Deeper, Wider and More Competitive? Monetary Integration, Eastern Enlargement and Competitiveness in the European Union.*

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Abstract

What determines a country's ability to compete in international markets? What fosters the global competitiveness of its firms? And in the European context, have key elements of the EU strategy such as EMU and enlargement helped or hindered domestic firms' competitiveness in local and global markets? We address these questions by calibrating and simulating a conceptual framework that merges the insights of traditional trade theory and new trade theory in a multi-country, multi-sector model with monopolistic competition and variable markups. The framework highlights the interactions between technological leadership, freeness of entry and market accessibility in determining the competitive environment of a country. Countries exhibiting technological advantage, freer entry and better accessibility to foreign firms develop a tougher competitive environment in which firms are more productive, operate at a larger scale and earn larger profits while quoting lower prices and lower markups. Our conceptual framework allows us to disentangle the effects of technology and freeness of entry from those of accessibility. On the one hand, by controlling for the impact of accessibility, we are able to construct an index of 'revealed competitiveness', which would drive the relative performance of countries in an ideal world in which all faced the same barriers to international transactions. On the other hand, by focusing on the role of accessibility while keeping 'revealed competitiveness' as given, we are able to evaluate the impacts of EMU and enlargement on the competitiveness of European firms. We find that EMU positively affects the competitiveness of firms located in participating economies. Enlargement has, instead, two contrasting effects. It improves the accessibility of EU members but it also increases substantially the relative importance of unproductive competitors from Eastern Europe. Overall, while EMU increases the toughness of competition in member countries, and through this channel generates lower average (delivered) costs, markups, prices and quantities, enlargement can be expected to have similar effects only after an increase in the 'revealed competitiveness' of new members that is yet to come.

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1 Introduction

Globalization has been characterized, inter alia, by the entrance of new players into world markets. The growing integration of emerging Asia, as well as central and eastern European countries (CEECs), following the collapse of the Soviet Union, is expected to have lead to a sharpening in the competitive environment and to large changes in the structure of global trade. Against this changing background, the global economy has enjoyed an exceptionally rapid pace of growth over the current cycle.[1] However, in spite of these overall results at the world level, globalization has increasingly been associated with concerns, and even fears sometimes. Such concerns might not be completely unjustified since globalization is associated with major changes in the structure of production, employment and trade, affecting millions of citizens around the industrialized world. These concerns have given rise to protectionist pressures that might produce detrimental effects on our economies.

In the face of globalization, some argue that each country left alone could more flexibly respond to globalization challenges. Others instead support the view that being part of a larger set of countries, most notably the EU/EMU area, would create more favourable conditions. Who is right? Why countries - but also regions within countries, workers and firms - are variously affected by globalization, and not all of them are necessarily better off in the more open global environment? How to assess the stakes of different nations as filtered through the network of domestic and foreign firms in local and global markets?

Nesting the new trade theory framework originating in the works of Helpman and Krugman (1985) with the work on firm heterogeneity developed by Melitz (2003) provides helpful insights on what determines a country's ability to compete in international markets, and on what fosters the global competitiveness of its firms. It also allows to evaluate if, in the European context, key elements of the EU strategy such as EMU and enlargement have helped or hindered domestic firms' competitiveness in local and global markets.

By allowing for the joint presence of imperfectly competitive markets, increasing returns and firm heterogeneity, new trade theories predict that trade and FDI liberalisations induce not only trade creation but also, and more importantly, a general reallocation of resources across firms, countries and regions. Four types of reallocations are privileged by the most recent literature. First, the selection effect that reallocates resources from the least to the most productive firms, not only across industries but also, and more importantly, within industries. Second, the market size effect which induces a shift of resources from smaller to larger countries, firms being attracted by the associated higher market potential. Third, the higher sourcing from low cost countries. Finally, the reallocation effects derived from preferential trade agreements, which tend to favour insiders (countries that are part of them) to the detriment of outsiders. To sum up, the theoretical expectation is that - in general - liberalization leads to higher welfare for the participant countries, to degrees variously determined through the channels above. Higher welfare stems from richer product variety, higher productivity, lower average mark-ups and lower average prices, reflecting a more efficient allocation of resources across firms, sectors, and locations.

In order to quantify how these mechanisms concur to determine countries' performance in international markets, we calibrate and simulate a multi-country, multi-sector theoretical framework with monopolistic competition and variable markups in the wake of Melitz and Ottaviano (2005, Appendix B and C) as extended by Del Gatto, Mion and Ottaviano

[1] Freeman (2006) reports that after recovering from the ICT bubble, the global economy has expanded significantly above longer-term averages in the past three years, i.e. by about 5% in the period 2004-2006, 1.5 percentage points higher than in 1995-2003.

(2006). By merging the insights of traditional trade theory and new trade theory, the framework highlights the interactions between technological leadership, freeness of entry and market accessibility in determining the competitive environment of a country. Countries exhibiting technological advantage, freer entry and better accessibility to foreign firms develop a tougher competitive environment in which firms are more productive, operate at a larger scale and earn larger profits while quoting lower prices and lower markups.

Our conceptual framework allows us to disentangle the effects of technology and freeness of entry from those of accessibility. On the one hand, by controlling for the impact of accessibility, we are able to construct an index of 'revealed competitiveness', which would drive the relative performance of countries in an ideal world in which all faced the same barriers to international transactions. On the other hand, by focusing on the role of accessibility while keeping 'revealed competitiveness' as given, we are able to evaluate the impacts of EMU and enlargement on the competiveness of European firms. We find that EMU positively affects the competitiveness of firms located in participating economies. In particular, we find that, if in 2002 France had been outside EMU, its firms would have been on average less competitive of up to 7 percentage points while the country as a whole would have been downgraded of two positions in the European competitiveness ranking. Adoption of the euro by Great Britain in the same year would have increased average productivity of British firms by 0.5 to 3 percentage points but its position in the European ranking would have remained unaffected.

Enlargement has, instead, two contrasting effects. It improves the accessibility of EU members but it also increases substantially the relative importance of unproductive competitors from Eastern Europe. Overall, while EMU increases the toughness of competition in member countries, and through this channel generates lower average (delivered) costs, markups, prices and quantities, enlargement can be expected to have similar effects only after an increase in the 'revealed competitiveness' of new members that is yet to come.

The rest of the paper is organised in five sections. Section 2 presents the theoretical framework and derives its equilibrium properties. Section 3 calibrates the model to the data. Section 4 discusses the model's fit to the data. Section 5 simulates alternative macroeconomic scenarios while section 6 concludes and draws some policy implications.

2 Theoretical framework

Our model is based on Melitz and Ottaviano (2005, Appendix B and C) as extended by Del Gatto, Mion and Ottaviano (2006). The set-up considers M countries (indexed by $l = 1, ..., M$). Labor is the only factor of production and is internationally immobile with country l hosting L^l units of labor. Each worker supplies one unit of labor inelastically, so L^l is both the number of workers and the number of consumers residing in country l. Countries may differ in terms of size, technology and trade barries.

2.1 Demand

Preferences are defined over $S + 1$ goods. One of them is homogenous while the other S goods are horizontally differentiated and we index them by $s = 1, ..., S$. Each differentiated good s comes in a set of varieties Ω_s indexed by $i \in \Omega_s$. Utility is linear in the consumption of the homogenous good and additive quadratic in the consumption of the differentiated goods. This assumption neutralizes the effect of income on demand and allows us to focus on the consumer surplus only. Specifically, the preferences of a typical consumer in country

l are represented by the quasi-linear utility function:

$$U^l = d_0^l + \sum_{s=1}^{S} \left\{ \alpha_s \int_{i\in\Omega_s} d_s^l(i)di - \frac{1}{2}\gamma_s \int_{i\in\Omega_s} \left[d_s^l(i)\right]^2 di - \frac{1}{2}\eta_s \left(\int_{i\in\Omega_s} d_s^l(i)di\right)^2 \right\}, \quad (1)$$

where d_0^l and $d_s^l(i)$ represent the individual consumption levels of the numeraire good and variety i of good s.

Parameters α_s, η_s, and γ_s are all positive and have the following interpretations. The parameters α_s and η_s measure the substitutability between the varieties of good s and the homogeneous good 0. Larger α_s and smaller η_s increase the demand for the differentiated varieties relative to the numeraire. The parameter γ_s measure the substitutability between the varieties of good s. When $\gamma_s = 0$, varieties are perfect substitutes and utility depends on the total consumption level over all varieties, $D_s^l = \int_{i\in\Omega_s} d_s^l(i)di$, but not on its allocation across varieties. Such allocation becomes increasingly important as γ_s rises, hence γ_s is a measure of product differentiation.

