Productivity Dispersion and its determinants: the role of import competition

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Abstract

The paper, making use of a large dataset for Italy, confirms the existence in the same sector of a great disparity in firm productivity. We shed some light on this evidence working both at sector and firm level. First, we try to explain the determinants of the sectoral productivity dispersion investigating the role of the international involvement, the ICT adoption and the domestic competitive context. The technology diffusion doesn't seem to affect the within-sector heterogeneity, while we show a significant relationship with the domestic competition and the import penetration from low and medium income countries. The increase in trade flows with non-developed partners is a quite recent fact in the Italian economic system that contributes to shape the industry dynamics. Then, building on these findings, we turn our attention on the firm and we look at the potential heterogeneous firm responses to the exposure to emergent countries. Our results suggest that this tougher competition has negative effects on firm efficiency, more deleterious effects for more productive firms close to the frontier, and, in this regard, it helps to close the productivity gaps across firms.

Keywords: Productivity, Dispersion, Imports, Heterogeneity
JEL codes: L25, F14, O33, O47

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1 Introduction

Recent firm and plant-level works have found large and persistent differences in productivity levels across firms even within a narrowly defined sector (Bartelsman and Doms, 2000, Haller, 2008 for Ireland, and Escribano and Stucchi, 2008 for Spain). This evidence is confirmed both for labour productivity and total factor productivity, thus the factor intensity is not the unique determinant behind the great disparity in firm productivity. A growing theoretical literature has started dealing with firm heterogeneity, especially in international economics a new strand has developed on heterogeneous firm hypothesis (the pioneering work is Melitz, 2003). The availability of firm and plant level datasets has allowed the proliferation of the empirical works in this field, and most research has focused on manufacturing industries. The finding of the co-existence of heterogeneous firms in the same sector also arises the question about the factors behind the sectoral productivity dispersion, with both a cross-sectional and longitudinal perspective. The analysis of this issue has received, up to now, scant attention and results shown by the existing evidence are not conclusive.

Our contribution is to provide new evidence for Italy on the existence of a large within-sector disparity in firm productivity and to shed some light on the potential determinants that could affect the sectoral dispersion. We investigate the role of the domestic market and the technological factors, but our main focus is on the import competition. The international involvement of the sector has recently been studied as one of the main drivers behind the within-industry firm dynamics (see for example Melitz, 2003 and Bernard et al., 2003; and the debate on the trade openness and resource reallocation among firms). The period of our analysis is very interesting in this perspective because Italy has seen its imports grow, especially from less developed countries (e.g., Central-Eastern Europe and China) following the EU-enlargement and the increasing involvement of these countries in international markets (due both to their industrial development and the implementation of liberalization strategies). The increased import exposure has concerned all sectors, and a restructuring process may have been at work. For these reasons, it's important to show the link between openness to trade and industry dynamics, in terms of sectoral productivity dispersion and differences of firms' performance. In our analysis we follow two methodological approaches. First, we build indicators of sectoral productivity dispersion in order to investigate the evolution of dispersion and shed some light on the impact of the internationalisation and other explanatory factors. On the basis of our results, we try also to estimate a catching-up model at firm-level, investigating the effects of import penetration that we demonstrate to be an

important variable in the shaping of the sectoral productivity. The process of firm entry and exit contributes to explain the evolution in productivity dispersion, but also heterogeneous responses of firms to changes in the external environment may play an important role: firms with different efficiency levels may display different behaviour coping with the increased competitive pressure from foreign countries.

The work is organized as follows. The next section gives a brief overview of the related literature. Section 3 describes the data and shows a preliminary statistical analysis on the evolution of firm productivity, its dispersion and the sectoral exposure to imports. Section 4 presents a comprehensive framework for an investigation of the determinants of the sectoral dispersion. Then, in Section 5, we turn our attention on firm level and, building on the findings of the Section 4, we test if the import competition, the main variable of interest, has heterogeneous effects on firms' efficiency according to their position in the productivity distribution. A final Section gives concluding remarks.

2 Review of the related literature

Our paper relates to different strands of literature. The study of firm heterogeneity is a relatively recent research field: theoretical works rejecting the representative firm hypothesis date back to the end of 70s (see for example Jovanovic, 1982), and first empirical works followed in the 1990s (Kremp and Mairesse, 1991 and Oulton, 1998), nevertheless it has been in the last decade that this topic has incurred a growing interest especially in empirical studies. Even if research is increasing, the existing productivity dispersion and its evolution is still a puzzling topic. The investigation of the reasons for these large disparities could give important suggestions about the productivity growth process.

The productivity heterogeneity can be explained both by supply-side factors, like technology, firm ownership, management and human capital and demand-side determinants, such as sectoral elasticity of substitution, institutional framework and trade exposure. One of the first empirical works aiming the explanation of the co-existence, in the same sector, of firms with different efficiency levels is Syverson (2004). After showing high levels of dispersion for a cross-section of manufacturing industries in Usa, he verifies a negative correlation between the product substitutability, that causes stronger competition, and the disparity of producer productivity levels. He finds also that sectors more exposed to international trade present higher productivity dispersion. In opposite to this evidence, according to the new international trade literature based on the firm heterogeneity hypothesis (Melitz, 2003 and

Bernard et al., 2003) trade openness should cause a resource reallocation toward more efficient firms, the exit of less productive firms and the entry of more productive ones, as a consequence we should observe a lower within-sector dispersion following the increased international involvement. Ito and Lechevelier (2008) for Japan also show some evidence about the role of internationalization on dispersion contrasting with theoretical suggestions. In addition to trade involvement and competitive environment, they analyse the role of technology adoption for productivity dispersion trying to verify the conclusions of Neo-Schumpeterian models (Caselli, 1999). No significant effect is found from the introduction of ICT, while a significant and positive impact is revealed for the sectoral internationalization and the industry competitive level. This evidence, at odds with recent theoretical models in international economics, could be justified by a malfunctioning of the natural selection mechanism (hypothesized by Melitz model), or the need of a long period for his correct functioning. In opposite, using data on Italian firms for the period 1983-1999, Del Gatto et al. (2008) support the theoretical hypothesis that openness to trade contributes to lower the within-sector dispersion, in addition to increase the productivity median level. All these reviewed works are strictly related to the literature dealing with the Schumpeterian mechanism of "'creative destruction"' in the industry dynamics and the importance of the between-component[1] for sectoral productivity growth. Many studies have verified the existence of a within-sector reallocation process and have linked this process to market regulations (see, for instance, Arnold et al., 2008), the presence of foreign firms (Maliranta and Nurmi, 2004), the changing of the international environment and the increasing foreign pressure from imports (Maliranta, 2005 and Eslava et al., 2009).

