2 Firm heterogeneity and competitiveness in the European Union

Firms are very heterogeneous in terms of economic performance within even narrowly defined sectors, as is confirmed by the evidence provided in this article for several EU countries. This has major implications for a country's competitiveness, understood as its ability to export or, more broadly, as its aggregate productivity growth. The article discusses those implications and the ensuing policy recommendations to enhance competitiveness in the EU. Regarding trade performance, only a relatively small number of firms – the largest and the most productive in a given sector – are able to export. This implies that the aggregate export performance of each country crucially depends on the dynamics of these firms. In turn, trade participation affects the productivity of exporting and, indirectly, non-exporting firms, thereby positively affecting developments in aggregate productivity. Furthermore, extensive firm heterogeneity means that aggregate productivity growth can be fostered significantly by a better allocation of capital and labour across firms, with evidence suggesting that significant productivity gains can stem from enhanced allocative efficiency within sectors. However, some indicators of capital misallocation have been trending upwards in several EU countries in recent years, on account of both uncertainty and frictions in the production factor and credit markets.

1 Introduction

Owing to the increased availability of firm-level data, various empirical studies have documented the existence of a marked heterogeneity in performance across firms. Empirical literature based on granular data shows that firms are very different in terms of e.g. size, cost structure, profits and productivity, even within finely disaggregated sectors.[92] This also holds true for EU countries, as is confirmed by a database recently produced by the Competitiveness Research Network (CompNet).[93] In the "old" EU Member States (i.e. the nine countries that had joined the EU by 1995 at the latest, for which data are available), the top 10% most

[92] For a review of the literature, see Bartelsman, E.J. and Doms, M., "Understanding Productivity: Lessons from Longitudinal Microdata", *Journal of Economic Literature*, Vol. 38, 2000, pp. 569-594; and, more recently, Syverson, C., "What Determines Productivity?", *Journal of Economic Literature*, Vol. 49, No 2, 2011, pp. 326-365.

[93] CompNet is a research network originally created within the European System of Central Banks (ESCB) in 2012, which is devoted to the analysis of competitiveness from a multi-dimensional prospective. It is composed of economists from the ECB/ESCB, the European Commission and a number of European and international organisations, universities, statistical institutes and think tanks. The CompNet dataset is based mainly on administrative data from firm registries and provides harmonised cross-country information on the main moments of the sector distribution (e.g. mean, median, standard deviation, deciles of the distribution, etc.) for a number of variables related to firm performance and competitiveness. For details on this micro-aggregated productivity database, see Lopez-Garcia, P., di Mauro, F. and the CompNet Task Force, "Assessing European competitiveness: the new CompNet micro-based database", *Working Paper Series*, No 1764, ECB, 2015, as well as Berthou, A., Dhyne, E., Bugamelli, M., Cazacu, A.-C., Demian, C.-V., Harasztosi, P., Lalinsky, T., Meriküll, J., Oropallo, F. and Soares, A.C., "Assessing European firms' exports and productivity distributions: the CompNet trade module", *Working Paper Series*, No 1788, ECB, 2015, for the details on trade data.

productive firms are, on average, nearly three times more productive than firms located at the bottom 10% of the productivity distribution within each sector (see Chart 1).[94] This figure is even higher for most of the ten "new" EU Member States for which data are available.[95] Moreover, the productivity distribution is asymmetric as it displays a large density of low-productive firms and few highly productive firms. Although this empirical regularity applies to all countries and sectors, the shape of the distribution can differ across countries, reflecting their structural characteristics. For example, the productivity distributions of the manufacturing sector in France and Germany are characterised by a higher mean and fatter right tail than those in countries such as Spain and Italy (see Chart 2).

Firm heterogeneity has implications for the overarching assessment of competitiveness, which covers both trade outcomes and productivity developments. In a broad sense, competitiveness relates to the business environment and institutional framework that allow efficient firms to thrive,[96] thus supporting trade performance and productivity. The existence of a significant degree of heterogeneity across firms has important implications for the assessment of competitiveness along both such dimensions.

Regarding trade performance, both the empirical and the theoretical literature highlight a two-way link between firm-level trade and productivity. In line with empirical evidence based on granular data, the most recent theoretical international trade literature predicts that exporters are the most productive firms in an economy.[97] Moreover, in addition to the traditional gains from trade, both models and empirical analyses show that trade liberalisation can, in turn, boost aggregate productivity by reallocating resources to exporting, more productive firms.

Firm heterogeneity also has implications for aggregate productivity growth. In the presence of heterogeneous firm performance, aggregate productivity developments also depend on the efficiency with which production factors are

94 In most cases, the cross-country evidence on trade outcomes provided in this article covers 16 EU countries: ten euro area countries (Belgium, Estonia, France, Italy, Latvia, Lithuania, Portugal, Slovenia, Slovakia and Finland) and six other EU Member States (the Czech Republic, Denmark, Croatia, Hungary, Poland and Romania). The charts containing only productivity indicators also include Germany, Spain and Austria. The use of (slightly) different country samples is flagged in the note to the related chart. Information for 2013 is only available for 12 countries, since it is not available for Lithuania, Hungary, Romania and Slovenia. This article considers 54 two-digit sectors in the non-financial business economy, 23 of which are in manufacturing, according to the NACE rev. 2 system. Moreover, throughout the article, only CompNet data referring to firms with more than 20 employees are considered. This sample is population-weighted, which enhances cross-country comparability. However, some comparability issues, related to, for example, sampling procedures, remain. For detailed information on the dataset, see Lopez-Garcia et al., op. cit., and Berthou et al., op. cit.

