Trade, Competition and Productivity Growth in the food industry

Alessandro Olper[1], Lucia Pacca[2] and Daniele Curzi[3]

University of Milan

E-mails: alessandro.olper@unimi.it[1]; lucia.pacca@unimi.it[2]; daniele.curzi@unimi.it[3]

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Abstract. Melitz and Ottaviano's (2008) firm-heterogeneity model predicts that trade liberalization induces a selection process from low to high productivity firms, which translates to an industry productivity growth. A similar firms' selection effect is induced by market size. In this paper, 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 model predictions, namely that an increase in import penetration is systematically positively related to productivity growth. The results are robust to measurement issues in productivity, 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 are closer substitutes for domestic production than non-EU imports. These results have some potentially interesting policy implications.

Keywords: Import competition, Productivity growth, Food Industry, European Countries, Dynamic panel model

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 imports to apparent consumption increased substantially, passing from 16% in 1995 to 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 extent the huge increase in the exposure of European food firms to international trade is at the heart of this slowdown in productivity growth.

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. The idea is to investigate In fact, despite the negative perception of the European citizens 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. However, with the exception of Ruan and Gopinath (2008), 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 industry in developed countries, as an effect of both border measures, like tariffs and non-tariff barriers, and different market regulations.

Starting from the firm heterogeneity model of Melitz and Ottaviano (2008), the present paper tests the predicted pro-competitive effect of trade liberalization whether EU imports exert a more significant competitive impact than non-EU imports, i.e. they constitute 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

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

econometric strategy relies on dynamic panel data approaches, using both fixed effects and the system generalized method of moments (GMM) estimator.

Main results show that a 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 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.

Our paper is related to a large and growing literature on the relationship between industry and firm-level productivity growth and trade liberalization, a literature too large to be summarized here. Within this literature, our paper is close in the spirit to that of Chen et al. (2009), who find, among other things, a robust positive short run effect of trade openness on productivity growth in seven EU manufacturing industries. A second important related paper is that of Trefler (2004), who investigates the economic effects of NAFTA on Canada at both industry and plant level, finding an effect on industries which is very close to ours in magnitude. Finally, our paper shares with that of Ruan and Gopinath (2008) the sector of investigation – the food industry – and the conceptual framework – a trade model with firm-heterogeneity.

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

Our attention is mainly focused on two channels which might theoretically explain the existence of a positive effect of trade and trade liberalization on productivity growth. First, the fact that a growth in 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). Second, a greater market size may stimulate competition and, thus, firms' productivity (Helpman and Krugman, 1985; Melitz and Ottaviano, 2008). In what follows we consider 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 indexed by *i*, endogenously determined. Under this setting, demand for varieties is linear in prices and 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, labor is the only factor of production. In a monopolistically competitive industry, firms compete by producing different varieties of the same product, which are close substitutes. Firms differ only in their marginal costs c_i, or in their productivity $1/c_i$. The model defines the cutoff level of marginal costs c^*, where the operating profit is zero. A firm with a marginal cost above the cutoff, $c_i > c^*$, is out of the market, as it has a negative operating profit. The model assumes that entrant firms face some randomness about their future production cost c_i, which will disappear only after the fixed setup costs *f* are paid and are sunk. This means that for some firms the entry decision is wrong, as they will have a negative net profit, while some other will discover to have a low production cost c_i and a positive net profit. Thus, firm heterogeneity involves that the realized net profit varies among the firms. Firms with cost $c_i < c^*$ will be the ones that 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 competition increases without an increase in market size. This will generate an inward shift in each firm's residual demand curve, namely 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 its price will gain a higher market share. These changes in market size and market competition affect differently the heterogeneous firms in the market. From the perspective of smaller and less productive firms, the effect of tougher competition prevails, while for larger and more productive firms the effect of the larger market size dominates.

First, the reduction of the residual demand for smaller firms implies that the cutoff production cost will change into a new lower cost $c^{*\prime}$. Now firms with a higher cost level, $c_i > c^{*\prime}$, 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), gaining additional market share. Thus, as an effect of market integration, we will have winners and losers.

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 to the high-productivity ones (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 (industry) productivity growth through a process of firms selection. 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.

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. Specifically, the focus will be on the role played by market size, and the resulting differences between the short vs. long run effects of trade liberalization.

First, concerning market size, the model also accounts for the fact that, in larger markets, the price and markup of the average firm should be lower and its productivity higher, as an effect of tougher competition (see Melitz and Ottaviano, 2008; Chen et al. 2009). These 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. This suggests that, if we want to isolate empirically the import competition effects on productivity, we need to control properly for these country size effects.

Second, concerning the predictions of the model in the short versus 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. Thus, the effect of trade liberalization does 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, 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 reversed as opposed to the short run. This is because, in the long run, firms respond to the 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).

3. Econometric identification, data and measures

3.1 Econometric strategy

Given the theoretical predictions, our focus here is only on the short run effect of import competition on productivity, since the long run predictions are ambiguous, and difficult to be estimated.[2]

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

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

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; ε_{cit} is the 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. According to the theoretical predictions, we expect $\beta_2 > 0$.

Our main concern in estimating equation (1) is that import penetration could be an endogenous variable. Indeed, 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, our productivity estimation suffers from the lack of specific deflators at industry level (see Rodrik, 2013), raising potential issues of measurement error in the dependent variable. For these reasons, 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 its trend growth. Supposing that 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 errors in

[2] 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 properties of the panel, and is problematic when the panel structure is unbalanced and relatively short in his time dimension.

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).[3] 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). This implies 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 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.