Our work is also related to the wide literature studying the impact of trade openness on productivity at sector and firm level. There are many theoretical and empirical contributions supporting the beneficial effects of the international integration and research has investigated both the easier access to foreign market and the higher competition as main causes. Good examples of this strand of literature are the studies of Pavcnik (2002), Muendler (2004), Topalova (2004), Amiti and Konings (2007), Fernandes (2007) and Eslava et al. (2009) for Chile, Brazil, India, Indonesia and Colombia, respectively. Empirical studies on developed countries are more scant and they focus on the effects of the increased flow of imports, see for example the recent work of Dovis and Milgram-Baleix (2009) showing the positive impact of tariff reduction and import penetration on Spanish sectoral and within-firm pro-

[1]The between component concerns the resource reallocation process among firms, especially from less efficient firms to more productive ones.

ductivity. More related to our paper, for Italy, Bugamelli and Rosolia (2006) find that competition from non developed and emergent countries has positively affected the productivity of 3-digit sectors (in large part attributable to a creative destruction process), while, moving at the firm level, Altomonte et al. (2008) explore both horizontal and vertical (from upstream and downstream sectors) import flows disclosing positive correlations with the firm efficiency, even if the vertical channel seems to play a more important role. Even if a great part of research shows that trade is usually beneficial for sectoral and firm productivity there are also models shedding light on the potential negative effects of import competition for the firm efficiency. Rodrik (1991) and Traga (1997) find that lower trade protection or higher import competition reduce a firm's investments in productivity improvements, when the incentives to invest depend on the firm's output or market share reduced by trade openness. Thus higher international involvement may result in either productivity gains or losses, and empirical investigation is essential.

Finally we are especially interested in looking for heterogeneous effects of import competition according to the firm initial productivity level. Thus we relate to recent empirical evidence that investigates the potential asymmetrical impact of sectoral factors and external shocks on firm productivity. Chevalier et al. (2009) analyse the firm-level convergence in France during the period 1992-2004 as an important source of growth. They support the convergence process among firms and investigate its potential determinants: globalisation, ICT and competition turn out to affect positively the productivity growth, and this effect is asymmetric according to the firm position in the productivity distribution, the gains are larger for leading firms. Griffith et al. (2003), Sabirianova et al. (2005) and Bekes et al. (2006) analyse the role played by FDI spillovers and foreign ownership testing heterogeneous gains for firms with different efficiency levels. Alvarez and Crespi (2007) find that the presence of foreign firms has accelerated the catching-up process of Chilean firms. Konings and Vandenbussche (2008) display the heterogeneous response, in terms of productivity, of firms to antidumping protection. Schor (2004) and Dimova (2008) allow for the impact of liberalization in Brazil and Bulgaria to be heterogeneous across different firms. Both works show that the reduction of nominal tariffs and the increased competitive pressure have lead firms at the lower tail of productivity distribution to increase their efficiency in order to survive in the liberalized market. The same does not happen to firms with higher productivity that don't face with the failure risk (Muendler, 2004). Different conclusions are presented in Iacovone (2009) that, building on the predictions of neo-Schumpeterian growth theories (Aghion et al., 2005), model and test a positive impact of the liberalization in Mexico during NAFTA, shedding light on weaker effects for plants

more distant to the production technology frontier. Only firms close to the productive frontier increase their innovative efforts in order to prevent entry of potential foreign competitors, in opposite less efficient firms are not able to compete successfully with foreign entrants at the frontier.

3 Sample construction and preliminary analysis

3.1 Data

We use data from a commercial database AIDA[2], the online version, produced by the private company Bureau Van Dijk. This database contains balance sheet information of Italian unconsolidated firms and we recover data for the period 1998-2006 for manufacturing firms. Bureau van Dijk updates continuously the dataset, especially it keeps in the sample firms that exit or stop reporting their financial statements for four years, but after the fifth year of non-reporting these firms are removed. In addition, through the analysed time period, Bureau van Dijk has changed the criteria for firm inclusion: it collects information for all firms with a turnover higher than a fixed threshold and this threshold has lowered, in 1998 and till 2000 firms were included in the database if they had a turnover higher than 1 million euros, in 2002 the threshold was set to 500,000 euros and in 2004 to 100,000 euros. In order to take into account these database characteristics we have retrieved data for deleted firms (the exited firms) using the different releases of AIDA CD-ROMs for the years in our sample. Then we have dropped firms having a turnover lower than 1 millions euros[3], the 1998 threshold, in order to analyse an uniform sample. Data tend to be more representative of larger firms, anyway also medium and some small firms are recorded. We use the value of operating revenues as a proxy for output; the value of firm level tangible fixed assets as a proxy for fixed capital; and the number of employees[4] and material costs, as proxies for inputs. We obtain also the information about

[2]This database is the version for Italy of the more known AMADEUS covering different European countries.

[3]Our database presents the peculiarity that the threshold is on the total turnover and not on the number of employees as many micro-level datasets.

[4]The number of employees is in some cases missing because firms have not the duty to declare this information to the Chambers of Commerce. Anyway we have always the information about the personnel costs. In order to keep the largest sample as possible we have replaced missing data for the number of employees with the product between the firm personnel cost of that year with the average unit labour cost of the firm in the previous year, in the belief that the unit labour cost is quite constant in the short-term for the firm.

the firm sector of activity at 3-digit NACE. We deflate the variables using sectoral price indexes for output, value added, materials and capital stock from Istat[5]. We drop observations with missing data for variables of interest (output, input variables), or with implausible figures (for example, negative values). After this cleaning procedure we have information about more than 30,000 firms. With AIDA database we have also calculated concentration ratios (C10: the sectoral output share of the ten highest firms) for 3-digit NACE industries[6], this index is used as a proxy for the sectoral degree of domestic competition. Then we have built import competition ratios as:

$$IMP\_COMP_{jt} = \frac{M_{jt}}{M_{jt}+Y_{jt}-X_{jt}}$$

and export openness as:

$$EXP\_OPENjt = \frac{X_{jt}}{Y_{jt}}$$

where j indexes a 3-digit sector, M_{jt} and X_{jt} are, respectively, the total import and export in the year t and sector j, and Y_{jt} is the total sectoral output. We have measured import competition and export openness for every 3-digit sector[7] also breaking between different partner countries according to their development stage. We use the classification between high, medium and low income countries from the World Bank. Trade data are from the database WITS of World Bank, while sectoral output data are from the Firm Economic Accounts (ISTAT)[8].

We are aware that the under-representation of small firms could prevent us to analyse an important part of the story. This is a drawback that a lot of analysis have to cope with because it's difficult to have reliable economic information for small firms. Anyway we are trustful that the bias of results is not so severe: we find that the median firm size, in terms of number of employees, is 30 employees. In addition, to cope, at least partially, with this

[5]The use of sectoral deflators instead of firm level prices has become a standard method in literature, even if it may lead to biased estimation of production function coefficients. A recent paper by Mairesse and Jaumandreu (2005) on a panel of firms finds that whether value added is deflated with an industry output-price index, with an individual firm-output price index or not at all makes little difference for the estimation of the coefficients in the production function. Anyway it's important to keep in mind that our productivity indicator may reflect both true efficiency and mark-up.

[6]Since our dataset doesn't cover the whole firm population, especially under-represents small firms, we have compared C10 indices with the same indices as reported in Firm Economic Accounts (ISTAT). We could make this comparison only for 2-digit sectors and we find an highly significant correlation of more than 0.80.

[7]The last year covered by the Firm Economic Accounts is 2005, thus this is the last year we can construct the import competition variable.

[8]For some years and sectors output values are missing because of confidentiality.

problem, we have also applied our analysis to a sample concerning a shorter time period, 2002-2006, and firms with a turnover at least of 500,000 euros (the threshold set in 2002).

Because of our interest in within-sector dynamics we require a firms' sample enough large for each investigated sector, thus we have discarded from our analysis sectors with less than 50 firms by year in order to obtain reliable measures for sectoral dispersion[9].