95 Bartelsman et al. explain the differences in within-sector dispersion in productivity between central and eastern European countries and western Europe with the fact that during the initial years of the transition, low-productivity firms were able to survive in the market and coexist with new, far more productive firms created in the private sector (see Bartelsman, E., Haltiwanger, J. and Scarpetta, S., "Cross-Country Differences in Productivity: The Role of Allocation and Selection", *The American Economic Review*, Vol. 103, No 1, 2013, pp. 305-334).

96 See, for example, the definition given in *The Five Presidents' Report: Completing Europe's Economic and Monetary Union*, European Commission, June 2015, p. 8: "*In the end, a competitive economy is one in which institutions and policies allow productive firms to thrive*."

97 It should not be overlooked that this literature originates from the contribution of economists such as Joseph Schumpeter, who already in the 1930s took into account the dynamic evolution of heterogeneous economic agents in his work (see, for example, Schumpeter, J.A., *The Theory of Economic Development*, Harvard University Press, Cambridge, Massachusetts, 1934).

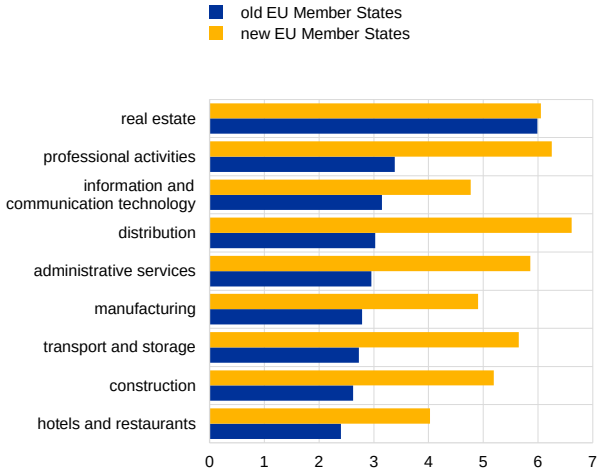
allocated across firms as a result of two fundamental developments: (i) the birth and death of firms, and (ii) their expansion and contraction. Factor reallocation is productivity-enhancing when, as a result of such developments, resources shift from the least to the most productive firms. However, constraints such as credit frictions or structural rigidities may impair the efficient allocative process.

The aim of this article is to take stock of the implications of firm heterogeneity for competitiveness in the EU. The structure of the article is as follows. Section 2 examines the link between firm productivity and trade from an empirical standpoint. Within that section, Box 1 discusses the workhorse theoretical trade models underpinning the empirical analysis, whereas Box 2 assesses the role of firm heterogeneity in explaining the reactivity of aggregate exports to changes in real exchange rates, within and across countries. Section 3 focuses on the efficiency with which capital and labour are allocated across firms within a given sector, which is an important determinant of productivity growth. Section 4 concludes with some policy implications.

Chart 1

Dispersion of firm productivity within sectors in 19 EU countries

(ratio of the labour productivity level of the top and bottom deciles of firms in each two-digit sector, then aggregated to the macro-sector level; averages across countries in the years 2001-13)

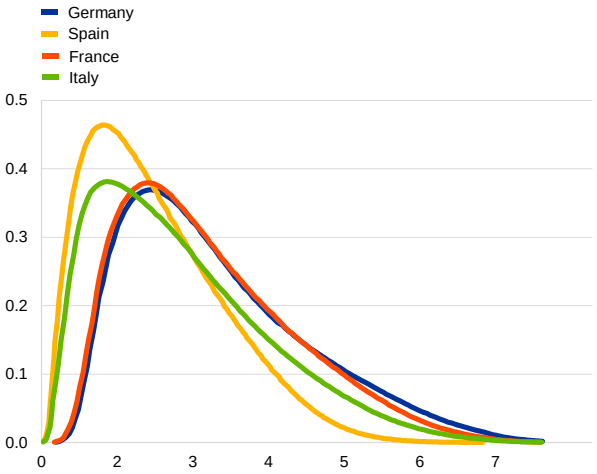


Source: ECB staff calculations based on CompNet data.
Notes: The old EU Member States included in the chart are: Belgium, Denmark, Germany, Spain, France, Italy, Austria, Portugal and Finland. The new EU Member States considered here are: the Czech Republic, Estonia, Croatia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia and Slovakia. The ratios in each two-digit sector are aggregated to the macro-sector level using value-added shares. Unweighted averages across countries and years. 2013 data are available for 12 countries, since they are not available for Germany, Lithuania, Hungary, Austria, Portugal, Romania and Slovenia.