Under the assumption that the typical consumer in country l has positive demand for the homogeneous good, the maximization of (1) under her budget constraint yields a linear inverse demand for each variety i:

$$p_s^l(i) = \alpha_s - \gamma_s d_s^l(i) - \eta_s D_s^l, \quad (2)$$

which can be inverted to obtain aggregate demand:

$$q_s^l(i) \equiv L^l d_s^l(i) = \frac{\alpha_s L^l}{\eta_s N_s^l + \gamma_s} - \frac{L^l}{\gamma_s} p_s^l(i) + \frac{\eta_s N_s^l}{\eta_s N_s^l + \gamma_s} \frac{L^l}{\gamma_s} \bar{p}_s^l \quad (3)$$

for each variety featuring positive demand, i.e. such that:

$$p_s^l(i) \leq \frac{1}{\eta_s N_s^l + \gamma_s} \left(\gamma_s \alpha_s + \eta_s N_s^l \bar{p}_s^l\right) \equiv p_s^l. \quad (4)$$

where N_s^l is the number of varieties with positive demand and $\bar{p}_s^l = \left(1/N_s^l\right) \int_{i\in\tilde{\Omega}_s^l} p_s^l(i)di$ is their average price. Note that a lower average price $\bar{p}_s^l$ or a larger number of varieties N_s^l increase the price elasticity of demand and decrease the price bound for positive demand defined by the right hand side of (4). Hence, falling $\bar{p}_s^l$ or rising N_s^l lead to a 'tougher' competitive environment.

2.2 Supply

National labor markets are all perfectly competitive. Perfect competition also characterizes the market of the homogeneous good. This good is assumed to be freely traded, so its price is the same everywhere. It is also assumed to be produced in all countries so that, due to perfect competition, also the wage is the same everywhere. Then, choosing the homogeneous good as numeraire allows us to pin down the wage to one in all countries.

The differentiated goods markets are monopolistic competitive and geographically segmented. Entry requires the payment of a sector specific sunk cost f_s^l in units of numeraire, which is the same for each entrant in sector s. Such cost is associated with R&D activities that lead to the invention of new varieties whose marketability is ex ante uncertain. The reason is that an entrant does not know the marginal production cost c of its variety until its entry cost is sunk. This cost is then determined by a draw from a common and known distribution $G_s^l(c)$, with support $[0, c_{A,s}^l]$. The fact that the support varies across sectors and countries allows us to introduce (probabilistic) 'comparative advantage' due to technological differences that impact the distribution of firm-level productivity draws. For instance, if $\left(c_{A,s}^{l}/c_{A,r}^{l}\right) < \left(c_{A,s}^{h}/c_{A,r}^{h}\right)$, countries l and h are said to have comparative advantages in sectors s and r respectively because relative to entrants in h (l), entrants in l (h) have a 'better chance' of getting lower cost draws in sector s than in sector r.

All entrants draw their marginal costs simultaneously. Hence, after their draw, they can figure out whether they are productive enough to survive competition. In particular, given that the entry cost f_s^l is sunk, only entrants whose operating profits can cover their marginal costs choose to stay in the market. Other entrants exit immediately. Survivors can serve not only the domestic market but also foreign ones. In so doing, they face however per-unit trade costs. In particular, the overall cost of a delivered unit with cost c from country h to country l is $\tau_s^{hl}c$ with $\tau_s^{lh} > 1$, where $(\tau_s^{hl} - 1)c$ is the frictional trade cost. Such cost should be interpreted in a wide sense as due to all distance-related barriers. That is why, even within countries, trade may not be costless: $\tau_s^{ll} \geq 1$.

Under monopolistic competition, each survivor maximizes profit taking the demand function (3) into account as well as the average price $\bar{p}_s^l$ and the number of competitors N_s^l as given. The profit maximizing price and quantity sold for a firm in sector s producing in country l with cost c and selling to country h equals:

$$p_s^{lh}(c) = \frac{1}{2}(c_s^{hh} + \tau_s^{lh}c), \quad q_s^{lh}(c) = \frac{L^h}{2\gamma_s}\left(c_s^{hh} - \tau_s^{lh}c\right) \tag{5}$$

with associated operating profit and mark-up

$$\pi_s^{lh}(c) = \frac{L^h}{4\gamma_s}\left(c_s^{hh} - \tau_s^{lh}c\right)^2 \tag{6}$$

$$\mu_s^{lh}(c) = \frac{1}{2}\left(c_s^{hh} - \tau_s^{lh}c\right) \tag{7}$$

In these expressions c_s^{hh} denotes the upper bound ('cutoff') cost inclusive of trade costs ('delivered cost') for firms selling to country h. It corresponds to the marginal cost of sellers that just break even: $\pi_s^{lh}(c_s^{hh}) = 0$. In particular, given (4), c_s^{hh} satisfies:

$$c_s^{hh} = \sup\left\{\tau_s^{lh}c : \pi_s^{lh}(c) > 0\right\} = p_s^h \tag{8}$$

Sellers with marginal cost c such that $\tau_s^{hl}c = c_s^{hh}$ just break even while firms with c such that $\tau_s^{hl}c > c_s^{hh}$ choose not to sell as they anticipate operating losses. Since the cutoff (8) is the same for sellers from any origin, higher trade barriers from l to h make it harder for exporters from l to break even as they need better cost draws to do so.

Before entering, firms are uncertain about their marginal cost. They know, however, the probability distribution of cost draws and can thus calculate their expected operating profits from sales to each country. Free entry then implies that the sum of expected operating profits across all countries exactly match the fixed entry cost:

$$\sum_{h=1}^{M}\left[\int_0^{c_s^{hh}/\tau_s^{lh}} \pi_s^{lh}(c)dG_s^l(c)\right] = f_s^l. \tag{9}$$

Substituting (6) into (9) and solving the resulting system of M equations for $l = 1, ..., M$ gives the M cost cutoffs. These summarize all the effects of market conditions relevant for firm performance. Moreover, substituting (8) into (4) and solving the M resulting equations individually yields the number of sellers to each country:

$$N_s^h = \frac{2\gamma_s}{\eta_s} \frac{\alpha_s - c_s^{hh}}{c_s^{hh} - \bar{c}_s^h}, \tag{10}$$

where $\bar{c}_s^h = \sum_{l=1}^M \left\{ \left[\int_0^{c_s^{lh}} \tau_s^{lh} c dG_s^l(c) \right] / G_s^l(c_s^{lh}) \right\}$ is the average delivered cost of sellers.

2.3 Equilibrium

Explicit solutions for the equilibrium cutoffs can be derived by specifying the distribution of cost draws $G_s^l(c)$ as a Pareto distribution with upper bound $c_{A,s}^l$ and shape parameter $k_s \geq 1$:

$$G_s^l(c) = \left(\frac{c}{c_{A,s}^l} \right)^{k_s}, \quad c \in [0, c_{A,s}^l]. \tag{11}$$

As we will show in the empirical sections, the Pareto assumption allows us to capture in a simple way one of the key features of the data, namely the skewness of the distribution of firms across cost levels. This is captured by the shape parameter k_s, which is assumed to vary across sectors but not across countries. In particular, $k_s = 1$ corresponds to a uniform cost distribution while increasing k_s raises the relative number of high cost firms by concentrating more density in the upper part of the support $[0, c_{A,s}^l]$. As k_s approaches infinity, the distribution becomes degenerate at $c_{A,s}^l$ and firm heterogeneity vanishes.

In the present setting, another useful property of the Pareto distribution is that any truncation from above at $c_s^{hh}/\tau_s^{lh} < c_{A,s}^l$ is also a Pareto distribution with shape parameter k_s such that $G_s^{lh}(c) = [c/(c_s^{hh}/\tau_s^{lh})]^{k_s}$, $c \in [0, c_s^{hh}/\tau_s^{lh}]$. Therefore expressions (5)-(8) allow us to express the average performance variables for sellers in country h as functions of the cutoff c_s^{hh}. In particular, average (delivered) costs, markups, prices, quantities and operating profits are respectively equal to:

$$\bar{c}_s^h = \tfrac{k_s}{k_s+1} c_s^{hh} \quad \bar{\mu}_s^h = \tfrac{1}{2(k_s+1)} c_s^{hh} \quad \bar{p}_s^h = \tfrac{2k_s+1}{2(k_s+1)} c_s^{hh} \tag{12}$$

$$\bar{q}_s^h = (k_s+2) \tfrac{\sum_{l=1}^M |C_s^{lh}|/(\psi_s^l/f_s^l)}{|P_s|} \left(c_s^{hh}\right)^{-(k_s+1)} \quad \bar{\pi}_s^h = \tfrac{\sum_{l=1}^M |C_s^{lh}|/(\psi_s^l/f_s^l)}{|P_s|} \left(c_s^{hh}\right)^{-k_s}$$

Smaller cutoffs are associated with smaller average costs, markups and prices as well as larger average quantities and profits. A percentage fall in the cutoff c_s^{hh} leads to the same percentage fall in the average cost $\bar{c}_s^h$ ('selection effect'), in the average markup $\bar{\mu}_s^h$ ('pro-competitive effect') and thus in the average price. Since (12) implies $\bar{p}_s^h = (2k_s + 1) \sqrt{\bar{\mu}_s^h \bar{c}_s^h / 2k_s}$, lower average cost and lower average markup each account for half of the percentage fall in the average price. Moreover, a percentage fall in the cutoff leads to $-(k_s + 1)$ and $-k_s$ per cent rise in average quantity and average profit respectively. For this reason, the cutoff c_s^{hh} can be interpreted as a measure of the equilibrium '*toughness of competition*' in country h and sector s.

