no previous papers have investigated this issue.

As measure for technological change, we use two measures of innovation outputs, i.e. process and product innovation outputs. We believe this distinction is important since firms' strategies behind these innovation activities are generally different, as the likely labour market consequences that might affect also unions' attitude toward them. According to Schumpeter (1934) product innovation is defined as the "introduction of a new good (...) or a new quality of good", while process innovation is the "introduction of a new method of production (...) or a new way of handling a commodity commercially". Hence, due to the different nature of these two kinds of innovation activities, also their scope and macroeconomic consequences might be different. Process innovation is a kind of innovation labour and/or capital saving, that leads to greater efficiency of production with a potential for price reduction, and generally brings to a loss of employment. Nonetheless, to the extent that process innovation increases product quality or reduced prices, a rise in demand may result in more jobs. On the other hand, product innovation in general is based on internal innovative activities and can be a radical innovation (new to the world) as well as incremental improvements of previous ones, or imitation of goods already produced in other countries. Generally, product innovation increase the quality and variety of goods and may open up new markets, leading to greater production and employment. Nonetheless, these products might also be used simply to replace old ones, with limited effects on firm employment, or be designed to reduce costs with a similar impact of process innovation (Pianta, 2003, Pianta 2001). Due to these differences between the two kinds of innovation outputs considered and their labour market consequences, also unions' attitude toward each kind of these innovations might be different.

We use firm level panel data coming from the RIL-AIDA database, elaborated by ISFOL from 2005 and 2010, which is a database resulting from the merge between the Italian *Survey on Firms and Workers* RIL ("*Rilevazione su Imprese e Lavoro*") database and the AIDA database (provided by Bureau Van Dick) which contains detailed information on the balance sheets of the Italian capital-owned firms. The RIL-AIDA database provides information on the innovative status of the firm (i.e. whether a firm

as introduced any form of process or product innovation during the past three years) and on the unionization status of the firm, i.e. it identifies those firms characterized by any form of workers' representation at the workplace that is legally entitled to participate in the firm-level bargaining process. By focusing on manufacturing, we merge the RIL-AIDA data with manufacturing industrial data on China's imports, distinguished by end-of-use characteristics (intermediates and final goods), using sectoral data (NACE Rev. 2) coming from the OECD Stan database. Also, in the vein of Colantone and Crinò (2014), for our analysis we build a more comprehensive measure of industrial intermediate inputs, using sectoral input-output matrixes, in such a way to consider backwards linkages across industries.

We carry out our empirical analysis taking into account all the relevant factors proved to be important when study this kind of relationship. We estimate linear probability models where we control for firm unobserved heterogeneity, with the introduction of firm fixed effects in the estimation, and we employ an instrumental variable strategy in order to control for possible unobserved factors able to contemporaneously affect the demand for imports and the likelihood to innovate, such as domestic industry demand or productivity shocks. As instrument, we use industry imports from China in the US and in the UK, following the idea developed in Autor et al. (2013a,b).<sup>3</sup> The identifying assumption is that US and UK China's imports might isolate the China supply driven component of change in Italian import penetration, but at the same time are not correlated with domestic industrial demand conditions. Moreover, we choose these two countries because they are characterized by a distinct institutional pattern with respect to other European countries, such as Italy, which should further strengthen the exogeneity of the instrument. Hence, the implementation of this IV strategy, will allow to get reliable estimates of the impact of China's imports on innovation.

Our first results show that import competition from China affects the innovation activity of Italian firms. In particular, imports of final goods increase innovation activity in terms of both process and product innovation, while imports of intermediates inputs discourage product innovation. These findings are consistent with the view that Italian firms respond to final goods competition by trying both to increase their range and quality of products (through product innovation) and

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<sup>3</sup> To instrument US China's imports they use China's imports from other high income countries.

reducing labour and capital costs to decrease final goods prices (through process innovation). Also, intermediate inputs entail a substitution of the domestic production process and therefore discourage innovative activities.

We then focus on the role of unions within this relationship, since in Italy unions represent an important actor in the bargaining process between workers and employers. An important premise is that in this paper we consider union at the firm level as exogenous. This might not be the case. However, Breda (2015), analyzing the case of France, has shown that conditional on observables characteristics and under a specific institutional environment that makes very easy to organize firm workers in unions, estimates are unlikely to be biased by a selection of best firms by union (Breda, 2015). The Italian institutional framework is very similar to the French one, thus supporting the choice of considering union as exogenous when applying a similar approach.