Chart 2

The distribution of firm productivity in manufacturing in the four largest euro area countries

(labour productivity kernels, normalised to country GDP per capita, in EUR ten thousands; manufacturing sector; average over the years 2006-12)



Sources: ECB staff calculations based on CompNet data, Eurostat data and Statistical office of Germany – AFiD-Panel data for Germany.
Notes: The productivity levels are rescaled so that the mean of the productivity distribution is equal to the GDP per capita sourced from Eurostat. It should be noted, however, that rescaling with GDP per capita might alter the order of countries for reasons not necessarily related to productivity, such as the sector composition, the size of the shadow economy or unusual demographic patterns.
Data for Germany refer to a stratified representative sample of manufacturing firms with more than 20 employees. As the revised German data are available by size class, a weighted average was computed, where the weights are the number of firms within a given size class.

2 Productivity and trade: a two-way link

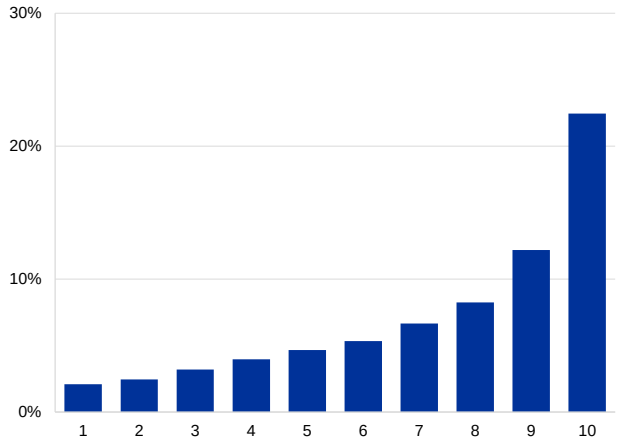
2.1 The importance of firms' productivity for trade

Firms' participation in international trade and their relative importance in a country's exports hinge crucially on their productivity level. Micro-founded evidence based on CompNet trade data, which are available for the manufacturing sectors in 15 EU countries, shows that the export share of firms that are in the top decile of the labour productivity distribution is about four times that of the median firm (see Chart 3).

Chart 3

Export share of manufacturing firms in different deciles of the labour productivity distribution in 15 EU countries

(average across countries over the period 2001-13; percentage share of total manufacturing exports)

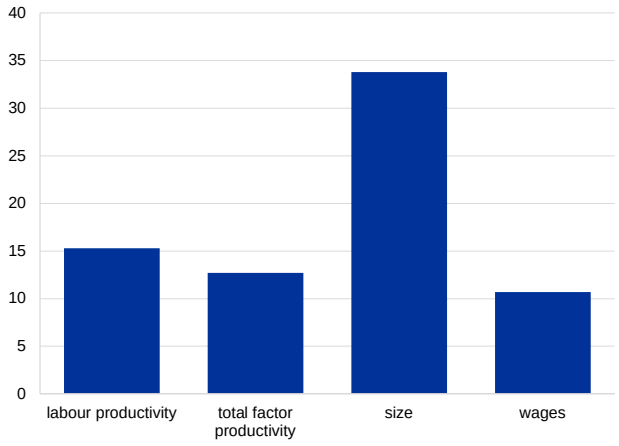


Source: ECB staff calculations based on CompNet data.
Note: Average share of exports as a percentage of total manufacturing exports per labour productivity decile across the 15 EU countries (the 16 EU countries mentioned in footnote 3, with the exception of Hungary).

Chart 4

Performance gap of new manufacturing exporters vis-à-vis non-exporting firms in the same sector in 16 EU countries

(percentage points)



Source: ECB staff calculations based on CompNet data.
Notes: The countries covered in this chart are the 16 EU countries mentioned in footnote 3. Bars represent the estimated coefficient of a dummy variable taking the value of one for the new exporters, and zero otherwise, after controlling for country and two-digit sector-specific fixed effects. All dummy coefficients are significant. The ordinary least squares (OLS) regressions are conducted over the period 2001-13. New exporters are defined as firms that export in time t and t+1, but not in t-1.

Based on firm-level empirical studies, exporting firms in all sectors are found to be not only more productive, but also larger, more capital-intensive and able to pay higher wages than non-exporting firms in the same sector.[98] After controlling for country and sector-specific fixed effects, it is found that new exporting firms (i.e. firms that have just started to export) in the sample of EU countries are, on average, about 15% more productive, 30% larger and pay 10% higher wages than non-exporting firms in the same narrowly defined sector (see Chart 4). This supports

[98] For example, Bernard and Jensen document large, significant differences between exporters and non-exporters among US manufacturing firms (see Bernard, A.B. and Jensen, J.B., "Exporters, Jobs, and Wages in US Manufacturing: 1976-1987", *Brookings Papers on Economic Activity, Microeconomics*, Vol. 1995, 1995, pp. 67-112; "Exporters, skill upgrading and the wage gap", *Journal of International Economics,* Vol. 42, 1997, pp. 3-31; and "Exceptional exporter performance: cause, effect, or both?", *Journal of International Economics,* Vol. 47, No 1, 1999, pp. 1-25).

