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ABSTRACT

The effects of increasing import competition on output displacement and exit of heterogeneousdomestic firms are investigated within the context of an oligopolistic rivalry model.The displacement effect is found to be stronger for large "output flexible" firms, while small"cost flexible" ones are less affected by increasing import pressure. Extending the model to allow for product heterogeneity between domestic and foreign firms, we also find that product differentiation lowers the displacement effect. The theoretical findings are supported at the empirical level by the analysis of firm exit dynamics for 12 manufacturing sectors in 8 European countries, from 1997 to 2003. In particular, we find that the exit of large firms is sensitive to the shock of increasing 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 firms' strategic planning and public policy are discussed.

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

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

1 INTRODUCTION

During the last fifteen years, the world economy has been undergoing a pervasive globalisation 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. Indeed, consistent with policy concerns, Bernard et al. (2006) and Coucke and Sleuwaegen (forthcoming) have found that increasing import competition from low-wage countries is associated to higher firm exit for the United States and Belgium respectively, with labour intensive firms being relatively more affected. The literature has identified different strategic channels of firm-level reaction to such global threats. First of all, cost reductions and efficiency gains are of crucial importance when competing with foreign firms based in low-wage countries. In addiction to this, firms have been shown to respond to the higher competitive pressure by changing their product-mix towards niche and more capital/skill intensive products, thus specializing in activities which are more consistent with their comparative advantages (Bernard et al., 2006; Coucke and Sleuwaegen, forthcoming).

Finally, international sourcing of intermediate goods and services, through de-localization of production or arms length trade, has been found to increase the likelihood of survival for manufacturing firms (Coucke and Sleuwaegen, forthcoming). 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). This is consistent with the recent developments of international trade theory: Melitz (2003) and Bernard et al. (2003) in the first place. And yet, there is one important dimension of heterogeneity whose implications in this context have not been explored so far: firm size. The present paper aims at filling this literature gap. Indeed, we analyse the relative competitive position of small and bigger firms within the same industry, following trade liberalisation with respect to low-wage countries.

The addressed issue is extremely relevant from a policy perspective, as companies of different size might require a diverse policy approach in the adjustment phase.

We start our analysis by developing an asymmetric oligopoly model of international competition, in which domestic and foreign firms compete in quantities. In this framework, the effects of trade liberalisation are then studied through a comparative statics exercise. The model predicts 2 that domestic firms shrink and loose profits due to increased import competition. However, small “cost flexible” firms are relatively less affected by the trade shock than large “output flexible” ones. Indeed, the latter face a stronger reduction in output and profits, which in turn implies lower probabilities of survival, as they might no longer be able to cover their high level of fixed costs. The latter predictions hold also when allowing for product differentiation between domestic and foreign firms. Moreover, we find that higher levels of product heterogeneity shelter domestic producers from the import displacement effect. In the second part of the paper, the theoretical findings are tested at the empirical level by using sectoral exit data for twelve manufacturing industries in eight European countries, for the time span 1997-2003. Consistent with the model, we find that large domestic firms are affected by the shock of increasing import competition from low-wage countries in terms of higher death rates. Exit of small firms (with less than 20 employees) is instead only enhanced 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, pointing to higher product differentiation with respect to the trading partners, are associated to lower exit, but only for small producers. These results convey the idea that small firms, thanks to their cost flexibility and product differentiation, find themselves in a relatively favourable competitive position when faced with a structural shock such as the fast increase in import penetration from low-wage countries. The remaining of the paper is organized as follows. In section 2, we present the theoretical model and analyse the comparative statics results. 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 Cournot-type oligopoly model of international competition, in the spirit of Brander (1981) and Brander and Krugman (1983). We first analyse a quantitycompeting asymmetric oligopoly with two representative firms, a domestic and a foreign one, producing the same homogeneous good. Then, we extend the model by allowing for product differentiation.