To characterize the equilibrium cutoff, let $\rho_s^{lh} \equiv \left(\tau_s^{lh}\right)^{-k_s} \in (0, 1]$ be a measure of the 'freeness' of trade for exports from l to h such that

$$P_s \equiv \begin{pmatrix} \rho_s^{11} & \rho_s^{12} & \cdots & \rho_s^{1M} \\ \rho_s^{21} & \rho_s^{22} & \cdots & \rho_s^{2M} \\ \vdots & \vdots & \ddots & \vdots \\ \rho_s^{M1} & \rho_s^{M2} & \cdots & \rho_s^{MM} \end{pmatrix}.$$

is the trade freeness matrix for sector s with determinant $|P_s|$ and cofactor $\left|C_s^{lh}\right|$ for its ρ_s^{lh} element. The free entry condition (9) in country l can then be rewritten as:

$$\sum_{h=1}^{M} \rho_s^{lh} L^h \left(c_s^{hh}\right)^{k_s+2} = \frac{2\gamma_s(k_s+1)(k_s+2)f_s^l}{\psi_s^l} \qquad l = 1, ..., M, \tag{13}$$

where $\psi_s^l = \left(c_{A,s}^l\right)^{-k_s}$ is an index of absolute advantage in sector s. In each sector s the cutoffs can thus be obtained by solving the M conditions (13):

$$c_s^{hh} = \left(\frac{2(k_s+1)(k_s+2)\gamma_s}{L^h} \frac{\sum_{l=1}^{M} \left|C_s^{lh}\right| / (\psi_s^l/f_s^l)}{|P_s|}\right)^{\frac{1}{k_s+2}} \qquad h = 1, ..., M, \tag{14}$$

The fact that c_s^{hh} is an increasing function of γ_s shows that competition is tougher in sectors in which varieties are less differentiated. Cross-country differences in the toughness of competition in country h are driven instead by two factors: own country '*size*' L^h, as well as a combination of trade freeness, entry barriers and comparative advantage $\left[\sum_{l=1}^{M} \left|C_s^{lh}\right| / (\psi_s^l/f_s^l)\right] / |P_s|$. This sum deserve closer inspection. The ratio ψ_s^l/f_s^l measures how easily country l generates firms with high productivity ('good competitors') and, hence, we call it the '*producer competitiveness*' of country l in sector s. Since competitiveness depends positively on the absolute advantage ψ_s^l and negatively on the entry cost f_s^l, a technologically disadvantaged country with low entry barriers can be as 'competitive' as a technologically advantaged one with high entry barriers. When all countries have the same competitiveness, $\psi_s^l/f_s^l = \psi_s/f_s$ can be factored out of the sum to yield (ψ_s/f_s) times $\sum_{l=1}^{M} \left|C_s^{lh}\right| / |P_s|$. This last term measures how difficult it is for local and foreign firms to reach consumers in country h. It is, therefore, an inverse index of the '*accessibility*' of country h to firms. Accordingly, in the general case of cross-country differences in competitiveness, the sum $\left[\sum_{l=1}^{M} \left|C_s^{lh}\right| / (\psi_s^l/f_s^l)\right] / |P_s|$ represents an inverse index of the distance-weighted average competitiveness of countries whose firms sell to country l. We will refer to it as the inverse index of (average) '*seller competitiveness*' of country h.

To summarize, expression (14) reveals that competion is tougher in countries benefiting from larger local markets and stronger seller competitiveness. Given (12), on average such countries exhibit lower average (delivered) costs, markups, prices as well as higher quantities and operating profits. Note that seller competitiveness and producer competitiveness coincide only when trade barriers are prohibitive. When international trade is feasible, the two concepts may diverge: seller competitiveness in a country with weak producer competitiveness can be as high as in a country with strong producer competitiveness if the former is more accessible than the latter.

Apart from average performance variables, the toughness of competition also determines the numbers of producers and sellers across countries. Specifically, substituting $\overline{c}_s^h$ from (12) into (10) allows us to solve the latter for the numbers of sellers:

$$N_s^h = \frac{2\gamma_s(k_s+1)}{\eta_s} \frac{\alpha_s - c_s^{hh}}{c_s^{hh}} \tag{15}$$

These include domestic producers, whose number is $G_s^h(c_s^{hh})N_{E,s}^h$, and foreign exporters, whose number is $G_s^l(c_s^{hh}/\tau_s^{lh})N_{E,s}^l$ for each country of origin. We can, therefore, write $N_s^h = \sum_{l=1}^{M} G_s^l(c_s^{hh}/\tau_s^{lh})N_{E,s}^l$. Using (8) and (11) in that equality then gives:

$$\sum_{l=1}^{M} \rho_s^{lh} \psi_s^l N_{E,s}^l = \frac{N_s^h}{(c_s^{hh})^{k_s}}.$$

For $h = 1, ..., M$ the above expression gives a system of M linear equations is that can be solved for the number of entrants in the M countries:

$$N_{E,s}^{l} = \frac{2(k_s+1)\gamma_s}{\eta_s |P_s| \psi_s^l} \sum_{h=1}^{M} \frac{\left(\alpha_s - c_s^{hh}\right) \left|C_s^{lh}\right|}{\left(c_s^{hh}\right)^{k_s+1}} \tag{16}$$

Among them, $N_{E,s}^{l} G_s^l(c_s^{ll}/\tau_s^{ll})$ firms survive and produce for the local market while $N_{E,s}^{l} G_s^l(c_s^{hh}/\tau_s^{lh})$ export to country h. This implies that the number of producers located in country l equals:

$$N_{P,s}^{l} = \psi_s^l N_{E,s}^{l} \rho_s^{ll} \left(c_s^{ll}\right)^{k_s} \tag{17}$$

Finally, the model generates a simple measure of welfare for each country h. Since profits are zero both ex-ante (due to free entry) and ex-post (due to the law of large numbers), such measure considers only consumer surplus net of the sunk costs of entry. It is obtained by substituting the quantities that are consumed in equilibrium into utility (1):

$$U^h = 1 + \sum_{s=1}^{S} \frac{1}{2\eta_s} \left(\alpha_s - c_s^{hh}\right) \left(\alpha_s - \frac{k_s+1}{k_s+2} c_s^{hh}\right). \tag{18}$$

where 1 is individual income that coincides with the equilibrium wage. According to (18), the welfare of country l decreases monotonically with its domestic cost cutoff.

3 Calibration

The previous section has presented a theoretical model that determines the economic performance of a country as a function of the toughness of competition in its local markets. This is inversely measured by the endogenous cost cutoff c_s^{hh} and depends on some exogenous parameters capturing both the size and the (seller) competitiveness of the country. The aim is now to calibrate those parameters to real world data and, after validation, to use the calibrated model for policy analysis. In particular, we calibrate the model to 12 manufacturing industries operating in 14 European economies in the year 2002.[2]

All the relevant parameters of the model can be directly observed or estimated except the '*revealed* (producer) *competitiveness*' index ψ_s^l/f_s^l. However, if we assume that the observed behavior of the economy is well captured by the equilibrium of the theoretical model, ψ_s^l/f_s^l can be calibrated to fit the observed distribution of productivity across industries and countries given all other parameters.[3]

3.1 Trade frictions

We explain the estimation of the parameters of the model starting with the trade freenes matrix P. This is recovered by exploiting the fact that the theoretical model generates a 'gravity' prediction of bilateral exports based on the characterics of the countries of origin and destination as well as on their reciprocal distance. To see this, note that in sector s an exporter from h to l with cost c earns f.o.b. export revenues $r_s^{hl}(c) = p_s^{hl}(c) q_s^{hl}(c)$.

[2] An overview of the data used is available in Appendix A.

[3] Expression (17) would allow us to disentangle also the absolute advantage parameter ψ_s^h from the entry cost f_s^h.

Aggregate bilateral exports EXP_s^{hl} can then be obtained by aggregating $r_s^{hl}(c)$ over all exporters from h to l (with cost $c \leq c_s^{ll}/\tau_s^{hl}$). Using expressions (5) and (8) yields:

$$EXP_s^{hl} = \frac{1}{2\gamma_s\left(k_s+2\right)} N_{E,s}^h \psi_s^h L^l \left(c_s^{ll}\right)^{k_s+2} \rho_s^{hl} \tag{19}$$

which is a gravity equation in so far as it determines bilateral exports as a function of bilateral trade barriers and country characteristics. Note that tougher competition in the country of destination (lower c_s^{ll}) dampens exports by making it harder for potential exporters to break into that market. Differently, given (16), tougher competition in the country of origin (lower c_s^{hh}) promotes exports by increasing the number of entrants into that market.

Following standard practice, equation (19) can be estimated in logs as

$$ln(EXP_s^{hl}) = EX_h + IM_l + \delta_s ln(d^{hl}) + \beta^l Border^{hl} + \lambda Lang^{hl} Border^{hl} + du^{time} + \epsilon^{hl} \tag{20}$$

where EX_h and IM_l are dummies specific to the countries of origin and of destination respectively, $Lang^{hl}$ is a dummy that equals 1 when the two countries share a common language, du^{time} is a time dummy, and ϵ^{hl} is the error term. Trade barriers are captured by two variables. While bilateral distance d^{hl} is used to measure all distance related trade frictions, the border effect $Border^{hl}$ targets international trade frictions due to crossing one or more borders.

