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Rethinking the import-productivity nexus for Italian manufacturing

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Abstract We provide evidence on the firm level productivity effects of imports of intermediates. By exploiting a large panel of Italian manufacturing firms, we are able to separately explore the role of importing from high and low income countries. Importing does not permanently affect the firm productivity growth. This finding holds both when we test for the import entry by means of Propensity Score Matching techniques and when we analyse the import intensity within a dynamic panel data model framework. On the contrary, we confirm the existence of self-selection into importing. Also, our evidence supports the learning-by-exporting effects in Italian manufacturing and we prove that this result is robust to the control of firm import activity.

Keywords Imports · Exports · Productivity

JEL Classification F14 · D24

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1 Introduction and relevant literature

The widespread documented expansion of production fragmentation across countries is posing new questions to the academic debate and the policy makers. In particular, it is of interest to understand the firm level impact of offshoring practices and whether heterogeneous effects emerge according to the income level of the import origin country. From a developing country perspective, imports of intermediates may allow firms to use higher quality inputs, to exploit new complementarities in production and to take advantage from potential technology transfers from advanced partners. Then, as the empirical evidence confirms (Kasahara and Rodrigue 2008; Paul and Yasar 2009), *learning by importing* may be at work, i.e. the foreign sourcing of inputs may enhance firm productivity. From a developed country perspective, instead, imports from other advanced partners may present only a slight technological superiority and the consequent efficiency gains may be negligible. On the contrary, even if intermediate purchases from developing countries often hide a cost saving motivation, moving abroad the less efficient production stages may deliver static gains from specialisation. Also, if firms turn to specialise in growth promoting activities (e.g. R&D), it is very likely that they will enjoy a permanent higher efficiency growth rate. Thus, for developed countries, the existence and/or the extent of the productivity effects stemming from intermediate imports is not clear and may be strictly related to the inputs origin. To shed some light on this issue, we dissect the role of imports from high and low income countries for a developed economy, focusing our analysis on Italian manufacturing firms.

In order to identify the causal effect of importing on the firm productivity we follow a twofold empirical strategy. Firstly, we adopt a Propensity Score Matching (PSM) with difference-in-differences estimator. We consider starting to import from high and low income countries as two separate treatments and we disclose the impact of foreign input market entry. In a second step, we assess, instead, the role of the import intensity from the two country groups by estimating a linear dynamic panel data model for the firm total factor productivity (TFP).[1] We, thus, explore whether it is the intensity of the involvement in the import market, more than the import status, that may enhance the firm efficiency. However, importing represents only one of the firm international activities which may affect its productivity. As a matter of fact, established literature suggests that exporting may importantly shape the firm efficiency (Van Biesebroeck 2005; De Loecker 2007; Maggioni 2012) and the existence of such learning effects stemming from the firm penetration of foreign markets has been detected for Italy (Serti and Tomasi 2008a). Resting on the latter finding together with the evidence of a strict linkage existing between the purchasing of foreign inputs and the export activity (Castellani et al. 2010; Lo Turco and Maggioni 2012b), it emerges the need to control for the impact of exports on firm efficiency. Its omission might erroneously deliver a significant effect of imports on productivity even when there is a simple spurious correlation. As a consequence, we will try to dissect the role of importing, once accounted for the

[1] This strategy is close to the one in Görg et al. (2008) and Forlani (2010).

effect of exports. Finally, we will also explore the consequences of importing on the firm's value added to uncover whether besides its indirect—through productivity—effect, there may be a direct effect by means of cost saving.

Our work adds to the recent empirical literature investigating the consequences of imports in terms of firm productivity. In line with the above discussion, while the evidence on developing and transition economies confirms the positive productivity effect of imported inputs,[2] empirical work on developed economies conveys mixed results. Görg et al. (2008), using plant-level data for Irish manufacturing between 1990 and 1998, show that only offshoring of service inputs enhances TFP and the positive effect is confined to exporting firms, while non exporting firms are not significantly affected. This finding is at odds with the one in Forlani (2010) on the same country for the years 2000–2006 and the opposite result might be related to the different period of analysis. The latter study corrects for the endogeneity of the imported inputs via Difference GMM and discloses that the intensity of foreign material inputs, instead of service inputs, is the main driver of productivity improvements in manufacturing, especially as long as domestic laggards are concerned. On the contrary, Vogel and Wagner (2010), for the case of German manufacturing, adopt a difference-in-differences PSM strategy and find no evidence of learning-by-importing at all, supporting instead the self-selection hypothesis.

All the works reviewed so far treat imports from developed and developing countries as having a homogeneous impact on efficiency. This is a strong assumption as the quality and technological content of inputs may well change according to the development stage of the source country. In this respect, closer to our research line, Lööf and Andersson (2010) find that the share of imports from high R&D intensive countries—the G7 countries—in total imports is an important source of productivity in their sample of Swedish firms, especially for small and non affiliated firms, while it does not matter for persistent exporters. In the same line, Jabbour (2010) studies the relationship between offshoring—measured as the share of both imports from foreign independent suppliers and imports from foreign affiliates—by French manufacturing firms to developed and developing countries and productivity and profitability. The author does not test for the causal effect of importing, nevertheless her results point at an opposite insight: both performance measures are positively related to international outsourcing to developing countries only, even if the stronger correlation with profitability suggests that outsourcing to low income economies is mainly motivated by profit more than efficiency enhancing reasons.

Within this framework, our work is one of the very few papers focusing on the efficiency effect of imports from different sources. Similarly to Lööf and Andersson (2010) we estimate the causal impact of importing by input origin on the firm level productivity. Nevertheless, whereas they focus on the total value of imports from different sources and on their relative weight in total imports, we depart from them in studying the impact of the import market entry too and, especially, in assessing the impact of the import intensity in production. The latter choice allows to account

[2] See Halpern et al. (2005) for Hungary et al. (2008) for Paul and Yasar (2009) for Turkey and Burger and Rojec (2011) for Slovenia. Some relevant papers also investigate and confirm the role of trade liberalisation episodes in fostering productivity (Amiti and Konings 2007; Fernandes 2007).

for the actual importance of importing within the overall firm activity. Secondly, from the recent evidence on the strict linkage between importing and exporting (Muûls and Pisu 2009; Kasahara and Lapham 2008; Aristei et al. 2011; Lo Turco and Maggioni 2012b) and on learning-by-exporting, throughout our work we dissect the role of importing once accounted for the role of exporting too. Finally, our focus on the Italian case can be considered of particular interest. Compared to other advanced countries, Italian manufacturing is specialised in low skilled labour intensive productions and the country has recently experienced a sharp increase in intermediate imports from developing countries. Ascertaining whether the proved short run labour market adjustment costs (Lo Turco et al. 2012) and the reduced labour intensity of production (Lo Turco and Maggioni 2012a) in Italian manufacturing are compensated by increased efficiency at the firm level is an important step for the overall evaluation of the firm internationalisation strategies on the contribution to the national welfare. To the best of our knowledge, this is the first piece of research to investigate the firm level effects of imports on productivity in Italy.[3] Some previous industry level studies have shown, even if focusing on different sample periods, that the material intermediates import intensity positively affects productivity (Lo Turco 2007; Daveri and Jona-Lasinio 2008). However, these papers exploit National Input–Output Tables to measure offshoring and, thus, neglect the origin of imported inputs that we address in the present work. Furthermore, whereas industry level studies may better capture the extent of reallocations across firms in the same industry following the increase in import openness, our work is meant to assess the direct effects of the firm internationalisation strategies that the sector level aggregation of data may conceal.

Anticipating our results, importing does not relevantly affect the Italian firm productivity and it does not positively affect firms' value added either.

Our work is structured as follows: the next section presents the data and some descriptive evidence on the import-productivity nexus, Sect. 3 presents the empirical strategy and results from the PSM and the dynamic linear model. Finally, conclusions are drawn in Sect. 4.

2 Data and descriptive evidence

The main data source for this work consists of a balanced panel of Italian limited companies covering a 5-year period from 2000 to 2004. The dataset has been used by the National Statistical Institute (Istat) for a descriptive analysis on offshoring practices by Italian firms published in the Istat Annual Report for 2006 and it has been obtained merging custom trade and balance sheet data. The sample represents

[3] Mazzola and Bruni (2000) and Calabrese and Erbetta (2005) focus on firms' production linkages for a sample of southern firms and for firms in the automotive industry, respectively, finding important effects of outsourcing on the firms' performance, but they do not deal with international linkages. Finally, Barba Navaretti and Castellani (2004) study the impact of becoming a multinational on a bunch of firm level performance measures between 1993 and 1997. However, our focus is on firm level imports that do not necessarily coincide with foreign direct investments. Furthermore, whereas we distinguish between importing from high and low income economies, they do not dissect the impact of investing abroad according to the income level of the destination country.

about 40 % of total manufacturing employment and output and reproduces their sectoral distribution.[4] The dataset provides detailed information for about 40,000 firms[5] on revenues, intermediate and labour costs, tangible and intangible fixed assets, exports, control participation and imports of intermediates. The amount of imported inputs are split according to their origin, developed or developing countries.[6] The firm activity sector is available at 3-digit NACE. "Appendix 1" contains the definition and the detailed description of all the variables we will use in our analysis and Table 9 shows descriptive statistics for the total sample and by groups of firms according to their import and export activity.