3.2 Descriptive statistics

Before moving to the empirical analysis it is useful to investigate the main trends of variables. We have calculated the total factor productivity (TFP) using a multilateral index suggested by Good et al. (1997)[10]. Then we have obtained the following sectoral dispersion indicators: the interdecile range (D1090), the interquantile range (D2575) and the standard deviation (STD) at 3-digit NACE disaggregation. We have also estimated the productivity using the Levinshon-Petrin (2003) approach. Anyway all results presented concern the TFP index[11].

First of all, the estimation of firm productivity confirms that in the last decade the firm efficiency performance has been unsatisfying[12] (Figure 1). For the whole manufacturing sector, after a little efficiency gain in 1999 the productivity evolution has fallen down till 2003, then since 2004 firms have gone through slight improvements. However after nine years the productivity has reverted about at the initial level. This evidence found at micro-level confirms the studies for the manufacturing sectors and disaggregated sectors in Italy (see for example Daveri and Jona-Lasinio, 2005) and reproduce the results presented by Altomonte et al. (2008)[13]. The poor productivity evolution is a common feature of all industries. Table 1 shows the average values of dispersion by sectors at 2-digit level[14], we can see some differences across

[9]We can't trust in dispersion indicator calculated on too much small samples. We end up with 68 three-digit sectors.

[10]The cost of capital is computed as the user cost of capital: interest rates plus depreciation minus the variation of prices, where we assume a constant depreciation rate of 10% and the interest rates are long-term rates from OECD.

[11]Results obtained using the TFP estimated with the Levinshon-Petrin approach are available upon request.

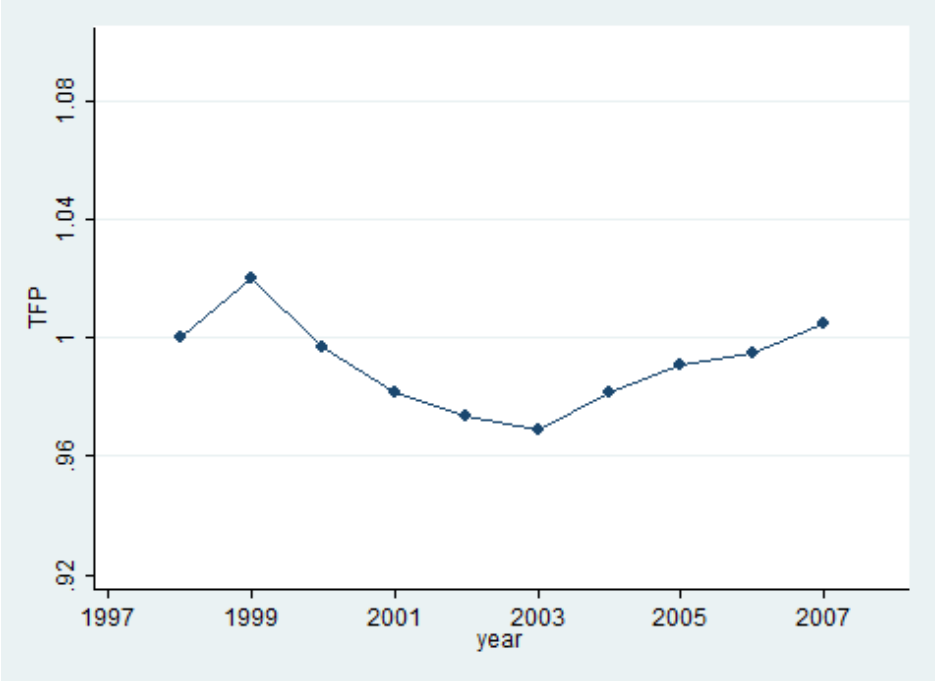
[12]We show the evolution of the unweighted TFP mean for the whole manufactuting sector.

[13]Even if we have found a slightly stronger productivity worsening in the period 1999/2003.

[14]Dispersion indicators are calculated at three-digit level and then averaged on two-digit sectors on the whole sample period.

industries, the more heterogeneous sector is "Manufacture of wearing apparel" (NACE 18), while the "Manufacture of fabricated metal products" sector (NACE 28) presents the lower dispersion. When we turn our attention on the time evolution we don't verify a monotonic trend in dispersion, but it is interesting to notice that during the expansion periods, when the average productivity grows, the within-sector heterogeneity increases, in opposite when there is a downturn in average productivity disparities widen[15].

Figure 1: TFP evolution



Focusing on the links between import penetration and domestic efficiency, it is important to keep in mind that two different effects could be at work. The first one is an increase of competition, while the second one is an increased availability of imported intermediates that may be cheaper than domestic intermediates or characterised by an higher quality. Thus, the same import flow may represent a threat for firms operating in the same sector and an opportunity for the downstream firms. Because of our interest in dealing with

[15]This is consistent with the analysis of Escribano and Stucchi (2008) that shows lower persistence and faster convergence in TFP during recessions and higher persistence and non convergence in TFP during expansions.

the import competition effect we have used a 3-digit sectoral disaggregation. This disaggregation allows us to investigate the foreign pressure coming from sectoral imports. At a fine disaggregation, we can trustfully suppose that sectoral imports represent for the firm an increase of competition because the intermediate share from the same (highly disaggregated) sector is small[16]. Looking at the exposure to imports, it is clear that, even if developed countries are always the main trade partners of Italy, the role of low and medium income countries has increased during time and this phenomenon can be observed in every sector. The import share from low and medium income countries (henceforth, LMCs) differs across industries: not surprising, the largest share of more than 27% is recorded by the sector NACE 18 (Manufacture of wearing apparel), while the lowest share (0.2%) concerns the sector NACE 22 (Publishing, printing and reproduction of recorded media). Anyway all sectors have experienced a growing competition from LMCs (see Table 9 in the appendix). For the whole manufacturing sector the exposure to LMCs countries has doubled from more than 4% in 1998 to more than 8% in 2005. This surge is in great part attributable to the industrial development and liberalization strategies of these countries, in fact it came with an increase of their total world export share and their share in total imports of developed countries. The importance of Italian imports from industrialized countries is, in opposite, quiet constant for the total manufacturing sector in the period 1998/2005 (even if also in this case we can see different trends across sectors).

4 The determinants of sectoral dispersion

In this section we present the results for a comprehensive analysis about the factors affecting the within-industry efficiency differences across firms. Following previous empirical studies we take into account the following variables: the competitive environment, the technology adoption and the international involvement of the sector. First, we expect that sectors characterized by a high degree of competition present low dispersion. In a more contendible market it is likely that less productive firms couldn't survive a long time, firms make efforts in order to improve their efficiency and stay in the market and competitive pressures lead to the flattening of any difference. We have

[16]As displayed in National Input-Output tables the input narrow share, the share of input coming from the same sector, at 2-digit level, is not so high. We find for example an average narrow share of 25% in the manufacturing sectors for the year 2004 and a narrow import share of 11% when we consider 2-digit level sectors. We expect that at 3-digit level these shares should be significantly smaller.