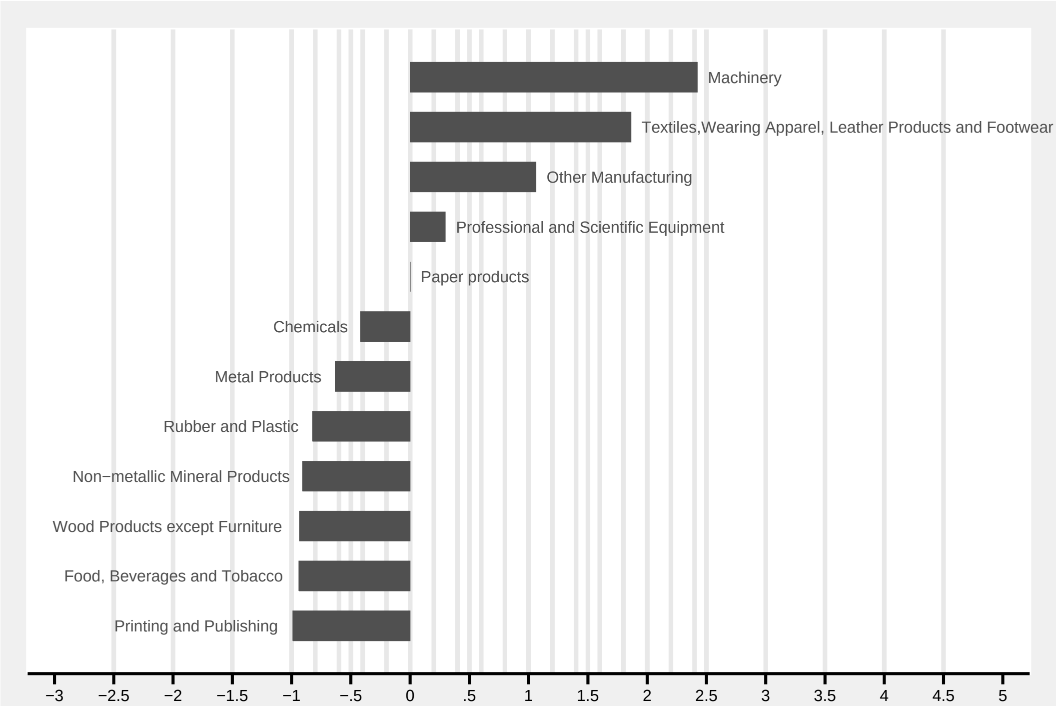
In estimating (20), we use data for the years 2000-2003. Although we are interested in calibrating the model relative to the cross-section of data for the year 2002, extending the estimates to the interval 2000-2003 increases the statistical robustness of the estimated coefficients. These are used to calculate industry-exporter-importer specific trade costs as $\rho_s^{hl} = exp(\beta^l - \lambda Lang^{hl})(d^{hl})^{\delta^s}$. Hence, trade barriers are modeled as a power function of distance that increases frictional costs when a new border is crossed and reduces them if countries share a common language. We allow for non-negligible distances within countries ($\rho_s^{hh} = (d^{hh})^{\delta^s} < 1$) and asymmetric trade barriers between countries ($\rho_s^{hl} \neq \rho_s^{lh}$).

The results of our estimation across sectors are reported in Figure 1, which ranks industries by degree of trade freeness, relative to the overall average value.

Table 1 reports the estimated components ρ_s^{hl} of the trade freeness matrix. For completeness, distance coefficients δ_s are also included. “Printing and Publishing”, “Wood Products except Furniture” and “Non-metallic Mineral Products” are the least tradable industries while “Professional and Scientific Equipment”, “Textiles, Wearing Apparel, Leather Products and Footwear” and “Electrical ad non-electrical Machinery” are the most tradable ones. The table also shows that the ρ_s^{hl}’s are highly correlated with the coefficients of distance elasticity δ_s, which largely explains the variation in tradability across sectors.

Turning to the country dimension, Table 2 reports the average ρ_s^{hl}’s by countries ranked from worst to best accessibility. The left hand side of the table shows how easy it is to access foreign markets from different countries of origin (ρ_s^{out}). The right hand side shows, instead, how easy it is to access different domestic markets from abroad (ρ_s^{in}). Unsurprisingly, the ease of accessing foreign market is the highest for the core European countries and the lowest for peripheral ones. More interestingly, the ease of accessing the domestic market from abroad seems to follow a cultural/linguistic divide, with the anglosaxon, germanic and scandinavian countries being more accessible than the latin/mediterreanean ones. This confirms that geography is an important determinant of trade costs but other factors also have a strong influence.

Figure 1: Freeness of trade with respect to average, by sector (2000-2003)



Source: Trade and Production database (CEPII), authors' calculations

3.2 Production costs

The skewness parameters k_s and the cut-offs c_s^{hh} can be recovered from estimated firm-level TFPs.[4] As to the former, call $x = 1/c$ the TFP of a firm with marginal cost c and $x^l_{A,s} = 1/c^l_{A,s}$ the lower bound of its support. If c follows the assumed Pareto distribution (11), also x is Pareto distributed with cumulative density function

$$F_s^l(x) = 1 - \left(\frac{x}{x^l_{A,s}}\right)^{-k_s}, \; x \in [c^l_{A,s}, \infty).$$

which can be rewritten as $\ln\left[1 - F_s^l(x)\right] = k_s \ln\left(x^l_{A,s}\right) - k_s \ln(x)$. Accordingly, if x is Pareto distributed with skewness parameter k_s and cumulative density function $F(x)$, the OLS regression of $\ln[1 - F(x)]$ on $\alpha + \beta \ln(x)$ consistently estimates k_s as $-\hat{\beta}$ with an R^2 close to 1. The results of this regression are shown in Table 3. The R^2 is on average 0.8, which indicates that the Pareto is a fairly good approximation of the underlying productivity distributions. As for the skewness parameter, larger k_s implies a larger share of high cost (low productivity) and therefore small firms. Hence, "Metal Products", "Rubber and Plastic" as well as "Machinery" appear to be the sectors with the highest concentration of inefficient and small firms, while "Textiles, Wearing Apparel, Leather Products and Footwear", "Food, Beverages and Tobacco" as well as "Chemicals" exhibit the most even distribution of firms across all levels of productivity and size. Turning to the cutoff cost, c_s^{hh} corresponds to the highest cost (the lowest productivity) of producers in country h. In principle, the reverse of the minimum observed productivity approximates well the cutoff cost. However, due to noise and extreme values associated with micro

[4] See Appendix B for details on firm level TFP estimates.

Table 1: Coefficients of freeness of trade and elasticity with respect to distance, by sector

Industry code	Industry	ρ_s	δ_s
1	Food, Beverages and Tobacco	6.52E-06	-1.93
2	Textiles,Wearing Apparel, Leather Products and Footwear	3.03E-04	-1.19
3	Wood Products except Furniture	7.02E-06	-1.91
4	Paper products	1.06E-04	-1.38
5	Printing and Publishing	1.12E-06	-2.29
6	Chemicals	6.16E-05	-1.49
7	Rubber and Plastic	1.87E-05	-1.72
8	Non-metallic Mineral Products	9.78E-06	-1.85
9	Metal Products	3.89E-05	-1.57
10	Machinery	3.63E-04	-1.16
11	Professional and Scientific Equipment	1.37E-04	-1.34
12	Other Manufacturing	2.18E-04	-1.25

Source: Trade and Production Dataset (CEPII) and authors calculations

Table 2: Freeness of trade, by countries of origin and destination

	Exporter			**Importer**	
	ρ_s^{out}	border effect		ρ_s^{in}	border effect
PT	1.56E-05	-1.29	NO	3.53E-06	-3.12
ES	2.10E-05	-1.23	ES	7.68E-06	-1.96
FI	2.18E-05	-1.28	IT	7.77E-06	-2.09
IT	2.53E-05	-1.22	FR	1.07E-05	-2.17
IE	3.50E-05	-1.31	PT	1.40E-05	-1.16
AT	3.53E-05	-1.28	FI	1.57E-05	-1.30
NO	3.65E-05	-1.14	AT	2.12E-05	-1.37
SE	3.65E-05	-1.29	SE	2.83E-05	-1.17
DK	4.31E-05	-1.35	IE	3.26E-05	-0.92
FR	4.68E-05	-1.22	GB	3.70E-05	-1.11
GB	5.81E-05	-1.30	DE	3.73E-05	-1.22
DE	6.94E-05	-1.29	DK	7.19E-05	-0.41
BE	1.08E-04	-1.38	NL	1.84E-04	-0.01
NL	1.09E-04	-1.38	BE	1.89E-04	-0.01

Source: Trade and Production Dataset (CEPII) and authors calculations

data, a more robust estimate can be obtained through a moment estimator. Specifically, if x is Pareto distributed with shape parameters k_s over the support $[x_s^{hh}, \infty)$, then its mean is equal to $x_s^{hh} k_s/(k_s - 1)$. Using the observed country-sector productivity mean and the estimated k_s, one can invert this formula to recover x_s^{hh} as a scaled average sectoral productivity. Raising this to the power of -1, generates the cost cutoff c_s^{hh}.

By averaging the cost cutoffs across sectors within countries, we can get the distribution of the toughness of competition and hence observed productivity across our European countries. This is reported in Table 4. The table shows that the most competitive EU country is Ireland followed by Norway and Denmark. Among large countries the toughest competitive environment can be found in Germany followed by France.

