Globalization and Firm Exit: Differences Between Small and Large Firms*

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Abstract

The effects of increasing import competition on the exit of heterogeneous domestic firms are investigated, both at the theoretical and empirical level. Within the context of an oligopolistic rivalry model, marginal cost flexibility and product differentiation with respect to the imported goods are shown to lower the displacement effect from international competition, thus helping firms to suvive. Both results point to small firms as being in a relatively favourable position with respect to their larger competitors, as industries adjust to increasing import penetration. These findings are consistent with empirical evidence on firm exit for 12 manufacturing sectors in 8 European countries, from 1997 to 2003. In particular, the exit of large firms is found to be sensitive to the shock of soaring import penetration from low-wage countries. Small firms in the same industries are instead only affected by marginal trade integration with respect to neighbouring EU countries and other relatively wealthy trading partners. Hence this paper shows, for the first time, that firms of different size might be affected differently by diverse sources of import competition. Implications on firm strategic planning and public policy are discussed.

JEL classification: F12, F14, L11, L25, L60

Keywords: oligopolistic competition, low-wage country import competition, firm exit

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1 Introduction

During the last fifteen years, the world economy has been undergoing a pervasive globalization process, characterised by increasing labour, capital and product markets' integration. Within this general change, the observed dramatic boost in international trade between rich Western countries and low-wage economies is one of the most controversial and debated phenomena. At this purpose, the figures are stark. Between 1990 and 2006, as the volume of global exports was almost tripling, the share accounted for by non-OECD countries has been growing from 25% to 33%. In particular, imports from low-wage economies have been the fastest growing component of total manufacturing imports for both the EU and the US. This pattern configures itself as a deep structural change, which implies an increase in the competitive pressure on domestic firms in Western countries.

In a globalizing environment, firms need to adapt their strategies to the new competitive scenario in order to survive and benefit from the opportunities offered by intenational trade (Coucke et al. 2007). Failure in doing so implies higher probabilities of exit. Indeed, consistent with policy concerns, Bernard et al. (2006) and Coucke and Sleuwaegen (2008) have found that increasing import competition from low-wage economies is associated to higher firm exit in industrialized countries, with less productive and more labour intensive firms being relatively more affected. International trade liberalization thus appears as an important driver of Shumpeterian industrial change. As trade integration deepens, the market selects those firms that are more fit to international competition, while their "unfit" counterparts are forced to exit.

The literature has identified different strategic channels of firm-level reaction to globalization threats. First of all, cost reductions and efficiency gains are of crucial importance when competing with foreign firms based in low-wage countries (Coucke et al., 2007). In addition to this, firms in industrialized countries have been shown to respond to the higher competitive pressure by changing their product-mix towards more capital and skill intensive products, thus specializing in activities which are more consistent with their comparative advantages (Bernard et al., 2006). Finally, international sourcing of intermediate goods and services, through delocalization of production or arms-length trade, has been found to increase the likelihood of survival for manufacturing firms (Coucke and Sleuwaegen, 2008). Overall, firm heterogeneity seems to matter decisively in determining the way in which companies are affected by deepening trade integration (Bernard et al., forthcoming; Tybout 2003), consistent with the recent developments of international trade theory (Melitz (2003) and Bernard et al. (2003) to quote the early contributions). And yet, there is one important dimension of heterogeneity whose implications in this context have not been explored so far: firm size. To the best of our knowledge, in fact, none of the available studies has investigated whether trade integration has a different impact

on small firms (i.e. with less than 20 employees) versus their larger competitors. The present paper aims at filling this literature gap by analysing, both theoretically and empirically, the relative competitive position of small and large firms within the same industry, in a context of increasing import penetration.

In principle, there are various reasons for expecting a differentiated impact of foreign competition on firms of heterogeneous size. These reasons are related to the two main factors which the literature has traditionally identified as sources of comparative advantage for small firms with respect to their larger competitors. First, small firms are normally characterized by high marginal cost flexibility. Indeed, their cost structure typically involves low fixed costs and high reliance on variable factors of production. Therefore, while small firms tend to produce at higher marginal costs at a given point in time, they are also likely to incur lower adjustment costs as demand fluctuates (Brock and Evans, 1989; Acs and Audretsch, 1990). Second, small firms usually display a strong "niche-filling" attitude. In particular, they tend to specialize their products in specific market-niches, as a strategy to make up for their lack of economies of scale and remain viable (Porter, 1980; Dean et al., 1998).

The first part of this paper shows, at the theoretical level, how marginal cost flexibility and niche-focus might play an important role in reducing the competitive displacement that domestic firms face due to rising import penetration. In particular, a standard oligopoly model of international competition is analysed, in which domestic and foreign firms compete in quantities of differentiable products. In this framework, the effects of import competition are studied through comparative statics. First, the model predicts that domestic firms shrink and loose profits due to increased import penetration. However small firms, thanks to their higher marginal cost flexibility, are relatively less affected by the trade shock than large firms. Indeed, the latter face a stronger reduction in output and operating profits, which in turn implies lower probabilities of survival, as they might no longer be able to cover their high level of fixed costs. Secondly, increasing levels of product differentiation with respect to foreign competitors are found to shelter domestic producers from import competition. Also this result points to a weaker import displacement effect for small domestic firms versus larger ones, as the former are more likely to be focused on highly differentiated market-niche products.

In the second part of the paper an empirical analysis is carried, focusing on the exit dynamics of small and large manufacturing firms in eight European countries and twelve manufacturing industries, over the time-span 1997-2003. In line with the theoretical results, large firms' exit is found to be positively affected by the shock of soaring import penetration from low-wage countries. The exit of small firms within the same industries is instead only affected, to a lower extent, by marginal increases in trade integration with respect to neighbouring European countries or other relatively wealthy trading partners. Finally, increasing levels of intra-industry

trade, reflecting higher product differentiation with respect to foreign competitors, are associated to lower exit, but only for small producers.