When introducing in the estimation the interaction term between unions and China's imports, other interesting findings emerge. In fact, first of all, we find that in general unions appear to foster product innovation (which may increase firm's productivity, firms' rents and employment), while they entail a negative but negligible impact on process innovation. Also, the interaction with the import variable is different according to the type of goods imported and the kind of innovation output considered. More specifically, when considering imports of final goods, unions seem to decrease the positive impact on process innovation, while they entail a not significant impact on product innovation, ie. unions seem not to foster process innovation in response to higher competition from China, since this kind of innovation is in general aimed to be labour costs saving. On the other hand, when considering imports of intermediate inputs, the negative impact on product innovation is counterbalanced by the presence of unions that attenuate this impact, trying to stimulate firms to react with product innovation to the substitution (or outsourcing) of the production process. This is again in line with the role of unions trying to prevent job losses due to outsourcing or substitution of domestic production processes for foreign inputs.

These results highlight the relevance of considering the role of institutions when studying globalization effects, because they significantly impact and influence firms strategies. These findings may be applicable to other European countries that, as Italy, are characterized by a similar institutional environment such as France.

The structure of the paper is as follows. In Section 2 we describe the data and present some descriptive statistics. Section 3 discusses the empirical specification and presents the main results. Section 4 concludes.

## 2. Data Description

We use firm level panel data coming from the RIL-AIDA database which is a database, elaborated by ISFOL<sup>4</sup> for 2005-2010, obtained by the merge between the Italian *Survey on Firms and Workers* RIL ("*Rilevazione su Imprese e Lavoro*") database and the AIDA database that contains information on the balance sheet of Italian capital-owned firms. Therefore, the RIL-AIDA data are representative of the universe of Italian (capital-owned) firms. The panel data are collected from three successive surveys (2005, 2007 and 2010) and contain the fiscal code of the firm as firm identifier.

The RIL-AIDA database provides a wide set of information about Italian firms such as the firm size and its composition by occupation and gender, location of the firm (NUTS 2 region) and the sector (NACE Rev.2, two-digits level), innovation status, union presence, as well as a set of balance sheet information such as value added, profits, sales and production.

We focus on the information on the innovative status of the firm (i.e. whether a firm as introduced any form of process or product innovation during the past three years) and on the unionization status, i.e. those firms characterized by any form of workers' representation at the workplace that is legally entitled to participate in the firm-level bargaining process.

We merge these data with data on China's imports of intermediate and final goods provided by the OECD Stan bilateral Database in Goods by Industry and End of Use (ISIC Rev.4, two-digits level<sup>5</sup>) and with data on industrial value added coming from the OECD Stan Database for Structural Analysis. Also, we use sectoral input-output matrixes for Italy, provided by Eurostat, in order to build our alternative variable for intermediate input, in the vein of Colantone and Crinò (2014).

We focus on manufacturing and we make some cleaning of the data. In particular, we drop firms with less than 15 employees since these firms are exempted from many

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<sup>4</sup> ISFOL stands for "Institute for the Development of Vocational Training".

<sup>5</sup> The NACE REV.2 classification and ISIC REV.4 coincide at the two-digits level.

labour regulations. Further we eliminate observations with missing data on our variables of interest (innovation and union) and observations for firms belonging to a few sectors for which information on import and/or value added were not available. Also we focus only on firms with at least two observations in the panel in order to be able to carry out firm fixed effects estimations. In this way we end up with a panel of 3,135 observations which account for 1,333 firms.