The 5-year period at our disposal could seem a too short time where to uncover productivity effects stemming from importing. Nevertheless, several papers in the literature dealing with this topic have a comparable short-time dimension and this does not prevent them from finding significant effects from importing at the firm level (Forlani 2010; Paul and Yasar 2009; Jabbour 2010; Lööf and Andersson 2010; Vogel and Wagner 2010). In addition, when longer time spans are available, the literature usually shows that most of the productivity effect from imports shows up immediately after the import entry (Burger and Rojec 2011). Productivity gains, indeed, occur in the first years and often fade away later in time. This evidence is also common to firm level studies on learning-by-exporting (De Loecker 2007).

Moving the attention to some descriptive evidence from our sample, Table 1 reports the overall share of importers and the share of firms importing from different origin country groups. About 31 % of our sample in 2004 is composed by firms purchasing inputs from developed countries, this share lowers to about 25 % when we turn on the firms offshoring to developing economies. One half of importers from high income economies is also importing from the other country group, while about 70 % of importers from low labour cost economies are purchasing inputs from both origins. Thus, even if there exists some overlap between purchases from the two kinds of country groups, some firms only rest on one type of origin. It follows that the two international linkages may present different underlying motivations and characteristics and this may drive to a different impact on the firm production processes.

[4] Details on the sample representativeness are available from the authors upon request.

[5] The original number of firms was slightly higher, however, as standard we cleaned the sample removing firms in NACE sectors 16 and 23 (these sectors include a small number of firms and for the nature of the performed activities they may behave differently from the rest of manufacturing sectors) and firms with some anomalous (zero or negative) or missing values for the main variables (output, materials, value added or capital). We have also excluded firms which are considered as outliers for at least one year in the sample period. We consider as outliers those observations from the bottom and top 0.5 % of the distribution of some main ratio (value added on labour and capital on labour).

[6] This breakdown has been performed by ISTAT researchers according to source countries' per capita income level. It is worth to notice that the import measure at our disposal prevents us from disentangling the effects of input purchases from foreign affiliates versus arm's length purchases. Nevertheless, we believe that our measure mainly captures the latter, as Italian multinationals only account for about 5 % of Italian manufacturing firms and 5 % of importers with at least 10 employees, then the vast majority of importers perform arm's length transactions. The latter evidence is gathered from the representative EFIGE database for firms having at least 10 employees (http://www.efige.org). Furthermore, we are not able to identify the goods purchased abroad by Italian manufacturing firms, relabeled—without any production process—and resold. This phenomenon will deserve further investigation, as soon as suitable data will be available.

Table 1 Distribution of importers (%)

	2000	2004
Importers	37.32	38.89
Importers LIc	20.88	24.99
Importers HIc	31.44	31.50
Importers HIc & LIc	15.00	17.59

Our elaborations from ISTAT dataset. *HIc* and *LIc* stand for high income countries and low income countries, respectively

Concerning the time evolution, the most interesting finding is the deepening of firms' involvement with developing suppliers, jointly with an unchanged share of importers from advanced economies. The growing role of low wage countries in Italian firms' purchases is mainly due to their recent economic growth and opening to international trade in last decades together with the Italian specialisation in labour intensive productions where the search for cheaper intermediates may represent a successful competitive strategy. Thus, from our evidence it emerges that, even if Italian manufacturing firms are highly integrated in international networks with suppliers from advanced countries, in recent years developing economies have become an important market where firms outsource parts of their production process and buy intermediates at lower prices.

As standard in the literature, in Table 2 we present the importers' premia on a set of firm level characteristics which are captured by the coefficients associated to the import status from Low and High Income countries (respectively γ_0 and γ_1) in the following regressions:

$$y_{it} = \alpha + \gamma_0 Imp_{it}^{LI} + \gamma_1 Imp_{it}^{HI} + \beta size_{it} + \delta_0 D_j + \delta_1 D_t + \eta_i + \epsilon_{it} \qquad (1)$$

where y_{it} is the variable we are interested in and it is alternatively the labour productivity of firm i at time t, *lp*, its TFP index, *tfp*, its average unit wage, *wage*, its capital-labour ratio, *kl*, and export status and share, *Exp* and *ExpSh*. The TFP index is computed following Caves et al. (1982) on the basis of a production technology with labour and capital inputs only, under the assumption of separability of intermediate goods from the remaining inputs[7] (Chambers 1988). Imp^{LI} and Imp^{HI} are two dummies capturing the import status from low and high income countries, respectively.[8] All regressions also include a control for the firm size, measured by the logarithm of the employment, and sector and time dummies (D_j and D_t). Estimates are obtained both from pooled ordinary least squares (OLS) and fixed effects (FE) regressions. Results show that firms purchasing inputs from both country groups are more productive than non importers, and this finding is confirmed regardless of the estimator (pooled or FE) and the productivity indicator (labour productivity or TFP index). Also, importers present a significantly higher average wage and capital intensity. The existence of import premia for firm productivity and

[7] In the empirical analysis below, we will relax this assumption and we will also adopt a TFP index calculated on the basis of an output production technology with material and service inputs too.

[8] See "Appendix 1" for the definition and the detailed description of the variables.

other firm level characteristics is in line with previous literature (Vogel and Wagner 2010; Kasahara and Lapham 2008), even if they shrink when firm fixed effects are controlled for. Also, the premia are significantly higher for the import status from advanced countries than the ones from low income countries. This result suggests the opportunity to treat the two types of importing activity as two different treatments the firm may undergo since they may potentially lead to different efficiency effects both in terms of significance and magnitude. Consistently with the evidence on two-way traders (Altomonte and Békés 2009; Vogel and Wagner 2010; Castellani et al. 2010), from the Table it turns out that export and import activities are strictly linked: importers have a higher probability to sell in foreign markets and this holds true for both import origins. This evidence together with the potential existence of learning-by-exporting reveal the importance to control for the firm export activity when the productivity gains of importing are investigated.

In the Appendix we also show the kernel density of the TFP index for the three different groups of firms: importers from the two origins and non importers. Figure 1 delivers us the same insights gathered from the estimated import premia in Table 2 along all the firm productivity distribution. The distribution of importers is shifted to the right of that of non importers, and this proves the productivity superiority of firms buying foreign intermediates. The graph also suggests that importers from high income countries seem to be more productive, as also reported by the above import premia.

The evidence we have shown only reveals a positive correlation between importing strategies of firms and their efficiency and does not give any information about the causal nexus that we investigate in the following section.

Table 2 Import premia

		Imp^{LI}		Imp^{HI}	
		Coeff	*p* value	Coeff	*p* value
Pooled	*lp*	0.084	0.000	0.200	0.000
	tfp	0.060	0.000	0.166	0.000
	Wage	0.008	0.003	0.093	0.000
	kl	0.167	0.000	0.239	0.000
	Exp	0.163	0.000	0.231	0.000
	ExpSh	0.019	0.000	0.023	0.000
Fixed effects	*lp*	0.014	0.000	0.030	0.000
	tfp	0.014	0.000	0.028	0.000
	Wage	0.004	0.005	0.014	0.000
	kl	0.012	0.013	0.021	0.000
	Exp	0.113	0.000	0.120	0.000
	ExpSh	0.010	0.000	0.014	0.000

The Table refers to the estimation of Eq. 1 and displays the γ_0 and γ_1 coefficients. All variables are in logarithm with the exception of *Exp* and *ExpSh*, being a dummy and a share, respectively. The difference between the coefficients of Imp^{LI} and Imp^{HI} are always statistically significant with the exception of the difference in *kl* and *Exp* in fixed effects estimations