This paper adds to the existing literature on trade and industry dynamics in two main ways. First of all our results strengthen, based on cross-country evidence, the view that domestic firms display higher exit rates as industries adjust to increasing import penetration, in particular when the latter is driven by low-wage countries. Second, and most importantly, this paper shows that firms of heterogeneous size may be affected differently by diverse sources of import competition. In particular, it is shown that small firms, thanks to their marginal cost flexibility and the ability to specialize in specific market-niche products, may enjoy a relatively favourable competitive position with respect to their larger counterparts, in a context of boosting import penetration from low-wage countries. These results are in line with recent evidence by Bellone et al. (2008), who have also found, focusing on firm age, that some determinants of firm survival might have different effects on heterogeneous firms within the same industry. The whole body of our findings conveys important managerial and policy implications, which are extensively discussed in the final section of the paper. Putting things in perspective, our results reinforce the line of thinking put forward by Ghemawat and Ghadar (2006), when they argue that globalization does not necessarily imply, as some predicted, that only a few large firms and product varieties will survive and win the international competition. Rather, it appears that there are multiple ways of competing successfully within the same industry, and a large number of heterogeneous firms can co-exist and remain viable in globalizing markets. In particular, small firms can still play a crucial role, by leveraging on their comparative advantages in terms of cost flexibility and niche-filling capabilities.

The remaining of the paper is organized as follows. In section 2, the theoretical model is introduced and comparative statics results are analysed. In section 3, data and empirical model are presented. Results are discussed in section 4, while section 5 concludes.

2 The theoretical model

In this section we develop a standard Cournot-type oligopoly model of international competition, in the spirit of Brander (1981) and Brander and Krugman (1983). In particular, we analyse a quantity-competing asymmetric oligopoly with two representative firms, a domestic and a foreign one, each producing one differentiable good.

The domestic firm produces and sells its output in country A, and its cost function is denoted by $C_d(q_d)$ (where we assume that C'_d, $C''_d > 0$). The cost function includes a recurrent fixed

component, F_d, and a variable one, $V_d(q_d)$. All the results of the model hold true for a large class of functional forms, including quadratic and higher-order well behaved cost functions. The domestic firm competes in the home market (country A) with a foreign producer (based in country B), which is assumed to be able to provide any quantity of its good at a constant marginal cost τ, inclusive of tariffs and transport costs. This simplifying assumption does not point to technological differences between the two producers. Rather, it proxies for the fact that a relatively small country can import up to big quantities of a good, from different foreign sources, at the prevailing international price. In this framework, increasing openness to imports is modelled as a decline in τ. Based on this, in what follows the model is used to investigate, through comparative statics, the effects of increasing import competition on domestic firms. The analysis is aimed to mirror the recent trend of boosting import penetration from low-wage economies in Western countries. Product differentiation between domestic and foreign output is modelled in a similar way as in Martin (2001).

The inverse demand functions for the domestic and foreign firm in country A are given by:

$$P_d = \alpha - \beta(\vartheta q_f + q_d) \tag{1}$$

$$P_f = \alpha - \beta(q_f + \vartheta q_d) \tag{2}$$

with $\alpha, \beta > 0$, where index d refers to the domestic firm, while f points to the foreign one. ϑ is a parameter for product differentiation, ranging between zero and one. Decreasing values of the parameter are associated to increasing product differentiation. For $\vartheta = 1$ we are in the case of homogeneous products.

Each firm solves a profit maximization problem as follows:

$$\max_{q_d} \pi_d(q_f, q_d, \tau) = [\alpha - \beta(\vartheta q_f + q_d)]\, q_d - C_d(q_d) \tag{3}$$

$$\max_{q_f} \pi_f(q_f, q_d, \tau) = [\alpha - \beta(q_f + \vartheta q_d)]\, q_f - C_f(q_f, \tau) \tag{4}$$

By studying the effects of a reduction in τ (e.g. decreasing tariff) we can prove the following:

Proposition 1 *The domestic firm shrinks in terms of output and loses operating profits following a decrease in τ. The displacement effect of increased import penetration is stronger for an "output-flexible" firm than for a "cost-flexible" one.*

Proof: By totally differentiating the profit maximizing conditions, and applying Cramer's rule, we obtain the following expressions (full derivation is given in the Annex):

$$\frac{\partial q_d}{\partial \tau} = \frac{\vartheta}{4\beta - \beta\vartheta^2 + 2\,\frac{\partial^2 C_d(q_d)}{\partial q_d^2}} \;>\; 0 \tag{5}$$

$$\frac{\partial \pi_d^o}{\partial \tau} = \frac{\vartheta}{4\beta - \beta\vartheta^2 + 2\,\frac{\partial^2 C_d(q_d)}{\partial q_d^2}} \left[\left(\beta + \frac{\partial^2 C_d(q_d)}{\partial q_d^2} \right) q_d + p_d - \frac{\partial C_d}{\partial q_d} \right] \;>\; 0 \tag{6}$$

Equations 5 and 6 show that the domestic firm reduces its level of output and loses operating profits following a decrease in τ[1]. This "diplacement effect" is inversely related to the second order derivative of the cost function, and thus is directly proportional to the output flexibility of the domestic firm. The concept of output flexibility goes back to Stigler (1939) and Marschak and Nelson (1962), and is related to the slope of the marginal cost curve. A firm is denoted as output flexible if changes in output are associated with small marginal cost changes, i.e. the marginal cost curve is flat, resulting in a small second order derivative of the cost function. By definition, the mirror image of output flexibility is marginal cost inflexibility. In manufacturing, output flexible firms are typically large entities characterized by a high level of fixed costs and low variable costs. Their marginal cost inflexibility constitutes a comparative disadvantage in reacting to the trade shock. Small cost flexible firms, instead, face a relatively lower displacement as import penetration rises. Assuming as an exit rule that the domestic firm exits if operating profits are lower than the recurrent fixed cost (i.e. $\pi_d^o < F_d$), the previous result also implies that large domestic firms incur a stronger decrease in the survival probability due to import competition; in fact, they face relatively higher operating profit losses and must cover greater fixed costs. In a different context, Ghemawat and Nalebuff (1985) also showed that smaller firms outlast their larger competitors in a declining industry. Our results are also consistent with those of Weiss (2001), who concluded that the attractiveness of output flexibility decreases with growing competition and decreasing market power. Output flexibility constitutes a strategic advantage in quickly growing markets with high entry barriers. However, under rising global competition, being output flexible becomes rather a disadvantage.