The domestic firm produces in country A, and its cost function is denoted by $C_d(q_d)$ (we assume $C_d^{'}, C_d^{''} > 0$). It competes on the domestic market (country A) with a foreign producer (country B), which is assumed to be able to provide any quantity of the homogeneous good at a constant marginal cost τ, inclusive of tariffs and transport costs. Increasing openness to imports is thus modeled in this framework as a decline in τ. Hence, we can exploit the model 3 to investigate, through comparative statics, the effects of the recent trend of import penetration from low-wage economies on domestic firms in developed countries.

The inverse demand function in country A is given by:

$$P = \alpha - \beta(q_f + q_d) \qquad (1)$$

with α, $\beta > 0$, where index f refers to the foreign firm, while d points to the domestic one.

Each firm solves a profit maximization problem as follows:

$$\max_{q_d} \pi_d(q_f, q_d, \tau) = [\alpha - \beta(q_f + q_d)]\, q_d - C_d(q_d) \qquad (2)$$

$$\max_{q_f} \pi_f(q_f, q_d, \tau) = [\alpha - \beta(q_f + q_d)]\, q_f - C_f(q_f, \tau) \qquad (3)$$

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 profits following a decrease in* τ *. The displacement effect of increased import penetration is stronger for a large output flexible firm than for a small cost flexible one.*

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

$$\frac{\partial q_d}{\partial \tau} = \frac{1}{3\beta + 2\frac{\partial^2 C_d(q_d)}{\partial q_d^2}} > 0 \quad (4)$$

$$\frac{\partial \pi_d}{\partial \tau} = \frac{1}{3\beta + 2\frac{\partial^2 C_d(q_d)}{\partial q_d^2}}[(\beta + \frac{\partial^2 C_d(q_d)}{\partial q_d^2})q_d + p - \frac{\partial C_d}{\partial q_d}] > 0 \quad (5)$$

From equations 4 and 5 we can see that the domestic firm reduces its level of output and loses profits following a decrease in τ . This "diplacement effect" is crucially determined by the second order derivative of the cost function, and hence by 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 4 changes in output are associated with small cost changes, i.e. the marginal cost curve is flat, resulting in a small second order derivative of the cost function. Thus, our model predicts that the displacement effect is going to be directly related to the level of output flexibility of the domestic firm. Indeed, as already noted by Stigler (1939), output flexibility is not a free good, being it associated to cost inflexibility. In manufacturing, for instance, output flexible firms are typically large entities characterized by a high level of fixed costs and low variable costs. Their inability to reduce production costs in a flexible way constitutes a disadvantage in reacting to the trade shock. Large firms are thus predicted to be harmed by increasing import pressure to a greater extent, in terms of output and profits. As a result, they are also more likely to exit, as they might be unable to cover their higher level of fixed costs, and do the necessary capital investments. 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 (1999), 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.

We now extend our framework by allowing for product differentiation between the output of the domestic and the foreign firm. We do so in a similar way as in Martin (2001).

Equation 6 and 7 represent the new inverse demand curves for the domestic and the foreign firm respectively:

$$P_d = \alpha - \beta(\vartheta q_f + q_d) \tag{6}$$

$$P_f = \alpha - \beta(q_f + \vartheta q_d) \tag{7}$$

with α, $\beta > 0$.

ϑ is a parameter for product differentiation, ranging between zero and one. Decreasing values of the parameter are associated to increasing product differentiation. If $\vartheta = 1$ we are back in the simple case with homogeneous products.