the hypothesis that new exporters display a productivity and size advantage in comparison with non-exporters before they even start competing in international markets.[99]

A key reason why exporting firms need to be more productive is that only in this way can they afford to pay the related trade costs, so that expansion into foreign markets is profitable.[100] Engaging in trading activities is costly. Examples of barriers to trade are infrastructure and logistic costs, tariffs and non-tariff barriers, hedging costs to the nominal exchange rate, the cost of credit, and the cost of obtaining information on foreign markets.[101] As discussed in Box 1, both the theoretical and the empirical literature suggest that there is a productivity threshold above which firms find it profitable to pay these costs and expand in foreign markets. A proxy for this unobservable threshold is the estimated labour productivity advantage of new exporters versus non-exporters operating in the same sector – the "exporter productivity premium".[102]

In line with the literature, evidence on EU countries suggests that the lower the level of economic development of a country, the higher tends to be the exporter productivity premium. Countries with low GDP per capita usually have less integrated markets; this allows non-exporters with low levels of productivity to survive, thus explaining the coexistence in the same sector of very productive firms that are able to afford the costs associated with exporting and low-productivity domestically oriented firms.[103] As a result, the exporter productivity premium is larger in economies such as Romania than in, for example, Finland and Denmark (see Chart 5). GDP per capita is also a proxy of institutional quality. Better institutions decrease both the fixed and the variable costs of trade faced by firms.[104] The exporter productivity premium in Chart 5 is indeed found to be low in countries where institutional quality is known to be high.

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99 Engagement in trading activities might in turn foster firms' own productivity growth (on this issue, see Section 2.2 below).

100 Evidence about the presence of sunk entry costs to exports and persistence in export activities were found for Columbia (see Roberts, M.J. and Tybout, J.R., "The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs", *The American Economic Review*, Vol. 87, No 4, 1997, pp. 545-564). Other examples of self-selection of firms into export markets refer to France (see Eaton, J., Kortum, S. and Kramarz, F., "An anatomy of international trade: evidence from French firms", *Econometrica*, Vol. 79, No 5, 2011, pp. 1453-1498), Germany (see Bernard, A.B. and Wagner, J., "Export entry and exit by German firms", *Weltwirtschaftliches Archiv*, Vol. 137, No 1, 2001, pp. 105-123), and the United States (see Bernard, A.B. and Jensen, J.B., "Exporting and Productivity in the USA", *Oxford Review of Economic Policy*, Vol. 20, No 3, 2004, pp. 343-357).

101 See, for example, Minetti, R. and Chun Zhu, S. "Credit constraints and firm export: Microeconomic evidence from Italy", *Journal of International Economics*, Vol. 83, No 2, 2011, pp. 109-125, on the role of credit rationing; and Fontagné, L., Orefice, G., Piermartini, R. and Rocha, N., "Product standards and margins of trade: Firm-level evidence" *Journal of International Economics*, Vol. 97, No 1, 2015, pp. 29-44, on the impact of tariffs and stringent non-tariff barriers in the foreign markets on export performance.

102 The exporter productivity premium in this article is estimated following the methodology of the International Study Group on Exports and Productivity (ISGEP), "Understanding Cross-Country Differences in Exporter Premia: Comparable Evidence for 14 Countries", *Review of World Economics*, Vol. 144, No 4, 2008, pp. 596-635. However, in contrast to that study, only new exporters among the set of exporting firms have been included here so as to better ensure that the productivity premium does not include the productivity gains due to firms' engagement in international trade.

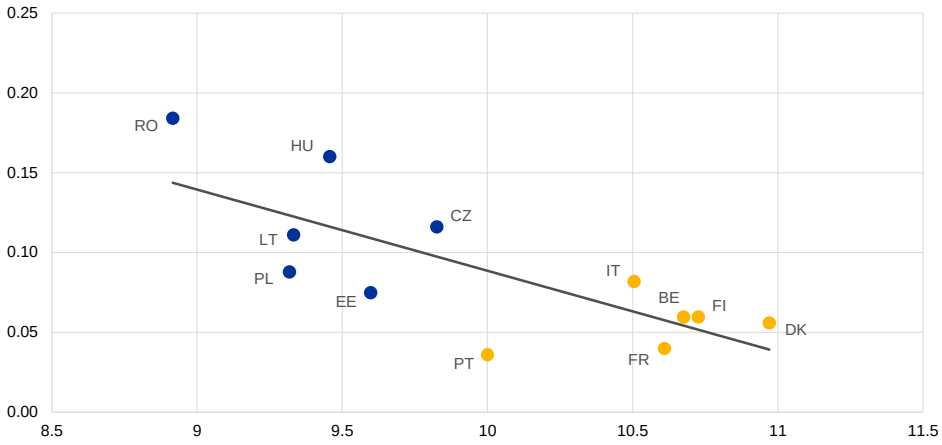
103 See Hallward-Driemeier, M., Iarossi, G. and Sokoloff, K.L., "Exports and Manufacturing Productivity in East Asia: A Comparative Analysis with Firm-Level Data", *NBER Working Papers*, No 8894, National Bureau of Economic Research, 2002.