Our main dependent variables are two dummy variables that take on a value of 1 if a firm has introduced a product innovation (or process innovation) within the past three years. Our main independent variables are the ratio of imports of intermediates or final goods over value added defined at the sector level. They will be lagged three years in order to be consistent with the definition of innovation. Also, we use a union dummy that says whether in the firm it is present a union representation.<sup>6</sup> Furthermore, we build an alternative measure of intermediate inputs that takes into account that industries source inputs not just from themselves but also from other industries in the economy, exploiting the idea developed in Colantone and Crinò (2014). In particular, we build a more comprehensive indicator of imported inputs that accounts for backward linkages across industries. Using Italian specific intermediates import matrices (defined at two digits level) for each industry  $i$  we compute the share of any industry  $j$  in its total imports of intermediates. Using these weights we construct an overall indicator of imported inputs as follows:

$$Impintov_{it} = \sum_j w_{ij} * Impint_{jt}$$

Table 1 shows the descriptive statistics of the variables of interest in the analysis. As for the innovation variables, it is possible to see that around 69% of the firms have introduced some kind of process innovation in the past three years, while 71% have carried out product innovation. Moreover, 60% of the firms are characterized by some forms of union representation. As for the import variables, it is possible to note that the

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<sup>6</sup> As for the institutional framework of unions, the Italian law gives the workers the right to join a union, engage in union activity and organize a plant-level union representation structure. The main workplace representation body is the so-called 'unitary workplace union structures' (*Rappresentanze Sindacali Unitarie*, RSU), and an alternative plant-level union body (*Rappresentanza Sindacale Aziendale*, RSA) can be elected by the members of a particular union. RSUs have tended to replace RSAs over time.

(log) of the 3-year lagged share of imports of final goods over value added is substantially higher than the one of intermediate inputs. Further, the average firm size is 131, while on average blue collar workers constitute 64% of the firms workforce, while females the 31%.

**Table 1: Descriptive Statistics of the Variables of the Analysis**

Variable	Mean	Std. Dev.	Min	Max
Process Innovation	0.687	0.463	0	1
Product Innovation	0.713	0.452	0	1
Union	0.602	0.490	0	1
Log L3 Share of China Import Final over value added	0.044	0.057	0.000	0.310
Log L3 Share of China Import Intermediate over value added	0.018	0.018	0.000	0.094
Log L3 Share of China Import Intermediate overall over value added	0.025	0.022	0.003	0.107
Firm Size	131	264	15	6,007
Share of blue collars over total Employment	0.639	0.233	0	1
Share of females over total Employment	0.307	0.221	0	1
Number of Observations	3,135			
Number of Firms	1,333			

Source: Panel RIL-AIDA.

### 3. Econometric Analysis

#### 3.1 Econometric Strategy

In this section we present our empirical strategy for investigating the impact of China's import competition on innovation, addressing also the role of unions in affecting this relationship. Using the RIL-AIDA data for 2005-2010 we specify the following linear regression model with firm fixed effects, in order to control for firm unobserved heterogeneity:

$$Inn_{it} = \beta_1 + \beta_2 * \log l3ImpFin_{j(i),t} + \beta_3 * \log l3ImpInt_{j(i),t} + \beta_4 * Char_{it} + \delta_i + \gamma_t + u_{it} \quad (1)$$

where  $i$  refers to firms,  $j(i)$  to the sector the firm  $i$  belongs to,  $t$  to time. The dependent variable,  $Inn_{it}$  is in turn product or process innovation. As main independent variables we use first the (log) of the 3-year-lagged share of total imports over value added, to have a first look on the impact of total imports on innovation, and then the separate components of the (log) of the 3-year-lagged shares of intermediate inputs over valued added  $\log l3ImpInt_{j(i),t}$  and of final imports over value added  $\log l3ImpFin_{j(i),t}$ .  $Char_{it}$  stands for a set of firm observable characteristics (in estimation with control variables)



such as the firm size (in log), the share of blue collars over total firm employment and the share of female over total firm employment. Finally  $\delta_i$  is a firm fixed effect (which automatically incorporates a sectoral firm fixed effect), while  $\gamma_t$  represents a set of time dummies.

However, the relationship under analysis might be endogenous. In fact, the relationship between imports and innovation might be affected by unobservable factors that at the same time affect both the likelihood to import from China and the propensity of firms to innovate, such as domestic demand shocks. In order to control for this endogeneity, we employ an instrumental variable strategy employing as instrument for the share of Italian imports over value added, the corresponding shares for the US and the UK. In line with Autor et al. (2013a,b) and Autor et al. (2014) the identifying assumption is that the share of imports of intermediates in other countries (characterized also by a different institutional pattern) with respect to Italy should be uncorrelated with Italian industrial (demand) conditions, while they should be likely to capture the shock attributable to the increase in the supply of China's exports. Our estimations will confirm this hypothesis.