In this extended set-up of the model, we can prove:

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

Proof : Solving the model, and repeating the same comparative statics analysis as before, we obtain the following results (see Annex):

$$\frac{\partial q_d}{\partial \tau} = \frac{\vartheta}{4\beta - \beta\vartheta^2 + 2\frac{\partial^2 C_d(q_d)}{\partial q_d^2}} > 0 \tag{8}$$

$$\frac{\partial \pi_d}{\partial \tau} = \frac{\vartheta}{4\beta - \beta\vartheta^2 + 2\frac{\partial^2 C_d(q_d)}{\partial q_d^2}} [(\beta + \frac{\partial^2 C_d(q_d)}{\partial q_d^2})q_d + p_d - \frac{\partial C_d}{\partial q_d}] > 0 \tag{9}$$

Equations 8 and 9 confirm the previous finding that the domestic firm shrinks in terms of output and loses profits following a decrease in τ. However, the displacement effect decreases with the level of product heterogeneity. In particular, the effect approaches zero as $\vartheta \rightarrow 0$, i.e. if there is complete differentiation between the domestic and foreign firm's products. Specularly, if $\vartheta = 1$ we are back in the previous case with homogeneous products.

Finally, also in the extended model the displacement effect is inversely related to the second order derivative of the domestic firm's cost function. Hence, both product differentiation and cost flexibility are predicted to reduce the displacement effect from increased import pressure. In the remaining of the paper we assess these theoretical findings through an econometric analysis, by focusing on the implications for firm exit at the industry level.

3 DATA AND EMPIRICAL MODEL

3.1 Data description and definitions

Our 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. 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[1]. 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)[2].

Insert 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 (with less than 20 employees) and larger firms (with 20 employees or more). 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 deaths if it gets reactivated within two years, which explains the time-lag in the data release[3].

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 death 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%.

Insert Table 2 and 3 About Here

In the empirical analysis presented in the next sections we study the relationship between exit dynamics and the evolution of trade exposure. 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[4].

Figure 1 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).

Insert Figure 1 About Here

This preliminary analysis confirms 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 7 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.

Insert Table 4 About Here

As previously anticipated, import flows from these low-wage trading partners 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 differential effects of imports from low-wage countries on firms of different size.

Insert 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, forthcoming):

$$IIT_{ijt} = 2 * \frac{\min(M_{ijt}, X_{ijt})}{M_{ijt} + X_{ijt}} \qquad (10)$$

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 liberalisation, IIT might grow because domestic firms specialize in the production of more capital/skill intensive goods and other niche products, as showed by Bernard et al. (2006) for the US manufacturing.

3.2 The empirical model

In this section we present the analytical framework which will be used in order to assess the predictions of our theoretical model. 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 raises firm exit at the sector level. However, in our analysis we go deeper by investigating, for the first time, the impact of import penetration from different sources on firms of different size. We do so through fixed effects panel data econometric regressions, which allow to control for heterogeneity across sectors and countries.

The baseline estimating equation looks as follows:

$$Exit_{ijt} = \beta_0 + \beta_1 \Delta impcomp\_low_{ij(t-1)} + \beta_2 \Delta impcomp\_high_{ij(t-1)} + \beta_3 \Delta IIT_{ijt} + \beta_4 Z_{ij(t-1)} + \beta_i + \beta_j + \beta_t + \varepsilon_{ijt} \quad (11)$$

$Exit_{ijt}$, 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 (≥ 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 sector. Thus, a negative association of this variable with sectoral 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, forthcoming). 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[5]. 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[6].

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 10 systematically 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[7]. 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[8]. 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 (output flexible) 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 (cost flexible) firms. In particular, a marginal increase of 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 support 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 surprising 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.

Insert Table 6 About Here

Overall, our results support the idea that small firms, thanks to their 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 poor countries. 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, and with the view that output flexibility may turn out to be a disadvantage in a context of growing competition and decreasing market power (Weiss, 1999).

Our findings, both at the theoretical and empirical level, reinforce 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, forthcoming; Greenaway et al., 2008). However, in this paper we add to the previous literature findings 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 output flexible 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, forthcoming). 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 globalisation on domestic producers in developed countries. In particular, starting from the established fact that increasing import competition determines higher death rates of domestic firms in the short-run, our contribution provides a deeper understanding of the underlying adjustment dynamics. Indeed, we have showed 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 globalisation is accommodated efficiently.