3.3 Revealed competitiveness

We have now all the information we need to calculate revealed competitiveness ψ_s^l/f_s^l from (13). In so doing, we proceed in two steps. First, we compute the bundling parameter $\psi_s^l/(\gamma_s f_s^l)$. Then, we remove the sectoral scaling term γ_s from $\psi_s^l/(\gamma_s f_s^l)$ by estimating the residuals of a regression of $\ln \psi_s^l/(\gamma_s f_s^l)$ on a set of industry dummies. These are reported in the last column of Table 3. By averaging the regression residuals across sectors, we obtain our index of revealed (producer) competitiveness.

Table 5 shows the results. According to this table, the most competitive EU country is Ireland followed by Finland and Denmark. Of the large countries, France is the

Table 3: Sectoral shape parameters of TFP Pareto distributions, by sector

Industry code	Industry	k_s	R^2
1	Food, Beverages and Tobacco	1.20	0.79
2	Textiles,Wearing Apparel, Leather Products and Footwear	1.19	0.81
3	Wood Products except Furniture	1.45	0.81
4	Paper products	1.50	0.82
5	Printing and Publishing	1.52	0.83
6	Chemicals	1.32	0.85
7	Rubber and Plastic	1.59	0.78
8	Non-metallic Mineral Products	1.49	0.80
9	Metal Products	1.80	0.78
10	Machinery	1.56	0.77
11	Professional and Scientific Equipment	1.48	0.75
12	Other Manufacturing	1.46	0.80
	Average	1.46	0.80

Source: AMADEUS, Trade and Production database (CEPII) and authors calculations

Table 4: Observed productivity, by country

Country	c^{hh}
IE	0.05
NO	0.14
DK	0.14
DE	0.17
FR	0.17
AT	0.18
GB	0.18
FI	0.19
IT	0.23
SE	0.25
ES	0.28
PT	0.33

Source: AMADEUS, Trade and Production database (CEPII) and authors calculations

most competitive followed by Germany. This remarkably squares with assessments of European competitiveness based on completely different methodologies such as the Global Competitiveness Index calculated by the World Economic Forum.

The comparison between Tables 4 and 5 reveals substantial rank correlation. Such correlation is, however, far from perfect. For instance, France and Germany switch positions with Germany ranking higher in terms of toughness of competition, and hence observed productivity, but lower in terms of revealed competitiveness. Accordingly, given different sectoral specialization, size and accessibility, the observed performance of French firms with respect to German ones, though worse, can be explained only if France is more likely to generate more productive firms. In other words, if Germany had the same specialization, size and accessibility of France, the observed performance of German firms would be worse than French ones. This can be explained in terms of absolute disadvantage or higher barriers to entry in the case of Germany. Quite remarkable are also the different rankings of Finland and Sweden. These countries face limited accessibility from other European countries. Accordingly, the observed performance of their firms can be explained only through substantial revealed competitiveness. If Finland and Sweden were more accessible, the observed productivity of their firms would be much higher. The opposite is true for Great Britain. Mediterranean countries are, instead, consistently at the bottom of both rankings.

Table 5: Revealed competitiveness, by country

Country	$\frac{\psi_s^o}{F_{E,s}^o}$
IE	2.44
FI	2.37
DK	1.81
AT	1.56
SE	1.32
FR	1.20
DE	1.05
NL	0.68
BE	0.57
IT	0.55
GB	0.52
ES	0.52
PT	0.47

Source: AMADEUS, Trade and Production database (CEPII) and authors calculations

4 Validation

In order to test the reliability of our calibration, we validate the model by reproducing other key properties of the distribution of firm sales and exports. We focus on France, this choice being dictated by the extensive and high quality coverage of French firm data as well as by comparability with existing works such as Eaton, Kortum and Kramarz (2004) and Del Gatto, Mion and Ottaviano (2006). French results are also amenable to comparison with Bernard, Eaton, Jensen and Kortum (2003) given the similarity of patterns uncovered in US and French firm-level data. We target two moments: the share of French firms that export and their productivity gap with respect to non-exporters. Data come from the EAE database compiled by the French National Institute of Statistics (INSEE) and covering around 25.000 firms for the year 2000.

4.1 Share of exporters

In Section 2.3 we have seen that, given country l and industry s, $N_{E,s}^l G_s^l(c_s^{ll}/\tau_s^{ll})$ firms survive and produce for the local market while $N_{E,s}^l G_s^l(c_s^{hh}/\tau_s^{lh})$ export to country h. Countries that are easier to export to are characterized by larger c_s^{hh}/τ_s^{lh}. Firms that are not able to serve the country with the largest c_s^{hh}/τ_s^{lh} do not export at all. Accordingly, if we define the least severe export cutoff as:

$$c_{X,s}^l \equiv \max_h \left[c_s^{hh}/\tau_s^{lh}\right] = \max_h \left[c_s^{hh}(\rho_s^{lh})^{1/k}\right]$$

the ratio $G_s^l(c_{X,s}^l)/G_s^l(c_s^{ll}/\tau_s^{ll})$ gives the percentage of exporters from country l. In the case of France in 2002, our calibration predicts that 20.8% of French firms export. Del Gatto, Mion and Ottaviano (2006) report that in the EAE dataset the real share is 22.26%. This figure is also very close to the one reported by Eaton, Kortum and Kramarz (2004) in 1986.

4.2 Productivity advantage of exporters

From the calibrated model it is also possible to measure the productivity advantage of exporters. Our model predicts a 72% productivity advantage of exporters. For the US, Bernard, Eaton, Jensen and Kortum (2003) report a 33% productivity advantage of exporters over non-exporters. They use this moment to calibrate their productivity variance parameter θ, obtaining a value of 3.6. This parameter θ is similar to the k_s used in this paper. By rescaling our parameter k_s from its current average value of 1.46 to 3.6 we obtain a 31% productivity advantage. In the EAE database, the productivity advantage for the year 2000 is slightly above 27% but it is likely to be underestimated as the database covers only firms with at least 20 employees, 73% of which are exporters.

5 Simulation

We now turn to simulating how changes in the freeness of trade implied by different EMU membership hypotheses and EU enlargement change average productivity. We consider two sets of scenarios and quantify the equilibrium c_s^{hh} by 14 under the different hypotheses.

5.1 EMU

Has EMU affected the toughness of competition in the euro area, and through this channel, average (delivered) costs, markups prices and quantities? To answer this question, we simulate the changes in the cost cutoffs in two counterfactual scenarios: non-participation of France to EMU and participation of the UK. In the first scenario, we investigate what would have happened to the productivity of French and other European firms if France had not been part of EMU in the period up to 2002. In the second, we study the implications of Great Britain having joined EMU over the same time frame.

The simulation is carried out by recomputing the components ρ_s^{lh} of the trade freeness matrix in the two cases. We then calculate the new cutoffs c_s^{hh} corresponding to the new trade freeness matrices. In so doing, we rely on recent assessments of the impact of the EMU on bilateral trade flows between European countries. In this respect, the most careful analysis is arguably presented by Flam and Nordstrom (2003). These authors measure the effects of the EMU on borders effects by introducing three specific dummies in otherwise standard gravity equations. Their findings are shown in Table 6. The dummy EA11 equals 1 when both the country of destination and the country of origin use the euro as national currency. The dummy EA10 takes value 1 when the country of origin uses the euro whereas the country of destination does not, whereas the dummy EA01 equals 1 when the opposite is true. The table reports the results for two regressions that

Table 6: EMU effect on trade volumes

	(a)	(b)
EA11	0.114***	0.088***
(EMU trade creation effect)	(0.025)	(0.025)
EA10	0.064***	0.008
(EMU export boosting effect)	(0.023)	(0.027)
EA01	0.071***	0.071***
(EMU import boosting effect)	(0.024)	(0.025)
Ln (real GDP exporter)	1.214***	1.194***
	0.08	0.08
Ln (real GDP importer)	1.077***	0.99***
	0.074	0.072
Observations	2912	2184
R2	0.99	0.99
Data period	1989-2002	1989-2002
Country coverage	EU-15+EFTA	EU-15

Notes: Robust standard errors; All standard controls, including year, EU membership, nominal exchange rates, and bilateral fixed effects included in the regression but not reported.

Source: Flam and Nordstrom, 2003. Table 6

give us an upper and a lower bounds for the effects of EMU on trade flows. Regression (a) considers all Western European countries whereas regression (b) includes only EU-15 members. The observed period goes from from 1989 to 2002. Comparing the two regressions, the dummy EA11 has an estimated coefficient that ranges from about 9 to 11 per cent and is statistically significant. Also the coefficient of the dummy EA01 is statistically significant and estimated around 7 per cent. Both are statistically significant. The coefficient of the dummy EA10 is instead significant only when all Western European countries are considered with an estimated value of 6 per cent. It is less than 1 per cent and statistically non significant when the sample is restricted to EU countries only.[5]

In our first counterfactual scenario, we reallocate France from the EMU to the non-EMU groups of countries and adjust the border effects accordingly using the coefficients of the dummies estimated by Flam and Nordstrom (2003). In the second scenario, we adopt the same procedure to reallocate Great Britain from the non-EMU to the EMU groups. The corresponding results are reported in Table 7.