These theoretical insights can be illustrated by comparing the reaction curves of a small and large domestic firm, in case of a standard quadratic cost function of the following form (Marschak and Nelson, 1962):

$$C_d(q_d) = F + \gamma q_d + \delta q_d^2 \tag{7}$$

We assume that F is higher for the large firm than for the small one. At the same time, the variable cost parameters, γ and δ, are both assumed to be higher for the small firm, thus reflecting a greater reliance on variable factors of production (Brock and Evans, 1989; Acs and Audretsch, 1990). In this framework, given a certain level of product differentiation (i.e. constant ϑ), it is easy to show that the small domestic firm is less displaced by a decrease in τ, thanks to the higher second order derivative of its cost function. The economic intuition is related to the marginal cost flexibility enjoyed by low-scale firms, which turns out to be an important comparative advantage in reacting to increasing import penetration. In Figure 1 this theoretical result is presented graphically, for the simple case of homogeneous products (i.e. $\vartheta = 1$). As τ goes down, the reaction function of the foreign firm shifts upwards. In the new equilibrium, the output loss is higher for a large than for a small domestic firm, as the reaction function is less steep in the former case.

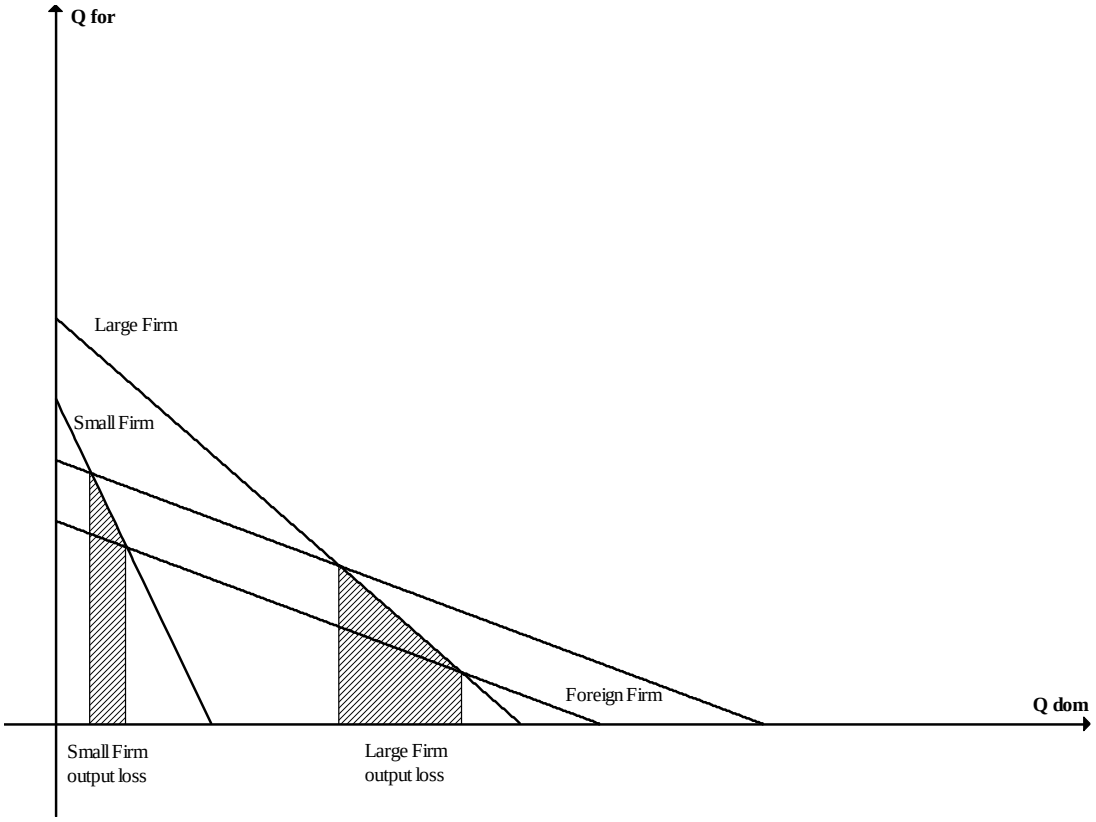
In the analysis above the role of product differentiation has not been explored. And yet, by focusing on the parameter ϑ, it is possible to prove the following:

Proposition 2 *Ceteris paribus, following a decrease in τ, higher levels of product differentiation (lower ϑ) are associated to a lower displacement effect on the domestic firm's output and operating profits.*

Proof: From equations 5 and 6 it is straightforward to see that, other things equal, the import displacement effect decreases with the level of product heterogeneity. In particular, the effect approaches zero as $\vartheta \to 0$, i.e. if there is complete differentiation between the domestic and foreign firm's products. The output and profit losses reach instead their maximum for $\vartheta = 1$, i.e. in the case of homogeneous products.

This result is fairly easy to interpret: in times of rising import penetration, a domestic firm' s performance is positively related to the level of differentiation between its output and the imported good. Hence, also this second finding of our analysis suggests that small firms might be in a favourable position with respect to their larger competitors when facing import penetration.

Figure 1: Output loss for a small vs. large domestic firm



In fact, as previously said, small producers tend to focus on very differentiated niche-products, as a strategy to compensate for their lack of economies of scale and be profitable (Porter, 1980; Dean et al., 1998). In our framework, by assuming a lower level of ϑ for the small producers and considering the exit rule explained above, Proposition 2 reinforces the previous result that large firms incur relatively higher increases in the exit probability than small ones due to increasing import penetration.

Summing up, the described theoretical analysis shows that product differentiation and marginal cost flexibility reduce the displacement effect from increased import pressure, thus helping domestic firms to survive. Both factors lead to expect a higher sensitivity to import competition for the exit of large firms than for the exit of small ones. In the remaining of the paper these expectations are assessed against empirical evidence from several European countries, over a period of soaring import penetration from low-wage economies.