In particular, our analysis reveals that small firms might play a crucial role for economic growth and job creation in times of globalisation, thanks to their flexibility and the ability to develop specific niches on the internationalising 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. This has been done by studying the displacement of domestic firms by competitive imports within the framework of an oligopolistic rivalry model, characterised by Cournot competition between domestic and foreign firms. The displacement effect is found to be stronger for large output flexible firms, while small cost flexible ones are less sensitive to increasing import pressure. In turn, large firms face lower probabilities of survival, as they become unable to cover their high level of fixed costs and do the necessary capital investments. Moreover, when allowing for product heterogeneity between domestic and foreign producers, we also find that product differentiation reduces the import displacement effect.

The theoretical propositions are supported by the analysis of 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, for the first time, 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 accommodating the adjustment process of industries and countries to globalisation. Moreover, small firms are shown to play an important role within industries facing throat-cutting competition from low-wage countries, thanks to their flexibility and the ability to develop successful market niches.

Further research efforts, employing suitable data, should explore these issues deeper. In particular, 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] NACE (Rev 1.1) is the European classification of economic activities, corresponding to ISIC (Rev 3.1).

[2] 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.

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

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

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

[6] 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".

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

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

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ANNEX: COMPARATIVE STATICS

Homogeneous products

The first order conditions of the profit maximization problem outlined in equations 2 and 3 are as follows:

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

$$\frac{\partial \pi_d (q_{f,} q_d, \tau)}{\partial q_d} = \left[\alpha - \beta(q_f + q_d)\right] - \beta q_d - \frac{\partial C_d(q_d)}{\partial q_d} = 0 \qquad \text{(2A)}$$

Total differentiation of the FOCs leads to:

$$\frac{\partial^2 \pi_f (q_f, q_d, \tau)}{\partial q_f^2} \partial q_f + \frac{\partial^2 \pi_f (q_f, q_d, \tau)}{\partial q_f \partial q_d} \partial q_d = - \frac{\partial^2 \pi_f (q_f, q_d, \tau)}{\partial q_f \partial \tau} \partial \tau \qquad \text{(3A)}$$

$$\frac{\partial^2 \pi_d (q_f, q_d, \tau)}{\partial q_d \partial q_f} \partial q_f + \frac{\partial^2 \pi_d (q_f, q_d, \tau)}{\partial q_d^2} \partial q_d = - \frac{\partial^2 \pi_d (q_f, q_d, \tau)}{\partial q_d \partial \tau} \partial \tau \qquad \text{(4A)}$$

In matrix notation:

$$\begin{pmatrix} \dfrac{\partial^2 \pi_f (q_f, q_d, \tau)}{\partial q_f^2} & \dfrac{\partial^2 \pi_f (q_f, q_d, \tau)}{\partial q_f \partial q_d} \\ \dfrac{\partial^2 \pi_d (q_f, q_d, \tau)}{\partial q_d \partial q_f} & \dfrac{\partial^2 \pi_d (q_f, q_d, \tau)}{\partial q_d^2} \end{pmatrix} \begin{pmatrix} \dfrac{\partial q_f}{\partial \tau} \\ \dfrac{\partial q_d}{\partial \tau} \end{pmatrix} = \begin{pmatrix} -\dfrac{\partial^2 \pi_f (q_f, q_d, \tau)}{\partial q_f \partial \tau} \\ -\dfrac{\partial^2 \pi_d (q_f, q_d, \tau)}{\partial q_d \partial \tau} \end{pmatrix} \qquad \text{(5A)}$$

Substituting the derivatives from equations 1A and 2A we obtain:

$$\begin{pmatrix} -2\beta & -\beta \\ -\beta & -2\beta - \dfrac{\partial^2 C_d(q_d)}{\partial q_d^2} \end{pmatrix} \begin{pmatrix} \dfrac{\partial q_f}{\partial \tau} \\ \dfrac{\partial q_d}{\partial \tau} \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \qquad \text{(6A)}$$