Table 1: Dispersion and import competition by sector

ATECO	StdTFP	D2575TFP	D1090TFP	$\text{IMP}_{ita}^{HIGH}(\%)$	$\text{IMP}_{ita}^{LMC}(\%)$	$\text{IMPsh}_{high}^{LMC}(\%)$	$\text{IMPsh}_{world}^{LMC}(\%)$
15	0.657	0.653	1.378	16.29	3.09	22.67	35.60
17	0.601	0.554	1.238	10.69	11.78	45.93	59.72
18	0.720	0.732	1.559	7.47	19.50	69.96	70.28
19	0.651	0.636	1.38	7.60	20.57	56.07	63.26
20	0.528	0.518	1.094	15.41	5.92	37.20	43.27
21	0.569	0.544	1.169	38.62	3.97	11.84	26.83
22	0.602	0.609	1.302	3.74	0.17	16.31	30.28
24	0.655	0.644	1.376	37.42	1.94	8.59	28.20
25	0.513	0.48	1.053	17.28	4.21	21.35	34.49
26	0.520	0.502	1.089	9.09	2.82	26.72	36.42
27	0.577	0.520	1.131	37.22	12.83	30.50	44.12
28	0.509	0.462	1.031	10.71	2.64	21.46	35.99
29	0.553	0.503	1.121	17.89	3.76	15.24	30.03
31	0.569	0.524	1.180	23.05	5.66	37.13	42.73
32	0.634	0.581	1.259	60.00	4.31	26.87	47.10
33	0.571	0.547	1.183	41.07	4.11	16.16	30.87
34	0.574	0.501	1.139	19.57	3.61	14.74	30.69
35	0.586	0.511	1.209	19.93	4.51	19.80	43.77
36	0.598	0.533	1.210	9.78	8.10	43.97	52.60
Total	0.589	0.555	1.216	21.20	6.50	28.55	41.38

Source: Our elaborations from AIDA, WITS and Firms Economic Accounts (ISTAT)
IMP_{ita}^{HIGH} and IMP_{ita}^{LMC} are Italian import penetration ratios from high income and LMCs countries.
$IMPsh_{high}^{LMC}$ and $IMPsh_{world}^{LMC}$ are the world and high-income countries import shares from LMCs.
All trade variables are lagged to one year.

Table 2: Dispersion and import competition by year

YEAR	StdTFP	D2575TFP	D1090TFP	$\text{IMP}_{ita}^{HIGH}(\%)$	$\text{IMP}_{ita}^{LMC}(\%)$	$\text{IMPsh}_{high}^{LMC}(\%)$	$\text{IMPsh}_{world}^{LMC}(\%)$
1998	0.536	0.536	1.109	19.58	4.62	23.32	32.12
1999	0.724	0.660	1.604	19.54	4.49	23.77	33.03
2000	0.670	0.602	1.307	22.29	5.02	24.31	33.06
2001	0.517	0.482	1.038	21.78	5.78	26.60	42.76
2002	0.555	0.481	1.060	22.37	6.55	27.69	43.78
2003	0.531	0.498	1.087	20.27	6.71	28.90	44.30
2004	0.568	0.550	1.202	20.60	7.25	30.03	45.18
2005	0.582	0.575	1.218	21.31	7.83	30.95	46.47
2006	0.613	0.617	1.318	20.90	8.74	32.53	47.45
Total	0.589	0.555	1.216	20.97	6.32	27.57	40.91

Source: Our elaborations from AIDA, WITS and Firms Economic Accounts (ISTAT)
Definition of variables as in Table 1.

used two different variables to capture the competitive context: the number of firms in the sector and the concentration ratio (C10). The number of firms in the sector is retrieved from the Firms Economic Accounts by Istat, while C10 is calculated using AIDA. Following Syverson (2004) we add also a variable capturing the sunk entry cost, the amount of capital (relative to the sectoral market size) required to build a median firm[17].

Second, we test the role of the ICT diffusion. The technology adoption may have an ambiguous impact on dispersion according to the dominance of innovation or knowledge spillovers. New technologies are employed only gradually and represent an important source of heterogeneity among firms in the same industry, thus the technology diffusion may increase the within-sector heterogeneity. As shown by Jovanovic and Lach (1997) the diffusion of technologies takes often long time[18], and this gradual diffusion process may explain persistent productivity differences across firms within an industry. In order to capture the technology effects we rely on the ratio between the sectoral ICT capital on the total sectoral employment[19].

However, our main focus is on the sectoral international involvement. As already said in the literature review, the new heterogeneous firms models in international economics suggest a reduction of the dispersion following trade liberalisation and the increase in trade openness. We deal with both export openness and import competition.

In this comprehensive framework, we run the following regression:

$$\begin{aligned} disp_{jt} &= \alpha + \beta imp\_comp_{j,t-1} + \delta exp\_open_{j,t-1} + \phi ict_{j,t-1} + \\ &\quad + \eta dom\_comp_{j,t-1} + d_j + d_t + \epsilon_{it} \end{aligned} \tag{1}$$

where $disp_{jt}$ is the dispersion indicator that could be the standard deviation (STD_{jt}), the interquantile range ($D2575_{jt}$) or the interdecile range ($D1090_{jt}$). imp_comp_{jt} is the import competition ratio, exp_open_{jt} is the export openness, ict_{jt} is the ICT capital stock in the 2-digit sector and dom_comp_{jt} represents the variables capturing the domestic competitive pressure in the sector (the number of firms, the C10 ratio and the sectoral sunk costs)[20]. All variables refer to 3-digit NACE sectors (with the exception of

[17]Using our firm-level dataset the variable $SunkCost_{ijt}$ is calculated as the market share of a median-sized firm in the sector multiplied by the capital-output ratio for the sector.

[18]Jovanovic and Lach (1997) show that a new technology takes, on average, 15 years to go from 10% usage to 90% usage.

[19]The ICT capital represents the software, office and communication stock provided in ISTAT National Accounts. We can calculate this indicator only at two-digit disaggregation.

[20]We have analysed the pairwise correlations and we have found that only exp_open_{jt}

ict_{jt}). Every regression includes sector fixed effects and time fixed effects. Regressors are lagged to one year both because we assume that the effects on the industrial structure and on the within-sector dispersion take some time before to display[21] and, in addition, to ease the problem of reverse causation.

Table 3: Determinants of sectoral dispersion

VARIABLES	D2575TFP (1)	D1090TFP (2)	StdTFP (3)	D2575TFP (4)	D1090TFP (5)	StdTFP (6)
$imp\_comp_{j,t-1}$	-0.003	-0.862*	-0.199*			
	[0.098]	[0.483]	[0.116]			
$exp\_open_{j,t-1}$	0.039	0.805	0.187			
	[0.096]	[0.526]	[0.123]			
$imp\_comp_{jt-1}^{LMC}$				-0.317*	-0.999*	-0.494**
				[0.173]	[0.581]	[0.236]
$imp\_comp_{jt-1}^{High}$				0.072	-0.251	-0.012
				[0.081]	[0.186]	[0.081]
$exp\_open_{jt-1}^{LMC}$				0.058	0.941	0.221
				[0.111]	[0.760]	[0.248]
$exp\_open_{jt-1}^{High}$				0.066	0.192	0.098
				[0.096]	[0.251]	[0.137]
$ict_{j,t-1}$	-0.072	0.028	-0.046	-0.07	0.054	-0.041
	[0.052]	[0.138]	[0.064]	[0.052]	[0.136]	[0.066]
$nfirm_{j,t-1}$	-0.038	-0.183	-0.023	-0.05	-0.185	-0.035
	[0.039]	[0.122]	[0.037]	[0.037]	[0.118]	[0.039]
$c10_{j,t-1}$	0.156**	0.202*	0.108*	0.160**	0.202*	0.111*
	[0.061]	[0.114]	[0.057]	[0.062]	[0.114]	[0.058]
$sunk_{j,t-1}$	0.032***	0.046*	0.006	0.033***	0.049*	0.007
	[0.012]	[0.026]	[0.017]	[0.012]	[0.026]	[0.016]
$Const$	1.691***	3.067*	1.243*	1.778***	2.942*	1.301*
	[0.520]	[1.633]	[0.658]	[0.506]	[1.590]	[0.672]
Obs	541	541	541	541	541	541
R^2	0.611	0.661	0.47	0.615	0.661	0.473

Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1
Every regression controls for sector and time dummies.