3 Data and empirical model

3.1 Data description and definitions

The empirical analysis is based on firm exit data from the Eurostat "Business Demography Statistics" database. In particular, we employ sectoral exit rates for eight European countries: Belgium, Denmark, Finland, Italy, Netherlands, Spain, Sweden and the United Kingdom[2]. We focus on the manufacturing sector, for the time-span: 1997-2003. Data are provided at the Eurostat NACE (Rev. 1.1) "sub-section" level of industry aggregation[3]. Sub-sections are identified by two-character alphabetical codes (from DA to DN) and correspond to two-digit sectors or aggregations of them (see Table 1)[4].

[Table 1 about here]

Exit rates in a given country, industry and year are defined as the ratio of exiting firms over the number of active ones. For each sector-country pair (and year) we could retrieve two separate figures, referring to the population of small and larger firms. At this purpose, the binding cut-off is set by Eurostat at the level of 20 employees. Data are comparable across countries and are constructed in order to identify "true" exits of firms. Indeed, as reported by Eurostat, firm exit figures reflect only real dissolution of enterprises. In practice, this is obtained by processing the full national business registers' data in order to identify and exclude those exits which are just due to mergers and take-overs. Changes of activities at the firm level are also not registered as exits from a given sector. Moreover, a company is excluded from the count of exits if it gets reactivated within two years, which explains the time-lag in the data release[5].

Table 2 provides some descriptive statistics referring to country-specific exit rates, on average over the time span, for the whole manufacturing sector. The cross-country mean exit rate is 6.3%, with figures ranging from 4.8% in Sweden up to 9.8% in the UK. As one would expect, small firms' exit rates are much higher than their equivalents referring to the population of larger firms: 7.1% vs. 1% on average. In Table 3 the evolution of exit rates over time is displayed, on average across countries. The figures depict a pattern of increasing exit rates for both categories of firms. In particular, large firms' exit rates witness a three-fold increase between 1997 and 2003, moving from 0.4% to 1.3%.

[Tables 2 and 3 about here]

In the next sections, the relationship between exit dynamics and the evolution of trade exposure is investigated. At this purpose, we employ international trade data retrieved from

the Eurostat COMEXT Database, from 1995 to 2003. As a first step, we proxy the extent of import pressure through a volume-based index, as in Davis et al. (1996). In particular, for each industry we compute the overall level of import competition as the following ratio: sectoral imports over the sum of domestic production and imports[6]. Figure 2 shows the evolution of this index at the country level, for the whole manufacturing sector, from 1995 to 2003. As it can be seen, import pressure is increasing in all the considered countries. The index moves from an average value of 0.29 to 0.33, with the highest increases witnessed by Belgium (from 0.40 to 0.49) and the Netherlands (from 0.39 to 0.45).

[Figure 2 about here]

These observations illustrate the general idea that manufacturing firms in the European Union have been facing increasing competition from foreign producers on the domestic markets. However, the general import competition index does not say anything about "where" the increased import pressure is coming from. Thus, given the focus of our analysis, we have further decomposed the import competition index into two components: one representing import penetration from low-wage countries (impcomp-low) and the other referring to the remaining trading partners (impcomp-high). This is done, as in Bernard et al. (2006), by keeping at the numerator the level of imports from the two sets of countries alternatively. At this purpose, Table 4 shows the list of the 52 low-wage trading partners. It is the same as in Bernard et al. (2006), and includes China, India and other economies with a level of GDP per-capita lower than 5% of the US figure.

[Table 4 about here]

Import flows from the set of low-wage countries have almost quintuplicated between 1995 and 2003, and their share of total imports has doubled, moving from 4% to 8%, on average across the considered EU countries and sectors. In particular, in 2003 low-wage countries accounted for 30% and 22% respectively of total imports of leather and textile products, with these shares rising up to 44% in the Netherlands and 28% in the UK. Apart from the latter labour intensive sectors, import penetration from relatively poor countries has been increasing substantially also in other industries, like electrical and optical equipment, non-metallic mineral products, wood, plastic and rubber products, machinery and equipment (see Table 5). As a result, when considering the dynamics of the two import competition indexes described above, we find that "impcomp-low" has more than doubled over the time period: from 0.016 in 1995 to 0.035 in 2003 (on average across countries and sectors). At the same time "impcomp-high", although larger in magnitude, has grown only marginally: from 0.3 to 0.32. Thus, the increase in import

competition from low-wage countries configures itself as "the" trade shock for manufacturing firms over the considered period. In the empirical analysis, while controlling for the overall dynamics of trade, we will focus in particular on the effects of imports from low-wage countries on firms of different size.

[Table 5 about here]

Finally, one of the predictions of the theoretical model concerns the extent of product differentiation between domestic and foreign firms. At the empirical level, this is proxied through the Grubel-Lloyd (1975) index of intra-industry trade, which is computed as follows (Coucke and Sleuwaegen, 2008):

$$IIT_{ijt} = 2 * \frac{\min(M_{ijt}, X_{ijt})}{M_{ijt} + X_{ijt}} \tag{8}$$

where M_{ijt} and X_{ijt} represent, respectively, import and export flows for sector i in country j at time t.

IIT_{ijt} ranges between zero and one. Increasing values of the index represent higher levels of intra-industry trade, which point to growing product differentiation between domestic and foreign producers within the same sector (Caves, 1981). For instance, following trade liberalization, IIT might grow because domestic firms specialize in the production of more capital/skill intensive goods and other niche products, as shown by Bernard et al. (2006) for the US manufacturing.

3.2 The empirical model

In this section, the analytical framework for the econometric study is presented. The empirical approach is similar to the one followed by Bernard et al. (2006) and Colantone and Sleuwaegen (2007). In particular, the latter authors have shown, using the same Eurostat data described above, that an increase in import competition generates higher exit at the industry level in the following year. In our analysis we add to previous evidence by investigating, for the first time, the impact of import penetration from different sources on firms of different size within the same industry. This is done through fixed-effects panel data econometric regressions, which allow to control for heterogeneity across industries and countries.

The baseline estimating equation is as follows:

$$Exit_{ijt} = \beta_0 + \beta_1 \, \Delta impcomp\_low_{ij(t-1)} + \beta_2 \, \Delta impcomp\_high_{ij(t-1)} \tag{9}$$

$$+\beta_3\ \Delta IIT_{ijt} + \beta_4\ Z_{ij(t-1)} + \beta_i + \beta_j + \beta_t + \epsilon_{ijt}$$

$Exit_{ijt}$, the dependent variable, is the exit rate for sector i in country j at time t. As previously anticipated, we alternatively employ exit rates referring to the population of small ($<$ 20 employees) and larger ($\geq$ 20 employees) firms within the same industry/country observational unit.