Applying Cramer's rule we get:

$$\frac{\partial q_d}{\partial \tau} = \frac{1}{3\beta + 2\frac{\partial^2 C_d(q_d)}{\partial q_d^2}} > 0 \tag{7A}$$

$$\frac{\partial q_f}{\partial \tau} = -\frac{2\beta + \frac{\partial^2 C_d(q_d)}{\partial q_d^2}}{3\beta^2 + 2\beta\frac{\partial^2 C_d(q_d)}{\partial q_d^2}} < 0 \tag{8A}$$

The foreign firm increases its output level following a reduction in τ . The gain in output is lower for decreasing levels of output flexibility of the domestic firm.
In order to compute the variation in profits, we first focus on the price effect:

$$\frac{\partial p}{\partial \tau} = -\beta\left(\frac{\partial q_f}{\partial \tau} + \frac{\partial q_d}{\partial \tau}\right) \tag{9A}$$

Plugging in the results from equations 7A and 8A, we get:

$$\frac{\partial p}{\partial \tau} = -\beta\left(-\frac{2\beta + \frac{\partial^2 C_d(q_d)}{\partial q_d^2}}{3\beta^2 + 2\beta\frac{\partial^2 C_d(q_d)}{\partial q_d^2}} + \frac{1}{3\beta + 2\frac{\partial^2 C_d(q_d)}{\partial q_d^2}}\right) \tag{10A}$$

and, in reduced form:

$$\frac{\partial p}{\partial \tau} = \frac{\beta + \frac{\partial^2 C_d(q_d)}{\partial q_d^2}}{3\beta + 2\frac{\partial^2 C_d(q_d)}{\partial q_d^2}} > 0 \tag{11A}$$

From equation 11A we can see that trade liberalization (lower τ) has the expected precompetitive effect in terms of lower prices.

We now focus on the variation in profits, starting with the domestic firm:

$$\pi_d = p(\tau)q_d(\tau) - C_d(q_d(\tau)) \tag{12A}$$

$$\frac{\partial \pi_d}{\partial \tau} = \frac{\partial p}{\partial \tau} q_d + p\frac{\partial q_d}{\partial \tau} - \frac{\partial C_d}{\partial q_d}\frac{\partial q_d}{\partial \tau} \tag{13A}$$

Plugging in previous results, we get:

$$\frac{\partial \pi_d}{\partial \tau} = \frac{1}{3\beta + 2\frac{\partial^2 C_d(q_d)}{\partial q_d^2}}\left[\left(\beta + \frac{\partial^2 C_d(q_d)}{\partial q_d^2}\right)q_d + p - \frac{\partial C_d}{\partial q_d}\right] > 0 \tag{14A}$$

For the foreign firm we have:

$$\pi_f = p(\tau)q_f(\tau) - C_f(q_f(\tau), \tau) \tag{15A}$$

$$\frac{\partial \pi_f}{\partial \tau} = \frac{\partial p}{\partial \tau} q_f + p\frac{\partial q_f}{\partial \tau} - \frac{\partial C_f}{\partial \tau} - \frac{\partial C_f}{\partial q_f}\frac{\partial q_f}{\partial \tau} \tag{16A}$$

$$\frac{\partial \pi_f}{\partial \tau} = \left(-\frac{2\beta + \frac{\partial^2 C_d(q_d)}{\partial q_d^2}}{3\beta + 2\frac{\partial^2 C_d(q_d)}{\partial q_d^2}} \right) q_f + \left(\frac{2\beta + \frac{\partial^2 C_d(q_d)}{\partial q_d^2}}{3\beta^2 + 2\beta\frac{\partial^2 C_d(q_d)}{\partial q_d^2}} \right)(\tau - p) < 0 \tag{17A}$$

The foreign firm enjoys an increase in profits from a reduction in τ . The profit gain is directly proportional to $\frac{\partial q_f}{\partial \tau}$