Table 3 shows the results for the Equation 1. Columns (1)-(3) present results of the baseline specification without any distinction for exports and imports across origin/destination countries. Neither trade variables nor technology adoption seem to play a significant role in shaping the sectoral productivity distribution. Only import competition is negatively related to the interdecile range and the standard deviation. There are, in opposite, significant effects of the competitive domestic context: sectors characterised by

and imp_comp_{jt} present a high correlation of 0.63, anyway this correlation significantly drops when we split the import competition and export openness according to their origin and destination countries.

[21] Maliranta (2005), for example, finds that international trade affects the sectoral restructuring process only after some years.

higher competitive tensions (that is an higher number of firms, lower concentration ratios or lower sunk costs) present a lower dispersion. Because of the unsatisfying results for variables capturing the international involvement of the sector, we try now to split the effects of imports according to the origin countries (and the export effects according to the destination countries). We believe that trade flows can have different effects on firm efficiency and firm dynamics if trade partners are high income countries or low and medium income countries. Columns (4)-(6) shows results when we split imports and exports according to the origin/destination countries. Looking at the regressions it is clear that imports from LMCs contribute to reduce differences across firms and lower sectoral dispersion. No role is, in opposite, detected for other variables of international trade. In addition it is confirmed the significant coefficients for the domestic competition captured by the concentration ratio and the sunk entry cost, while the ICT capital stock still remains not significant. We use also Prais-Winsten regressions with panel-corrected standard errors. It is a weighted least squares estimator that allow us to consider the first-order serial correlation. Results for this estimation are presented in the appendix and reproduce in general our previous findings.

Even if some doubts about the direction of causality may rise, this analysis sheds some light on the linkages between sectoral characteristics and the within-industry dynamics of firms. Especially from the investigation it results that the international exposure to competition from LMCs, our main focus, is significantly related to within-sector productivity distribution. Building on this evidence we further study the impact of this competitive pressure looking at the firm-level. The negative relationship we found between dispersion and import penetration from emergent countries could be attributable to the firm dynamics, entry of more productive firms and exit of less efficient firms (as conjectured in Melitz, 2003 and Bernard et al., 2003), but could also disclose an heterogeneous impact of this higher competition according to the firm initial efficiency level. We try to verify this hypothesis in the following section.

5 The heterogeneous responses of the firms

5.1 The role of import competition

In the previous review of literature it has been shown that the documented great efficiency heterogeneity across firms may be related to asymmetrical behaviours at firm level in response to external shocks. We suppose that firms may react differently in front of an increase in the competitive tensions,

that is, in our case, the growing flow of foreign goods. In order to test this hypothesis we regress the following equation:

$$\begin{aligned} tfp_{ijt} &= \alpha + \beta tfp_{ij,t-1} + \delta imp\_comp^{LMC}_{jt-1} + \varphi imp\_comp^{LMC}_{jt-1} * tfp_{ij,t-1} + \\ &+ \eta x_{ijt-1} + d_i + d_j + d_t + \epsilon_{it} \end{aligned} \tag{2}$$

where tfp_{ijt} and $tfp_{ij,t-1}$ are firm productivity indicators for time t and $t-1$, $imp\_comp^{LMC}_{jt}$ is, as in previous section, the import competition from LMCs and x_{ijt} are firm-level controls. We add time and sectoral dummies[22]. Our interest is on the coefficient φ capturing the heterogeneous responses of firms to imports from LMCs[23]. We want to verify if less productive firms react differently in front of a tougher competition if compared with more efficient firms. We use both OLS estimator and within estimator (fixed effects).

We don't think that the endogeneity of import competition is a so severe problem in our framework because we are analysing the effect of a sectoral variable on the firm level efficiency. In addition the import competition is lagged to one year and this further mitigates the problem. Another consideration that supports the exogeneity of the import competition from LMCs is that the recent raise of these flows is not mainly linked to the domestic efficiency, but it is likely to be caused by the recent economic development of emergent countries and their liberalisation strategies, as also suggested in the descriptive analysis.

The presence of the lagged dependent variable among regressors, cause some difficulties in the estimation strategy. The conventional panel Least Squares estimators potentially incur into the Nickell bias (Cameron and Trivedi, 2005). In particular OLS regression leads to an upward-biased estimation of the lagged dependent variable, while fixed effects lead to a downward bias, thus the true value should lie in this range (Bond, 2002). In order to take into account this bias we apply the first-differenced GMM estimator proposed by Arellano and Bond (1991). This estimator allows us also to control for the potential endogeneity of the other regressors, in particular the imports and their interaction with the lagged productivity. We instruments the first difference of regressors with their lagged levels. Then we check the validity of our estimation using the Hansen test of overidentifying restrictions and a test for autocorrelation. The disturbance term in first

[22]Sectoral dummies help us to correct for the correlation between the productivity in the sector and the import competition: non developed countries could enter especially in less efficient sectors.

[23]It is important to notice that when we interact the import penetration variable with the lagged productivity we are assuming a linear relationship, and we are placing the a priori restriction that the efficiency effects of imports are monotonically increasing (or decreasing) with the initial firm position in the productivity distribution.

differences should present negative and significant first-order autocorrelation but no second-order autocorrelation. If we find second-order autocorrelation in the differenced residuals it means that instruments are not valid. Thus we use as instruments for the equation in first differences the dependent variable and the regressors lagged n times and more till we find no second-order autocorrelation in the disturbance term in first differences. In our analysis we verify a deep serial correlation in the productivity series and we need to take the seventh and eight lags of TFP and explanatory variables as instruments[24].

Table 4: The firm heterogeneous responses to imports

VARIABLES	OLS	FE	GMM-DIFF	OLS	FE	GMM-DIFF
tfp_{it-1}	0.440***	0.019***	0.567***	0.431***	0.011	0.379**
	[0.006]	[0.006]	[0.156]	[0.007]	[0.007]	[0.150]
imp^{LMC}_{jt-1}	-0.446***	-0.406***	-0.707	-0.415***	-0.429***	-1.257
	[0.094]	[0.113]	[0.913]	[0.096]	[0.114]	[0.802]
$imp^{LMC}_{jt-1} * tfp_{ij,t-1}$	-0.233***	-0.243***	-4.946**	-0.203***	-0.211***	-4.363**
	[0.075]	[0.067]	[1.965]	[0.072]	[0.067]	[1.783]
$size_{it-1}$				0.006***	-0.048***	0.420***
				[0.002]	[0.009]	[0.118]
kl_{it-1}				-0.067***	-0.065***	0.12
				[0.002]	[0.004]	[0.163]
$solvency_{it-1}$				0.261***	-0.218***	-0.544
				[0.009]	[0.025]	[0.663]
$aver\_wage_{it-1}$				-0.034***	0.019***	0.165**
				[0.005]	[0.005]	[0.083]
$c10_{jt-1}$				-0.051***	-0.051**	-0.015
				[0.020]	[0.021]	[0.341]
$Const$	0.059***	0.097***		0.087***	0.398***	
	[0.012]	[0.006]		[0.017]	[0.038]	
Obs.	156778	156778	129920	153336[a]	153336[a]	126394[a]
Time Dummies	YES	YES	YES	YES	YES	YES
Sector Dummies	YES	NO	NO	YES	NO	NO
Firm Effects	NO	YES	NO	NO	YES	NO
Hansen test			0.205			0.083
AR(1) test			0.000			0.000
AR(2) test			0.060			0.606

Robust standard errors in brackets are clustered by firm. *** p<0.01, ** p<0.05, * p<0.1
Even if we cluster by sector-year the variables still remain significant.
P-values for first and second order autocorrelation and for the Hansen test are reported.
[a] The drop in the number of observations is due to missing values for controls.