One important contribution of the paper is then to analyze the role of unions in affecting the relation between China's imports and innovation outputs. It is important to stress that, in our analysis, we will consider union at the firm level exogenous. This might not be the case. However, it is well-known that it is hard to find an exogenous variation in unions, especially in European countries.<sup>7</sup> Nonetheless, Breda (2015), focusing on France, argues that, conditional on observable characteristics, it is not necessarily the case that workplace unionization systematically targets more profitable/efficient/better firms. This is mainly due to the fact that it is typically very easy to organize a firm's workers in a union, since what is needed is only to find a worker who is willing to act as union representative, or to contact the local union officials who are always willing to help on how to set up a union in a firm. In such an institutional environment, Breda (2015) assumes that that estimates are unlikely to be biased by a selection of the best firms by unions, and hence that the assignment to treatment can be assumed as 'quasi-random'. The Italian institutional framework is

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<sup>7</sup> Recent studies by Di Nardo and Lee (2004), Lee and Mas (2012) and Frandsen (2012) use regression discontinuity design (RDD) techniques to identify the 'causal effect' of unions by comparing closely run union certification elections for the US case. For most of European countries, however, there are no such natural experiments to exploit, as unions do not generally need to win a majority election to be recognized as bargaining partners.

very similar to the French one, thus supporting the choice of considering union as exogenous when applying a similar approach.

Therefore, we will re-estimate eq.(1) by introducing interaction terms between the union dummy and the shares of China's imports over value added, as follows:

$$\begin{aligned}
Inn_{it} = & \beta_1 + \beta_2 * \log l3ImpFin_{j(i),t} + \beta_3 * (\log l3ImpFin_{j(i),t} * Union_i) + \\
& + \beta_4 * \log l3ImpInt_{j(i),t} + \beta_5 * (\log l3ImpInt_{j(i),t} * Union_i) + \beta_6 * Char_{it} + \\
& + \delta_i + \gamma_t + u_{it}
\end{aligned}
\tag{2}$$

Where  $\log l3ImpFin_{j(i),t} * Union_i$  and  $\log l3ImpInt_{j(i),t} * Union_i$  stand respectively for the interaction terms between the firm level union dummy and the (log) 3-years-lagged shares of final imports and intermediates imports over valued added. This specification is being estimated by IV fixed effects. Further, standard errors in all estimates are clustered at the firm level.

### 3.2 Results

Table 2 shows the results of the IV fixed effects estimates of model (1). Instruments behave quite well, since they are not weak as shown by the value of the F\_statistics of the first stage always above the threshold of 10, and they turn out to be exogenous in all estimates as shown by the P\_values of the Sargan test at 5% of significance level (in most cases also at 10%).

As for the results of the analysis, columns (1) and (4) of Table 2 show the impact of the total share of China's imports over value added on process and product innovation. There is a positive, but highly no significant impact, of total China's imports on innovation outputs. This suggests at a first sight that there is no response of Italian firms from China's import competition, in terms of innovation activity. We go further in exploring this issue by looking at whether this not significant impact might hide two distinct offsetting effects generated by the import components. Hence, columns (2) and (5) show the estimates distinguishing China's imports for their end-of-use status, final and intermediate goods. It is possible to see that the previous no significant impact on total imports was indeed uncovering two opposite impacts generated by the imports components. In fact, as for final goods imports, it is possible

to infer a positive and significant impact on both process and product innovation. This seems to point out that firms respond to China's competition in final goods by both trying to implement product innovation in order to enlarge the range and the quality of the supplied goods, and by implementing process innovations to reduce firms costs of production. This finding is in line with previous empirical literature investigating the impact of China's import competition on innovation (see for instance, Bloom et al. 2015). As for intermediate imports, table 2 suggests that, on the contrary, they entail a negative impact on product innovation and a negative but not significant impact on process innovation. This outcome seems to suggest that firms use intermediate inputs to substitute part of the production process or outsource it, thereby reducing the incentive to innovate. Columns (3) and (6) show the same estimates controlling also for a set of firm level observable characteristics (firm size and shares of females or blue collars on total employment). Results remain consistent. Therefore, a first analysis reveal that imports from China have an impact on innovation activities of Italian firms, which is different according to the kind of good imported.