3 The empirical strategy

3.1 Evaluating the impact of import entry

Compared to the opposite causal direction, the investigation of the causal nexus running from importing to the firm productivity can be considered a more relevant issue, as it may deliver important insights in terms of policy implications. Indeed, the finding of beneficial effects of imports for the firm efficiency and competitiveness may drive policy makers to adopt interventions aimed at easing the access to foreign supply markets. In order to test the learning-by-importing hypothesis, i.e. the hypothesis on whether the firm import activity enhances its productivity growth, we exploit a treatment framework, where the treatment is the import entry. The measure of interest in this empirical setting is the average treatment effect on the treated (ATT) that, in our context, is represented by the difference between the efficiency importers attain when purchasing inputs abroad and the one they would have experienced if had they not imported at all. As usual, the latter counterfactual outcome is not observable and we have to rely on the post-treatment efficiency level of non importers. To attenuate the issue of simultaneity, we focus on import starters as treated units and never importers as untreated units. As documented in the previous section, important differences exist between the two groups of firms and, to account for this, we apply PSM techniques that allow for the selection of a proper control group. The latter is, then, made up of those never importers that are the most similar to the import starters in all relevant pre-treatment observable characteristics, so as summarised by their propensity score (Blundell and Dias 2000). In our analysis, we define as import *starters* those firms starting to import in year t and not importing in the previous 3 years (i.e. $t-1$, $t-2$ and $t-3$). As a consequence, the sample of starters consists of two cohorts: firms that start importing in 2003 and the ones that start importing in 2004. We consider imports from low income countries and imports from high income countries as two different treatments, following the prior, supported by our descriptive evidence, that the two types of activity may partially reflect different underlying reasons and may drive to different consequences in the firm production processes. We end up with 2,572 starters for imports from low income countries and 1,855 starters for imports from developed economies. In oder to select the never importers to match with the import starters, we rest on the propensity score retrieved from the estimation of a probit model for the probability to import from each origin county group for the first time. To account for any observed difference between starters and controls in the pre-entry period, in both probit models we include the first, second and third lag of the following variables as regressors: firm size measured in terms of units of labour, *lab*, TFP index, *tfp*, capital-labour ratio, *kl*, real average wage, *wage*, stock of intangible assets, k_{int}, export share, *ExpSh*, and import share from high (low) income countries, $ImpSh^{HI}$ ($ImpSh^{LI}$) for the probability of importing from low (high) income countries. Finally, the models contain a full set of two-digit sector[9] and year dummies. It is worth to notice that, as mentioned above, in the control group selection

[9] The inclusion of three digit sector dummies caused convergence problems so we decided to stick to the use of two digit dummies, also not to incur in the inconsistent parameter estimates related to the presence of a large number of fixed effects in short T panels when estimating a model with Maximum Likelihood (see Wooldridge 2002, p. 484).

equation for each treatment we include a variable to control for firms undergoing the other treatment (in terms of share) and we also include the firm export share, thus taking into account the degree of firm involvement in foreign markets in terms of export activity in the period before the import entry. This choice follows from the recent evidence on the existence of important complementarity between importing and exporting (Muûls and Pisu 2009; Kasahara and Lapham 2008; Aristei et al. 2011) and from our descriptive evidence too. Resting on these findings, we select never importers that in the pre-entry period do not present a significant difference in the export activity and all the other relevant observables with respect to future importers.

Table 3 shows the marginal effects from the probit estimations of the import entry in both source markets. The estimated propensity scores will, then, be used for the selection of the control units. From the data it emerges that the most relevant differences between import starters and the remaining firms concern the pre-entry year, with a few exceptions mostly related to exporting and importing. Columns 1 and 3, indeed, confirm our expectations: larger and more productive firms are more likely to start importing, the same is true for firms characterised by a higher capital intensity and having a larger endowment of intangible assets. This evidence supports the validity of the self-selection into importing hypothesis in line with Vogel and Wagner (2010). Also, previous internationalisation strategies, both in terms of exports and imports from other origins, ease the establishment of linkages with suppliers in new foreign origins. The role of all determinants is pretty similar between the two import status. The only exception concerns the average wage that has no significant impact on the probability of starting importing from advanced countries, while, when measured in $t-2$, it has a negative and slightly significant effect on the purchases from suppliers in developing economies. The usual interpretation of the average wage as a proxy for the average firm skill intensity (Bernard and Jensen 1999, 2004) may suggest that, *ceteris paribus*, firms with higher skill intensity have a lower probability to start importing from low income countries. This may be due to the kind of activity these firms perform requiring more technology and quality intensive inputs that are more likely to be found in high income countries. The estimated probit specification allows us to correctly classify most of the observations (95 % for imports from low income countries and 96 % for imports from high income countries).

By exploiting the estimated scores, we then apply the “Nearest Neighbour” (NN) matching on the “common support”, that is we match the starter with the single never importer having the most similar propensity score. The matching is applied ”with replacement” and cross-section by cross-section, so that the same never importer may be used as a match more than once and import starters are matched with controls from the same year.

In order to appraise the quality of our matching procedure, columns 2 and 4 of Table 3 display the goodness of the matching emerging from the re-estimation of the probit on the sample of treated units and matched controls. We find that all coefficients are not significant, with the exception of the second lag of the TFP measure in the probit for importing from high income countries in column 2. Nevertheless, the pseudo-R^2 is not statistically different from 0 for both probit models run on the starters and the matched controls. These checks are standard in

Table 3 Probit for first-time import entry

	Import from LI countries		Import from HI countries	
	All sample [1]	Matched sample [2]	All sample [3]	Matched sample [4]
lab_{t-1}	0.029***	−0.017	0.032***	−0.002
	[0.004]	[0.045]	[0.004]	[0.053]
tfp_{t-1}	0.013***	−0.01	0.021***	0.035
	[0.003]	[0.034]	[0.003]	[0.040]
kl_{t-1}	0.005***	0.000	0.004**	−0.004
	[0.002]	[0.017]	[0.002]	[0.018]
$wage_{t-1}$	0.002	−0.012	0.006	−0.031
	[0.006]	[0.057]	[0.006]	[0.070]
$k_{int\ t-1}$	0.002***	−0.005	0.000	−0.002
	[0.000]	[0.004]	[0.000]	[0.005]
$ExpSh_{t-1}$	0.068***	0.003	0.063***	0.002
	[0.008]	[0.075]	[0.008]	[0.082]
Imp^{HI}_{t-1}	0.044***	0.088	0.047***	0.078
	[0.011]	[0.102]	[0.016]	[0.176]
lab_{t-2}	−0.011*	0.024	−0.014**	0.000
	[0.006]	[0.063]	[0.006]	[0.069]
tfp_{t-2}	0.003	0.029	0.004	−0.091**
	[0.004]	[0.039]	[0.004]	[0.045]
kl_{t-2}	−0.002	0.004	0.000	0.005
	[0.002]	[0.023]	[0.002]	[0.024]
$wage_{t-2}$	−0.011*	0.001	−0.001	0.060
	[0.007]	[0.070]	[0.006]	[0.077]
$k_{int\ t-2}$	0.000	0.006	0.001**	0.000
	[0.001]	[0.005]	[0.000]	[0.006]
$ExpSh_{t-2}$	0.006	0.031	0.007	0.033
	[0.010]	[0.090]	[0.010]	[0.111]
Imp^{HI}_{t-2}	−0.006	−0.092	0.001	−0.009
	[0.014]	[0.120]	[0.021]	[0.239]
lab_{t-3}	−0.001	0.004	−0.003	0.009
	[0.004]	[0.038]	[0.003]	[0.040]
tfp_{t-3}	0.006*	−0.031	−0.001	0.026
	[0.003]	[0.034]	[0.003]	[0.038]
kl_{t-3}	0.003*	−0.004	0.001	−0.013
	[0.002]	[0.016]	[0.001]	[0.018]
$wage_{t-3}$	−0.006	0.047	−0.003	0.017
	[0.005]	[0.055]	[0.005]	[0.057]
$k_{int\ t-3}$	0.000	−0.003	0.000	0.004
	[0.000]	[0.004]	[0.000]	[0.004]

Table 3 continued

	Import from LI countries		Import from HI countries	
	All sample [1]	Matched sample [2]	All sample [3]	Matched sample [4]
$ExpSh_{t-3}$	0.014*	−0.05	0.017**	−0.067
	[0.008]	[0.076]	[0.009]	[0.092]
Imp^{HI}_{t-3}	0.031***	−0.025	0.028	0.016
	[0.011]	[0.090]	[0.018]	[0.195]
Firms	53,020	5,144	46,115	3,701
Obs.	0.159	0.002	0.135	0.003
Pseudo-R^2	3,264	16.82	2106	17.66
Wald Chi^2	−8,660	−3,557	−6,725	−2,557

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. All regressions include a full set of time and two-digit sector dummies

Marginal effects are reported. Robust standard errors are in brackets

the literature (Caliendo and Kopeinig 2008) and imply that participation in the treatment is random, as treated units and their matched controls have the same ex-ante probability to start importing from low income or high income countries. Also, in Table 10 in the Appendix, we show the *t* tests of the differences in the relevant characteristics in the three pre-entry years: while before the matching there are large and significant gaps in the pre-treatment variables, afterwards any difference disappears. In the bottom of the Table we display that the quasi-totality of treated are in the common support—their propensity score falls within the controls' propensity score distribution—and that the median standardised bias—the distance in marginal distributions of the pre-treatment variables between treated and controls—across covariates is largely reduced after the matching. Furthermore, Fig. 2 in the Appendix shows that the distribution of the propensity score for matched controls overlaps the one of treated firms after the matching procedure for both the treatments. All this evidence confirms the validity of the matching for the two treatments, i.e. importing from high and low income countries.