Table 7: Changes in cutoffs, by country

	effective c_s^{hh}	counterfactual c_s^{hh} with France out of EMU	% change cutoff	counterfactual c_s^{hh} with France out of EMU (conservative estimate)	% change cutoff
AT	0.1783	0.1781	-0.11	0.1782	-0.07
DE	0.1664	0.1663	-0.04	0.1663	-0.02
DK	0.1375	0.1371	-0.25	0.1373	-0.15
ES	0.284	0.284	-0.01	0.284	0
FI	0.1946	0.1945	-0.03	0.1946	-0.02
FR	0.1724	0.1844	6.97	0.1813	5.15
GB	0.1839	0.1838	-0.06	0.1839	-0.04
IE	0.0457	0.043	-5.85	0.0439	-3.92
IT	0.2335	0.2335	-0.01	0.2335	-0.01
NO	0.1369	0.1361	-0.61	0.1364	-0.32
PT	0.3252	0.3252	-0.01	0.3252	-0.01
SE	0.2471	0.247	-0.04	0.2471	-0.03
	effective c_s^{hh}	counterfactual c_s^{hh} with Great Britain in EMU	% change cutoff	counterfactual c_s^{hh} with Great Britain in EMU (conservative estimate)	% change cutoff
AT	0.1783	0.1783	0.02	0.1783	0.01
DE	0.1664	0.1664	0.01	0.1664	0
DK	0.1375	0.1376	0.09	0.1375	0.04
ES	0.284	0.284	0	0.284	0
FI	0.1946	0.1946	0.01	0.1946	0
FR	0.1724	0.1724	0.02	0.1724	0.01
GB	0.1839	0.1786	-2.89	0.1832	-0.41
IE	0.0457	0.0505	10.48	0.0477	4.41
IT	0.2335	0.2336	0	0.2336	0
NO	0.1369	0.1372	0.22	0.137	0.09
PT	0.3252	0.3252	0	0.3252	0
SE	0.2471	0.2472	0.02	0.2471	0.01

Source: AMADEUS, Trade and Production database (CEPII) and authors calculations

The upper part of the table refers to the French experiment. It shows that, if France had been excluded from the EMU in 2002, its firms would have exhibited an average productivity of 5 to 6 per cent lower and, in the best case, would have dropped from fifth to seventh in the European ranking. Accordingly, prices would have been from 5 to 6 per cent higher due to higher average production costs and larger mark-ups. The reason is that a less competitive French market would have allowed for less resources to transfer from less to more efficient firms. Among the other countries, only Ireland would have experienced a relevant change in the average productivity of its firms. This would have risen by 3 to 5 per cent due to the exit of inefficient firms in a competitive environment made tougher by a substantial increase in Ireland's relative accessibility.

The bottom part of the table regards the British experiment. The adoption of the euro would have increased the average productivity of British firms by 0.5 to 3 per cent

[5] A positive EMU effect on trade is a finding common in the literature. See, e.g., Micco, Stein and Ordonez (2003) as well as Berger and Nitsch (2005) and Baldwin (2006) for a review of the literature.

with comparable drops in prices and mark-ups. While Great Britain's position in the European ranking would have not been affected, the increased exposure to international competition would have triggered the exit of inefficient firms. This would have been of little consequence for the other European countries with the exception of Ireland that would have experienced a substantial fall in average productivity as well as comparable increases in prices and mark-ups.

5.2 Enlargement

Let us now turn to the simulation of the changes in average productivity induced by changes in the freeness of trade associated with two additional scenarios: EU enlargement ('wider integration') and a fully integrated enlarged Europe ('deeper and wider integration'). In designing these scenarios, we will play with the border effects as we did in the previous section.

We start with recalibrating the model on an expanded dataset with 25 rather than 14 European countries.

Table 8: Freeness of trade and distance decay by industry (25 countries)

Industry code	Industry	ρ_s 14 countries	ρ_s 25 countries
1	Food, Beverages and Tobacco	6.52E-06	1.32E-05
2	Textiles,Wearing Apparel, Leather Products and Footwear	3.03E-04	2.03E-04
3	Wood Products except Furniture	7.02E-06	3.70E-06
4	Paper products	1.06E-04	2.43E-06
5	Printing and Publishing	1.12E-06	6.10E-07
6	Chemicals	6.16E-05	1.33E-05
7	Rubber and Plastic	1.87E-05	4.30E-06
8	Non-metallic Mineral Products	9.78E-06	2.52E-06
9	Metal Products	3.89E-05	1.76E-05
10	Machinery	3.63E-04	5.54E-05
11	Professional and Scientific Equipment	1.37E-04	5.02E-05
12	Other Manufacturing	2.18E-04	1.81E-05

Source: Trade and Production Dataset (CEPII) and authors calculations

Table ?? reports the estimated components ρ_s^{hl} of the trade freeness matrix for the enlarged dataset by industry. For the sake of comparison, in the first column we report once more the coefficients ρ_s^{hl} from Table 1. With the only exception of "Food, Beverages and Tobacco", accessibility is reduced for all sectors, reflecting increases in distance and trade barriers. "Paper products" is the most affected industry while "Textiles,Wearing Apparel, Leather Products and Footwear" is the least affected one.

Turning to the country dimension, Table 9 reports the average ρ_s^{hl}'s for the 25 European countries under analysis, ranked from worst to best accessibility. Similarly to Table 9, the left hand side of the table shows how easy it is to access foreign markets from different countries of origin as quantified in the first column by ρ_s^{out}. The right hand side shows, instead, how easy it is to access different domestic markets from abroad (ρ_s^{in}). The ease of accessing foreign markets remains highest for core European countries and lowest for peripheral ones. Nevertheless, the boundaries of the EU core seem to have shifted eastward.

Table 10 shows how changing accessibility as well as the presence of new competitors from the East affect the toughness of competition across countries. It reports a new ranking of countries by observed productivity that favors central European countries and leaves the observed productivity in other areas of the continent unchanged. Unsurprisingly, also revealed competitiveness ψ_s^l / f_s^l changes. The corresponding values are reported in Table ??. For some countries (Finland, Germany and Sweden) revealed competitiveness falls when we enlarge the dataset from 14 to 25 countries, for others it increases. When the block of eastern European countries is considered in the analysis, observed firm performance

Table 9: Freeness of trade, by countries of origin and destination

Exporter		Importer	
	ρ_s^{out}		ρ_s^{in}
IS	5.73E-06	UA	1.85E-07
UA	5.93E-06	RO	6.60E-07
PT	6.14E-06	BG	6.78E-07
BG	7.14E-06	NO	6.94E-07
FI	7.62E-06	IS	9.17E-07
ES	8.14E-06	LV	1.35E-06
RO	8.39E-06	ES	1.53E-06
LV	1.05E-05	PT	1.83E-06
IT	1.20E-05	PL	2.06E-06
NO	1.34E-05	IT	2.45E-06
SE	1.37E-05	FR	2.53E-06
HU	1.44E-05	SV	3.27E-06
PL	1.54E-05	FI	3.43E-06
IE	1.60E-05	CZ	4.46E-06
SK	1.76E-05	SE	4.90E-06
SV	1.83E-05	SK	6.17E-06
AT	1.92E-05	IE	8.05E-06
DK	2.15E-05	GB	1.00E-05
CZ	2.19E-05	CH	1.09E-05
FR	2.51E-05	HU	1.22E-05
CH	2.76E-05	AT	1.50E-05
GB	3.29E-05	DE	1.77E-05
DE	3.98E-05	DK	2.23E-05
BE	6.14E-05	NL	1.59E-04
NL	8.15E-05	BE	2.18E-04

Source: Trade and Production Dataset (CEPII) and authors calculations

Table 10: Observed productivity, by country

14 Countries		25 Countries	
Country	c^{hh}	Country	c^{hh}
IE	0.05	IE	n.a.
NO	0.14	DK	0.15
DK	0.14	DE	0.17
DE	0.17	AT	0.17
FR	0.17	NO	0.17
AT	0.18	FR	0.18
GB	0.18	GB	0.19
FI	0.19	FI	0.20
IT	0.23	IT	0.23
SE	0.25	SE	0.25
ES	0.28	ES	0.28
PT	0.33	PT	0.33

Source: AMADEUS, Trade and Production database (CEPII) and authors calculations

and trade flows suggest that the implied ability of countries such as Denmark, Austria, Germany and Sweden to generate good firms is someway lower whereas it is higher for the countries in which revealed competitiveness increases. In other words, neglecting Eastern markets, overplays the competitiveness of the former group of countries and underplays the competitiveness of the latter.

We now proceed to recompute the trade freeness matrix isolating the impact of EU membership by introducing corresponding dummies in the gravity equation (20): the dummy $EU00$ equals 1 when neither the country of destination nor the country of origin are EU members in the period 2000-2003; the dummy $EU01$ takes value 1 when the country of destination is a EU member whereas the country of origin is not; the dummy $EU10$ takes value 1 in the opposite case when the country of origin is a EU member whereas the country of destination is not. As shown in Table 12, all estimated coefficients are statistically significant and quite large. Interestingly, being part of the EU favors exports to non-EU location reducing the border effect by half.