**Table 2: IV Fixed Effects Regressions of Innovation Outputs on China's Imports**

	Process Innovation			Product Innovation		
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Log L3 Share of China Import over Value Added</b>	0.078 [0.111]			0.025 [0.108]		
<b>Log L3 Share of China Import of Final Goods over Value Added</b>		0.125* [0.070]	0.121* [0.073]		0.147** [0.073]	0.170** [0.075]
<b>Log L3 Share of China Import of Intermediate Goods over Value Added</b>		-0.060 [0.075]	-0.051 [0.076]		-0.167** [0.072]	-0.167** [0.073]
<b>Firm Control Variables</b>	no	no	yes	no	no	yes
<b>Time dummies</b>	yes	yes	yes	yes	yes	yes
<b>Firm dummies</b>	yes	yes	yes	yes	yes	yes
<b>F test</b>	206.31	46.19	41.33	206.31	46.19	41.33
<b>Sargan Test P value</b>	0.834	0.964	0.893	0.588	0.096	0.065
<b>N. Observations</b>	3,135	3,135	3,108	3,135	3,135	3,108
<b>N. Firms</b>	1,333	1,333	1,323	1,333	1,333	1,323

Notes: Clustered standard errors (at the firm level) in square brackets. \*\*\*,\*\* and \* denote significance at 1%, 5% and 10% respectively. Instruments are the logarithm of the three-years lagged share of imports over value added of UK and US.

We now turn to see what is the role of unions within this relationship, i.e., to see whether the impacts of imports on innovation change according to the presence or not of a union representation within the firm. In fact, unions in general have at the core the interest of the workers and therefore, as already pointed out, they can act by fostering or dampening innovation activities according to the labour consequences entailed by these two kinds of innovations. Table 3 shows the IV fixed effects estimates of the

specification of model (2). Also for these estimates it is possible to observe that instruments are not weak and the Sargan test always accepts the null of exogeneity of the instruments at 5% level (and mainly at 10%).

Columns (1) and (4) of Table 3 show the estimates of the impact of the share of China's imports of intermediates and final goods and their interactions with the union variable, for process and product innovation. Also it is shown the union main effect. Columns (2) and (5) of Table 3 show the same estimates controlling also for observable firm characteristics, while columns (3) and (6) show the same estimates but with the use of the more comprehensive measure of intermediate inputs built in the vein of Colantone and Crinò (2014), to better proxy the China's imports of intermediate inputs by taking into account backward linkages across industries. Results are very similar in all specifications. In particular, it is possible to see that in general unions positively affect product innovations, and this is not surprising considering the fact that this kind of innovation is mainly aimed to increase productivity and demand, thus fostering employment growth. The impact of unions on process innovation is negative, but negligible and not significant. This might also be expected since this kind of innovation is generally labour costs saving. As for what concerns the import variables, and in line with previous outcomes, still imports of final goods increase innovation activities, while imports of intermediate inputs discourage product innovation, while not entailing a significant impacts on process innovation.

Looking at the interaction with the union variable other interesting findings emerge. In fact, the interaction of the union dummy with final goods imports show a negative effect on process innovation and a no significant impact on product innovation. Also, by testing the significance in the difference between the impact of China's final imports and the interaction with union variable, we cannot reject the null of equality of coefficients at 5% and 10% level. Therefore, from a statistical point of view, unions counterbalance the positive effect of final goods imports on process innovation, thus suggesting that in unionized firms the firm response to import competition in final good from China in terms of process innovation is strongly dampened. This finding points out a negative attitude of unions toward process innovation likely due, as already stressed, to its labour costs saving nature.

As for the interaction between the union dummy and imports of intermediate inputs, Table 3 shows that this turns out to be positive and significant for product innovation, thus counterbalancing the negative effect of imports of intermediate inputs

already detected. Therefore, in unionized firms, the negative impact on product innovation due to the likely substitution of production process or outsourcing turns out to be limited. Also, by testing the null of the zero-sum of the two main effects of imports and its interaction with union, this time at 10% of significance we can reject the null hypothesis, while at 5% is accepted. Hence, this finding points out that unions stimulate product innovation in response to the firm reliability on foreign inputs that can bring to strong employment loss within the firm. Product innovation might be beneficial for the firm employment and might offset at least in part the likely firm job losses due to the firm sourcing of foreign inputs or outsourcing activities.