After the implementation of the matching algorithm, which controls for any observable characteristic driving the selection into the "treatment", we apply the difference-in-difference (DID) estimator on the matched sample. Thus, by comparing the after/before productivity differences for import starters to the same differences for the matched controls, we also allow for selection into importing to occur on time invariant unobservables. As affirmed by Blundell and Dias (2000) the use of matching estimator in combination with difference-in-difference approach can "improve the quality of non-experimental evaluation results significantly" and allows for the interpretation of ATTs as causal effects. In the literature, this approach has been followed by Vogel and Wagner (2010) and Burger and Rojec (2011) who deal with the assessment of the productivity effects of importing in the case of German and Slovenian manufacturing firms, respectively. Once defined *t* as the starting year of the intermediate import activity, we compare the productivity growth between t and $t-1$ and between $t+1$ and $t-1$. The average treatment effects on the treated (ATT) are then calculated as follows:

$$\gamma^{DID-PSM} = \frac{1}{n_i}\sum_{i \in I}\left[(Y_{i,post} - Y_{i,pre}) - \sum_{j \in C}\omega(i,j)(Y_{j,post} - Y_{j,pre})\right] \quad (2)$$

Y is the outcome (in our case the productivity), subscripts *post* and *pre* denote that the variable concerns the pre ($t-1$) or post-entry period (t and $t+1$); I denotes the group of import starters in the region of common support, while C denotes the control group of never importers, always in the region of common support. n_i is the number of treated units on the common support. $\omega(ij)$ is a weight equal to the inverse of the number of control firms that are matched with a starter and, in our analysis, it is equal to 1 due to the single nearest neighbour matching.

Results Table 4 shows the ATT effects from PSM–DID estimations both for imports from high and low income countries. The left hand side of the Table shows average treatment effects on the TFP index calculated on the basis of value added (*tfp*), while, in the right hand side of the Table we relax the assumption of separability of intermediate inputs and report ATTs for the TFP index calculated on the basis of firm real sales (tfp^s). Below ATTs in the Table we report both analytical and bootstrapped standard errors and we base on the latter our inference, as they may be considered as more reliable (Caliendo and Kopeinig 2008). When the first TFP measure is used, starting to purchase abroad has a significant impact on the firm's productivity growth only upon entry in the import market, as from the bootstrapped standard errors the impact on the difference between $t-1$ and $t+1$ never turns significant, thus revealing that any possible benefit is only temporary. Even if the sign of the effect is similar across the two import activities, the coefficient size and significance level are higher for the first time sourcing from developing countries. This finding would confirm the recent increase in the relative importance of these

Table 4 ATT effects of import entry

	$\Delta tfp_{t,t-1}$	$\Delta tfp_{t+1,t-1}$	$\Delta tfp^s_{t,t-1}$	$\Delta tfp^s_{t+1,t-1}$
Import from LI countries				
$\gamma^{DID-PSM}$	0.028	0.036	−0.001	0.011
Ase	[0.008]***	[0.018]**	[0.004]	[0.008]
Bse	[0.009]***	[0.023]	[0.005]	[0.011]
Treated units	2,572	579	2,572	579
Import from HI countries				
$\gamma^{DID-PSM}$	0.019	0.035	−0.002	0.027
Ase	[0.009]**	[0.024]	[0.005]	[0.010]***
Bse	[0.011]*	[0.029]	[0.006]	[0.014]*
Treated units	1,853	401	1,853	401

Both analytical, *Ase*, and bootstrapped (with 250 draws), *Bse*, standard errors are reported

The reduction in the number of firms at time $t+1$ is due either to some missing values or to the lack of time $t+1$ for the 2004 wave of starters and their relative control units

*, ** and *** indicate the significance at 10, 5 and 1 %

economies for manufacturing firms in developed economies and the lack of any significant growth effect after the entry would support the existence of temporary static, more than dynamic, gains from importing stemming from specialisation. All this evidence, though, is not robust to the change of the TFP index computation method. As a matter of fact, when moving to the definition of TFP based on total sales any import effect on productivity disappears. This follows from the removal of the separability assumption which might deliver a slightly upward biased TFP measure when the latter is based on value added (Oulton and O'Mahony 1994).

From this set of results, first time import entry does not deliver significant productivity gains. It is worth to highlight, though, that more than just importing or not, the extent of involvement in international markets might prove the key factor for productivity growth. For this reason, we will pursue this view in the next section by testing the impact of import intensity from high and low income countries on the firm TFP growth in a linear dynamic panel data model. Furthermore, as the following analysis will be based on the use of the total sample made up of both import starters and established importers, we will also be able to account for the effect of a longer run experience in the import market. Established importers, indeed, are the majority of importing firms and any possible productivity effect from importing would then also reflect their older tenure in foreign input markets, thus, making up for any potential shortcoming represented by the short post-entry period at our disposal in the PSM. Finally, moving to the parametric approach of the linear dynamic model allows to control for any possible change in the evolution of the observables upon entry in the import market, not properly accounted for in the PSM.

3.2 Appraising the role of import intensities

In order to assess the role of the extent of involvement in foreign input markets in shaping firm productivity, we explore the relationship between import intensities and productivity in a linear dynamic model for the whole sample of importers and non importers. We assume that firm TFP, is a function of the import share from developed and developing economies:

$$TFP_{it} = e^{\gamma_0 ImpSh_{it}^{LI} + \gamma_1 ImpSh_{it}^{HI} + \delta_0 D_j + \delta_1 D_t}$$

Thus, taking the logs of variables and including the lag of TFP to account for the autoregressive nature of productivity, we obtain the following equation to estimate:

$$tfp_{it} = \alpha\, tfp_{it-1} + \gamma_0\, ImpSh_{it}^{LI} + \gamma_1\, ImpSh_{it}^{HI} + \delta_0\, D_j + \delta_1\, D_t + \mu_i + \epsilon_{it} \qquad (3)$$

tfp is the TFP index, $ImpSh^{LI}$ and $ImpSh^{HI}$ are the firm import shares from low and high income countries over total output respectively, D_j and D_t are two digit sector and time dummies, μ_i is the firm level unobserved heterogeneity, and ϵ_{it} is an idiosyncratic shock.

The presence of the lagged dependent variable represents a source of endogeneity for our estimates and, in order to evaluate the performance of different estimators and choose the more appropriate one, we compare the resulting estimates from four candidates: OLS, FE, the difference generalised method of moments (GMM–DIFF)

(Arellano and Bond 1991) and the system generalised method of moments (GMM–SYS) (Blundell and Bond 1998). GMM–DIFF and GMM–SYS also allow us to correct for the potential endogeneity of imports: the lagged levels of the dependent variable and import intensities are used as instrument in the differenced equation in both GMM–SYS and GMM–DIFF while the lagged differences of the variables become instruments for the level equation in GMM–SYS. It is known that in this framework FE deliver a downward biased estimate of the lagged dependent variable, while OLS delivers an upward bias, and, in line with our expectations, we find that both the GMM–DIFF and GMM–SYS coefficient estimates of the lagged TFP fall within this range. Concerning the instruments choice in GMM estimations, when we use the second—and deeper—lags of the variables in levels to instrument the differenced equation as suggested in Blundell and Bond (1998), the Hansen test of over-identifying restrictions does not fail to reject the validity of lagged levels dated $t - 2$ and we can not reject the null of no second order autocorrelation ($AR2$ test). This is consistent with the presence of measurement errors as also shown in Bond (2002) and, as suggested by the latter, we use instruments dated $t - 3$ and $t - 4$ of both import intensities and TFP that are, instead, not rejected in GMM–DIFF.[10] Blundell and Bond (1998) advise to combine the difference equation with the equation in levels in a system estimation since GMM–DIFF may be characterized by weak instruments if the series has a near unit root behaviour and if cross-section variability dominates time variability. However, in our empirical context GMM–DIFF proves to perform better than GMM–SYS, where the Hansen test does not support the validity of the estimations. We then prefer the former to the latter.

