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Alessandro Olper, Lucia Pacca and Daniele Curzi
University of Milan, Italy
and
Centre for Institution and Economic Performance,
Catholic University of Leuven (A. Olper)

alessandro.olper@unimi.it
lucia.pacca@unimi.it
daniele.curzi@unimi.it

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Trade, Import Competition and Productivity Growth in the Food Industry*

Alessandro Olper [a,b] Lucia Pacca [a] Daniele Curzi [a]

[a] *Department of Economics, Management and Quantitative Methods (DEMM),University of Milan, Italy*

[b] *LICOS – Centre for Institution and Economic Performance, Catholic University of Leuven, Belgium*

Abstract. Melitz and Ottaviano's (2008) firm heterogeneity model predicts that trade liberalization induces a selection process from low to high productivity firms, that translates into an industry productivity growth. A similar firms' selection effect is induced by market size. These predictions are tested across 25 European countries and 9 food industries, over the 1995–2008 period. Using different dynamic panel estimators we find a strong support for the model predictions, namely that import penetration is systematically positively related to productivity growth. The results are robust to measurement issues in productivity after controlling for market size, country and sector heterogeneities, and for the endogeneity of import competition. Interestingly, this positive relationship is almost exclusively driven by competition in final products coming from developed (especially EU-15) countries, suggesting that EU food imports constitute closer substitutes for domestic production than non-EU imports. These results have some potentially interesting policy implications.

Keywords: Import competition, Productivity, Food Industry, European Countries, GMM
JEL: F13, F14, Q17

1. Introduction

In the last decades European food market has experienced an impressive growth in import competition coming primarily from multilateral and bilateral trade agreements, as well as from the enlargement to the Central and East European countries. The ratio of food import to apparent consumption increased substantially, passing from 16% in 1995 to the 42% in 2008. Yet, in the same period many EU countries have experienced a total factor productivity (TFP) growth close to zero, or even negative.[1] Thus the key question that arises is to what

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Corresponding author: Alessandro Olper, mail: alessandro.olper@unimi.it

[1] Considering EU-15 members and the time period covered by this analysis (1995–2008), seven out of fifteen EU members displayed a negative annual TFP growth rate in the food industry. These seven countries and the respective yearly average TFP growth rate (in bracket), are the following: Germany (–1.7%), Denmark (–0.61%), Spain (–0.7%), Greece (–3.8%), Italy (–0.58%), Luxembourg (–4.6%) and Netherlands (–0.89). For

extent the huge increase in the exposure to international trade of European food firms is at the heart of this slowdown in productivity growth.

In fact, despite the negative perceptions of the European public opinion towards globalization, there is theoretical (e.g Melitz, 2003; Melitz and Ottaviano, 2008) and empirical evidence, at both industry (e.g. Trefler, 2004; Chen et al. 2009) and firm level (e.g. Pavcnik, 2002; Aghion et al., 2006) for a positive relationship between trade openness and industry productivity growth.[2] However, with the exception of Ruan and Gopinath (2008), who investigated the effect of trade liberalization on the across countries reallocation of production in five food industries, no paper to date have had an explicit focus on the food sector. This is quite surprising, as food industry represents for several reasons an ideal case study for testing the relationship between trade openness and productivity growth. This is because although in the last decades this sector has experienced a process of trade liberalization, it still remains the most protected manufacturing sector in developed countries, as an effect of many border measures, like tariffs and non-tariff barriers. Therefore, understanding the relation between import competition and productivity is potentially rich in policy implications.

Starting from the firm heterogeneity model of Melitz and Ottaviano (2008), the present paper tests the predicted pro-competitive effect of trade liberalization on the within industry resources reallocation in the EU food sector. More specifically, the aim of the paper is to investigate the extent to which the significant growth of import penetration in the EU matters for the food industries productivity growth, and whether this impact changes when considering different origins of imports. We work with an unbalanced panel of more than 1600 observations across 25 European countries and 9 food industries at 3 digit level. To account for the difficulty to consistently estimate the productivity growth at industry level (see Rodrik, 2013), we rely on both real value added per person employed, and total factor productivity growth estimated from a Cobb-Douglass production function.

Import penetration is measured considering both import from the world and the ones differentiated according to the following origins: EU-15, New Member States (NMS), OECD non-EU and the BRIC countries. The idea is to investigate whether EU imports exert a more significant competitive impact than non-EU imports, i.e., constituting closer substitutes for domestic production. To overcome the well-known endogeneity issue between import penetration and productivity, and to take care of the growth dynamics, our econometric strategy relies on dynamic panel data approaches, using both fixed effects and the system generalized method of moments (GMM) estimator.

The main results show that growth in import penetration is systematically positively associated with a growth in productivity. The results prove to be robust to measurement issues in productivity after controlling for several observed and unobserved heterogeneities, and

an in-depth discussion about the source of the EU productivity growth slowdown in manufacturing, see O'Mahony and Timmer (2009).

[2] There exist also an important literature showing that the response of productivity to trade liberalization could be more ambiguous, especially for developing countries (see Goldberg and Pavcnik, 2007 for a review).

treating import penetration as endogenous to productivity. Interestingly, we show that this positive relationship is conditional to the origin of imports, and that it is almost exclusively due to competition in final products coming from developed (especially EU-15) countries. Thus, EU food imports constitute closer substitutes for domestic production than non-EU imports. This last result has important practical policy implications.

The remainder of the paper is organized as follows. In the next section we theoretically motivate our empirical exercise, by relying on the predictions from international trade models with heterogeneous firms. Section 3 describes the data, the measurement issues and our identification strategy. In section 4 the results are presented and discussed. Finally, in Section 5 the conclusions are drawn.

2. Theoretical considerations and hypotheses

From a theoretical point of view, several channels might explain the existence of a positive effect of trade and trade liberalization on productivity growth (see, e.g., Altomonte et al. 2008). A growth in market competition may stimulate firms to reduce their x-inefficiences or even lead the less productive firms to leave the market (Melitz, 2003; Melitz and Ottaviano, 2008). Other important channels consider the increased availability of foreign intermediate inputs with lower price or higher quality (Colantone and Crinò, 2011) and their effects on technological innovation (Grossman and Helpman, 1991), as well as the effects of a greater market size due to scale economies and selection effects (Krugman and Helpman, 1985; Melitz and Ottaviano, 2008). In what follows we focus our attention on the first and the last of the above channels to motivate our empirical exercise, considering the most recent extension of the Krugman (1981) monopolistic competition trade model in presence of firms heterogeneity. More precisely, we sketch a simplified version of the Melitz and Ottaviano (2008) model, along the line of Melitz and Trefler (2012).

2.1 Market size, trade and productivity in a firms heterogeneity model

On the demand side, the Melitz and Ottaviano (2008) model is based on quasi-linear preferences over a continuum of varieties index by i, endogenously determined. Under this setting demand for varieties is linear in prices and, unlike the standard 'love for varieties' monopolistically competitive setup (Dixit and Stiglitz, 1977), the price elasticity of demand depends on the number of varieties, equal to the number of firms in the sector. Variation of the number of firms (varieties) in the market is the key mechanism through which trade integration affects firm performance.

On the supply side, labour is the only factor of production. In a monopolistically competitive industry firms compete by producing different varieties of the same product, that are close substitutes. Firms differ only in their marginal costs c_i, or in their productivity $1/c_i$. Panel A of figure 1 represents the production quantitative and the price choices of two of these firms. Every firm faces the same (residual) demand curve *D*, that depends on the behavior of the other firms in the market. On the production side we assume that the marginal cost of firm 1 is lower than that of firm 2, namely $c_1 < c_2$ or, equivalently firm 1 has a higher productivity than firm 2.[3] Moreover, the model assumes the existence of scale economies, due to fixed costs incurred to develop a product and to setup the initial production.