104 See ISGEP, op. cit.

Chart 5

Exporter productivity premium in manufacturing and GDP per capita in 12 EU countries

(averages over the period 2001-13; x-axis: GDP per capita (log); y-axis: exporter productivity premium)



Sources: ECB staff calculations based on ISGEP, CompNet data, and World Bank Development Indicators database.
Notes: The exporter productivity premium is estimated on the basis of the ISGEP methodology. It is computed as the coefficient on a dummy variable taking the value of one for the new exporters, and zero otherwise, in a regression where the dependent variable is the log of the average sector labour productivity. Additional explanatory variables include the average firm size, average wage, year and two-digit sector-specific fixed effects. The countries covered in this chart are the 16 EU countries mentioned in footnote 3, with the exceptions of Croatia, for which data are not available, and Latvia, Slovenia and Slovakia, for which estimated coefficients were not statistically significant at conventional levels. Countries marked in blue are central and eastern European countries; countries in yellow are western European countries.

Box 1

Reconciling empirical evidence with theory: introducing heterogeneous firms in trade theory

Until the 1990s most studies assumed that firms were homogeneous when assessing competitiveness, understood as trade performance. In neoclassical trade models, welfare gains from trade arise from the increase in world production and consumption following the specialisation of countries in industries where they have a comparative advantage. Specifically, countries export those products for which they have lower opportunity costs of production relative to other industries and to other countries. Later "new-trade" models incorporated the empirical feature that countries exchange similar goods, implying that trade across countries also occurs within the same industry, by assuming increasing returns to scale, monopolistic competition and consumers' preference for a variety of products. In these models, the gains from trade arise because trade liberalisation leads to an increase in market size, which allows firms to reduce production costs and widens the availability of cheaper varieties of goods.[105] In all these models, firms are assumed to be homogeneous.

The so-called "new new-trade" theory acknowledges the presence of firm heterogeneity, as unveiled by empirical studies, and provides for a tractable framework to analyse competitiveness through the link between trade and productivity. In a seminal article of 2003, Marc Melitz introduced firm heterogeneity in productivity into the standard new-trade theory

[105] The reference point for this literature is Krugman, P.R., "Scale Economies, Product Differentiation, and the Pattern of Trade", *The American Economic Review*, Vol. 70, 1980, pp. 950-959.

models.[106] Building on earlier theoretical models of firm size and dynamics,[107] the Melitz model offers a tractable framework and has become the new cornerstone of trade theory. In this model, firms need to pay a fixed cost to be able to produce domestically. Participation in export activities also requires the payment of an additional fixed cost, as well as of a variable cost. This implies that firms will enter the market and produce, and eventually export, only if they find it profitable (i.e. if their revenues are larger than these fixed and variable costs). Since profitability depends on the productivity level of each firm, only a fraction of the total number of firms (i.e. those above a certain "productivity threshold") will be able to produce for the domestic market, and only a fraction of these firms will in turn be able to export.[108] At the same time, while trade liberalisation leads to an increase in potential export market sales, it also heightens domestic competition. Consequently, the most productive firms – those that are able to pay the cost of exporting – engage in export activities and expand to take advantage of the larger foreign market, whereas the least efficient producers tend to exit the market as increased competition causes their revenues to contract. Resources are, therefore, reallocated towards the most productive producers, which leads to an increase in aggregate productivity.

106 See Melitz, M.J., "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity", *Econometrica*, Vol. 71, 2003, pp. 1695-1725. Firm heterogeneity was introduced in Krugman's model (see Krugman, op. cit.).

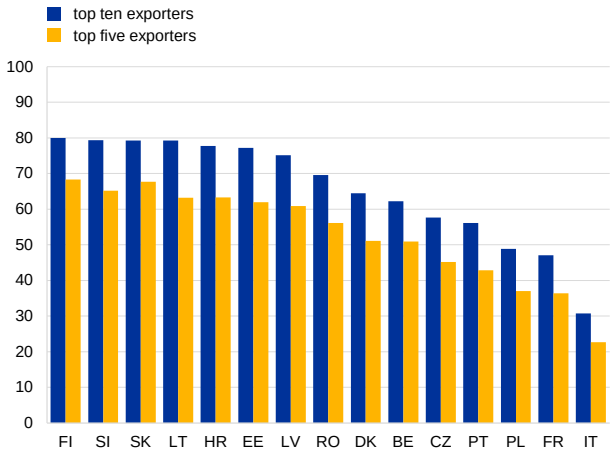
107 Older theoretical models in this strand of the literature include, for example, Jovanovic, B., "Selection and the evolution of industry", *Econometrica*, Vol. 50, No 3, 1982, pp. 649-670, and Hopenhayn, H., "Entry, Exit, and Firm Dynamics in Long Run Equilibrium", *Econometrica*, Vol. 60, No 5, 1992, pp. 1127-1150.