Results Table 5 displays the results from the estimation of the base model 3 by means of different methods. It emerges that only OLS estimation displays a significant impact of import activity on firm efficiency. From FE purchasing inputs abroad does not enhance the productivity regardless of the origin country. The same holds for GMM–DIFF estimations, where we also control for the potential endogeneity of our right hand side variables. On the contrary, turning to results from GMM–SYS, whereas the finding of no role for imports from high income economies is confirmed, an efficiency enhancing effect stems from purchases from low wage countries. However, it is worth to notice that, as already mentioned, the Hansen test reveals some problems about the validity of the instruments. For this reason, in the rest of the paper we stick to GMM–DIFF.[11]

[10] Unfortunately, due to our sample time span, we are not able to test for third order autocorrelation. However, we rest on the Hansen test to evaluate the goodness of the instruments.

[11] GMM–SYS estimations are available from the authors upon request. They mimic the findings of GMM–DIFF, and the impact of offshoring to low income countries turns to be non significant when the firm involvement in export markets is accounted for. However, even if the Hansen test often rejects the null in this set of estimates, the Hansen/Sargan test is found to be inclined to some weakness (Roodman 2006). As a matter of fact, Blundell and Bond (2000) observe some tendency for the Sargan/Hansen test statistics to reject a valid null hypothesis too often in their experiments, and this tendency is greater at higher values of the autoregressive parameter. Furthermore, the Hansen test rejection in large firm level samples is not an uncommon feature (Bontempi and Mairesse 2008). Meschi et al. (2011), indeed, discuss that the very large number of observations makes the occurrence of a significant Sargan/Hansen more likely. They report that when in their work they repeat the test over random subsamples the test was not significant most of the times.

Table 5 TFP impact of import intensity

	Ols	Fixed effects	GMM—DIFF	GMM–SYS
L.tfp	0.786***	0.045***	0.362***	0.546***
	[0.002]	[0.004]	[0.031]	[0.025]
$ImpSh^{LI}$	0.035***	0.021	0.496	0.190***
	[0.011]	[0.033]	[0.329]	[0.056]
$ImpSh^{HI}$	0.152***	−0.024	−0.224	−0.250*
	−0.018	[0.015]	[0.259]	[0.149]
Cons	−0.021***	−0.209***		−0.030***
	[0.001]	[0.051]		[0.007]
Firms	40,468	40,468	40,455	40,468
Obs.	161,758	161,758	121,285	161,758
R^2	0.622	0.009		
Hansen			0.150	0.000
AR(1)			0.000	0.000
AR(2)			0.000	0.000

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. All regressions include a full set of two-digit sector and time dummies. Robust standard errors are in brackets. *L.tfp* denotes the lagged TFP. GMM–SYS and GMM–DIFF estimates are obtained using the 3rd and 4th lags of the dependent variable and regressors as instruments for the equation in differences, additionally GMM–SYS uses the 2nd lag of the differenced variables for the equation in levels. *Hansen* shows the *p* value of the test of the validity of the over-identifying restrictions. *AR*(1) and *AR*(2) show the *p* value for the tests of the null hypothesis of no first and second order serial correlation in the differences of residuals

To prove the robustness of our findings we have accounted for a set of firm level and sectoral variables. First of all, some recent work on Italian manufacturing has shown robust evidence on learning-by-exporting (Serti and Tomasi 2008b; Bratti and Felice 2011). When we include the firm experience in foreign markets, estimates, as displayed in Table 6, confirm the lack of any role of import activity in the efficiency improvement. Firm export share instead significantly contributes to boost firm productivity. The same results hold when we add other firm level variables, that is the stock of intangible assets, k_{int}, and the firm share of domestic materials, $MatSh_{dom}$, and when we test for the sector level import penetration, imp_pen_{sect}, export openness, exp_open_{sect}, and the sectoral skill ratio, $skill_{sect}$. It is interesting to notice that the stock of intangible assets, k_{int}, that may capture the investments of firms in innovation, quality, R&D, advertisement, and, thus, the level of sophistication of their activity,[12] drives to efficiency gains even if the significance level is low. Also, the activity of domestic outsourcing, as captured by the intensity in domestic intermediates, has no impact, thus disclosing that purchases of inputs have no role regardless of their origin, domestic or foreign. Concerning the sectoral context, the significant coefficient on the sector import penetration, imp_pen_{sect}, that should catch the pressure from foreign competition, may reveal that firms invest in

[12] As a matter of fact, in our sample we observe that if sectors are split into High Tech and Traditional according to Pavitt's 1984 taxonomy, the largest stock of intangible assets is recorded for firms in the former group while the lowest stock is for firms in the latter.

efficiency improvements to escape from a deepening of foreign competitive pressures.[13] On the contrary, no role is found out for the skill intensity and the export orientation of the sector.

Summing up, an increase in the firm import intensity, regardless of the input origin, does not affect the firm efficiency growth in Italian manufacturing. This finding is also confirmed in Table 7, when we use the TFP index computed on the basis of firm's real sales and is in line with the previous evidence on the lack of a permanent shift in the TFP growth path after entry.

The lack of learning-by-importing mimics the finding highlighted by Vogel and Wagner (2010) for Germany, while it is at odds with the evidence on Irish, Swedish and French manufacturing (Forlani 2010; Görg et al. 2008; Jabbour 2010; Lööf and Andersson 2010). However, results in some of the latter works may be driven by the omission of any control concerning firm export strategies that, indeed, emerge from our analysis as an important driver of firm productivity growth.[14] Then, our evidence would suggest that, as already shown by Serti and Tomasi (2008b), learning-by-exporting is at work in Italy and this is a peculiar finding for advanced economies where usually no gain stems from export activity (ISGEP 2008). Finally, our firm level evidence appears to be at odds with the positive productivity effect stemming from the sector level studies by Lo Turco (2007) and Daveri and Jona-Lasinio (2008). One possible explanation is related to the across firms reallocation that may originate from increased sector level intermediate import penetration. Both studies use two digit industry measures of imports of intermediates and productivity, then it is highly likely that in response to increased imported intermediates intensity the less productive intermediate good producers, classified in the same two digit industry of the final good producers, exit the market. The consequent reallocation of resources to higher productivity firms, then, increases the sector level productivity. In line with the theory on heterogeneous firms in international trade (Melitz and Ottaviano 2008), evidence in this direction for the Italian manufacturing is shown by Del Gatto et al. (2008). Then, the overall sector and firm level evidence would suggest that imports do not induce important within firm productivity gains, nevertheless higher competition in intermediate production may well generate overall productivity gains at the sector level.

[13] Unfortunately, we are not able to control for the foreign ownership of the firm in this sample. We also lack any information on the firm foreign investments abroad. The inclusion of inward and outward FDI dummies would be desirable here, due to the large intra-firm share of trade that is generally operated by multinationals and to the higher efficiency stemming from being a multinational. To assess whether the omission of such controls may result in a serious misspecification of our empirical model, we made a check on the EFIGE representative database for manufacturing firms with at least 10 employees. This database reports that foreign owned firms (firms with 10 % or more of foreign owned capital) represent in Italy about 5 % of all manufacturing firms. At the same time, only 2.5 % of Italian firms declare to invest abroad. In addition, only 7 % of exporters and 9 % of importers are foreign owned and only 4 % of exporters and 5 % of importers are foreign investors. These figures, concerning the population of firms with at least 10 employees, confirm that multinational activity is not very common within the Italian manufacturing sectors, and that the majority of importers and exporters are not part of a multinational group.

[14] Consistently with this view, Lööf and Andersson (2010) find that no import effect on productivity when focusing on persistent exporters.