Under this structure, firms 1 and 2 will set the level of the output q_i by maximizing the respective profit, such that $q_1 > q_2$ and $p_1 < p_2$. Moreover, firm 1 will also set a higher markup than firm 2, namely $p_1 - c_1 > p_2 - c_2$. Thus, firm 1 earns a higher operating profit than firm 2, $\pi_1^0 > \pi_2^0$. This is represented in panel A of Figure 1 by the area of the rectangle comprised between the price and the marginal costs of the two firms, and the respective production level. If we assume that all the firms have the same setup costs *f*, then firm 1 will also have the higher *net* profit. Thus under this assumption of different marginal costs, firm 1 will set a lower price but at a higher markup over marginal cost, produce more output, and earn higher profits.

From panel A of figure 1 we can define the cutoff level of marginal costs c^* where the operating profit is zero. Each firm has a positive operating profit so long as its marginal costs is below the intercept of the demand curve on the vertical axis. Panel B of Figure 2 depicts how the level of firm profit varies with the marginal costs c_i. A firm with a marginal cost above the cutoff, $c_i > c^*$, is out of the market, as it has a negative operating profit. Clearly, if this firm had known about its high marginal costs prior to the decision to enter, having to spend the fixed cost *f*, it would have remained out of the market.

Next, the model assumes that entrant firms face some randomness about their future production cost c_i, and that this will disappear only after the setup costs *f* is paid and is sunk. This uncertainty about the future realization of production cost means that for same firms the entry decision is wrong, since their net profit will be negative as an effect of the sunk fixed costs *f*. This is the situation faced by firm 2, who experiences a positive operational profit, but a negative net profit, because it does not cover the fixed costs *f*. Differently, some firms – this is the case of our firm 2 – will discover that their production cost c_i is low and the net profit will be positive.

The long-run equilibrium with firm heterogeneity is thus different with respect to the case in which all firms realize the same cost c_i. In this case, the entry decision drives the realized net profit to zero for all firms. Instead, with firms heterogeneity the expected net profit is once again zero, but the *realized* net profit will vary, as shown in panel B of figure 1 that depicts the industry equilibrium for a given market size. The figure shows that firms with cost $c_i < c^*$ will survive and produce, with a profit that varies with c_i.

The key question is now what happens to this firm heterogeneity equilibrium when the economies integrate in a larger market. First, a larger market means more competition because it can support a larger number of firms. Now suppose that, for whatever reason, market

[3] It is important to note that similar conclusions can be drawn by assuming that firms are heterogeneous not in terms of productivity, but of quality of produced goods (see Melitz, 2003; Crinò and Epifani, 2012). Curzi and Olper (2012) applied a similar model to study the extent to which heterogeneity in products quality affects the export performances and behavior of Italian food firms.

competition increases without an increase in market size. This will generate an inward shift in each firm's residual demand curve as depicted by the dot line in Figure 2 (panel A) or, put differently, the market share of every firm will shrink. Differently, if we assume to take market competition as fixed, an increase in market size will induce a flatter residual demand curve for all firms, namely every firm that reduces the price will gain a higher market share. The two combined effects are depicted in Figure 2 by the counterclockwise rotation of the demand curve from *D* to *D'*.

These changes in market size and market competition affect differently the heterogeneous firms in the market. From the perspective of smaller firms that operate on the (left) higher part of the demand curve, the downward rotation of residual demand curve means that here the effect of tougher competition dominates. On the other hand, from the perspective of the larger firms that operate on the lower (right) part of the demand curve, the residual demand shifted upward suggesting that here the effect of the larger market size dominates. In panel B of figure 2, the overall effects of these changes in the demand conditions due to market integration are summarized.

First, the reduction of the residual demand for smaller firms implies that the cutoff production cost will move to the left at a new lower cost $c^{*\prime}$. Now firms with a higher cost level, namely $c_i > c^{*\prime}$, cannot survive the decrease in the demand and are forced to exit. At the same time firms with a lower cost level can exploit the flatter demand curve by lowering their markup (hence their price) in view of the increased competition, gaining additional market share.[4] Thus, as an effect of market integration we have winners and losers as depicted in panel B of figure 2. The lower costs firms will earn a higher operative and net profit, while the high-cost firms will contract, with the highest cost firms exiting.

In summary, in the Melitz and Ottaviano (2008) model the effect of economic integration does not affect directly firm productivity. Yet, market integration will generate an overall increase in industry (or aggregate) productivity, as market share is relocated from low-productivity firms with high marginal costs to the high-productivity ones with low marginal costs (Melitz and Trefler, 2012).

2.2 Discussion and extensions

The above predictions suggest that as an effect of an increase in import competition, due for example to multilateral or bilateral trade agreements, the new competitive environment should induce a (industry) productivity growth. This growth in productivity is due to a process of firms selection, namely a re-allocation of production and market share from the lower to the higher productivity firms. This productivity growth effect is the combination of an increase in market size and an increase in competition due to the new (foreign) varieties that compete in the market. Thus in this model, welfare gains from trade come from a

[4] Note that smaller or high-cost firms cannot further reduce their markup to exploit the flatter demand, as they have already set low markup to contrast the competition of the low-cost firms in the pre-integration equilibrium (see Figure 1).

combination of productivity gains (via selection), lower markups (pro-competitive effect), and increased product variety.[5]

Since our objective is to study empirically the impact of an increase in import competition on productivity growth, it is important to achieve a deeper understanding of some peculiarities of the model setup, that will be useful to guide our empirical exercise. Specifically, the focus will be on the role played by market size in the model, and the resulting differences between the short vs. long run effects of trade liberalization.

First, concerning market size, as it is evident from the discussion above, the model also predicts the so called 'home market effect', namely the fact that in larger markets the price and markup of the average firm should be lower and productivity higher, as an effect of the tougher competition (see Melitz and Ottaviano, 2008; Chen et al. 2009). This market size forces affect the long-run equilibrium in average firm size, markups, and productivity in a way that is observationally equivalent to the effect of import competition. Thus, it is important to understand the consequence of market size differences for cross-country characteristics in the open economy equilibrium. In fact, in this model (costly) trade does not completely integrate markets, because the respective country size plays an important role in determining all firm performance measures and welfare in each country (Melitz and Ottaviano, 2008). For example, when trade costs between two countries are symmetric, the larger country will have a lower cut-off c^*, and thus higher average productivity and product variety, and lower mark-up and prices. Thus, all the size-induced differences across countries persist also in the long-run open-economy equilibrium. This implicitly suggests that if we want to isolate empirically the import competition effects on productivity, we need to control properly for this country size effects.

Second, concerning the predictions of the model in the short vs. long run, we have to consider how differences in market size affect the number of new entrants. In the short run, the number of firms in each market is fixed. Trade liberalization induces the same qualitative results as before, although these effects do not depend on relative country size, but only on firm selection induced by the reduction in the cut-off cost c^*. In the long run, as an effect of trade liberalization, a difference in the country size induces important changes in the relative pattern of entry (and competition), as a bigger market becomes relatively more attractive. Thus, location decisions will affect the long-run consequences of trade liberalization. Interestingly, under certain conditions, the long-run impact of falling trade costs could be reverted as opposed to the short run. This is because in the long run firms respond to increased competition by relocating to more protected overseas markets, as the fall in trade costs makes it more viable to serve the domestic market through exports from there (Chen et al, 2009).

[5] In this kind of model, the decrease in the number of producers due to firms selection is always dominated by an increase in the number of new exporters, so that as an effect of trade liberalization the number of varieties always increases.

More in general, the long-run effect of trade liberalization in Melitz and Ottaviano (2008) will depend on the kind of liberalization (i.e. unilateral vs. bilateral) and on the nature of the setup fixed costs *f*. With unilateral liberalization, the liberalizing country will experience once again an increase in productivity and welfare in the short run, but lower productivity and welfare in the long-run. This is due to firm localization decisions, which will make the number of entrants shrink, leading to lower competition. Differently, in presence of setup costs that are endogenous to trade costs, it can be shown that the effect of trade liberalization becomes ambiguous in the long run. Thus, while in the short run the model unambiguously predicts a productivity growth effect of higher import competition, in the long run, as an effect of firm localization decisions, this prediction is ambiguous and can be even reversed.