108 In the model put forward by Marc Melitz, only the first moment of the productivity distribution, i.e. average firm productivity, matters for exports. However, a recent study based on CompNet data for 16 EU countries in the period from 2001 to 2012 shows how exporter competitiveness (measured as the residual of an export regression, once all possible characteristics of the destination market, trade costs, and geographical, cultural and historical features are netted out) is positively correlated not only with average firm productivity, but also with other moments of the productivity distribution, namely with its dispersion and asymmetry. See Barba Navaretti, G., Bugamelli, M., Forlani, E. and Ottaviano, G., "The importance of micro data in assessing aggregate outcomes", in Altomonte, C. and Békés, G. (eds.), *Measuring competitiveness in Europe: resource allocation, granularity and trade*, Bruegel Blueprint Series, Vol. 24, 2016, pp. 14-25.

Chart 6

Share of manufacturing exports sold by top exporting firms, broken down by country

(average percentage shares in the period 2001-13; weighted averages across sectors, where the weights are value-added shares in total manufacturing value added)

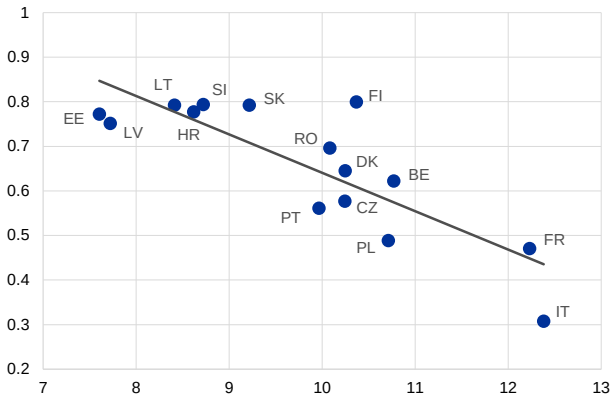


Source: ECB staff calculations based on CompNet data.
Note: The countries covered in this chart are the 16 EU countries mentioned in footnote 3, with the exception of Hungary.

Chart 7

Share of manufacturing exports sold by top exporting firms and size of manufacturing in each country

(export share of the top ten exporting firms in each manufacturing sector and the size of the manufacturing sector in real value-added terms in each country; value-added-weighted sector averages for each country over the period 2001-13; x-axis: manufacturing value added (log); y-axis: concentration of exports in top ten exporters)



Source: ECB staff calculations based on CompNet and Eurostat data.
Notes: The countries considered are those in Chart 6. The correlation between these two series is -0.83.

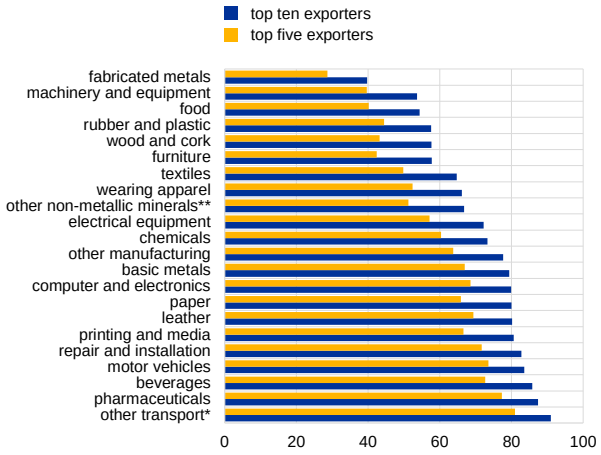
These findings also imply that the international performance of a given country will depend on its productivity distribution, as depicted in Chart 2, and, in particular, on the behaviour of relatively few exporting firms. In the 15 EU countries considered in Chart 6, the top exporters (top ten firms in terms of exporting value) account for about 50% to 80% of aggregate exports, with the exceptions of France and, more starkly, Italy, where the shares of top exporters are lower. There is evidence of the concentration of exports being higher the smaller the size of a country's manufacturing sector (see Chart 7).[109] The generally large concentration of exports in most countries implies that aggregate trade performance is driven by very few firms. Export concentration also varies significantly across manufacturing sectors, the highest being recorded in sectors such as transport equipment and pharmaceuticals and the lowest in, for example, the machinery and equipment and fabricated metals sectors (see Chart 8). Sector differences in export concentration can be partially related to sector-specific technological characteristics of production processes, which require different firm sizes across sectors. Chart 9 shows a positive correlation between the cross-country average export concentration and the median size of firms in each sector, which is a proxy of the required scale of operations in the sector.

[109] Moreover, according to CompNet data, the median size of exporting firms in a given sector in Italy is about 60% the size of the median exporting firms in the same sector in all other countries considered in Chart 6. The small size of exporters in Italy can contribute to explaining its low concentration of exports.