Table 6 TFP impact of import intensity: controls

	Firm level controls				Sector level controls		
	Adding *ExpSh*	Lagged Regressors	Adding k_{int}	Adding $MatSh_{dom}$	Adding imp_pen_{sect}	Adding exp_open_{sect}	Adding $skill_{sect}$
L.tfp	0.414***	0.359***	0.460***	0.422***	0.421***	0.419***	0.411***
	[0.037]	[0.031]	[0.053]	[0.037]	[0.038]	[0.038]	[0.037]
$ImpSh^{LI}$	−0.147	0.183	−0.088	0.256	−0.193	−0.157	−0.107
	[0.460]	[0.385]	[0.566]	[1.532]	[0.476]	[0.473]	[0.460]
$ImpSh^{HI}$	−0.199	−0.048	−0.087	−1.389	−0.183	−0.179	−0.188
	[0.279]	[0.059]	[0.209]	[2.183]	[0.272]	[0.271]	[0.275]
ExpSh	1.106***	0.239*	1.416***	1.213***	1.082***	1.051***	1.095***
	[0.294]	[0.128]	[0.356]	[0.315]	[0.291]	[0.287]	[0.293]
k_{int}			0.033*				
			[0.020]				
$MatSh_{dom}$				−0.280			
				[0.900]			
imp_pen_{sect}					0.043**		
					[0.022]		
exp_open_{sect}						−0.008	
						[0.021]	
$skill_{sect}$							0.033
							[0.034]
Firms	40,243	40,240	36,408	40,110	36,346	36,346	40,243
Obs.	120,305	120,320	102,595	119,627	107,294	107,294	120,195
Hansen	0.257	0.003	0.078	0.248	0.105	0.086	0.290
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. GMM–DIFF estimates are reported. All regressions include a full set of two-digit sector and time dummies. Robust standard errors are in brackets. *L.tfp* denotes the lagged TFP. Estimates are obtained using the 3rd and 4th lags of the dependent variable and regressors as instruments for the equation in differences. *Hansen* shows the p value of the test of the validity of the over-identifying restrictions. $AR(1)$ and $AR(2)$ show the p value for the tests of the null hypothesis of no first and second order serial correlation in the differences of residuals

3.3 Extension: the role of importing in value added

A reason of concern in empirical analysis which, as ours, deal with the impact of importing on total factor productivity may stem from the fact that, due to the lack of firm level input prices, any possible positive impact of importing on TFP measure might capture a cost saving effect, especially when imported inputs originate from developing economies.[15] Then, the fall in the unit cost of material inputs, not properly accounted for by sectoral price indexes, would cause an increase in firm's value added, under the implicit assumption that imported inputs only substitute for

[15] We thank one referee for the suggestion of this line of inquiry.

Table 7 TFP impact of Import Intensity: controls—TFP from sales

	Firm level controls				Sector level controls		
	Adding *ExpSh*	Lagged Regressors	Adding k_{int}	Adding $MatSh_{dom}$	Adding imp_pen_{sect}	Adding exp_open_{sect}	Adding $skill_{sect}$
$L.tfp^s$	0.517***	0.461***	0.339***	0.512***	0.503***	0.499***	0.510***
	[0.124]	[0.108]	[0.106]	[0.134]	[0.135]	[0.134]	[0.123]
$ImpSh^{LI}$	−0.409*	−0.117	−0.381	0.085	−0.369	−0.353	−0.385
	[0.248]	[0.160]	[0.265]	[1.162]	[0.252]	[0.249]	[0.246]
$ImpSh^{HI}$	−0.049	−0.019	−0.102	0.161	−0.046	−0.045	−0.043
	[0.095]	[0.018]	[0.119]	[1.835]	[0.094]	[0.094]	[0.093]
ExpSh	0.833***	0.155**	0.774***	0.889***	0.797***	0.785***	0.820***
	[0.235]	[0.072]	[0.255]	[0.265]	[0.225]	[0.222]	[0.232]
k_{int}			0.016				
			[0.012]				
$MatSh_{dom}$				0.142			
				[0.752]			
imp_pen_{sect}					0.008		
					[0.014]		
exp_open_{sect}						−0.015	
						[0.014]	
$skill_{sect}$							0.034
							[0.021]
Firms	40,243	40,240	36,408	40,110	36,346	36,346	40,243
Obs.	120,305	120,320	102,595	119,627	107,294	107,294	120,195
Hansen	0.837	0.077	0.783	0.348	0.738	0.715	0.843
AR(1)	0.000	0.000	2.31E−10	0.000	0.000	0.000	0.000
AR(2)	0.001	0.000	0.0256	0.002	0.003	0.003	0.001

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. GMM–DIFF estimates are reported. All regressions include a full set of two-digit sector and time dummies. Robust standard errors are in brackets. *L.tfp* denotes the lagged TFP. Estimates are obtained using the 3rd and 4th lags of the dependent variable and regressors as instruments for the equation in differences. *Hansen* shows the *p* value of the test of the validity of the over-identifying restrictions. *AR*(1) and *AR*(2) show the *p* value for the tests of the null hypothesis of no first and second order serial correlation in the differences of residuals

domestic materials. In this case, the detection of any positive impact of importing on productivity could be overestimated as it could just reflect an increase in the value of output net of the cost of intermediates. In our empirical analysis, though, we find no impact at all of importing on firm level TFP, so the mis-measurement of the latter does not seem to be an issue in our work. Indeed, we only find a positive role of exporting more than importing, so as reported by other studies too (Serti and Tomasi 2008b). However, in order to check if importing has a positive role for value added, by means of cost saving, we explore this issue in Table 8. The upper panel reports results from the PSM, while the lower one displays results for the linear model GMM estimates where we account for the firm labour and capital stock. The value added measure adopted corresponds to the one calculated in the first line of Eq. A.1

Table 8 VA impact of import intensity

PSM–DID

	Imp^{LI}		Imp^{HI}	
	$\Delta va_{t,t-1}$	$\Delta va_{t+1,t-1}$	$\Delta va_{t,t-1}$	$\Delta va_{t+1,t-1}$
$\gamma^{DID-PSM}$	0.032	0.088	0.038	0.121
Ase	[0.008]***	[0.022]***	[0.010]***	[0.028]***
Bse	[0.010]***	[0.028]***	[0.011]***	[0.031]***
Treated units	2,572	579	1,853	401

GMM–DIFF

	Firm level controls			Sector level controls		
	Baseline	Adding k_{int}	Adding $MatSh_{dom}$	Adding imp_pen_{sect}	Adding exp_open_{sect}	Adding $skill_{sect}$
L.va	0.287***	0.287*** 0.294***	0.295***	0.314***	0.315***	0.285***
	[0.037]	[0.045]	[0.037]	[0.039]	[0.039]	[0.037]
lab	0.557***	0.532***	0.589***	0.488***	0.481***	0.559***
	[0.065]	[0.068]	[0.067]	[0.068]	[0.068]	[0.065]
kap	0.080**	0.071*	0.101***	0.056	0.056	0.081**
	[0.035]	[0.038]	[0.038]	[0.038]	[0.037]	[0.035]
$ImpSh^{LI}$	−0.205	−0.232	0.843	−0.238	−0.205	−0.182
	[0.461]	[0.556]	[1.457]	[0.477]	[0.473]	[0.461]
$ImpSh^{HI}$	−0.103	−0.036	0.147	−0.116	−0.113	−0.096
	[0.229]	[0.189]	[2.029]	[0.228]	[0.228]	[0.226]
ExpSh	1.306***	1.549***	1.341***	1.282***	1.251***	1.299***
	[0.224]	[0.251]	[0.233]	[0.224]	[0.222]	[0.223]
k_{int}		0.011				
		[0.014]				
$MatSh_{dom}$			0.291			
			[0.840]			
imp_pen_{sect}				0.056***		
				[0.020]		
exp_open_{sect}					0.000	
					[0.019]	
$skill_{sect}$						0.023
						[0.031]
Firms	40,254	36,413	40,121	36,358	36,358	40,254
Observations	120,345	102,618	119,667	107,334	107,334	120,235
Hansen	0.033	0.031	0.064	0.037	0.029	0.041
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000

Table 8 continued

GMM–DIFF

	Firm level controls			Sector level controls		
	Baseline	Adding k_{int}	Adding $MatSh_{dom}$	Adding imp_pen_{sect}	Adding exp_open_{sect}	Adding $skill_{sect}$
AR(2)	0.813	0.987	0.921	0.734	0.665	0.768

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The upper panel shows the ATT effects for *va* from PSM–DID estimations. Both snalytical, *Ase*, and bootstrapped (with 250 draws), *Bse*, standard errors are reported

The lower panel shows the results from the GMM–DIFF estimations of the dynamic model for *va*. All regressions include a full set of two-digit sector and time dummies. Robust standard errors are in brackets. *L.va* denotes the lagged value added. GMM–DIFF estimates are obtained using the 3rd and 4th lags of the dependent variable and regressors as instruments for the equation in differences. *Hansen* shows the *p* value of the test of the validity of the over-identifying restrictions. *AR*(1) and *AR*(2) show the *p* value for the tests of the null hypothesis of no first and second order serial correlation in the differences of residuals

in the Appendix and results in the Table show that, although from PSM–DID starting to import both from developed and developing countries importantly increases value added, from the dynamic model estimates, once again, only the positive role of exporting is confirmed.[16]

On the one hand, the discrepancy between the PSM and the linear dynamic model can be explained by the lack of a proper control for the simultaneous change in the input availability and in the export activity which may allow for the exploitation of scale economies. On the other hand, the lack of any import effect on value added can depend on the fact that the cost saving driven by importing stems from the reduction in the cost of labour more than from the reduction in the cost of material inputs. In other words, materials may show up in technology as *p-substitutes* for labour and the decline of their price pushes the increase in their own demand and the decline in the demand for labour.[17] For a given wage,[18] this causes a reduction in the total cost of labour and, thus, of the value added going to labour. It follows that value added per unit of output would decline, but the overall average cost reduction resulting from the substitution of materials for labour may push the firm's competitiveness and the expansion of sales and value added once again. This may explain the lack of any significant value added effect from importing.[19]

[16] However, it is worth to notice that the validity of GMM instruments is not strongly supported by Hansen tests.