3. Econometric identification, data and measures

3.1 Econometric strategy

Given the prediction of the theoretical model, our focus here is only on the short run effect of import competition on productivity. This is because the long run predictions of the model are ambiguous, and difficult to be estimated with a panel data structure that is unbalanced and has a quite short time dimension.[6]

Our starting point is a standard productivity growth equation on panel data (Caselli et al. 1996). Formally, the growth of real labor productivity Δy_{cit} of country *c* in industry *i* in year *t*, can be represented by the following empirical equation

(1) $$\Delta y_{cit} \equiv ln y_{cit} - ln y_{cit-1} = \beta_0 + \beta_1 ln y_{cit-1} + \beta_2 \Delta IP_{cit-1} + \gamma X_{cit-1} + \varepsilon_{cit}$$

where the lagged productivity level y_{cit-1} is the standard convergence term; $\Delta IP_{cit-1} \equiv lnIP_{cit-1} - lnIP_{cit-2}$ is the growth rate of import penetration lagged one year; X_{cit-1} is a set of other covariates; finally ε_{cit} is an error term. Our interest is on the sign and significance level of the import penetration coefficient, that captures the short run effect of import competition on labor productivity growth. As discussed in the previous section, the theoretical prediction is that $\beta_2 > 0$.

Our main concern in estimating equation (1) is that import penetration could be an endogenous variable potentially reflecting the influence of many factors. For instance, as suggested by the political economy literature, firms in low productivity sectors may lobby for protectionism, which would lead to a positive bias in the estimate of the trade openness effect on productivity (see Trefler, 1993; 2004). Moreover, as better explained in the data section, sectoral productivity estimation suffers from the lack of specific deflators at industry level (see Rodrik, 2013), raising issues of measurement error in the dependent variable. Thus, the

[6] Chen et al (2009) used, among other things, an error correction model to capture this long run effects. However, as recognized by the authors themselves, this specification is particularly demanding in terms of time series property of the panel, that is problematic when the panel structure is unbalanced and relatively short in his time dimension.

assumption about the error term is crucial for our identification hypothesis. We address these endogeneity issues in different ways.

First, we assume that the error term, $\varepsilon_{cit} = \mu_c + \vartheta_{it} + \omega_{cit}$, comprises industry-year fixed effects, ϑ_{it}, time-invariant country fixed effects, μ_c, and an identically and independently distributed time-varying component, ω_{cit}. As a result, β_2 only picks up the impact of competition on country-industry growth that departs from their trend growth. To the extent to which the price dynamic at the food sub-sectors level does not vary too much across countries, by introducing industry-year fixed effects we significantly attenuate measurement error in productivity due to the lack of food sub-sector deflators (see Rodrik, 2013, for a discussion). Moreover, note that the inclusion of country and industry fixed effects transforms the growth equation (1) in a difference-in-differences specification, where we assume that, after removing country and industry observed and unobserved heterogeneity, the lagged growth in import penetration is exogenous to productivity growth.

Second, a potential issue in estimating the growth equation (1) with a full set of fixed effects, is that the lagged level of the dependent variable tends to be endogenous in a panel with a short time structure (see Arellano and Bond, 1991).[7] To avoid this inconsistency, Arellano and Bond (1991) propose a Generalised Method of Moments (GMM) estimator as an alternative to the least square with dummy variable (LSDV). They suggested transforming the model into a two-step procedure based on first difference to eliminate the fixed effects, as a first step. In the second step, the (endogenous) lagged dependent variable is instrumented using the $t - 2$, $t - 3$, and longer lag levels of the dependent variable. Moreover, as the output displays strong autocorrelation, its lagged levels tend to be weak instruments. To overcome this issue, we use the system GMM (SYS-GMM) estimator (Blundell and Bond, 2000) that exploits also the second moment conditions of the level equation.

An important feature of this estimator is that measurement errors in the dependent variable can be accounted for through a proper instruments specification. Moreover, it also gives the possibility of treating any right-hand side variable suspected to be endogenous – like import penetration – in a way similar to the one for the lagged dependent variable, by using its $t - 2$, $t - 3$, and longer lag levels and differences as instruments for the first difference and level equation, respectively (see Bond et al. 2001). The validity of a particular assumption can then be tested using standard generalized methods of moment tests of overidentifying restrictions. In summary, the SYS-GMM specification should allow for greater flexibility and greater consistency even in presence of endogenous regressors.

3.2 Data and measures

Our data cover the 1995-2008 time period, for a sample of 25 European countries and 9 processed food industries, based on NACE Revision 1.1 3-digit classification. The panel is

[7] Note however that, the standard dynamic panel bias translates in a downward bias estimation of the convergence term β_1, but its effect on the import penetration coefficient of interest, β_2, tends to be close to zero.

unbalanced, as data availability varies by country and industry. In particular, data for the New Member States are not available before 1999.

3.2.1 Dependent Variables

The hypothesis of a growth effect of import competition is tested using two different dependent variables: labour productivity, measured as real value added per employee, and total factor productivity (TFP), derived from our estimate. Eurostat SBS (Structural Business Statistics) provides data on nominal value added at factor cost, number of employees, and gross fixed capital formation. Data on gross fixed capital formation are used to estimate the capital stock, following the perpetual inventory approach (see Hall et al., 1988; Crego et al., 1998; Gopinath and Ruan, 2008). Formally

$$K_t = (1-d)K_{t-1} + I_{t,}$$

where K is capital stock, I is the gross fixed capital formation and d represents the depreciation, assumed at a constant rate of 0.8.[8] TFP is then estimated using a value-added function which allows for country, industry ad time-specific effects and assumes variable returns to scale (see Harrigan, 1999; Ruan and Gopinath, 2008). The TFP estimation process and the results are explained in details in Appendix 1.

Real value added and real gross fixed capital formation are computed starting from nominal values and by using price indices (2000 = 100) from Eurostat, National Accounts. Value added price indices are available for the food sector, while the ones of the overall manufacturing sector have been used to deflate gross fixed capital formation.

The lack of specific deflators at the industry level potentially raises a problem of measurement errors in the dependent variable that needs to be accounted for in our econometric analysis. For this purpose, as explained above in the identification section, we tackled this issue in two different ways. First of all, following Rodrik (2013), the absence of industry specific price indices can be overcome by including in our regressions a set of time-varying industry fixed effects, which turns out to capture the omitted industry-year specific deflators. Second, use was made of the system GMM estimator which is also suitable in presence of endogeneity due to measurement errors in the dependent variable (see Bond et al., 2001).

Table 1 reports cross country and cross industry values for our two dependent variables. The basic data reveals a strong variability among countries, being the newest member states from Eastern Europe (Bulgaria and Romania) the least productive, and Ireland and Great Britain the ones with higher productivity levels. Across time productivity measures show an average TFP growth of 2.9% per annum, and a labour productivity growth of 3.8%. However, our dataset displays a strong variability of productivity growth across countries and industries.

[8] Initial capital stock is obtained as follows (Hall et al. 1988): $K_0 = I_{t0}/(d+g)$, where g is a country-specific average rate of growth of gross fixed capital formation over the 10 pre-sample years in the aggregate economy, taken from WDI dataset, and d (depreciation rate) is set equal to 0.8.

3.2.2 Import Penetration

In order to compute the import penetration (IP), we need information on trade flows (imports and exports) and production values. Data on production are collected from Eurostat SBS, while import and export values are taken from Eurostat COMEXT at CN 8-digit level and aggregated at 3-digit NACE Revision 1.1 level. Import penetration in a country c, within an industry i, in year t is obtained by weighting the import value from a partner z with the apparent consumption of country c:

$$IP_{czit} = \frac{IMP_{czit}}{IMP_{cit} + PROD_{cit} - EXP_{cit}}$$

where partner z, when computing total import penetration in a country c, is the world.
In order to differentiate the effect of import competition depending on the group of partners, the index is also computed for 4 sub-groups: EU-15 countries, New Member States, BRICs, and OECD non EU countries.