Table 4 shows a coefficient $\beta < 1$, this confirms a catching-up process: less productive firms grow fastly than firms at the frontier. In addition results seems to disclose a negative effect of the imports, especially the competition from LMCs negatively affects more the productivity of firms with high efficiency ($\delta < 0$ and $\varphi < 0$). Thus, this asymmetrical negative impact goes

[24]We use the 7th and 8th lags as instruments for all GMM-DIFF estimations we present.

together previous finding of the negative linkage between sectoral dispersion and import competition. As Iacovone (2009) we find that the deeper international integration has significantly shaped the firm productivity distribution, but the kind of relationship is different: a negative effect of the foreign pressure and a more harmful effect on the more productive firms. The last three columns of table 4 shows that our findings are also confirmed when we add firm controls for the firm size (measured by the number of employee), the relative unit wage[25], as a proxy for the labour quality, the capital intensity, the solvency ratio (shareholds' funds on total assets), and a sectoral control for the domestic competition (the concentration ratio). Capital intensity and sectoral domestic concentration are negatively related to firm productivity, while the labour quality and the firm financial solidity present opposite signs in ols and within regressions.

A possible explanation for this counterveiling finding is that the foreign competition from LMCs is a threat that domestic firms have to cope with, but it's a particular difficult task because their rivals can benefit from lower labour and material costs. Domestic firms may be unable to successfully react to the growing flow of foreign goods. The foreign competitive pressure reduce the market shares and the expected profits for domestic firms, and this reduction may lower the opportunity and the gain from innovation and investments. Thus firms may decide to stop innovating and investing and this would reduce their productivity. Especially if the high efficiency of firms at the frontier is linked to their innovation efforts we may expect that competitive pressure impacts more on productivity of these firms. In this respect a source of the productivity differentials across firms fails because the competition discourages the innovation efforts. In opposite the negative effects for less efficient firms may be mitigated because they benefit from within-sector spillovers. We can suppose that their productivity growth depends more on imitation and technology adoption than innovation[26]. The harmful impact of foreign exposure is stronger for more productive firms because the increased competition affects more the innovation incentives that are at the basis of the growth for efficient firms. In addition firms at the lower tail of the distribution may make some efforts in order to survive and stay in the market. Due to the increased import penetration the competition is stronger and less productive firms might have more incentives to reduce costs of production coping with the import flows since they are the main candidates to exit the

[25]The relative unit wage is the deviation of the firm unit labour cost from the year-sector mean.

[26]As Bernard and Jones(1996) have introduced for convergence across countries and industries and Griffith et al. (2006) and Nishimura et al. (2005b) have applied at firm-level the growth rate depends in part on a catching-up component.

market. These arguments may help to explain why the loss of productivity seems to be smaller for less efficient firms.

An alternative explanation for the strong negative impact on more efficient firms is related to the product-switching. Firms may try to escape the competition thanks a restructuring process and a change in the mix of their products (Bernard et al., 2006), for example moving in production of higher quality goods in the same sector. The consequent reorganization may lead in a first period to an efficiency drop because firms are engaged in a new learning process. Anyway we can't test this hypothesis because we should have at our disposal firm data at product-level.

Because we are interested in the sectoral dispersion, in table 5 we show that the asymmetrical firm effects of the exposure to LMCs hold true when we interact the import competition with an indicator of distance to frontier Tfp_Gap_{ijt} (as in Griffith et al., 2006 and Iacovone, 2009). Following Cameron et al. (2003)[27] and Griffith et al. (2006) we allow the imports exposure to affect the convergence process and we estimate the following model:

$$\begin{aligned} Tfp_{ijt} &= \alpha + \beta TfpFront_{jt} + \chi Tfp\_Gap_{ijt-1} + \delta imp\_comp^{LMC}_{jt-1} + \\ &\quad + \gamma imp\_comp^{LMC}_{jt-1} * Tfp\_Gap_{ijt-1} + \eta x_{ijt-1} + d_i + d_j + d_t + \epsilon_{ijt} \end{aligned} \tag{3}$$

where $TfpFront_{jt}$ is the productivity of the sectoral frontier that we define as the average efficiency of the top 5% firms at the highest tail of the sectoral-yearly distribution, and $Tfp\_Gap_{ijt-1} = TfpFront_{j,t-1}/Tfp_{ij,t-1}$ is a measure of distance to the frontier[28]. Thus the coefficient γ captures the impact of the import penetration on the firm productivity convergence to the frontier. The estimates of this regression presented in table 5 are consistent with the previous findings. The positive and significant coefficient γ suggests that the negative impact of exposure to LMCs ($\delta < 0$) is mitigated for firms more distant to the frontier. Thus also this analysis shows that imports from LMCs have reduced the efficiency disparity across firms but due to a worsening of the performance of more productive ones. The results from GMM estimation of equation 3 with firm controls (last column in table 5) are not reliable, in fact the Hansen test rejects the validity of instruments and AR(2) test shows the presence of second-order autocorrelation.

[27]Cameron et al. (2003), analysing sectoral data, start with the ADL(1,1) model for the non-frontier sector $TFP_{ijt} = \beta_0 + \beta_1 TFP_{ij,t-1} + \beta_2 TFP_{Fjt} + \beta_3 TFP_{Fj,t-1} + \epsilon_{ijt}$, where TFP_{Fjt} is the productivity of the frontier sector, and under the assumption of long-run homogeneity ($1 - \beta_1 = \beta_2 + \beta_3$) they develop the ECM representation: $\Delta TFP_{ijt} = \beta_0 + \beta_2 \Delta TFP_{Fjt} + (1 - \beta_1)\frac{TFP_{Fj,t-1}}{TFP_{ij,t-1}} + \epsilon_{ijt}$.

[28]We set this indicator to 0 for firms at the frontier.