[17] Evidence in this line is reported by Lo Turco and Maggioni (2012a). By the same token, evidence of p-substitutability bewteen material inputs and labour in Italian Manufacturing is displayed by Bettin, Lo Turco, and Maggioni (2012).

[18] Usually wages are considered as rigid in the Italian labour market.

[19] To corroborate this interpretation we tested the impact of importing on the firm average cost, the costs of materials and of labour per unit of output and the ratio of material to labour costs. Importing from low income economies goes with a reduction in total average cost, an increase in the cost of material per unit of output and, a reduction in the cost of labour per unit of output and an increase in the ratio of material to labour cost. Results are not shown for brevity but are available upon request.

4 Conclusion

Within the recent strand of literature on the role of intermediate inputs in the manufacturing firm performance, we contribute offering evidence on the effect of imports from high and low labour cost countries on the Italian firms' productivity. By means of PSM techniques and of the estimation of a linear dynamic panel data model of the firm TFP, we appraise the effect of both the import status and intensity on the efficiency of import starters and all importing firms, respectively. Our overall evidence points at no productivity effects stemming from the firm import activity, regardless of the input origin, and this is valid both when considering the first time entry and a longer and deeper experience in the import market. As byproduct of the empirical analysis, we find the existence of self-selection into importing, as also highlighted by Vogel and Wagner (2010), and we confirm the relevant role of exporting in shaping the Italian manufacturing firm productivity, in line with Serti and Tomasi (2008b) and Bratti and Felice (2011). An increase in the export intensity, indeed, positively affects the firm TFP and value added growth. Thus, we confirm the validity of learning-by-exporting effects, when the firm import activity is controlled for. Our findings, together with other evidence on advanced countries in the literature, suggest that gains from imports may be rather modest for developed economies, thus marking an important distinction with respect to the evidence on the relevant role of imports for manufacturing in developing countries. Detailed information on the distinction between intra-firm and arm's length transactions together with the identification of imports of intermediate and final goods represents a fundamental step to refine this analysis in order to shed further light on the channels through which foreign purchases may affect the firm's production processes. Further evidence on advanced countries would be needed to explore in other contexts the simultaneous role of imports and exports on productivity.

In conclusion, as no efficiency gain emerges from our data, policy makers should be more concerned on the actual consequences of integration in the intermediate input markets. As a matter of fact, if importing, more than positively affecting the firm efficiency, only caused the exit of less productive firms from the market, national policies should be tailored at helping the resource reallocation, by favouring human capital formation and re-training of workers involved in this process.

Appendix 1: Variables definition and description

- *tfp*: total factor productivity. Throughout the paper the latter is computed following Caves et al. (1982)[20] as:

[20] The choice of this index is motivated by its robustness. Van Biesebroeck (2007) shows that, apart the case of large measurement errors in the data, the index produces consistently accurate productivity growth estimates, even when firms are likely to employ different technologies.

$$lnTFP_{ft} = lnY_{ft} - ln\bar{Y}_t + \sum_{s=2}^{t}(ln\bar{Y}_s - ln\bar{Y}_{s-1}) - \frac{1}{2}\sum_{i=1}^{n}(S_{fit} + \bar{S}_{it})(lnX_{fit} - ln\bar{X}_{it}) + \frac{1}{2}\sum_{s=2}^{t}\sum_{i=1}^{n}(\bar{S}_{is} + \bar{S}_{is-1})(ln\bar{X}_{is} - ln\bar{X}_{is-1}) \quad (A.1)$$

with Y and X respectively measuring real value added and the quantities of the $n = 2$ primary factors of production, i.e. labour and capital.[21] S refers to the expenditure share of each factor and the bar indicates the average over the relevant quantity. We define a hypothetical firm having input cost shares equal to the arithmetic mean cost shares over all observations, and with input and output levels equal to the geometric mean of inputs and output over all observations. The terms in the first sum describe the difference between the firm f and the hypothetical firm at time t, while the terms in the second sums chain together the hypothetical firms back to the base period. The index measure the productivity in each year relative to a hypothetical firm that represents the average firm in the sector in the first year of our sample time span.

- tfp^s: total factor productivity based on real sales. Throughout the paper the latter is computed following Caves et al. (1982) as:

$$lnTFP^s_{ft} = lnY_{ft} - ln\bar{Y}_t + \sum_{s=2}^{t}(ln\bar{Y}_s - ln\bar{Y}_{s-1}) - \frac{1}{2}\sum_{i=1}^{n}(S_{fit} + \bar{S}_{it})(lnX_{fit} - ln\bar{X}_{it}) + \frac{1}{2}\sum_{s=2}^{t}\sum_{i=1}^{n}(\bar{S}_{is} + \bar{S}_{is-1})(ln\bar{X}_{is} - ln\bar{X}_{is-1}) \quad (A.2)$$

This index depart from the one above since it rests on the output specification of the production function, where Y measures the real output and X denotes the quantities of the $n = 3$ primary factors of production, i.e. labour, capital and the sum of intermediate material and service purchases. S refers to the expenditure share of each factor and the bar indicates the average over the relevant quantity.

- *va*: logarithm of the firm real value added;
- *lp*: labour productivity, measured as the logarithm of the firm real value added over firm total employment;
- Imp^{LI}: import status from low income economies, measured as a dummy variable taking value 1 if the firm imports from low income countries and 0 otherwise;
- Imp^{HI}: import status from high income economies, measured as a dummy variable taking value 1 if the firm imports from high income countries and 0 otherwise;

[21] Labour is measured as the number of employees in the firm, while capital is proxied by the balance sheet value of material assets.

- *ImpSh*^{LI}: import intensity from low income economies, measured as the share of imported inputs from low income countries over total output;
- *ImpSh*^{HI}: import intensity from high income economies, measured as the share of imported inputs from high income countries over total output;
- *Exp*: export status, measured as a dummy variable taking value 1 if the firm exports;
- *ExpSh*: export intensity, measured as the value of total exports over total output;
- *wage*: average wage, logarithm of total labour cost over total employment;
- *kl*: capital labour ratio, measured as the logarithm of the ratio between the firm real material assets and the firm total employment;
- $MatSh_{dom}$: firm level intensity in domestic materials, measured as the share of material inputs purchased domestically over total material purchases;
- *lab*: size, measured as the logarithm of firm employment;
- k_{int}: intangible capital stock, measured as the logarithm of the firm real intangible assets;
- imp_pen_{sect}: sector level import penetration, measured as the three digit level sector imports over the summation of the total three digit level sector output and imports minus exports;
- exp_open_{sect}: sector level export openness, measured as the three digit level sector exports over total sectoral output;
- $skill_{sect}$: sector level skill ratio, measured as the ratio between the three digit level sector share of white collars over total sectoral employment.