As shown in table 1, where total import penetration is reported, there is strong heterogeneity among industries. The least integrated sector is the production of animal feeds (average IP = 0,16), while the most open to foreign imports is fish (average IP = 0,61). Graphs in figure 1 show both the evolution over time and the variability among countries of import penetration. Not surprisingly given their small dimensions, in most sectors Netherlands and Belgium prove to be the countries affected by the strongest import competition, while Italy and Spain are the ones with minimum import penetration values. Over time import penetration shows an average annual growth rate of 6.5% in the observed period, with some country-sector combinations representing an exception as they show a decreasing trend over the last few years (e.g. animal feeds in Austria, fish in the Netherlands).

3.2.3 Other covariates

In order to test the effect of import competition on productivity growth, we control for other covariates suggested by the theory and by previous empirical works. First, the traditional 'home market effect', namely the tendency to concentrate the production of a good near to the largest market (Krugman, 1980). As pointed out by Melitz and Ottaviano (2008), market size induces important changes in the industry distribution and performance measures, as bigger markets tend to exhibit tougher competition and a resulting higher productivity. In our regressions, we control both for average firm size, which is assumed to be higher in large markets (Melitz and Ottaviano, 2008) and for market size through the logarithm of real GDP (Chen et al. 2008). Data on production value and the number of enterprises are taken from Eurostat SBS, while real GDP is taken from Eurostat.

Moreover, following Trefler (2004), general industry business conditions are introduced in the model through the term Δb_{cit}. This results from estimating the extent to which a variation in real GDP and real exchange rate affects every industry s in the country c. More specifically, Δb_{cit} is generated by estimating the following regression

$$\Delta y_{cit} = \theta_{ci} + \sum_{j=0}^{J} \theta_{cij}\, \Delta z_{c,t-j} + \varepsilon_{cit},$$

where Δy_{cit} is the annual productivity growth[9] for country c and industry i, and $\Delta z_{c,t-j}$ represents the annual growth of the (log) of GDP_{ct} and (log) of RER_{ct}, with $J = 1$. We set J equal to 1, because the use of longer lags would make us loose too many (country-sector) observations.[10] Then, Δb_{cit} is generated by taking the (country) industry-specific predictions of the effect of current and past business conditions on current productivity growth, and represents the proportion of country-industry productivity growth driven by movements in GDP and real exchange rate. Since the term Δb_{cit} is endogenous by construction, it will enter the empirical equation lagged one year.

4. Results

4.1 Benchmark regressions

Table 2 reports estimates of equation (1) based on simple OLS and LSDV, using labour productivity as dependent variable. The table includes several different specifications in order to show that the estimates of β_2 are not particular sensitive to the choice of the specification. In Column 1 we start testing if in our country-industry sample there is absolute convergence, just by regressing productivity growth on the one year lagged level of productivity. The estimated convergence coefficient is negative and strongly significant (p-value < 0.01), confirming the recent evidence reported by Rodrik (2013), who finds strong support for absolute convergence in the manufacturing sector.[11]

Column 2 adds the import penetration ratio. The estimated effect of the one year lagged growth in import penetration is positive and highly significant (p-value < 0.01), a result in line with the prediction from the theory summarized above. The magnitude of the estimated coefficient suggests that a 1% increase in the growth of import penetration boosts industry productivity growth by about 0.11%, not a marginal effect from an economic point of view.

Regressions from 3 to 5 include in sequence the one year lagged values of the log of average firm size, country size measured as the log of real GDP and the (lagged) variation in business conditions, respectively. The coefficient on average firm size has its expected positive sign and significance (p-value < 0.05). This suggests that, as predicted by the theory, when controlling for import competition, larger markets tend to have higher productivity,

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[9] Productivity is expressed in terms of value added or total factor productivity, depending on how the dependent variable is measured.

[10] The estimation of Δb_{cit} is based on time series regressions at country-industry level. Thus, for country-sector combinations with less than 8 years of observations, using e.g. $J = 2$ means to run regressions with less than 6 observations, and makes the identification impossible because of the insufficient number of degrees of freedom.

[11] Rodrik (2013) found a convergence coefficient of 0.026 for the aggregated food industry, working across a large sample of developed and developing countries and with annual growth rate averaged over ten years. Our higher convergence coefficient (0.040) is the result of working with a different level of aggregation (2 digit vs. 3 digit) and with a country sample of only developed countries and, perhaps more importantly, of the use of a yearly industry growth equation, an approach that can exacerbate measurement errors in the dependent variable (see Barro, 2012).

ceteris paribus. Differently, the GDP coefficient loses its significance when lagged business conditions are added (see column 5).[12] However, more interesting is the fact that controlling for market size and business conditions does not almost affect the magnitude of the import penetration coefficient.[13]

In column 6 we add industry-year fixed effects to control for industry heterogeneity and the possible measurement errors coming from the lack of industry specific deflators. The results are very robust to this specification, and the estimated coefficient on import penetration significantly increases in magnitude suggesting that, if anything, the bias in measurement error seems to work against the positive relationship between import penetration and productivity. Finally, in column 7 we also control for country heterogeneity by adding country fixed effects. Even in this case, the coefficient on import penetration is significantly positive being only affected by a slight reduction. Regression 7 represents our preferred specification, and suggests that a 1% increase in the import penetration growth rate leads up to 0.11% rise in labour productivity growth.

Table 3 reports the same battery of regressions as table 2, but now we use TFP as the dependent variable. The results are quite similar to the previous ones, but some relevant exceptions are worth noticing. Once again we confirm absolute convergence in TFP, and a strong positive effect of import competition on TFP growth irrespective of the specification. Now the elasticity of TFP growth to import penetration, equal to 0.10 in our preferred specification, is just slightly lower than before. Interestingly, using TFP as dependent variable the market size effect represented by GDP retains its significance level in all the specifications (see regressions 5-7). This suggests that market size effects are magnified when controlling for the effect of capital and the related investment flows. A possible interpretation of this findings is that in bigger markets capital cost is lower and, for any level of firm size, firms have a higher capital labour ratio and are thus more efficient.

Overall, the above results point to a positive effect of import penetration on productivity growth. This results is robust to different specifications, obtained by controlling for market size and business conditions, and by the use of different productivity measures.

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[12] Note that, if we control for the investment rate the coefficient on GDP maintains its significance in all the specifications, and the investment rate turns out to be positive and significant. Moreover, the effect on import penetration does not almost change in this additional specification. We decide do not to show this regression (disposable upon request) for two main reasons. First, the well know problem of endogeneity of investment rate to productivity growth. Second, and most importantly, the fact that in the TFP regressions of Table 3, we in fact implicitly control for both investment and the capital labour ratio.

[13] It is worth noticing that when we condition the productivity growth regressions to other covariates the convergence term significantly increases in (absolute) magnitude. This results have an interest per se because, when read in the context of the neoclassical growth theory, it suggests that these covariates do not only affect the transitional growth path, but are also determinants of the steady-state productivity level.

4.2 Are the effect of competition sensitive to the origin and nature of imports ?

An interesting issue is understanding whether the positive effect of import penetration on productivity depends crucially on the origin of imports. For example, Chen et al. (2009) found that at the manufacturing level, EU and extra-EU import competition exert a similar effect on productivity growth. As for our context, what matters is the degree of substitutability between EU food products and food products coming from the rest of the world.

In order to investigate this question, we split the effect of import penetration into four different components depending on the trading partner: EU-15, OECD non EU countries, NMSs, and BRICs import penetration. Results from these additional regressions are reported in Table 4. As it is clear from the figures, in the food industry what matters is import competition coming from the EU markets. Differently, considering imports from rich developed countries (OECD non EU), the estimated effect is still positive, but not statistically significant. Moreover, note that the magnitude of this effect turns out to be more than ten times lower than the one of EU15 imports (0.1 vs. 0.011).[14] When we consider import competition coming from NMSs or BRICs the estimated effects on productivity is never statistically significant, and the import penetration coefficient is very low in magnitude and even negative in sign.