Differentiated products

The same comparative statics analysis is repeated allowing for product heterogeneity. In this case, the profit maximization problem is as follows:

$$\max_{q_f} \pi_f(q_f, q_d, \tau) = [\alpha - \beta(q_f + \vartheta q_d)]\ q_f - C_f(q_f, \tau) \qquad (18A)$$

$$\max_{q_d} \pi_d(q_f, q_d, \tau) = [\alpha - \beta(\vartheta q_f + q_d)]\ q_d - C_d(q_d) \qquad (18A)$$

The first order conditions are:

$$\frac{\partial \pi_f(q_f, q_d, \tau)}{\partial q_f} = [\alpha - \beta(q_f + \vartheta q_d)] - \beta q_f - \tau = 0 \qquad (20A)$$

$$\frac{\partial \pi_d(q_f, q_d, \tau)}{\partial q_d} = [\alpha - \beta(\vartheta q_f + q_d)] - \beta q_d - \frac{\partial C_d(q_d)}{\partial q_d} = 0 \qquad (21A)$$

By total differentiation we get the following linear system:

$$\begin{pmatrix} -2\beta & -\vartheta\beta \\ -\vartheta\beta & -2\beta - \dfrac{\partial^2 C_d(q_d)}{\partial q_d^2} \end{pmatrix} \begin{pmatrix} \dfrac{\partial q_f}{\partial \tau} \\ \dfrac{\partial q_d}{\partial \tau} \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \qquad (22A)$$

Applying Cramer's rule we obtain:

$$\frac{\partial q_d}{\partial \tau} = \frac{\vartheta}{4\beta - \beta\vartheta^2 + 2\dfrac{\partial^2 C_d(q_d)}{\partial q_d^2}} > 0 \qquad (23A)$$

$$\frac{\partial q_f}{\partial \tau} = -\frac{2\beta + \dfrac{\partial^2 C_d(2q_d)}{\partial q_d^2}}{4\beta^2 - \beta^2\vartheta^2 + 2\beta\dfrac{\partial^2 C_d(q_d)}{\partial q_d^2}} < 0 \qquad (24A)$$

In order to study the variation in profits, we start by deriving the price effect for the domestic and the foreign firm, respectively.

Domestic firm:

$$\frac{\partial p_d}{\partial \tau} = -\beta\left(\vartheta \frac{\partial q_f}{\partial \tau} + \frac{\partial q_d}{\partial \tau}\right) \tag{25A}$$

Plugging in the results from equations 23A and 24A, we get:

$$\frac{\partial p_d}{\partial \tau} = -\beta\left(-\frac{2\beta + \frac{\partial^2 C_d(q_d)}{\partial q_d^2}}{4\beta^2 - \beta^2\vartheta^2 + 2\beta\frac{\partial^2 C_d(q_d)}{\partial q_d^2}}\vartheta + \frac{\vartheta}{4\beta - \beta\vartheta^2 + 2\frac{\partial^2 C_d(q_d)}{\partial q_d^2}}\right) \tag{26A}$$

and finally:

$$\frac{\partial p_d}{\partial \tau} = \frac{\vartheta\left(\beta + \frac{\partial^2 C_d(q_d)}{\partial q_d^2}\right)}{4\beta - \beta\vartheta^2 + 2\frac{\partial^2 C_d(q_d)}{\partial q_d^2}} > 0 \tag{27A}$$

A decrease in τ has a negative effect on the price of the domestic firm's product. The magnitude of the effect is inversely related to the degree of product differentiation. If $\vartheta = 1$ we are back in the simple case of product homogeneity, while as $\vartheta \to 0$ the effect approaches zero.