3.2 Data and measures

3.2.1 Dependent Variables

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

The hypothesis of a growth effect of import competition is tested using two different dependent variables: labor productivity, measured as real value added per employee, and estimated total factor productivity (TFP). Eurostat SBS (Structural Business Statistics) provides data on nominal value added at factor cost, number of employees, and gross fixed capital formation. TFP is 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). For this estimation, we need to compute capital stock through the perpetual inventory approach (see Hall et al., 1988 and Ruan and Gopinath, 2008), using data on gross fixed capital formation (Eurostat SBS). For details on the TFP estimation process, we address the reader to Ruan and Gopinath (2008).

Real value added is 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.

As already explained above in the identification section, we tackled the issue about the lack of specific industry-level deflators in two different ways. First, following Rodrik (2013), we include in our regressions a set of time-varying industry fixed effects, which turns out to capture the omitted industry-year specific deflators. Second, we make use of the system

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

GMM estimator which is also suitable in presence of endogeneity due to measurement errors in the dependent variable (see Bond et al., 2001).

3.2.2 Import Penetration and other covariates

Import penetration (*IP*) is computed using data on production from Eurostat SBS, and import and export values taken from Eurostat COMEXT at CN 8-digit level and aggregated at 3-digit NACE Revision 1.1 level. Import penetration in country *c*, within industry *i*, in year *t* is obtained by weighting the import value from 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 country *c*, is the world. In order to split the effect of import competition into different groups of partners, the index is also computed for 4 sub-groups: EU-15 countries, New Member States, BRICs, and OECD non-EU countries.

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, we need to control for market size, as bigger markets tend to exhibit tougher competition and a resulting higher productivity (Melitz and Ottaviano, 2008). In our regressions, we control both for average firm size taken from Eurostat SBS, and for market size through the logarithm of real GDP from Eurostat (Chen et al. 2008).

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 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 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 $J = 1$.[4] 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. 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 1 reports estimates of equation (1) based on simple OLS and LSDV, obtained using labor productivity as dependent variable.

In Column 1, we regress productivity growth on the one year lagged level of productivity. The estimated coefficient is negative and strongly significant (p-value < 0.01), confirming the recent evidence reported by Rodrik (2013), who finds strong evidence for absolute convergence in the manufacturing sector.

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

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

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 0.108%, 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, *ceteris paribus*. Differently, the GDP coefficient loses its significance when lagged business conditions are added (see column 5).[5] 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.[6]

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 labor productivity growth.

The use of TFP as dependent variable produce quite similar results with respect to the use of LP. The strong positive effect of import penetration on productivity growth is thus confirmed, even if the elasticity is slightly lower (0.10 in our preferred specification)[7].

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

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

An interesting issue is to understand whether the positive effect of import penetration on productivity depends crucially on the origin of imports. Indeed, we are interested in the degree of substitutability between EU food products and food products coming from the rest of the world.

In order to address this issue, we estimate the effect of import penetration for four different trade partners: EU-15, OECD non-EU countries, NMSs, and BRICs. Results from these additional regressions are reported in Table 2. As it is clear from the figures, in the food industry what matters is import competition coming from the EU markets. By contrast, considering OECD non-EU countries, the estimated effect is not statistically significant, and

[5] 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. This additional regression is not shown, but is available from the authors upon request.

[6] It is worth noting that, when we condition the productivity growth regressions to other covariates, the convergence term significantly increases in (absolute) magnitude. This result has 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.

[7] Results for TFP are not shown because of the lack of space, but are available from the authors upon request.

has a considerably lower magnitude (0.011 vs. 0.1 for the EU).[8] When we consider import competition coming from NMSs or BRICs, the estimated effect on productivity is never statistically significant, 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. 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).

In the last two rows of table 2, we try to isolate the effect of import competition in final products, highlighted by Melitz and Ottaviano (2008), from the one related to the 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 rely on the classification by Broad Economic Categories (BEC) (see Olper and Raimondi, 2008). The estimated effects are positive for both intermediate and final goods, but only the last coefficient is significantly different from zero. Thus, the significant effect of openness on productivity arises primarily from competition in final products, a result in line with the theoretical prediction.

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. As already explained above, our analysis raises two different endogeneity concerns. First, import penetration may be endogenous due to political economy reasons. Second, the lack of industry specific deflators for value added and capital can add measurement errors in our dependent variables.

To address these issues, 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 instrument our business conditions variable (Δb), which is a generated endogenous regressor, with its $t-2$ and longer lags.

Table 3 reports the results obtained by using both labor 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. Moreover, the standard Hansen test rejects in all the specifications the hypothesis that our set of instruments is invalid.

Overall, our 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 on productivity growth (see columns 1-2).[9] What is new is the result which emerges when import penetration from the OECD (non-EU) countries is considered, which turns out to be significantly positive (p-value < 0.05) both in the LP regression, and in the TFP one. 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

[8] In interpreting these findings, it can be useful to note that in the observed period the annual growth rate of 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%).

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

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 interestingly, by comparing the results of regressions 8-9 in Table 2 with the ones of regressions 5-8 in Table 3, we systematically find that, when import penetration is treated as endogenous, its estimated effect increases in magnitude and significance level, but only for final goods regressions. This finding 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 Grossman and Helpman, 1994).

Finally, SYS-GMM regressions confirm that our market size measure 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) on the food industry. 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.

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% per year, the pro-competitive effect of import penetration is supposed to account for more than 20% of the overall growth in TFP.

The positive relationship between import competition and productivity growth proves to be robust, after 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.

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Table 1.

Import competition and food industry growth: Baseline regressions for labor 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 2.

Import competition and food industry growth: Regressions across trade partners and intermediate versus Final goods

	(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 3.
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 and business conditions instrumented with their $t-2$ 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 statistical significance at 10, 5 and 1 percent level, respectively.