$\Delta impcomp\_low_{ij(t-1)}$ represents the change in the index of import competition from low-wage countries between $t-1$ and $t-2$, computed as explained in the previous section. This variable is crucial in the empirical test. However, we also need to control for the evolution of import competition with respect to all the remaining trading partners. This is done by including in the set of regressors $\Delta impcomp\_high_{ij(t-1)}$, which stands for the change in import competition from relatively wealthy countries.

ΔIIT_{ijt} is the change in the Grubel-Lloyd index of intra-industry trade between t and $t-1$. As explained in the previous Section, a positive variation in this indicator points to increasing product differentiation between domestic and foreign firms within the same industry. Thus, a negative association of this variable with firm exit would provide evidence in favour of the theoretical result that product heterogeneity shelters domestic producers from foreign competition.

β_i, β_j and β_t represent industry, country and year fixed effects. They are included in order to account for unobserved heterogeneity and time trends. This allows us to focus on the short-run effects of changes in trade, while conditioning for structural characteristics and long-run trends of specific industries and countries, together with cyclical effects. However, we still need to control for other possible sources of short-run turbulence. At this purpose, we include a vector $Z_{ij(t-1)}$ of industry (and country) specific explanatory variables, which have been identified in the literature as significant determinants of firm exit. They are described in what follows.

First, many empirical studies have documented a positive correlation between firm exit in a period and previous entry in the same industry (Dunne et al., 1988; Siegfried and Evans, 1994; Mata and Portugal, 1994; De Backer and Sleuwaegen, 2003). A theoretical interpretation for this finding is provided by the carrying capacity models (Carree and Thurik, 1999), where new firms may drive incumbents out of the market thanks to the introduction of better products and more efficient technologies. We take this into account by including as a regressor the lagged entry rate, computed as the ratio of entering firms over total active ones in each sector/country pair.

Total factor productivity has also been identified as an important determinant of firm exit. Indeed, more productive firms tend to display higher survival probabilities (Bernard et al. 2006,

2006a; Coucke and Sleuwaegen, 2008). In our regressions we control for the lagged growth in TFP at the industry level; however, the expected effect of this variable on sectoral exit is not obvious, as it crucially depends on the underlying distribution of firm-level productivity changes within the industry. In fact, the same variation in sectoral TFP can be generated by very diverse firm-level dynamics, with different implications on exit. Data on total factor productivity have been retrieved from the EU KLEMS database (March 2007 release), which has been produced by a consortium of fifteen organizations in the EU, supported by the European Commission, the OECD and various National Statistical Institutes[7]. TFP is computed for each industry-country pair through a growth accounting exercise, by taking into account the output contribution of different categories of capital, labour, energy, materials and service inputs[8].

Finally, we include the logarithm of the lagged net investment in tangible assets over turnover at the industry level, computed starting from Eurostat Structural Business Statistics data. This variable constitutes a proxy for growth opportunities and the extent of restructuring undertaken in each sector, and reflects the evolution of industries through different stages of their products' life cycles. Indeed, as shown by Klepper (1996) and Agarwal and Gort (1996), exit rates depend sysematically on the stage of market development in the cycle from birth to maturity.

The model for small firms is estimated through standard Least Squares Dummy Variables regressions. For larger firms, instead, a Tobit estimation is performed, due to the presence of zero cells in the database (i.e. no exit observed in some industry/country/year). As shown by Greene (2004), the estimation of a Tobit model with fixed effects does not suffer from an incidental parameters problem, as far as the coefficients' magnitude is concerned[9]. A bias arises instead in the estimation of variance and marginal effects. However, the latter bias is already lower than 1% when 20 observations are available. Since we employ data for 8 countries, 12 sectors and 7 years, our fixed effects are always identified over a high number of observations, which allows to be confident on the robustness of results[10]. Finally, heteroskedasticity robust standard errors are computed in both regressions. Results are presented in the next section.

4 Econometric results and discussion

Table 6 reports the outcome of the econometric analysis outlined above. Results referring to small and larger firms are reported in column 1 and 2, respectively. In the latter case, unconditional marginal effects from the Tobit estimation are reported.

Focusing on the trade-related variables, estimation results point to the same direction as our theoretical findings. Indeed, consistent with Proposition 1, we find that large firms' exit is positively affected by the trade shock of increasing import pressure from low-wage countries,

while the same does not hold true for small firms. In particular, a marginal increase by 0.01 in the impcomp-low index generates higher exit rates of large firms by 0.4 percentage points, which represent about 40% of the average sectoral exit rate for this category of incumbents. Instead, exit rates of small firms are sensitive, to a lesser extent, to marginal increases in import competition from the set of relatively wealthy trading partners. In fact, a 0.01 increase in the impcomp-high index results in higher exit rates of small firms by 0.1 percentage points. Finally, in line with Proposition 2, an increase in intra-industry trade, pointing to higher product differentiation between domestic and foreign producers, is significantly associated to lower exit, but only for small firms.

Concerning the other control variables, results from both regressions confirm the empirical regularity that exit is positively associated to previous entry. This provides additional evidence in favor of the "creative destruction" view, by which new firms are expected to outcompete incumbents through the introduction of innovative products and/or production techniques (Carree and Thurik, 1999). Secondly, the exit of large firms is found to be positively related to lagged TFP growth, a finding not suprising given the industry level nature of our productivity measure, as already discussed. Finally, no significant effects on exit are detected with respect to the investment intensity at the industry level.

[Table 6 about here]

Overall, the empirical results are consistent with the idea that small firms, thanks to their marginal cost flexibility and product differentiation, enjoy a competitive advantage when faced with the shock of increasing import competition from low-wage countries. Indeed, we find that output-flexible manufacturing firms, characterised by larger-scale activities, are sensitive to rising import pressure from low-wage economies. Instead, small cost-flexible firms are only affected by the observed marginal deepening in trade integration with respect to European neighbours and other relatively wealthy countries. Moreover, small producers are also found to exit relatively less when intra-industry trade is increasing, which points to product differentiation as an effective strategy for reacting to soaring international competitive pressure. All these results are consistent with our theoretical findings, as presented in Section 2.