Based on these border effect estimates, we simulate two counterfactual scenarios. In

Table 11: Revealed competitiveness, by country

14 Countries		25 Countries	
Country	$\frac{\psi_s^o}{F_{E,s}^o}$	Country	$\frac{\psi_s^o}{F_{E,s}^o}$
IE	2.44	NO	3.80
FI	2.37	FI	2.50
DK	1.81	DK	1.46
AT	1.56	AT	1.40
SE	1.32	SE	1.22
FR	1.20	FR	1.16
DE	1.05	DE	1.02
NL	0.68	IT	0.58
BE	0.57	ES	0.57
IT	0.55	NL	0.51
GB	0.52	GB	0.49
ES	0.52	BE	0.43
PT	0.47	PT	0.42
NO	n.a.	IE	n.a

Source: AMADEUS, Trade and Production database (CEPII) and authors calculations

Table 12: EU membership effect on trade volumes

Dependent variable:ln(X)	
Border effect	-0.80***
	(0.06)
Border effect * EU00	-3.25***
(EU trade diversion effect on bilateral trade between third countries)	(0.26)
Border effect * EU01	-3.94***
(EU import diverting effect)	(0.06)
Border effect * EU10	0.43***
(EU export enhancing effect)	(0.27)
Observations	29416
R2	0.98
Data period	2000-2003
Country coverage	25 European countries

Source: Authors calculations

Notes: Robust standard errors; Specification as in Equation 20, including distance measure, importer, exporter and time dummies. Coefficients estimated but not reported.

the first scenario, we adjust the border effects to assume that all countries in the dataset were EU member states in the period of analysis. In the second scenario we eliminate all border effects, imagining an enlarged EU as integrated as if it were a single nation. The results are interesting. While the elimination of the border effect, benefits all European countries, and small countries to a larger degree than big countries, this is not the case for enlargement as all countries experience a loss in productivity.

These results can be explained in terms of equation (14). This shows that enlargement has two effects on the inverse index of (average) 'seller competitiveness' of an incumbent member country h. Recall that such index is an inverse measure of the distance-weighted average competitiveness of countries whose firms sell to country h. As such it depends on the average producer competitiveness of countries selling to h and on the accessibility of country h. Note also that it does not depend on the size of the integrated market as only own size L^h matters. Enlargement (lower border effects with respect to the East) has thus two effects. On the one hand, it improves the accessibility of incumbent EU members, on the other it increases a lot the relative importance of unproductive competitors from the East. This latter effect dominates, which reduces seller competitiveness and therefore the toughness of competition.

Table 13: Changes in cutoffs from deeper and wider integration, by country

	effective c_s^{hh}	counterfactual c_s^{hh} with enlargement	% change	counterfactual c_s^{hh} with no border	% change
AT	0.1707	0.1721	0.83	0.1604	-6.05
DE	0.1423	0.1438	1.05	0.1121	-21.21
DK	0.1327	0.1470	10.75	0.1026	-22.68
ES	0.2829	0.2831	0.08	0.2683	-5.17
FI	0.1946	0.2027	4.17	0.1618	-16.86
FR	0.1593	0.1602	0.55	0.1353	-15.07
GB	0.1786	0.1793	0.40	0.1736	-2.76
IT	0.2328	0.2330	0.11	0.2272	-2.41
NO	0.1401	0.2339	66.99	0.2993	113.71
PT	0.3250	0.3252	0.06	0.3022	-7.01
SE	0.2436	0.2566	5.34	0.2554	4.84

Source: AMADEUS, Trade and Production database (CEPII) and authors calculations

6 Conclusion and policy implications

Globalization is triggering major changes around the world as countries attempt to reap the benefits and absorb the costs of associated fast-paced structural changes. Measuring how countries are faring in this process is increasingly difficult using traditional indicators of comparative advantages, as the latter cannot account for the underlying heterogeneity in the competitiveness of domestic firms and the interactions within the network of local and global markets. Those questions can be fruitfully addressed by accounting for the interactions between countries fundamental characteristics, including their market access, institutional settings, technology and factor endowments, and the effective distribution of domestic and foreign firms with different productivity across sectors and markets.

To this end, this paper proposes a new conceptual framework of analysis, which merges the insights of traditional trade theory and new trade theory in a multi-country, multi-sector model with monopolistic competition and variable markups. As a result, an innovative indicator of 'revealed competitiveness' is presented. This latter is empirically derived by calibrating the model on firm level data and industry level trade figures from a large panel of European countries. The indicator is then used to provide a ranking of European countries which remarkably squares with assessments of European competitiveness based on completely different methodologies such as the Global Competitiveness Index of the World Economic Forum.

The calibrated model is further exploited to investigate whether key elements of the EU strategy, namely EMU and enlargement are helping or hindering the efforts of Europe to adapt to the challenges of a more competitive global environment. The results indicate that outside EMU, less firms would be able to survive competition on domestic and foreign markets. In particular, in the absence of EMU, a country's accessibility is lower and its share of unproductive firms higher. The quantification of these effects shows, however, that the effect is uneven across countries.

Enlargement has on the other hand two contrasting effects. On the one hand, it improves the accessibility of EU members, on the other it increases substantially the relative importance of unproductive competitors from the East. Overall, while EMU has increased the toughness of competition in Euro area countries, and through this channel lowered average (delivered) costs, markups, prices and quantities, enlargement can be expected to have similar effects only with an increase in average productivity in the new EU members.

All in all, four critical channels have been explicitly considered in the model - in line with new trade theories - as critical sources of a country's overall competitiveness. The first is accessibility. Regions with overall better access tend to be associated - ceteris paribus - with tougher competition, richer product variety, and higher productivity. These regions are indeed also better export-bases and therefore attract a greater amount of firms from neighbouring countries. The second important channel is market size. In a world embodying economies of scale, larger and more integrated markets are characterized by tougher competition, lower mark-ups and lower prices. EMU and EU enlargement have arguably implied the creation of a larger and more accessible domestic market, hence helping European firms to cope better with the structural changes associated with globalization than firms in the previous collection of smaller and less integrated national markets. The third channel is Ricardian technological advantage. Technologically advanced regions are associated with higher productivity level and tougher competition. Again, this generates higher product variety, lower prices and higher welfare. Finally, the last channel is the institutional and political framework, since the quality and resilience of the domestic institutions are key elements of success amid global competition. These two last channels are synthesised in the proposed indicator of 'revealed competitiveness'.

Though stylized our analysis bears two main policy implications for the euro area and other EU countries. First, in order to take full advantage of the positive effects of globalization - which are mostly related to increased accessibility to foreign markets and enhanced efficiency of the domestic markets - a continuation of structural reforms in euro area and other EU countries appears beneficial in enhancing their ability to adjust to major changes taking place in the global environment. In particular, implementing structural reforms which are beneficial for growth and innovation seems to be paramount. The success of the implementation of such reforms partly hinges on an important link between innovation, growth and reforms and, for the specific situation in the EU, the interaction between EU and national policies. At the same time, policies should aim at raising flexibility and lower the adjustment costs for domestic firms and workers facing the challenges of a globalisation process that they cannot control.

Second, while the euro has provided participating countries with a strong currency, a credible monetary policy and - together with other EU key strategies such as the Single Market Programme and enlargement - a better export base, it has also increased the need for cooperation and coordination of economic policies among member states leading to Europe-wide structural reforms. In particular, our model suggests that policies able to improve market access are likely to be associated with broad competitive gains.

All in all, as globalisation is triggering major transformations all over the world, a well balanced assessment of the adoption of a common currency and the deepening and broadening of EU integration would support the view that they have contributed to make member countries fitter for globalization but that there are also signs that further adjustments will need to take place.

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Appendix

A Data

The data we use to compute trade costs are provided by a combination of sources.

A.1 Trade flows and production data

Data on Trade figures and production are from the combined CEPII(BACI)-World Bank dataset described in Mayer and Zignago (2003) and freely downloadable at www.cepii.fr.

These data together allow us to recover both the intra-national flows (EXP_s^{dd}) and the external flows (EXP_s^{od} , with $o \neq d$) flows of goods. To recover the bilateral trade costs for the countries under analysis, we consider trade among 32 European countries in the years from 1999 to 2003. We use a larger number of countries and years to obtain more accurate measures.

A.2 Population and geographical data

Data on population (thousand of inhabitants) are from the World Development Indicators.

Geographical data are from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). The distance variables are in km and cover both simple and weighted measures. In this analysis we use weighted distance but we also checked the consistency of results for the simple distance. Simple (geodestic) distances are calculated following the great circle formula, which uses latitudes and longitudes of the most important cities/agglomerations (in terms of population) for the "dist" variable and the geographic coordinates of the capital cities for the "distcap" variable. Both variables incorporate internal distances that, as in the theoretical model, are allowed to be non-zero. As in Head and Mayer (2002, 2004), the internal distance d^{hh} of country h is calculated firm its area as $d^{hh} = \frac{2}{3} \times \sqrt{area^h/\pi}$. this formula models the average distance between producer and consumer on a stylised geography where all producers are centrally located and the consumers uniformly distributed across a disk-shaped region.