Thus, there is strong evidence supporting the view that EU food imports constitute closer substitutes for domestic production than non-EU imports. Moreover, there are also some indications that this effect is largely attributable to quality competition more than to price competition. Differently, it is difficult to explain why imports coming from NMS, a group of countries fully integrated in the EU market, do not exert any relevant effect on productivity. Overall, these results are consistent with the notion that richer countries import higher quality foods from other rich countries – namely the Linder (1961) hypothesis (see Curzi and Olper, 2012).

A final issue addressed in Table 3 consists in trying to isolate the effect of import competition in final products, a mechanism highlighted by Melitz and Ottaviano (2008), from the one related to the increased availability of foreign intermediate inputs with lower price or higher quality (see Altomonte et al. 2008; Colantone and Crinò, 2011). In order to do that, we make use of the classification by Broad Economic Categories (BEC) to differentiate between intermediate and final imported foods (see Olper and Raimondi, 2008).[15]

The last two rows of Table 4 report results which come from using measures of import penetration in terms of intermediate and final goods, respectively. The estimated effects are positive for both intermediate and final goods, but only the last coefficient is significantly different from zero, although only at the 10% level, and with a magnitude which is quite close

[14] In interpreting these findings, it can be important to note that in the observed period the annual growth rate in import penetration has been negative for the OECD (non EU) trading groups (–3.5%), and strongly positive for the NMSs (+19%) and the BRICs (+7.1%).

[15] Note that to properly disentangle intermediate from final goods, we need appropriate weights from input-output tables (i.e. Altomonte at al. 2008). However, these tables do not exist at 3 digit level of aggregation. So we are forced to use the BEC classification that represents a rough approximation.

to our benchmark specification. Thus, although some caveats are in order, as the BEC classification only imperfectly permits a classification in intermediate and final goods, there is clear evidence that the significant effect of openness on productivity arises primarily from competition in final products, a result in line with the theoretical predictions.

4.3 Robustness checks to further endogeneity issues

In what follows, we report robustness checks to show that our findings are robust to different forms of endogeneity bias. In the previous sections, by running regressions with a full set of country and industry-year fixed effects, and by treating all the right-hand side variables as predetermined, we already controlled for endogeneity bias due to selection bias and to country and industry heterogeneity. However, as discussed above, our findings may still be problematic mainly for two reasons.

First, the endogeneity of import penetration may be due to political economy reasons. Indeed, the least productive and declining industries may lobby for protection (Trefler, 1993). This political economy mechanism may introduce a positive correlation between import competition and productivity with a causality that runs from lower productivity to lower import penetration (or higher trade protection), and not the other way around. Second, the lack of industry specific deflators for the value added and the capital can add measurement errors in our dependent variables, an issue that is exacerbated by working with growth regressions on yearly data (see Barro, 2012).

To address whether these further endogeneity bias can affect our conclusions, we exploit the properties of the system GMM estimator. Specifically, we follow the usual treatment for an endogenous variable and we instrument import penetration by using its $t-2$ and longer lag levels for the first-difference equation, and its $t-2$ differences for the level equation. Moreover, to address measurement errors the lagged dependent variable is now instrumented with its $t-3$ and longer lag levels for the equation in first-differences and the $t-2$ differences and longer lags for the equation in levels (see Bond et al. 2001). In addition to this, we account for the fact that our business conditions variable (Δb) is a generated regressor raising further potential endogeneity problem. Thus we instrument it with its $t-2$ and longer lags.

Table 5 reports the results obtained by using both labour productivity and TFP as dependent variables. The bottom of the table reports the standard tests used to check for the consistency of the SYS-GMM estimator (see Roodman, 2009). The Arellano-Bond test for autocorrelation indicates the presence of first order serial correlation but rejects second order autocorrelation at 5% statistical level in all the specifications. Hence, under this circumstances the OLS estimator is inconsistent, while the use of a dynamic GMM specification is correct. Moreover, the standard Hansen test rejects in all the specifications the hypothesis that our set of instruments is invalid.

The overall results are robust to these further endogeneity problems, though some additional insights can be gained from the system GMM specifications. Once again, we find a robust positive effect of (world) import penetration and on productivity growth with a magnitude of the estimated effect which is very close to the LSDV counterpart, and around 0.1 (see columns 1-2).[16] What is new is the result which emerges when import penetration from the OECD (non-EU) countries is considered. Indeed, accounting for the endogeneity in the import penetration ratio now the estimated effect turns out to be significantly positive (*p*-value < 0.05) in both the labour productivity and TFP regressions, although the magnitude of the coefficient is about a tenth of the overall effect (see column 3-4). This is a remarkable result because, given the common external tariffs of the EU system, if one has to find some endogeneity bias due to political economy reasons, the first candidate is indeed food import coming from other developed countries.

The SYS-GMM results strongly confirm that what matters are imports in final, instead of intermediate, food products (see columns 5-8). Moreover and this is interestingly, by comparing the results of regressions 8-9 in table 4 with regressions 5-8 in table 5, we systematically find that when import penetration is treated as endogenous, its estimated effects increase in magnitude and significantly level but only for final goods regressions. This findings is fully consistent with the positive theory of the trade policy formation where, as an effect of the lobbies game, the unorganized consumer group bears the burden of protection (see, e.g., Grossman and Helpman, 1994).

Finally, considering other determinants, SYS-GMM regressions confirm that, after controlling for import competition and business conditions, measures of market size exert a strong positive effect on productivity growth, a result totally in line with the model predictions.

5. Conclusions

The aim of the paper was to test the main predictions from the firm heterogeneity model developed by Melitz and Ottaviano (2008), considering the food industry as a relevant case. These authors showed that trade liberalization should induce a firms' selection process from low to high productivity firms, which results in an industry productivity growth. A similar firms' selection effect is induced by market size.

These predictions are tested across 25 European countries and 9 food industries, over the 1995 – 2008 period. Using different dynamic panel estimators we find strong support for the key prediction of the model about the pro-competitive effects of import penetration in the short run. An increase in domestic import penetration tends to accelerate productivity growth. In particular, we find that a 1% increase in import penetration ratio would result in a rise in productivity growth that ranges from 0.09% to 0.14%, depending on the productivity measure and the econometric specification. As during the observed period the world import penetration has registered a growth of around 6% per year, and TFP has increased by 2.9%

[16] To save space we omit regressions considering EU-15, NMS and BRIC as trading partners, as they do not add anything to our discussion.

per year, the pro-competitive effect of import penetration is supposed to account for more than 20% of the overall growth in TFP. All these numbers are remarkably similar to previous findings (e.g. Trefler, 2004), suggesting that the contribution of international trade policy to productivity growth can be substantial.

We interpret this evidence as the empirical counterpart to the increased competition induced by foreign firms entering the domestic market as a result of diminished trade costs. Moreover, and consistently with the model predictions, we also find that, after controlling for import competition, market size matters for productivity levels and growth.

Overall, the positive relationship between import competition and productivity growth is robust to measurement issues in productivity. This robustness is checked by controlling for market size, country and sector heterogeneities, and for the endogeneity of import competition. Interestingly, this positive relationship is almost exclusively due to competition in final products coming from developed (especially EU-15) countries, suggesting that EU food imports constitute closer substitutes for domestic production than non-EU imports.

These results, taken together, have interesting practical implications. First, they support the notion that a trade policy which contributes to a more competitive environment is beneficial for economic growth and welfare. Second, the fact that food products coming from developing countries do not exert a significant pro-competitive effect suggests that European countries should not worry too much about the adverse effects of competition – i.e. on unemployment – from developing countries' exports, due, for example, to further trade liberalization. This is because price competition is softened by vertical differentiation through quality differences, and the (European) cultural bias towards high quality foods represents a sort of natural protection against third countries competition.