Our analysis, both at the theoretical and empirical level, reinforces the idea that opening to international trade increases the competitive pressure on domestic firms, thus resulting in higher exit rates. This view has been emerging from the new theoretical models of international trade allowing for firm heterogeneity (e.g. Melitz, 2003; Bernard et al., 2003) and has been supported by a number of empirical studies, which have found the survival probabilities of domestic firms in Western countries to be reduced by increasing import competition, especially if the latter

is driven by growing trade inflows from low-wage countries (Bernard et al., 2006; Coucke and Sleuwaegen, 2008; Greenaway et al., 2008). In this paper we add to the previous literature by showing, for the first time, that firms of different size might be affected differently by diverse sources of import competition. In particular, we find that large firms are more sensitive to the shock of increasing import competition from low-wage countries than their smaller counterparts. Failing to take this dimension of analysis into account might result in empirical findings which are biased by the composition of the firms' sample. For instance, in a recent paper on Swedish firms, Greenaway et al. (2008) find that the probability of exit by closedown is increased the most by rising import competition from non-OECD countries rather than from other OECD members. Moreover, the effect of import competition is not found to vary across firms of different size. In the light of our findings, the latter results might be driven by the fact that the analysed sample includes only firms with more than 50 employees.

Previous management studies have also put forward the view that firms of different size operate in distinct strategic groups within the same sector (Porter, 1973-1979; McGee and Thomas, 1986). Our paper provides the first evidence that a size-based partition of industries might also apply with respect to international competition. Indeed, we have shown that large firms active in high-scale production display higher exit rates in response to increasing import competition from low-wage countries. Firms of lower size are instead more likely to be competing "at the margin" in niche markets, and thus are more affected by deepening trade integration with respect to EU members and other relatively wealthy trading partners. Therefore, when assessing the impact of international trade on industry dynamics, firms of different size seem to fall in distinct strategic arenas, where they face foreign competition of a different nature. This has important implications for strategic planning at the firm level, as the identification of competitive threats is a crucial step for any decision making managerial process. Our findings suggest that especially large firms have to be pro-active in identifying and reacting to the sources of competition from developing countries, where producers can compete on a high scale by benefiting from lower labor costs and more flexible business regulations. For this purpose, re-locating part of the production chain abroad and/or out-sourcing intermediate inputs from foreign low-cost producers have been shown to be effective strategies for improving the survival perspectives of manufacturing firms in Europe (Coucke and Sleuwaegen, 2008). The relevant competitors for small European firms seem instead to be more localised in relatively wealthy partner countries, in particular within the EU. This finding is in line with the fact that small enterprises typically adopt a more regional strategic focus, aimed at defending and developing their specific market niches. Indeed, our empirical results show that small firms tend to display lower exit rates when intra-industry trade is increasing, thus pointing to a positive role for product differentiation in raising their survival probabilities.

Finally, our findings also provide important insights for policy makers concerned about the drawbacks of globalization on domestic producers in developed countries. In particular, starting from the established fact that increasing import competition determines higher exit rates of domestic firms in the short-run, our contribution provides a deeper understanding of the underlying adjustment dynamics. Indeed, we have shown that not all the import flows affect all firms to the same extent. While large firms are sensitive to foreign competition from China and other low-wage countries, small enterprises in the same industries appear to be more affected by increasing import pressure from wealthy countries. These insights are extremely important from the policy point of view. In fact, they provide useful elements for tailoring public policies to the real needs of heterogeneous firms, in such a way that the adjustment to globalization is accomodated efficiently. In particular, our analysis reveals that small firms might play a crucial role for economic growth and job creation in times of globalization, thanks to their flexibility and the ability to develop specific niches on the internationalizing markets.

5 Conclusions

In this paper we have analysed the relative competitive position of small and larger firms within an industry, following increasing import competition on the domestic market. At the theoretical level, this has been done by studying the import displacement of domestic firms within the framework of an oligopolistic rivalry model, characterised by Cournot competition between domestic and foreign producers. The displacement effect, both in terms of output and profits, is found to be reduced by the marginal cost flexibility of the domestic firm, and by increasing levels of product differentiation between domestic and foreign output. Both results point to small domestic firms as being in a relatively favourable position with respect to their larger competitors, as industries adjust to increasing import penetration. Indeed, small firms tend to be characterized by higher marginal cost flexibility (Brock and Evans, 1989; Acs and Audretsch, 1990) and greater niche-filling capabilities (Porter, 1980; Dean et al., 1998). As a result, the model predicts that, following increasing import competition, large domestic firms incur a stronger decrease in survival probabilities than small firms. In fact, large firms shrink more and are more likely to fail in covering their higher level of fixed costs.

The theoretical results are in line with empirical evidence based on firm exit dynamics in Europe, between 1997 and 2003, in response to the shock of soaring import competition from China and other low-wage countries. Indeed, only the exit of large firms is found to be sensitive to the latter source of import penetration, while small firms are only affected by marginal trade integration with respect to neighbouring EU partners and other relatively wealthy countries. Moreover, increasing intra-industry trade, pointing to growing product differentiation

with respect to foreign competitors, is associated to lower exit, but only for small firms.

Our findings, both at the theoretical and empirical level, corroborate the established view that increasing import competition raises the exit rates of domestic firms in the short-run. However, we add to the previous literature by providing deeper insights about the underlying adjustment process. Indeed we show that firms of different size are affected differently by diverse sources of import competition. Therefore firm size emerges as an important dimension of heterogeneity, which needs to be taken into account when studying the effects of trade on industry dynamics.

Our results have important implications for public policy making. In fact, small and larger firms seem to be competing in separate strategic groups, where they face different types of international competition. This provides useful insights for tailoring public policies to the specific needs of heterogeneous firms, in view of effectively accomodating the adjustment process of industries and countries to globalization. In particular, small firms are shown to play an important role within industries facing throat-cutting competition from low-wage countries, thanks to their marginal cost flexibility and the ability to develop successful market niches.