Chart 8

Share of manufacturing exports sold by top exporting firms, broken down by sector

(average percentage shares in the years 2001-13; unweighted averages across countries)

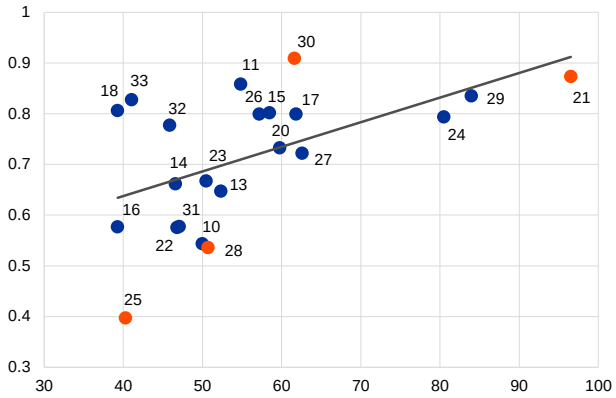


Source: ECB staff calculations based on CompNet data.
Notes: The countries included are those considered in Chart 6. *Manufacture of transport equipment net of motor vehicles. **Manufacture of non-metallic mineral products, such as glass, plastic, cement, etc.

Chart 9

Share of manufacturing exports sold by top exporting firms and median firm size in the sector

(export share of the top ten exporting firms in each manufacturing sector and median number of employees per company in a given sector; cross-country averages for each sector over the period 2001-13; x-axis: median firm size in a given sector (employees); y-axis: concentration of exports in top ten exporters)



Sources: ECB staff calculations based on CompNet data.
Notes: Unweighted averages across the countries considered in Chart 6. Sectors: 10. Food products; 11. Beverages; 13. Textiles; 14. Wearing apparel; 15. Leather and related products; 16. Wood and cork; 17. Paper; 18. Printing and media; 20. Chemicals; 21. Pharmaceuticals; 22. Rubber and plastic; 23. Other non-metallic minerals; 24. Basic metals; 25. Fabricated metal products; 26. Computer and electronics; 27. Electrical equipment; 28. Machinery and equipment; 29. Motor vehicles; 30. Other transport; 31. Furniture; 32. Other manufacturing; 33. Repair and installation of machinery. Sectors marked in red are sectors with the two highest (sectors 30 and 21) and lowest (sectors 25 and 28) average percentage shares of manufacturing exports sold by top exporting firms (see Chart 8). The correlation between these series is 0.54.

This granular distribution of exports implies that microeconomic shocks affecting a relatively small number of firms can have aggregate effects. An example of this is provided in Box 2, which discusses the impact that export granularity, as shown in Chart 6, and the shape of the productivity distribution, as displayed in Chart 2, can have on how a country's aggregate exports react to changes in the real effective exchange rate.[110] In particular, the increase of exports in response to a depreciation of the real effective exchange rate is the stronger, the larger the pool of productive firms that would find it profitable to start exporting under the improved price competitiveness conditions (i.e. the "fatter" is the right tail in a country's productivity distribution). Conversely, the elasticity of exports to fluctuations in the real effective exchange rate will tend to be lower in countries or sectors with a relatively higher concentration of exports in few firms.

[110] The real effective exchange rate is the weighted average of a country's exchange rate relative to a basket of currencies of its trading partners, adjusted for the effects of inflation. More generally speaking, several other macroeconomic questions can be clarified by looking at the behaviour of large firms. See Gabaix, X., "The granular origins of aggregate fluctuations", *Econometrica,* Vol. 79*,* No 3, 2011, pp. 733-772.

Box 2

The productivity distribution of firms, real exchange rate movements and aggregate exports

This box discusses how the distribution of productivity across firms, which differs from country to country, can affect the external rebalancing processes. Aggregate export dynamics depend, among other factors, on changes in a country's price competitiveness, which is commonly measured by the real effective exchange rate (REER). While, all other things being equal, a depreciation of the REER generally leads to higher export growth, it is critical to recall that this impact takes place via two different channels, namely (i) the "intensive margin" (the changes in foreign sales of *existing* exporting firms) and (ii) the "extensive margin" (the entry of *new* exporting firms). Recent empirical literature has shown that the magnitude of such effects across countries depends – via each of the two channels – on two factors reviewed in this article: first, the extent to which exports are concentrated in few firms (as illustrated in Chart 6) and second, the shape of the productivity distribution prevailing in a given country's manufacturing sector (as illustrated in Chart 2).

With respect to the intensive margin (i.e. the export intensity of existing exporters), large and more productive exporting firms tend to be less sensitive to real exchange rate developments, possibly because of higher market power, product diversification and import intensity. According to evidence based on 11 EU countries, the largest and most productive exporters are found to exhibit up to three times lower elasticities to REER movements than the smaller, less productive exporting firms.[111] Hence, all other factors being equal, the overall reactivity of exports to REER fluctuations will be the lower, the larger the concentration of exports in few, highly productive firms. A first possible explanation of the different reactivity of firms to exchange rate shocks is that firms have heterogeneous *pricing-to-market strategies*: for the largest, most productive exporters, it is easier to absorb exchange rate changes by varying their mark-up, which leads to a weaker reaction of their export volumes.[112] More *import-intensive exporters* are usually the largest and most productive firms even among exporters; they thus need to adjust their export prices less to changes in REERs because their mark-ups are larger and because there are offsetting exchange rate effects on their marginal costs.[113] Finally, large *multi-product firms* are less sensitive to REER movements because, in response to negative exchange rate shocks, they can afford to pull out their least profitable products from the export markets.[114]

111 This result is based on the estimation of export elasticities to unit labour cost-deflated real effective exchange rates by firm-level productivity quartile on CompNet data for 11 EU countries in the period from 2001 to 2008 (Berthou, A., Demian, V. and Dhyne, E., "Exchange rate movements, firm-level exports and heterogeneity", forthcoming). See also Demian, C.-V. and Di Mauro, F., "The exchange rate, asymmetric shocks and asymmetric distributions", *Working Paper Series*, No 1801, ECB, 2015.