Table 5: Distance to the frontier

VARIABLES	OLS	FE	GMM-DIFF	OLS	FE	GMM-DIFF
$TfpFront_{jt}$	0.018***	0.009	-0.084	0.018***	0.010*	0.411*
	[0.006]	[0.006]	[0.228]	[0.006]	[0.006]	[0.228]
$TfpGap_{it-1}$	-0.353***	-0.028***	-0.392***	-0.339***	-0.019***	-0.046
	[0.005]	[0.004]	[0.098]	[0.005]	[0.005]	[0.117]
imp^{LMC}_{jt-1}	-0.633***	-0.550***	-2.895**	-0.619***	-0.551***	-4.119***
	[0.108]	[0.118]	[1.308]	[0.110]	[0.119]	[1.339]
$imp^{LMC}_{jt-1} * TfpGap_{it-1}$	0.165***	0.262***	4.157***	0.152**	0.228***	5.107***
	[0.063]	[0.059]	[1.516]	[0.061]	[0.059]	[1.523]
$size_{it-1}$				-0.011***	-0.049***	0.102
				[0.002]	[0.008]	[0.128]
kl_{it-1}				-0.063***	-0.064***	0.337**
				[0.002]	[0.004]	[0.146]
$solvency_{it-1}$				0.302***	-0.222***	-0.218
				[0.011]	[0.025]	[0.716]
$aver\_wage_{it-1}$				-0.029***	0.012*	-0.032
				[0.007]	[0.006]	[0.098]
$c10_{jt-1}$				0.353***	-0.039*	0.215
				[0.023]	[0.022]	[0.364]
$Const$	0.207***	0.104***		0.145***	0.394***	
	[0.015]	[0.009]		[0.020]	[0.036]	
Obs.	156778	156778	129920	153336[a]	153336[a]	126394[a]
Time Dummies	YES	YES	YES	YES	YES	YES
Sector Dummies	YES	NO	NO	YES	NO	NO
Firm Effects	NO	YES	NO	NO	YES	NO
Hansen test			0.234			0.003
AR(1) test			0.000			0.000
AR(2) test			0.340			0.003

Robust standard errors in brackets are clustered by firm. *** p<0.01, ** p<0.05, * p<0.1
Even if we cluster by sector-year the variables still remain significant.
P-values for first and second order autocorrelation and for the Hansen test are reported.
[a] The drop in the number of observations is due to missing values for controls.

Results don't change when we re-estimate, as a further check, the equation 2 on the relative productivity calculated as deviation from the sector-year mean, that allows us to analyse the position of firm with respect to the sectoral distribution. These estimations are not shown but are available upon request.

5.2 Robustness checks

An important issue we have to dealt with concerns firm exit. Because it is likely to be at work a relationship between the firm exit and its productivity (especially we expect less productive firms are likely to exit the market), failing to control for exit could lead to biased results. Thus we correct for exit both including in the regression a dummy for firms exiting in period t+1 and applying the standard Heckman (1976) selection correction. In this latter case, we model the probability to exit assuming as additional regressors the firm age and its investments. Table 6 confirms the heterogeneous responses of firms to increased import competition from LMCs.

We have also applied our analysis to a sample including smaller firms (firms with a turnover at least of 500,000 euros[29]) but for a shorter time period, 2002-2006. From table 7 we can deduce that previous findings hold true if we extend our attention on small firms, thus our conclusions are not bounded to large firms that may be also more productive but they seem to be more general.

Finally as additional robustness checks, we analyse in more detail the imports trying to show the effects of an easier access of foreign intermediates and the importance of their origin countries. The main aim of the work has been to investigate the role of imports in terms of the increased competition and we believe that focusing on the 3-digit NACE disaggregation the sectoral imports capture the degree of the foreign competitive pressure. Anyway imports may affect positively domestic firms employing imported intermediates. In order to split and identify these two effects we exploit a variable of international material outsourcing. This variable is constructed using data drawn from the Italian input-output Tables elaborated by Giorgio Rampa[30]. The inclusion of this additional regressor doesn't change the main results as we can see in Table 8 and disclose that imports may have negative effects on firm efficiency through the competition channel and a potential beneficial impact through the access to foreign intermediates. We always find asymmetrical effects of import competition according to the previous

[29]The turnover threshold of AIDA in 2002.

[30]When we add offshoring we loose one year because Input-Output Tables are available till 2004.

firm productivity level. Up to now, building on findings in section 4 we have investigated only the role for imports from LMCs. Anyway it is interesting also to move the attention on the flow of goods from developed countries in order to confirm that imports are not important per se but according to their origin. Thus we have re-estimated the Equation 2 adding the imports from high income countries and their interaction with the lagged firm productivity. From Table 8 we can see that competitive pressure from developed countries has no a significant coefficient. Imports from industrialised countries is not a new fact, domestic firms are used to face with these flows of goods, and they are not displaced by this competition.

Table 6: Robustness: Control for exit

VARIABLES	OLS	FE	OLS	FE	Heckman-MLE
tfp_{it-1}	0.439***	0.019***	0.430***	0.011	0.446***
	[0.006]	[0.006]	[0.007]	[0.007]	[0.009]
imp^{LMC}_{jt-1}	-0.454***	-0.404***	-0.420***	-0.426***	-0.440***
	[0.094]	[0.113]	[0.096]	[0.114]	[0.142]
$imp^{LMC}_{jt-1} * tfp_{ij,t-1}$	-0.233***	-0.243***	-0.203***	-0.211***	-0.260***
	[0.075]	[0.067]	[0.072]	[0.067]	[0.087]
$size_{it-1}$			0.006***	-0.048***	0.021***
			[0.002]	[0.009]	[0.002]
kl_{it-1}			-0.067***	-0.065***	-0.073***
			[0.002]	[0.004]	[0.002]
$solvency_{it-1}$			0.259***	-0.219***	0.265***
			[0.009]	[0.025]	[0.012]
$aver\_wage_{it-1}$			-0.034***	0.019***	-0.039***
			[0.005]	[0.005]	[0.007]
$c10_{jt-1}$			-0.052***	-0.051**	-0.068**
			[0.020]	[0.021]	[0.027]
$exit_{it+1}$	-0.049***	-0.021**	-0.039***	-0.027***	
	[0.009]	[0.010]	[0.009]	[0.010]	
$Const$	0.061***	0.096***	0.090***	0.399***	0.061***
	[0.012]	[0.006]	[0.017]	[0.038]	[0.022]
Obs.	156778	156778	153336[a]	153336[a]	84933[b]
Time Dummies	YES	YES	YES	YES	YES
Sector Dummies	YES	NO	YES	NO	YES
Firm Effects	NO	YES	NO	YES	NO

Robust standard errors in brackets are clustered by firm. *** p<0.01, ** p<0.05, * p<0.1

[a] The drop in the number of observations is due to missing values for controls.

[b] We have many missing values for age and investment used in the selection equation. Even if we cluster by sector-year the variables still remain significant.

Table 7: Robustness: Adding smaller firms

VARIABLES	OLS	FE	OLS	FE
tfp_{it-1}	0.494***	-0.114***	0.451***	-0.136***
	[0.007]	[0.008]	[0.009]	[0.009]
imp^{LMC}_{jt-1}	-0.17	-0.462***	-0.173	-0.456**
	[0.187]	[0.166]	[0.224]	[0.194]
$imp^{LMC}_{jt-1} * tfp_{ij,t-1}$	-0.249***	-0.271***	-0.263***	-0.298***
	[0.072]	[0.077]	[0.081]	[0.085]
$size_{it-1}$			-0.002	-0.115***
			[0.002]	[0.013]
kl_{it-1}			-0.065***	-0.045***
			[0.002]	[0.006]
$solvency_{it-1}$			0.264***	-0.436***
			[0.011]	[0.037]
$aver\_wage_{it-1}$			0.088***	0.066***
			[0.008]	[0.007]
$c10_{jt-1}$			0.000	-0.018
			[0.033]	[0.034]
$Const.$	-0.136***	-0.091***	0.168***	0.583***
	[0.013]	[0.009]	[0.023]	[0.057]
Obs.	122524	122524	95250[a]	95250[a]
Time Dummies	YES	YES	YES	YES
Sector Dummies	YES	NO	YES	NO
Firm Effects	NO	YES	NO	YES

Robust standard errors in brackets are clustered by firm. *** p<0.01, ** p<0.05, * p<0.1
[a] The drop in the number of observations is due to missing values for controls.