Further research efforts, employing suitable data, should explore these issues deeper. For instance, it would be interesting to assess to what extent our empirical results are specific to the European Union case, in which a pervasive economic integration process has been shaping the competitive environment already since the sixties. The role of country-specific labour and product market institutions in this context should also be analysed. Moreover, deeper insights on the adjustment dynamics could also be obtained through case-studies, by focusing on firm-level managerial choices.

Notes

[1]Operating profits are defined as: $\pi_d^o = \pi_d + F_d$

[2]The selection of countries is driven by data availability.

[3]NACE (Rev 1.1) is the European classification of economic activities, corresponding to ISIC (Rev 3.1).

[4]Two sectors have been excluded from the analysis: "manufacturing of coke, refined petroleum products and nuclear fuels" (DF) and "manufacturing n.e.c." (DN). In the first case, the choice is due to the peculiar nature of the industry, whose dynamics are essentially driven by legal changes and natural factors, rather than trade. The other industry constitutes a "catch-all" residual category for relatively heterogeneous activities (from the manufacturing of furniture to recycling), which would raise problems when trying to relate sectoral firm exit to the evolution of import competition.

[5]More details can be found on the Eurostat metadata documents: http://epp.eurostat.ec.europa.eu

[6]Domestic production data are retrieved from the Eurostat Structural Business Statistics Database.

[7]Further information is available on the EU Klems website: http://www.euklems.net/index.html

[8]Detailed information on the methodology and employed variables is available in the document "EU KLEMS growth and productivity accounts (Version 1.0). Part I Methodology".

[9]The bias is always smaller than 1%, even with only two observations.

[10]See also Kee et al. (2007).

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Annex: Comparative Statics

The first order conditions for the profit maximization problem outlined in equations 3 and 4 are as follows:

$$\frac{\partial \pi_f(q_f, q_d, \tau)}{\partial q_f} = [\alpha - \beta(q_f + \vartheta q_d)] - \beta q_f - \tau = 0 \tag{1A}$$

$$\frac{\partial \pi_d(q_f, q_d, \tau)}{\partial q_d} = [\alpha - \beta(\vartheta q_f + q_d)] - \beta q_d - \frac{\partial C_d(q_d)}{\partial q_d} = 0 \tag{2A}$$

Total differentiation of the FOCs leads to:

$$\begin{pmatrix} -2\beta & -\vartheta\beta \\ -\vartheta\beta & -2\beta - \frac{\partial^2 C_d(q_d)}{\partial q_d^2} \end{pmatrix} \begin{pmatrix} \frac{\partial q_f}{\partial \tau} \\ \frac{\partial q_d}{\partial \tau} \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \tag{3A}$$

Applying Cramer's rule:

$$\frac{\partial q_d}{\partial \tau} = \frac{\vartheta}{4\beta - \beta\vartheta^2 + 2\ \frac{\partial^2 C_d(q_d)}{\partial q_d^2}} \ > \ 0 \tag{4A}$$

In order to study the variation in profits, the price effect is derived as a first step.

$$\frac{\partial p_d}{\partial \tau} = -\beta(\vartheta \frac{\partial q_f}{\partial \tau} + \frac{\partial q_d}{\partial \tau}) \tag{5A}$$

$$\frac{\partial p_d}{\partial \tau} = -\beta \left(-\frac{2\beta + \frac{\partial^2 C_d(q_d)}{\partial q_d^2}}{4\beta^2 - \beta^2\vartheta^2 + 2\beta\ \frac{\partial^2 C_d(q_d)}{\partial q_d^2}} \vartheta + \frac{\vartheta}{4\beta - \beta\vartheta^2 + 2\ \frac{\partial^2 C_d(q_d)}{\partial q_d^2}} \right) \tag{6A}$$

$$\frac{\partial p_d}{\partial \tau} = \frac{\vartheta \left(\beta + \frac{\partial^2 C_d(q_d)}{\partial q_d^2} \right)}{4\beta - \beta\vartheta^2 + 2\ \frac{\partial^2 C_d(q_d)}{\partial q_d^2}} \ > \ 0 \tag{7A}$$

Finally, the variation in profits is computed.

$$\pi_d = p(\tau) q_d(\tau) - C_d(q_d(\tau)) \tag{8A}$$

$$\frac{\partial \pi_d}{\partial \tau} = \frac{\partial p}{\partial \tau} q_d + p \frac{\partial q_d}{\partial \tau} - \frac{\partial C_d}{\partial q_d} \frac{\partial q_d}{\partial \tau} \tag{9A}$$

$$\frac{\partial \pi_d}{\partial \tau} = \frac{\vartheta}{4\beta - \beta\vartheta^2 + 2\,\frac{\partial^2 C_d(q_d)}{\partial q_d^2}} \left[\left(\beta + \frac{\partial^2 C_d(q_d)}{\partial q_d^2} \right) q_d + p_d - \frac{\partial C_d}{\partial q_d} \right] \; > \; 0 \qquad \text{(10A)}$$