Appendix 2: Additional graphs and tables

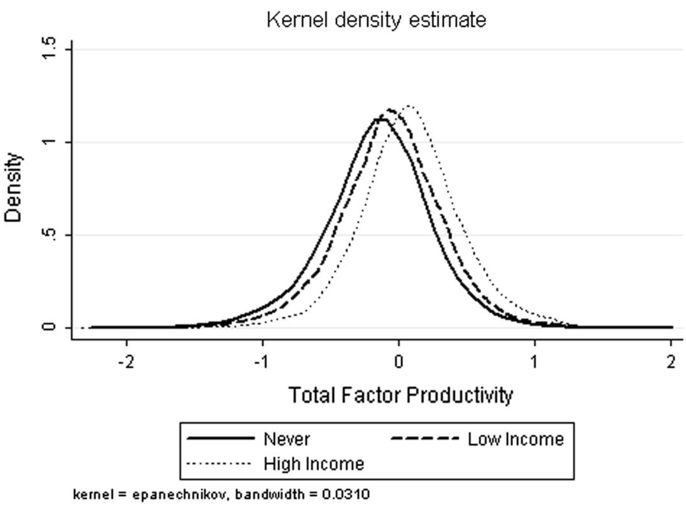

Fig. 1 Productivity—Kernel density

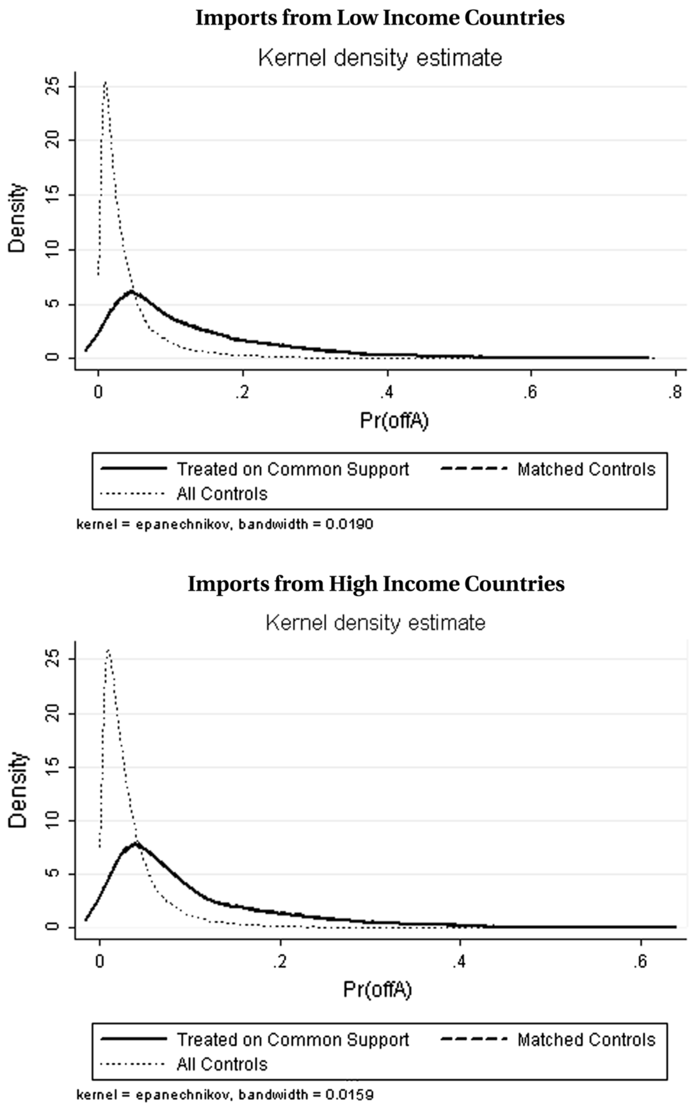

Fig. 2 Propensity score—Kernel density

Table 9 Descriptive statistics

Firm status	N-2000	N-2004	Total N	*tfp*	tfp^s	*va*	*lab*	*kl*	*wage*	k_{int}	$ImpSh^{LI}$	$ImpSh^{HI}$	*ExpSh*
Non Trader	14,154	13,258	68,420	−0.205	−0.101	12.642	2.369	9.377	9.909	7.430	0.00	0.00	0.00
Imp^{HI}&Imp^{LI}&Exp	5,715	6,736	31,380	0.158	−0.041	14.697	3.962	10.035	10.261	10.550	0.05	0.09	0.38
Only Exp	11,035	11,259	55,227	−0.092	−0.076	13.100	2.678	9.605	10.007	8.409	0.00	0.00	0.17
Only Imp^{HI}	812	693	3,816	0.030	−0.044	13.472	2.867	9.896	10.116	8.601	0.00	0.11	0.00
Imp^{HI}&Exp	5,736	4,841	26,762	0.097	−0.037	14.060	3.387	9.923	10.212	9.688	0.00	0.07	0.28
Imp^{HI}&Imp^{LI}	224	218	1,117	0.022	−0.072	13.594	2.999	10.149	10.070	8.503	0.06	0.13	0.00
Only Imp^{LI}	314	325	1,566	−0.172	−0.125	12.859	2.526	9.790	9.872	7.795	0.07	0.00	0.00
Imp^{LI}&Exp	2,014	2,601	11,889	−0.048	−0.089	13.405	2.960	9.660	10.005	8.776	0.06	0.00	0.30
Total	40,004	39,931	200,177	−0.061	−0.074	13.348	2.890	9.650	10.042	8.602	0.01	0.03	0.16

Our elaborations from ISTAT dataset

The firm status denotes the exclusive group to which the firm belong to, taking into account the export activity, Exp, the import activity from high income countries, Imp^{HI}, and from low income countries, Imp^{LI}

The descriptive statistics refer to the mean of variables computed on the pooled sample

Table 10 Balancing tests

	Imp^{LI}						Imp^{HI}					
	Before matching		After matching		t test		Before matching		After matching		t test	
	Treated	Control	Treated	Control	Before	After	Treated	Control	Treated	Control	Before	After
lab_{t-1}	3.171	2.578	3.171	3.128	34.49	1.65	2.926	2.471	2.925	2.898	24.62	0.98
tfp_{t-1}	0.015	−0.133	0.015	0.013	17.81	0.23	−0.012	−0.173	−0.012	−0.010	16.87	−0.13
kl_{t-1}	9.776	9.538	9.776	9.777	9.24	−0.03	9.699	9.479	9.697	9.741	7.27	−1.15
$wage_{t-1}$	10.113	9.989	10.113	10.102	16.86	1.12	10.073	9.942	10.073	10.068	15.25	0.44
$k_{int\ t-1}$	9.449	7.947	9.449	9.441	19.65	0.08	8.927	7.699	8.923	8.902	13.66	0.18
$ExpSh_{t-1}$	0.247	0.073	0.247	0.251	49.40	−0.50	0.209	0.060	0.208	0.214	40.20	−0.67
Imp^{HI}_{t-1}	0.071	0.020	0.071	0.071	26.49	−0.12	0.027	0.007	0.026	0.023	14.87	0.92
lab_{t-2}	3.142	2.568	3.142	3.097	33.47	1.74	2.892	2.463	2.891	2.861	23.22	1.09
tfp_{t-2}	0.028	−0.114	0.028	0.020	17.21	0.70	−0.005	−0.154	−0.004	0.011	15.77	−1.18
kl_{t-2}	9.776	9.540	9.776	9.778	9.28	−0.04	9.708	9.477	9.706	9.747	7.74	−1.07
$wage_{t-2}$	10.097	9.977	10.097	10.083	16.13	1.46	10.061	9.930	10.061	10.055	15.22	0.50
$k_{int\ t-2}$	9.423	8.060	9.423	9.362	18.51	0.69	9.015	7.826	9.012	8.965	13.76	0.44
$ExpSh_{t-2}$	0.238	0.072	0.238	0.241	47.28	−0.48	0.200	0.059	0.199	0.205	38.23	−0.71
Imp^{HI}_{t-2}	0.070	0.021	0.070	0.072	25.32	−0.52	0.023	0.006	0.023	0.020	13.57	0.85
lab_{t-3}	3.100	2.541	3.100	3.053	32.19	1.75	2.854	2.436	2.852	2.819	22.24	1.16
tfp_{t-3}	0.017	−0.125	0.017	0.013	16.95	0.38	−0.032	−0.166	−0.031	−0.032	13.87	0.07
kl_{t-3}	9.778	9.524	9.778	9.779	9.85	−0.03	9.689	9.455	9.687	9.739	7.73	−1.31
$wage_{t-3}$	10.075	9.951	10.075	10.059	16.26	1.61	10.029	9.902	10.029	10.019	14.26	0.90
$k_{int\ t-3}$	9.337	8.091	9.337	9.310	17.26	0.30	8.915	7.870	8.912	8.820	12.35	0.84
$ExpSh_{t-3}$	0.233	0.071	0.233	0.238	46.01	−0.65	0.195	0.058	0.194	0.202	37.13	−0.88
Imp^{HI}_{t-3}	0.072	0.021	0.072	0.074	25.52	−0.48	0.020	0.006	0.020	0.018	12.43	0.75

Table 10 continued

	Imp^{LI}						Imp^{HI}					
	Before matching		After matching		*t* test		Before matching		After matching		*t* test	
	Treated	Control	Treated	Control	Before	After	Treated	Control	Treated	Control	Before	After
Treated on the common support	100 %						99.89 %					
	Before		After		% Reduction		Before		After		% Reduction	
Median Bias	20.787		1.042		−94.99		18.762		2.307		−87.70	

The table reports the balancing tests for the matching for the import entry in Low income countries, Imp^{LI}, and in High income countries, Imp^{HI}, on the left and right side, respectively. The mean of observable variables for treated and control units and the *t* test for their difference both before and after the matching are displayed. Furthermore, in the bottom of the Table we show the share of treated units in the common support and the median standardised bias across covariates both before and after the matching

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