Table 8: Robustness: Offshoring and Imports from High Income countries

VARIABLES	OLS	FE	OLS	FE	OLS	FE
tfp_{it-1}	0.442***	0.021***	0.427***	-0.005	0.376***	-0.02
	[0.008]	[0.008]	[0.007]	[0.006]	[0.014]	[0.016]
imp_{jt-1}^{LMC}	-0.483***	-0.428***	-0.414***	-0.292**	-0.420***	-0.294**
	[0.096]	[0.117]	[0.109]	[0.128]	[0.109]	[0.128]
$imp_{jt-1}^{LMC} * tfp_{ij,t-1}$	-0.232***	-0.242***	-0.304***	-0.296***	-0.296***	-0.295***
	[0.075]	[0.068]	[0.081]	[0.072]	[0.080]	[0.072]
imp_{jt-1}^{HIGH}	0.094**	0.051				
	[0.047]	[0.053]				
$imp_{jt-1}^{HIGH} * tfp_{ij,t-1}$	-0.013	-0.011				
	[0.032]	[0.041]				
$offmat_{jt-1}$			0.230***	0.415***	0.269***	0.425***
			[0.074]	[0.078]	[0.075]	[0.080]
$offmat_{jt-1} * tfp_{ij,t-1}$					0.152***	0.044
					[0.039]	[0.051]
$Const$	0.043***	0.090***	0	-0.036	-0.011	-0.039
	[0.015]	[0.009]	[0.022]	[0.024]	[0.022]	[0.025]
Obs.	156778	156778	136127	136127[b]	136127[b]	136127[b]
Time Dummies	YES	YES	YES	YES	YES	YES
Sector Dummies	YES	NO	YES	NO	YES	NO
Firm Effects	NO	YES	NO	YES	NO	YES

Robust standard errors in brackets are clustered by firm. *** p<0.01, ** p<0.05, * p<0.1
[b] The drop in the number of observations is due to missing values for offshoring variable in 2005..

6 Conclusions

During the last decade, Italy experienced a rapid growth of import penetration, especially from low and medium income countries. This phenomenon has been common to all developed countries, and it is in great part due to the implementation of liberalization strategies by emerging and developing countries and their industrial development, and not linked to specific domestic factors in Italy. Aware of this evidence, we analyse if this foreign competition contributes to shape the sectoral productivity distribution and firm dynamics. First, we verify that, in a comprehensive framework, the exposure to LMCs is negatively related with the high productivity dispersion at sector level. The within-sector disparity in firm productivity presents also significant linkages with the concentration of the domestic market and more in general with the domestic competitive context. No role is instead detected for the ICT adoption and other trade variables.

Second, we turn on firm level and we show that behind the negative relationship between dispersion and import penetration from LMCs there are asymmetrical firm responses according to their initial efficiency level. We find that more productive firms support more deleterious effects from

the increased exposure to foreign competition. We suggest that the surge in imports from emergent countries may have reduced the incentives to innovate and invest, but it may have also stimulated efforts of less productive firms facing with the risk of exit. We put forward also the hypothesis of a process of product-switching. Anyway it needs more research efforts in order to clarify the heterogeneous firm behaviour. More attention should also be posed on the within-industry dynamics and efficiency dispersion. Even if we have shed some light on linkages between productivity heterogeneity and important characteristics, a large part of the dispersion remain unexplained.

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A Tables

Table 9: Evolution of exposure to imports by sector

ATECO	$IMP^{HIGH}_{ita,1998}$	$IMP^{HIGH}_{ita,2005}$	$IMP^{LMC}_{ita,1998}$	$IMP^{LMC}_{ita,2005}$	$IMPsh^{LMC}_{high,1998}$	$IMPsh^{LMC}_{high,2005}$
15	16.67	12.17	3.31	1.88	21.65	24.64
17	10.29	10.31	7.88	16.87	39.93	52.65
18	6.43	9.66	14.04	27.27	65.1	75.5
19	6.76	8.58	14.87	24.77	51.06	61.55
20	17.35	13.86	5.96	6.2	33.38	41.35
21	39.95	36.73	3.38	5.2	8.76	15.48
22	3.64	3.88	0.14	0.26	12.2	20.99
24	32.41	41.41	1.59	2.49	7.08	10.52
25	17.64	16.41	3.29	5.81	17.67	25.21
26	9.24	8.52	1.98	3.77	21.83	31.76
27	36.85	33.32	10.37	17.14	26.65	36.5
28	9.46	11.15	1.42	4.58	16.38	27.9
29	17.64	16.74	2.14	6.06	11.09	20.83
31	23.3	24.61	3.95	8.97	31.87	42.86
32	52.85	61.16	2.14	7.86	19.65	36.88
33	37.91	37.76	2.78	6.92	13.78	19.52
34	17.95	18.44	2.33	5.03	11.62	19.78
35	14.03	22.36	3.12	5.12	18.26	24.53
36	8.77	9.96	5.15	9.85	37.49	51.97
Total	19.95	20.9	4.73	8.74	24.5	33.71

Source: Our elaborations from AIDA, WITS and Firms Economic Accounts (ISTAT)

Definition of variables as in table 1. Variables are in percentage (%)

Table 10: Determinants of sectoral dispersion: Prais-Winsten

VARIABLES	D2575TFP	D1090TFP	StdTFP	D2575TFP	D1090TFP	StdTFP
$imp\_comp_{j,t-1}$	-0.003	-0.862***	-0.199			
	[0.081]	[0.321]	[0.159]			
$exp\_open_{j,t-1}$	0.039	0.805***	0.187			
	[0.084]	[0.251]	[0.149]			
$imp\_comp^{LMC}_{jt-1}$				-0.317***	-0.999**	-0.494***
				[0.123]	[0.430]	[0.155]
$imp\_comp^{High}_{jt-1}$				0.072	-0.251	-0.012
				[0.073]	[0.195]	[0.122]
$exp\_open^{LMC}_{jt-1}$				0.058	0.941**	0.221
				[0.107]	[0.475]	[0.224]
$exp\_open^{High}_{jt-1}$				0.066	0.192	0.098
				[0.094]	[0.216]	[0.179]
$ict_{j,t-1}$	-0.072	0.028	-0.046	-0.07	0.054	-0.041
	[0.044]	[0.125]	[0.085]	[0.047]	[0.123]	[0.087]
$nfirm_{j,t-1}$	-0.038	-0.183	-0.023	-0.05	-0.185*	-0.035
	[0.042]	[0.114]	[0.055]	[0.043]	[0.103]	[0.056]
$c10_{j,t-1}$	0.156***	0.202	0.108*	0.033***	0.049	0.007
	[0.051]	[0.164]	[0.061]	[0.010]	[0.037]	[0.015]
$sunk_{j,t-1}$	0.032***	0.046	0.006	0.160***	0.202	0.111*
	[0.011]	[0.038]	[0.015]	[0.051]	[0.161]	[0.061]
$Const$	1.710***	3.232*	1.18	1.878***	3.021*	1.301
	[0.569]	[1.677]	[1.020]	[0.627]	[1.612]	[1.139]
Obs	541	541	541	541	541	541
R^2	0.826	0.793	0.668	0.827	0.793	0.67

Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1
Every regression controls for sector and time dummies.