Figure 2: Variation in import competition: 1995-2003

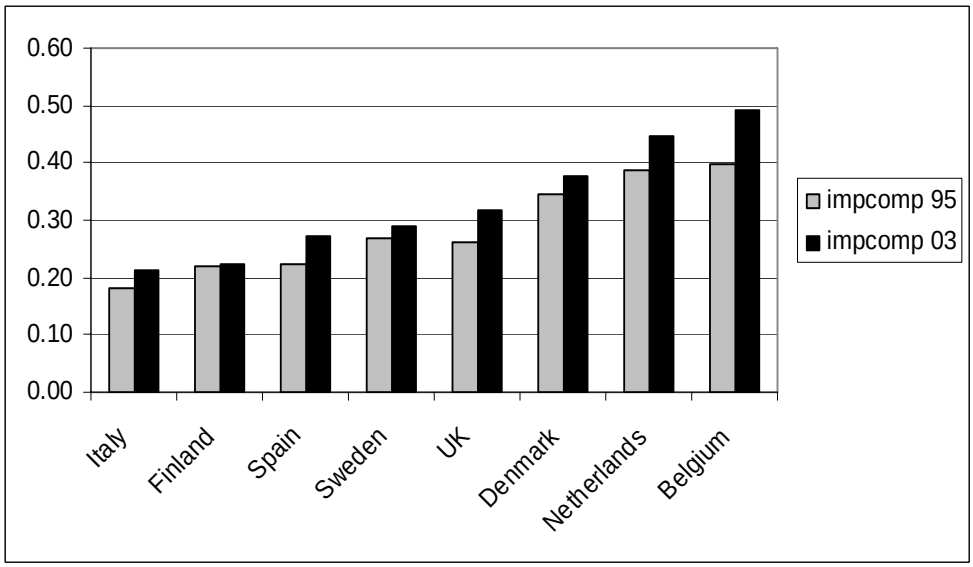

Table 1: Nace (revision 1.1) manufacturing sub-sections

DA	Manufacture of food products, beverages and tobacco
	15 Manufacture of food products and beverages
	16 Manufacture of tobacco products
DB	Manufacture of textiles and textile products
	17 Manufacture of textiles
	18 Manufacture of wearing apparel; dressing and dyeing of fur
DC	19 Manufacture of leather and leather products
DD	20 Manufacture of wood and wood products
DE	Manufacture of pulp, paper and paper products; publishing and printing
	21 Manufacture of pulp, paper and paper products
	22 Publishing, printing and reproduction of recorded media
DF	23 Manufacture of coke, refined petroleum products and nuclear fuel
DG	24 Manufacture of chemicals, chemical products and man-made fibres
DH	25 Manufacture of rubber and plastic products
DI	26 Manufacture of other non-metallic mineral products
DJ	Manufacture of basic metals and fabricated metal products
	27 Manufacture of basic metals
	28 Manufacture of fabricated metal products, except machinery and equipment
DK	29 Manufacture of machinery and equipment n.e.c.
DL	Manufacture of electrical and optical equipment
	30 Manufacture of office machinery and computers
	31 Manufacture of electrical machinery and apparatus n.e.c.
	32 Manufacture of radio, television and communication equipment and apparatus
	33 Manufacture of medical, precision and optical instruments, watches and clocks
DM	Manufacture of transport equipment
	34 Manufacture of motor vehicles, trailers and semi-trailers
	35 Manufacture of other transport equipment
DN	Manufacturing n.e.c.
	36 Manufacture of furniture; manufacturing n.e.c.
	37 Recycling

Table 2: Exit rates - country averages

	Overall figures	Small firms (<20 empl)	Large firms (≥20 empl)
Country	Exit rate	Exit rate	Exit rate
Belgium	5.7%	7.0%	1.1%
Denmark	6.2%	7.0%	0.2%
Finland	5.7%	6.3%	0.1%
Italy	5.9%	6.5%	0.3%
Netherlands	6.3%	7.3%	1.4%
Spain	6.1%	7.0%	0.8%
Sweden	4.8%	5.2%	0.5%
UK	9.8%	10.9%	3.9%
Mean	6.3%	7.1%	1.0%

Table 3: Exit rates - yearly averages

	Overall figures	Small firms (<20 empl)	Large firms (≥20 empl)
year	Exit rate	Exit rate	Exit rate
1997	6.2%	6.8%	0.4%
1998	6.4%	7.3%	0.9%
1999	6.4%	7.1%	1.2%
2000	6.3%	7.0%	1.0%
2001	6.1%	6.8%	1.1%
2002	6.4%	7.2%	1.2%
2003	6.5%	7.4%	1.3%

Table 4: Low-wage trading partners

Afghanistan	Ethiopia	Moldova
Albania	Gambia	Mozambique
Angola	Georgia	Nepal
Armenia	Ghana	Niger
Azerbaijan	Guinea	Pakistan
Bangladesh	Guinea Bissau	Rwanda
Benin	Guyana	Samoa
Bhutan	Haiti	Sao Tome
Burkina Faso	India	Sierra Leone
Burundi	Kenya	Somalia
Cambodia	Lao PDR	Sri Lanka
Central African Rep	Lesotho	St. Vincent
Chad	Madagascar	Sudan
China	Malawi	Togo
Comoros	Maldives	Uganda
Congo	Mali	Vietnam
Equatorial Guinea	Mauritania	Yemen
Eritrea		

Table 5: Share of sectoral imports coming from low-wage economies (on average across the eight EU countries in our sample)

Sector Description	Nace code	Low-income share 1995	Low-income share 2003
Manufacture of leather and leather products	dc	18%	30%
Manufacture of textiles and textile products	db	15%	22%
Manufacture of electrical and optical equipment	dl	2%	7%
Manufacture of other non-metallic mineral products	di	2%	6%
Manufacture of rubber and plastic products	dh	2%	5%
Manufacture of wood and wood products	dd	3%	5%
Manufacture of machinery and equipment n.e.c.	dk	1%	4%
Manufacture of basic metals and fabricated metal products	dj	2%	4%
Manufacture of food products, beverages and tobacco	da	2%	2%
Manufacture of chemicals, chemical products and man-made fibres	dg	1%	2%
Manufacture of pulp, paper and paper products; publishing and printing	de	0%	1%
Manufacture of transport equipment	dm	0%	1%
	Mean	4%	8%

Table 6: Econometric Results

Dep. var.: Industry/country specific exit rate, defined over the population of small and large firms

	(1) **Small Firms**	**(2)** **Large Firms**
Δ Imp Comp Low (t-1)	-0.0447	0.4143***
	(0.112)	(0.138)
Δ Imp Comp High (t-1)	0.1094**	0.0517
	(0.046)	(0.037)
Δ IIT Index	-0.0584**	0.0026
	(0.024)	(0.018)
Entry Rate (t-1)	0.2455***	0.7227***
	(0.048)	(0.172)
TFP Growth (t-1)	0.0236	0.06**
	(0.029)	(0.025)
Investment/Turnover (t-1)	0.0028	-0.0016
	(0.002)	(0.002)
Constant	0.0662***	
	(0.007)	
industry dummies	yes	yes
country dummies	yes	yes
year dummies	yes	yes
N. of obs.	302	298
R-sq	0.87	
Pseudo R-sq		0.79

Robust standard errors in parentheses
** significant at 5%; *** significant at 1%