Appendix 1
TFP estimation

Following the method developed by Miller and Upadhayay (2002) and recently applied by Gopinath and Ruan (2008), total factor productivity is estimated for each country *c* and industry *i* at time *t* from a Cobb Douglas production function

$$Y_{cit} = A_{cit}\, K_{cit}^{\alpha}\, L_{cit}^{\beta}\ ,$$

where *A* is an index of total factor productivity, *K* equals capital stock, and *L* equals the number of employees.

Allowing the possibility of non-constant returns to scale, and putting capital and TFP on a per worker basis, the resultant equation will be

$$y_{cit} = A_{cit}\, k_{cit}^{\alpha}\, l_{cit}^{\alpha+\beta-1}$$

where $\alpha + \beta - 1$ indicates the function's deviation from constant return to scale. The estimable form of the equation results from rewriting it in natural logarithms

$$lny_{cit} = lnA_{cit} + \alpha lnk_{cit} + (\alpha + \beta + 1)lnl_{cit}.$$

In order to account for the TFP variability across countries, industries and time, we perform a fixed effects specification

$$lny_{cit} = lnA_{cit} + \alpha lnk_{cit} + (\alpha + \beta + 1)lnL_{cit} + b_c + b_i + b_t + \varepsilon_{cit},$$

where b_c, b_i and b_t are, respectively, country, industry and time intercepts, and ε_{cit} denotes a disturbance term. As a result, the estimated logarithm of total factor productivity is given as the constant, plus country, industry and time specific fixed effects, plus the error term.

Table A1 reports the results of the TFP estimation described above. Both coefficients on capital per labour unit and log of employment are statistically significant at the 1 per cent level. The first indicates an elasticity of value added to capital of 0.241; the second is equivalent to –0.075, suggesting decreasing returns to scale in the food industries, consistently with previous literature (see Ruan and Gopinath, 2008).

TFP is derived across countries, industries and time, revealing the presence of strong heterogeneity in all the three dimensions.

Table A.1

TFP estimation results

	Ln LP				
Log (*K/L*)	0.241***				
	(0.022)				
Log (*L*)	–0.075***				
	(0.013)				
Country intercepts			**Year Intercepts**		
Austria	8.738***	(0.277)	1995	0.0118	(0.0422)
Belgium	8.873***	(0.284)	1996	-	-
Bulgaria	6.197***	(0.261)	1997	0.00670	(0.0392)
Cyprum	7.974***	(0.256)	1998	-0.00304	(0.0391)
Czech Republic	7.377***	(0.261)	1999	0.0234	(0.0366)
Germany	8.814***	(0.286)	2000	0.00590	(0.0380)
Denmark	8.686***	(0.283)	2001	0.0184	(0.0363)
Spain	8.728***	(0.277)	2002	0.0426	(0.0344)
Estonia	7.336***	(0.247)	2003	0.0879**	(0.0344)
Finland	8.481***	(0.287)	2004	0.0756**	(0.0354)
France	8.812***	(0.291)	2005	0.122***	(0.0345)
Great Britain	9.085***	(0.291)	2006	0.140***	(0.0352)
Greece	8.002***	(0.269)	2007	0.219***	(0.0364)
Hungaria	7.348***	(0.270)	2008	0.199***	(0.0388)
Ireland	8.957***	(0.271)			
Italy	8.693***	(0.298)	**Sector Intercepts**		
Lithuania	6.995***	(0.256)	Meat	0.198***	(0.0263)
Luxembourg	8.364***	(0.258)	Fish	0.328***	(0.0380)
Netherlands	8.950***	(0.285)	Fruit and Vegetables	0.110***	(0.0356)
Norway	8.736***	(0.285)	Oils and Fats	0.183***	(0.0540)
Poland	7.920***	(0.278)	Dairy Products	-0.047	(0.0324)
Portugal	8.021***	(0.273)	Grain Mill Products	0.032	(0.0477)
Russia	6.485***	(0.261)	Animal Feeds	0.014	(0.0451)
Slovakia	7.167***	(0.268)	Other Food Products	-	-
Slovenia	7.640***	(0.257)	Beverages	0.380***	(0.0400)
Sweden	8.773***	(0.282)			
Observations	2330				

Notes: Standard errors clustered within industry in parenthesis. *, **, *** indicate significance at 1, 5, and 10 per cent levels, respectively. The omitted reference dummy for food industry refers to “Other food products”.

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Table 1.
Summary statistics of key variables of interest across countries and industries

	Import penetration			Productivity			TFP		
	min	average	max	min	average	max	min	average	max
Austria	0.23	0.34	0.58	37,889	61,672	92,932	86.45	88.42	91.39
Belgium	0.19	0.55	1.03	52,566	72,099	96,778	88.00	89.70	92.85
Bulgaria	0.06	0.23	0.74	2,454	3,855	5,822	57.99	62.98	66.76
Cyprum	0.07	0.25	0.55	18,155	28,354	39,449	79.29	80.89	83.35
Czech Republic	0.06	0.15	0.34	7,911	11,611	23,159	72.47	74.74	80.05
Germany	0.14	0.26	0.56	30,040	54,693	90,475	86.34	89.11	92.31
Denmark	0.08	0.43	1.01	38,969	53,611	72,843	85.51	87.54	89.70
Spain	0.04	0.17	0.57	26,426	44,579	73,993	84.69	87.99	93.03
Estonia	0.15	0.43	0.63	6,421	12,109	21,108	70.82	73.97	78.47
Finland	0.06	0.21	0.50	38,622	57,267	79,111	82.51	85.53	87.99
France	0.05	0.18	0.48	34,405	55,093	101,327	85.58	88.63	94.21
Great Britain	0.10	0.23	0.43	35,905	74,968	138,489	85.98	91.37	94.92
Greece	0.19	0.38	0.89	16,545	27,946	47,897	78.35	81.33	86.33
Hungary	0.08	0.16	0.39	6,301	13,637	33,200	70.79	74.79	82.85
Ireland	0.11	0.36	1.12	31,186	93,780	219,142	81.88	90.42	100.00
Italy	0.07	0.18	0.51	41,054	56,746	72,756	84.95	87.77	89.23
Lithuania	0.16	0.48	1.25	4,136	9,351	18,199	66.41	70.75	77.39
Luxembourg	0.49	0.51	0.55	30,181	45,884	74,898	82.99	85.07	88.88
Netherlands	0.10	0.46	1.35	38,907	71,024	118,211	85.32	90.05	93.59
Poland	0.03	0.10	0.37	7,363	23,276	67,154	73.29	79.86	90.82
Portugal	0.13	0.30	0.66	15,549	26,684	38,070	77.81	81.05	84.45
Romania	0.04	0.25	0.70	2,545	4,852	11,362	59.52	65.76	74.41
Slovakia	0.15	0.24	0.43	4,449	13,138	23,832	64.21	72.68	77.29
Slovenia	0.14	0.33	0.91	13,590	19,612	30,123	75.29	77.46	79.29
Sweden	0.11	0.29	0.68	45,364	66,641	89,663	85.05	88.70	91.31
Sector									
Meat	0.05	0.20	0.57	2,995	28,679	54,317	61.21	81.04	89.70
Fish	0.20	0.61	1.35	2,454	27,493	56,419	57.99	79.75	88.80
Fruit And Vegetables	0.11	0.40	1.25	2,792	37,425	81,805	61.36	81.58	90.90
Oils and fats	0.18	0.46	1.21	5,427	57,946	138,489	66.14	84.54	94.21
Dairy Products	0.03	0.18	0.64	3,293	39,110	80,094	61.58	82.38	90.63
Grain Mill Products	0.08	0.25	0.74	3,248	53,458	109,340	63.90	83.83	94.53
Animal Feeds	0.04	0.16	0.44	2,545	44,924	78,442	59.52	83.17	91.51
Other food products	0.07	0.24	0.55	2,622	36,258	219,142	62.67	82.91	100.00
Beverages	0.04	0.24	0.55	5,822	63,482	212,706	66.76	86.54	99.81

Notes: See text for data sources and calculation details

Table 2.
Import competition and food industry growth: Basic regressions for labour productivity (LP)