To sum up, these latter findings point to a picture where unions show a positive attitude toward product innovation since, and in accordance to previous empirical literature, it can stimulate productivity and growth. On the contrary, process innovation is discouraged by unions, likely due to its labour costs saving nature. Therefore, unions act against the firm incentives to introduce process innovations in response to China's competition, while trying to limit the negative impact on product innovation. Also, in general, these findings show that in unionized firms all impacts of imports are attenuated compared to non-unionized firms, suggesting a general resistance to change in unionized firms.

**Table 3: IV Fixed Effects Regressions of Innovation Outputs on China's Imports**

	Process Innovation			Product Innovation		
	(1)	(2)	(3)	(4)	(5)	(6)
Log L3 Share of China Import of Final Goods over Value Added	0.148** [0.070]	0.142* [0.073]	0.138** [0.068]	0.134* [0.072]	0.158** [0.074]	0.094 [0.065]
Log L3 Share of China Import of Final Goods over Value Added * Firm Union Dummy	-0.049** [0.024]	-0.044** [0.024]	-0.044* [0.027]	-0.001 [0.024]	-0.003 [0.024]	-0.009 [0.030]
Log L3 Share of China Import of Intermediate Goods over Value Added	-0.068 [0.077]	-0.059 [0.078]		-0.190** [0.074]	-0.196** [0.075]	
Log L3 Share of China Import of Intermediates over Value Added * Firm Union Dummy	0.033 [0.026]	0.032 [0.026]		0.055** [0.024]	0.062** [0.024]	
Log L3 Share of China Import of Intermediates Overall over Value Added			-0.010 [0.072]			-0.162** [0.068]
Log L3 Share of China Import of Intermediates Overall over Value Added * Firm Union Dummy			0.034 [0.038]			0.064* [0.038]
Union Dummy	-0.025 [0.131]	-0.024 [0.130]	-0.033 [0.136]	0.270** [0.131]	0.298** [0.129]	0.247* [0.128]
Firm Control Variables	no	yes	yes	no	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Firm dummies	yes	yes	yes	yes	yes	yes
F test	24.12	21.76	11.62	24.12	21.76	11.62
Sargan Test P value	0.193	0.278	0.438	0.158	0.124	0.077
N. Observations	3,135	3,108	3,108	3,135	3,108	3,108
N. Firms	1,333	1,323	1,323	1,333	1,323	1,323

Notes: Clustered standard errors (at the firm level) in square brackets. \*\*\*,\*\* and \* denote significance at 1%, 5% and 10% respectively. Instruments are the logarithm of the three-years lagged share of imports over value added of UK and US.

#### 4. Conclusions

The contribution of this paper is to analyze the impact of China's imports on the innovative activity of Italian firms. Also, it is aimed to explore the role of unions in affecting this relationship.

We make use of a unique panel data of Italian firms, RIL-AIDA, for 2005-2010 and after having controlled for firm observed and unobserved heterogeneity and the endogeneity of the relationship analyzed, by means of an IV fixed effects estimation strategy, we have pointed out the following findings. First of all, the impact of imports on innovation strongly depends from the end-of-use of the good imported. Also, it depends on the kind of innovation output considered, product vs process innovation, which might be indicative of different firm strategies. In particular, imports of final goods stimulate innovation activities within the firms in response to increasing China's competition, while imports of intermediate inputs discourage activities toward product innovation, in line with a likely substitution of domestic production process for foreign inputs. No effect has been uncovered on process innovation. Therefore, firms react to China's import competition by innovating. On the contrary, the higher availability of foreign intermediate inputs seems to discourage it.

When exploring the relevance of unions within this relationship, other interesting findings emerge. In fact, overall unions seem to show a positive attitude toward product innovation that, by its nature, is likely able to generate employment gains, while they seem not to stimulate activities toward process innovation. This might be in line with the fact that process innovation in general are more likely to be labour costs saving. When considering how firms in unionized firms react to China's import competition, we have shown that unions in general tend to attenuate the impacts of imports on innovation. In particular, they tend to disincentive process innovation in response to final good competition, while they tend to increase the propensity to make product innovations in response to the negative impact entailed by intermediate inputs sourcing. These findings highlight how is important to consider the role of institutions within the analysis of the consequences of globalization, because they can significantly impact and influence firms strategies.

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