By contrast, weighted distances use city-level data on distance and the geographic distribution of population inside each nation. The basic idea is to calculate the distance between two countries as the weighted average bilateral distance between their biggest cities with the corresponding weights determined by the shares of those cities in the overall national populations. This procedure can be used in a totally consistent way for national and international distances. Specifically as Head and Mayer (2002) indicate: the distance betweeen country l and country h is:

$$d_{lh} = [\sum_{p \in l} \sum_{r \in h} \frac{pop^p}{pop^l} \frac{pop^r}{pop^h} (d^{pr})^\theta]^{\frac{1}{\theta}} \tag{21}$$

where $\frac{pop^p}{pop^l}$ and $\frac{pop^r}{pop^h}$ designate the populations of agglomerate p in country l and of agglomerate r in country l, respectively. The parameter θ measures the sensitivity of trade flows to bilateral distance d^{pr}. For the *distw* variable, θ is set equal to 1, while for the *distwces* variable, θ is set equal to -1, which corresponds to the standard distance coefficient estimated from gravity equations.

A.3 Firm Level Data

This paper retrieves data on value added, fixed assets (capital), sales and the cost of materials (intermediate consumption) in thousand of euros as well as the number of employees from a large cross section of manufacturing firms from 25 European countries. The data are from the Amadeus database(Bureau van Dijk, BvD)[6] We eliminate missing values and extreme observations defined as having either a value added/employee or capital/employee ratio out of the range identified by the 1st and 99th percentile. This leaves us with an initial sample of 149353 firms.

Table 14 shows number of firms and their average, minimum and maximum values for total factor productivity.

Table 14: Firms, by country

Country	Firms	TFP (OLS Method)			
		Average	Standard Deviation	Min	Max
AT	105	33.32094	26.39095	2.212487	193.4029
BE	2567	29.07782	48.90826	1.63548	2192.651
BG	1075	3.478918	6.956333	.0213871	129.778
CZ	2365	8.811675	7.5188	.3352955	105.8155
DE	278	39.31219	35.05724	.4000357	329.0522
DK	651	38.52366	34.14457	1.298811	361.1505
ES	57023	15.13584	10.98763	.1211805	182.9147
FI	5171	22.9919	26.79103	.4409083	1317.939
FR	32858	27.96352	17.82251	.969883	272.4582
GB	6615	27.24272	46.74277	.075911	2017.521
HU	94	9.751219	8.597522	1.465112	55.74363
IE	72	34.53856	114.58916	.3239747	2110.6823
IT	8542	20.79159	15.36606	.2417498	265.8112
LV	34	4.933191	2.765409	1.359142	15.1516
NL	410	44.68786	123.4879	.119943	2201.635
NO	3652	30.18319	26.15541	.5131263	299.1277
PL	2303	7.783876	7.787789	.0400448	118.2887
PT	355	12.88198	10.9181	.2936199	122.3479
RO	8533	2.376443	2.393516	.0511188	64.61783
SE	14621	18.3754	11.39272	.2973468	155.7835
SK	38	11.06216	19.38057	.4526804	109.7441
UA	1991	1.834839	1.710435	.0160045	21.85019
Total	149353	19.03911	20.87742	.0160045	2201.635

Source: Amadeus

As we can see from the table, data coverage for some countries including Germany is rather poor. This is a shortcoming as Germany is the biggest European economy as well as among the most productive.

We use these data to estimate firm-level total factor productivity by OLS (results in Section **??**) and Levinshon-Petrin method, which uses intermediate consumption to control for unobservables and provide unbiased estimates (See Appendix B for details about the specification and estimation of firm-level TFP vis this method).

Turning to the industry disaggregation we work with a 12 sectors breakdown of manufacturing activities, which is derived from merging the information contained in AMADEUS, classified in 4-digit NACE sectors with the database needed to compute

[6]Amadeus provides comparable firm-level balance-sheet data for 4 million companies in 34 European countries at the 4-digit NACE sectoral detail and covers all industries with exception of the bank and insurance sectors. Amadeus gathers information on firms that satisfy country specific size-thresholds. By construction, the database is biased towards large companies. A further shortcoming of the data is that statutory reporting and filing requirements differ from country to country, and the amount of balance sheet information required by each country varies correspondingly, so that the data coverage is very unbalanced. Also Amadeus, to date, is less complete in countries where there is a lack of centralisation, with companies registering at offices based in their region rather than at a single registry. This is a problem in particular for Germany where, furthermore, value added data is available only for a small subset of companies.

trade costs, organised by 3-digit ISIC sectors. The resulting disaggregation is detailed in Table 15.

Table 15: Representativeness of the AMADEUS sample

Own industry code	Industry description
1	Food, beverages and tobacco
2	Textiles, Wearing apparel and footwear
3	Wood products except furniture
4	Paper products
5	Printing and publishing
6	Chemicals
7	Rubber and Plastics
8	Non-metallic mineral products
9	Metal products
10	Machinery except electrical
11	Professional and scientific equipment
12	Other manufacturing and transport equipment

B Alternative Measurement of Total Factor Productivity from Firm-Level Data

Assuming a Cobb-Douglas production technology:

$$\mathrm{VA}_{it} = \mathrm{TFP}_{it} \times L_{it}^{\beta_l} \times \quad K_{it}^{\beta_k} \tag{22}$$

with VA denoting value added, L labour, K capital and TFP a efficiency parameter. We are ultimately interested in the efficiency parameter TFP. We can, however, only indirectly quantifying it by estimating the production function parameters β_l and β_k and calculating the residual. For that we write down Equation 22 in logs and add a constant:

$$va_{it} = \alpha + \beta_l l_{it} + \beta_k k_{it} + \epsilon_{it} \tag{23}$$

The residual now contains the respective productivity of firm i at time t%. This procedure is, however, only valid if one could rightly assume that the residual term is indeed orthogonal to the input choices of labour and capital. If firms input choices depend on some productivity component that is unobserved to the researcher but known to the firm, OLS estimates of β_l and β_k are potentially biased and resulting TFP measures seriously distorted.

This problem can be illustrated by decomposing the error term:

$$\epsilon_{it} = \omega_{it} + \eta_{it} \tag{24}$$

where ω_{it} is a state variable that is known to the firm and thus correlated with the input choices of L and K while η_{it} is i.i.d. Various solutions have been proposed to solve this issue (e.g., Blundell and Bond, 2000; Olley and Pakes, 1996, Levinsohn and Petrin (2003)).

In what follows, as robustness test, we recalibrate the model in Section **??** adopting the method proposed by Levinsohn and Petrin (2003) who suggest to use intermediate inputs as a proxy for the unobserved component ω_{it} in order to produce unbiased estimates of TFP. While the method is more robust, it requires information that is available only for a subset of countries, hence obliging us eliminate Great Britain and Denmark from the set of countries in the estimation.

Following Levinsohn and Petrin (2003), we invert the demand function for intermediate inputs $m_{it} = m_{it}(k_{it}, \omega_{it})$ into $\omega_{it} = \omega_{it}(k_{it}, m_{it})$. Hence the unobservable error component ω_{it} is now a function of observables, capital and material inputs.

One can now transform Equation 23 into:

$$\begin{aligned} va_{it} &= \alpha + \beta_l l_{it} + \beta_k k_{it} + \omega_{it} + \eta_{it} \\ &= \beta_l l_{it} + \phi_{it}(k_{it}, m_{it}) + \eta_{it} \end{aligned} \tag{25}$$

where

$$\phi_{it}(k_{it}, m_{it}) = \alpha + \beta_k k_{it} + \omega_{it}(k_{it}, m_{it}) \tag{26}$$

By approximating $\phi_{it}(k_{it}, m_{it})$ with a third-order polynominal one can write Equation 25 as:

$$va_{it} = \delta_0 + \beta_l l_{it} + \sum_{x=0}^{3}\sum_{z=0}^{3-x} \delta_{xz} k_{it}^x m_{it}^z + \eta_{it} \tag{27}$$

which can be estimated by OLS. Thus, from this first stage one can obtain consistent estimates of β_l and ϕ_{it}.[7]

$$\widehat{\phi_{it}} = \widehat{\delta}_0 + \sum_{x=0}^{3}\sum_{z=0}^{3-x} \widehat{\delta}_{xz} k_{it}^x m_{it}^z - \widehat{\beta}_l l_{it} \tag{28}$$

One can now use Equation 28 to obtain a prediction of ω_{it} for each candidate value of β_k^* at least up to a constant:

$$\widehat{\omega_{it}} = \widehat{\phi_{it}} - \beta_k^* k_{it} \tag{29}$$

with this one now proceeds to approximate ω_{it} in a non-parametric way.

$$\widehat{\omega_{it}} = \gamma_0 + \gamma_1 \omega_{i,t-1} + \gamma_2 \omega_{i,t-1}^2 + \gamma_3 \omega_{i,t-1}^3 + \varepsilon_{it} \tag{30}$$

Plugging this into the value added equation, we can obtain a consistent estimates of β_k^* by minimising

$$\min_{\beta_k^*} \sum_t (va_t - \beta_l l_t - \beta_k^* k_t - \widehat{\omega}_t)^2 \tag{31}$$

Levinshon-Petrin estimates of productivity are carried out separately for each sector. However, we do not make separate estimations by country, assuming de facto that countries have the same technology up to a scale factor (Hicks neutral augmenting technology).

Results are qualitatively similar to those for the OLS estimation in Section (**??**).

[7] up to a constant