	(1) ΔLP	(2) ΔLP	(3) ΔLP	(4) ΔLP	(5) ΔLP	(6) ΔLP	(7) ΔLP
Lagged LP	-0.040***	-0.046***	-0.066***	-0.082***	-0.080***	-0.088***	-0.323***
	(0.009)	(0.010)	(0.015)	(0.020)	(0.019)	(0.023)	(0.070)
Δ World import penetration (t-1)		0.108***	0.101***	0.104***	0.099**	0.142***	0.110***
		(0.030)	(0.027)	(0.027)	(0.032)	(0.029)	(0.028)
Lagged avg. firm size			0.023**	0.023**	0.023***	0.027**	0.030**
			(0.007)	(0.007)	(0.007)	(0.010)	(0.012)
Lagged real GDP				0.014**	0.011	0.013	0.149
				(0.006)	(0.006)	(0.007)	(0.085)
Lagged Business conditions					0.042	0.067	0.097
					(0.100)	(0.105)	(0.085)
Country F.E.	No	No	No	No	No	No	Yes
Industry-Year F.E.	No	No	No	No	No	Yes	Yes
# obs.	2334	1770	1743	1743	1598	1598	1598
R-square	0.039	0.059	0.069	0.075	0.079	0.153	0.291

Notes: OLS regressions; Robust standard errors clustered within industry in parenthesis. *, **, *** indicate significance at 1, 5, and 10 per cent levels, respectively; Each regression includes an omitted constant; Country and industry-year fixed effects are included when indicated.

Table 3.

Import competition and food industry growth: Basic regressions for total factor productivity (TFP)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ΔTFP	ΔTFP	ΔTFP	ΔTFP	ΔTFP	ΔTFP	ΔTFP
Lagged TFP	-0.056***	-0.061***	-0.081***	-0.112***	-0.112***	-0.124***	-0.361***
	(0.012)	(0.013)	(0.019)	(0.031)	(0.030)	(0.031)	(0.071)
Δ World import penetration (t-1)		0.097**	0.091**	0.095***	0.091**	0.134***	0.101***
		(0.030)	(0.028)	(0.026)	(0.032)	(0.031)	(0.028)
Lagged avg. firm size			0.020**	0.022**	0.022**	0.032**	0.030**
			(0.008)	(0.008)	(0.008)	(0.011)	(0.011)
Lagged real GDP				0.022**	0.023**	0.024**	0.206**
				(0.010)	(0.010)	(0.010)	(0.082)
Lagged Business conditions					0.029	0.053	0.072
					(0.106)	(0.110)	(0.091)
Country F.E.	No	No	No	No	No	No	Yes
Industry-Year F.E.	No	No	No	No	No	Yes	Yes
# Obs.	2110	1638	1638	1638	1587	1587	1587
R-square	0.057	0.078	0.087	0.101	0.101	0.175	0.314

Notes: OLS regressions; Robust standard errors clustered within industry in parenthesis. *, **, *** indicate significance at 1, 5, and 10 per cent levels, respectively; Each regression includes an omitted constant; Country and industry-year fixed effects included as indicated.

Table 4.
Import competition and food industry growth: Regressions across trade partners and intermediate vs. final products

	(1) ΔLP	(2) ΔTFP	(3) ΔLP	(4) ΔTFP	(5) ΔLP	(6) ΔTFP	(7) ΔLP	(8) ΔTFP	(9) ΔLP	(10) ΔTFP	(11) ΔLP	(12) ΔTFP
Δ EU15 import penetration (t-1)	0.115***	0.112***										
	(0.029)	(0.029)										
Δ OECD (noEU) import penetration (t-1)			0.010	0.011								
			(0.007)	(0.007)								
Δ NMS import penetration (t-1)					0.000	-0.001						
					(0.004)	(0.003)						
Δ BRIC import penetration (t-1)							-0.003	-0.003				
							(0.003)	(0.003)				
Δ Import penetration intermediate (t-1)									0.028	0.023		
									(0.019)	(0.018)		
Δ Import penetration final goods (t-1)											0.093*	0.087*
											(0.046)	(0.045)
# Obs.	1598	1587	1566	1555	1592	1581	1463	1452	1597	1586	1598	1587
R-square	0.293	0.317	0.288	0.310	0.282	0.306	0.280	0.304	0.286	0.309	0.290	0.314

Notes: OLS regressions; Robust standard errors clustered within industry in parenthesis. *, **, *** indicate significance at 1, 5, and 10 per cent levels, respectively; Each regression includes an omitted constant, country and industry-year fixed effects, and the following controls: lagged average firm size, lagged real GDP and lagged business conditions.

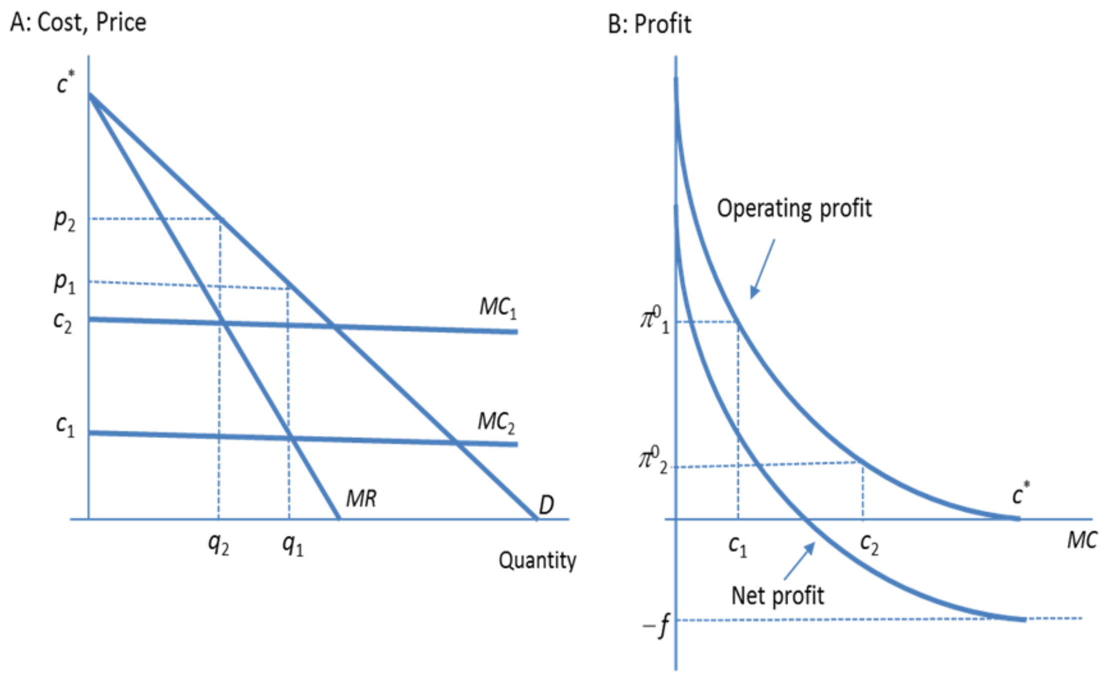
Table 5.
Robustness checks: SYS-GMM regressions