Foreign firm:

$$\frac{\partial p_f}{\partial \tau} = -\beta\left(\frac{\partial q_f}{\partial \tau} + \vartheta \frac{\partial q_d}{\partial \tau}\right) \qquad (28A)$$

$$\frac{\partial p_f}{\partial \tau} = -\beta\left(-\frac{2\beta + \frac{\partial^2 C_d(q_d)}{\partial q_d^2}}{4\beta^2 - \beta^2\vartheta^2 + 2\beta\frac{\partial^2 C_d(q_d)}{\partial q_d^2}} + \frac{\vartheta^2}{4\beta - \beta\vartheta^2 + 2\frac{\partial^2 C_d(q_d)}{\partial q_d^2}} \right) \qquad (29A)$$

$$\frac{\partial p_f}{\partial \tau} = \frac{2\beta - \beta\vartheta^2 + \frac{\partial^2 C_d(q_d)}{\partial q_d^2}}{4\beta - \beta\vartheta^2 + 2\frac{\partial^2 C_d(q_d)}{\partial q_d^2}} > 0 \qquad (30A)$$

A decrease in τ has a negative effect also on the price of the foreign firm's product. Finally, the variations in profits for both firms are computed.

For the domestic firm, by plugging the new results in equation 13A we get:

$$\frac{\partial \pi_d}{\partial \tau} = \frac{\vartheta}{4\beta - \beta\vartheta^2 + 2\frac{\partial^2 C_d(q_d)}{\partial q_d^2}}\left[\left(\beta + \frac{\partial^2 C_d(q_d)}{\partial q_d^2}\right)q_d + p_d - \frac{\partial C_d}{\partial q_d}\right] > 0 \qquad (31A)$$

For the foreign firm, going back to equation 16A, we get:

$$\frac{\partial \pi_f}{\partial \tau} = \left(-\frac{2\beta + \frac{\partial^2 C_d(q_d)}{\partial q_d^2}}{4\beta + -\beta\vartheta^2 + 2\frac{\partial^2 C_d(q_d)}{\partial q_d^2}} \right) q_f + \left(\frac{2\beta + \frac{\partial^2 C_d(q_d)}{\partial q_d^2}}{4\beta^2 - \beta^2\vartheta^2 + 2\beta\frac{\partial^2 C_d(q_d)}{\partial q_d^2}} \right)(\tau - p_f) < 0 \qquad (32A)$$

Following a decrease in τ, the foreign firm increases its profits. The effect is smaller for increasing levels of product differentiation.

FIGURE 1

Variation in import competition: 1995-2003

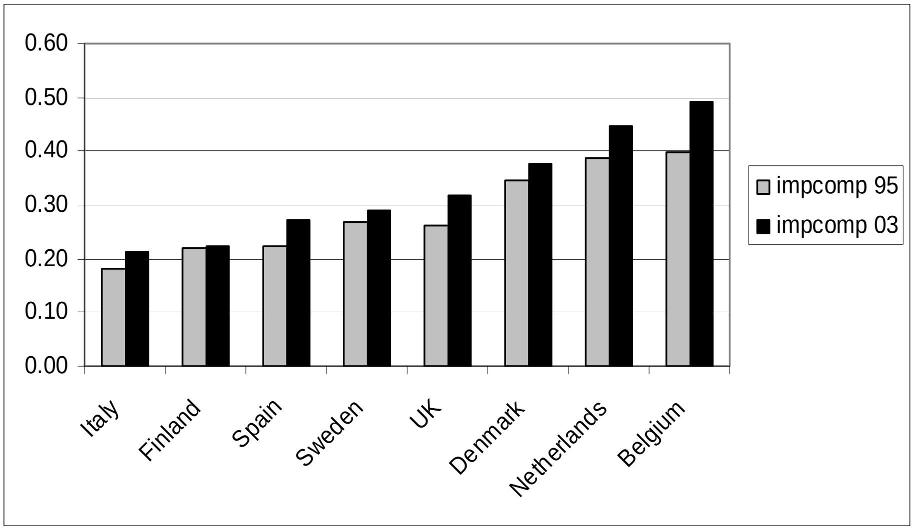

TABLE 1

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	

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