	(1) ΔLP	(2) ΔTFP	(3) ΔLP	(4) ΔTFP	(5) ΔLP	(6) ΔTFP	(7) ΔLP	(8) ΔTFP
Lagged LP (TFP)	-0.106***	-0.218***	-0.101***	-0.218***	-0.104***	-0.238***	-0.101***	-0.225***
	(0.026)	(0.041)	(0.023)	(0.040)	(0.028)	(0.048)	(0.026)	(0.044)
Δ World import penetration (t-1)	0.115***	0.098**						
	(0.044)	(0.038)						
Δ OECD (noEU) import penetration (t-1)			0.013*	0.014**				
			(0.007)	(0.006)				
Δ Import penetration intermediate (t-1)					0.026	0.026		
					(0.021)	(0.020)		
Δ Import penetration final goods (t-1)							0.136***	0.105**
							(0.043)	(0.042)
Lagged avg firm size	0.033***	0.051***	0.030***	0.050***	0.032***	0.058***	0.030***	0.052***
	(0.011)	(0.013)	(0.009)	(0.013)	(0.012)	(0.015)	(0.011)	(0.014)
Lagged real GDP	0.021***	0.054***	0.018***	0.053***	0.019**	0.059***	0.019**	0.057***
	(0.007)	(0.013)	(0.007)	(0.012)	(0.008)	(0.015)	(0.008)	(0.013)
Lagged business conditions	0.046	0.013	0.049	0.006	0.049	0.011	0.042	-0.003
	(0.069)	(0.066)	(0.068)	(0.064)	(0.067)	(0.062)	(0.066)	(0.067)
AR1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR2	0.136	0.216	0.095	0.160	0.112	0.189	0.155	0.254
Hansen	0.276	0.183	0.286	0.245	0.256	0.198	0.366	0.330
No. Of Obs.	1598	1587	1592	1581	1597	1586	1598	1587
No. Of groups	206	206	206	206	206	206	206	206
No. Of instruments	193	193	193	193	193	193	193	193

Notes: System GMM two-step estimator implemented in STATA, using the xtabond2 routine; lagged dependent variable instrumented with its $t-3$ and longer lags levels and its $t-2$ to $t-5$ first-differences in the differenced and level equation, respectively; import penetration instrumented with its $t-2$ and longer lags levels and $t-2$ first-differences in the difference and level equation, respectively; Year fixed effects included in each regression; Windmeijer-corrected cluster-robust standard errors in parentheses; *, ** and *** indicate statistically significance at 10, 5 and 1 percent level, respectively.

Figure 1.

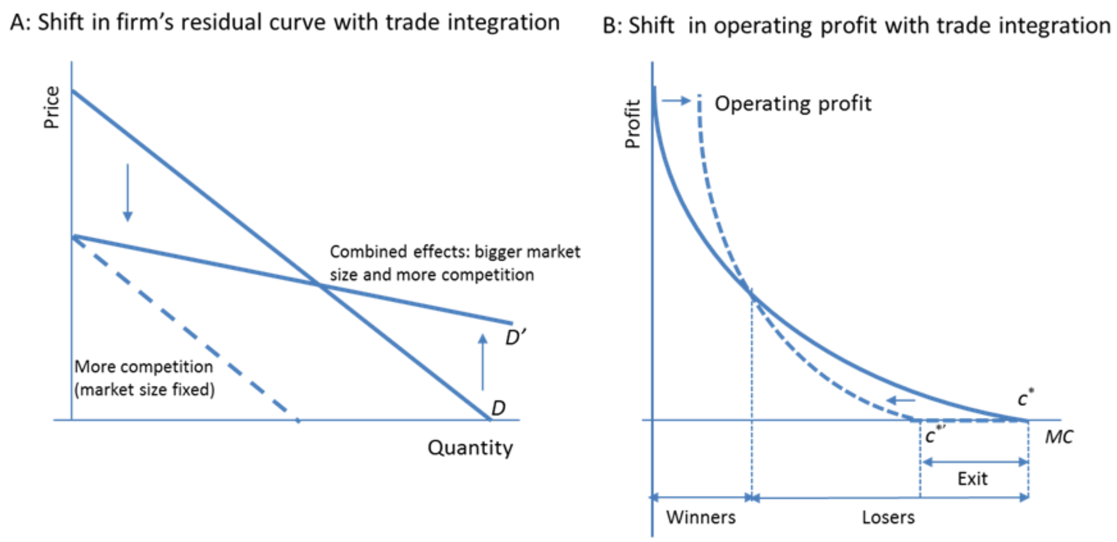
Differences in Performance across Firms



Source: adapted from Melitz and Trefler (2012)

Figure 2.

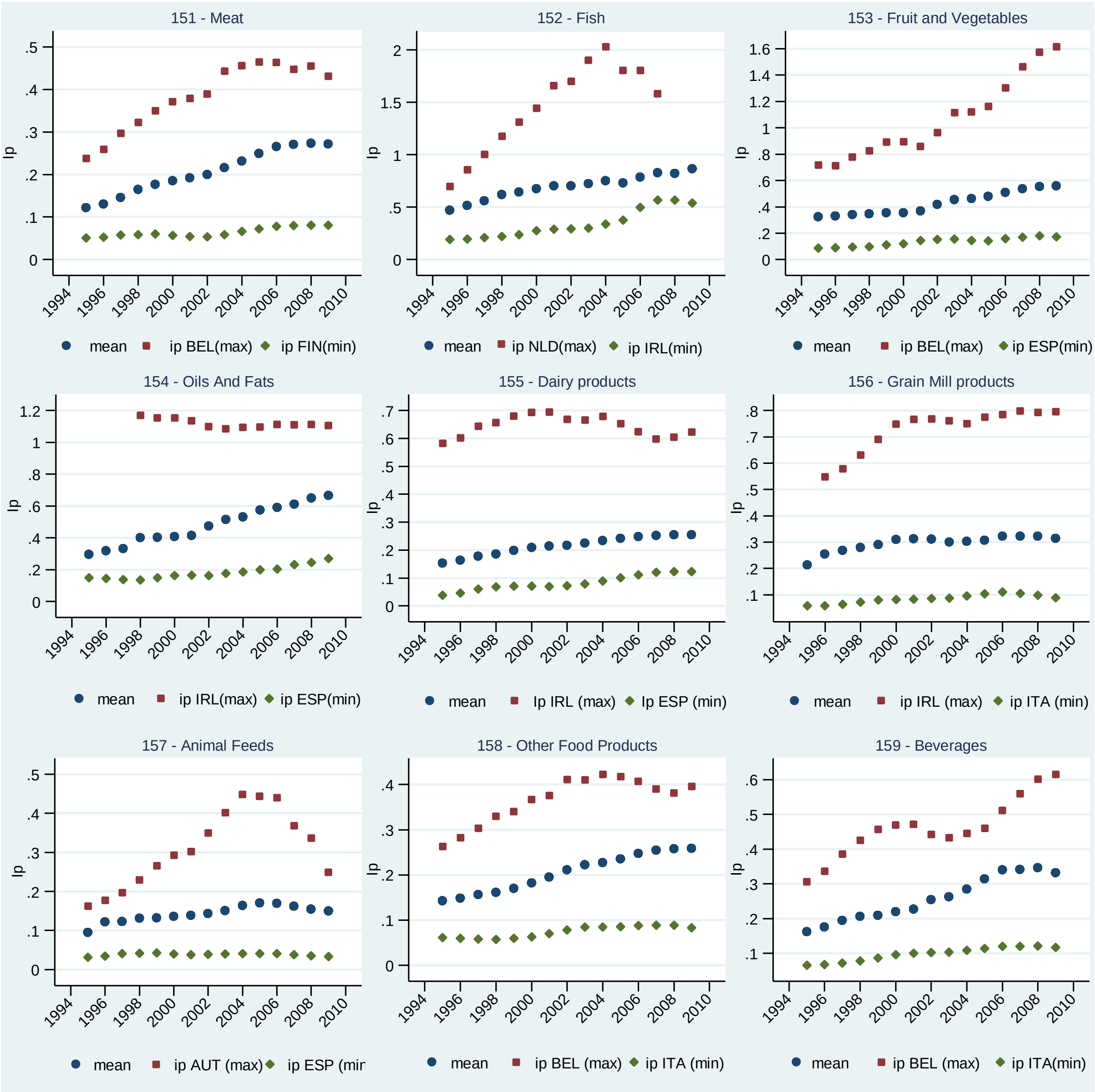
Winners and Losers from Market Integration



Source: adapted from Melitz and Trefler (2012).

Figure 3.

Minimum, average and maximum import penetration across sectors and years



Notes: The graphs reports the average (blue dots), maximum (red dots) and minim (green dots) level of import penetration across sectors and years.
Source: Authors computation using data describe in the text.