112 There is strong evidence of heterogeneous pricing-to-market strategies in France, for example (Berman, N., Martin, P. and Mayer, T., "How do different exporters react to exchange rate changes?", *The Quarterly Journal of Economics*, No 127, 2012, pp. 437-492).

113 Amiti, M., Itskhoki, O. and Konings, J., "Importers, Exporters, and Exchange Rate Disconnect", *The American Economic Review,* Vol. 104, No 7, 2014, pp. 1942-1978. For a thorough discussion of the determinants of the exchange rate pass-through (the degree to which exchange rate changes are transmitted to import prices and subsequently to final consumer prices), see "Exchange rate pass-through into euro area inflation", *Economic Bulletin*, ECB, July 2016. Such determinants include the degree of competition across industries, the currency of invoice for imports, menu costs, a country's degree of openness, and the perceived persistence of shocks.

114 Dekle, R., Jeong, H. and Kiyotaki, N., "Dynamics of Firms and Trade in General Equilibrium", *USC Dornsife Institute for New Economic Thinking Working Paper*, University of Southern California, 2015, No 15-12; and Mayer, T., Melitz, M. and Ottaviano, G., "Product Mix and Firm Productivity Responses to Trade Competition", *CEP Discussion Papers*, No 1442, Centre for Economic Performance, 2016.

Turning to the extensive margin, i.e. the extent to which more firms become exporters, this will also depend on the shape of the productivity distribution prevailing in the country in question. A depreciation of the REER in a given country will trigger higher demand for its tradable goods, thus leading to a decrease in the "productivity threshold" of exporting firms, i.e. the threshold above which it becomes feasible for firms to enter export markets. The country's aggregate exports will, therefore, increase as a result of additional sales by existing exporting firms, as well as on account of new firms becoming exporters. Against this background, the larger the pool of very productive firms in a given country, the higher the probability that new firms will be able to enter foreign markets when price competitiveness improves. All other things being equal, countries such as Germany and France, which are characterised by a higher average productivity and a fatter right tail in the productivity distribution (i.e. a larger reservoir of relatively highly productive firms) than countries such as Italy and Spain (see Chart 2), may record a more marked impact of a given exchange rate change on their exports via the extensive margin.[115]

Ultimately, the overall sensitivity of aggregate exports to real exchange rate changes will depend on the relative importance of the intensive versus the extensive margin. The existing empirical literature is inconclusive with respect to the relative importance of the two channels through which changes in the REER can affect aggregate exports, since this varies across sectors, the time-span considered and the granularity of the data employed.[116] However, the intensive margin is generally found to matter more than the extensive margin in advanced economies.[117] This would imply that, all other things being equal, the smaller share of large exporting firms in, for example, Italy relative to France and Germany would play an important role in explaining the higher reactivity of aggregate exports to REER changes in Italy, as documented in the macroeconomic literature.[118]

2.2 The effects of trade on productivity

Trade, in turn, can enhance aggregate productivity through two channels: first, through firms' own productivity growth and, second, through a better allocation of capital and labour across firms. Exposure to international trade can, indeed, induce exporting firms to increase their own productivity ("within-firm productivity growth"). It can also result in a different allocation of production factors across exporting and non-exporting firms, both within a given sector and across sectors ("reallocation effect"), with a potentially large impact on aggregate productivity.

115 Di Mauro, F. and Pappadà, F., "Euro area external imbalances and the burden of adjustment", *Journal of International Money and Finance,* Vol. 48, 2014, pp. 336-356.

116 See, for example, Crozet, M. and Koenig, P., "Structural gravity equations with intensive and extensive margins", *CEPII Working Papers*, No 30, 2008.

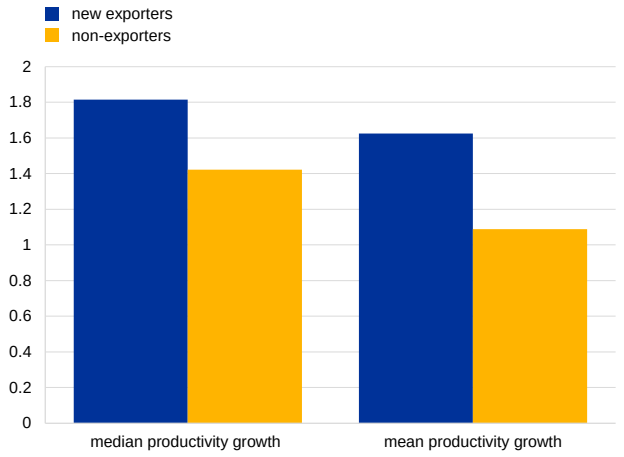
117 Besedeš, T. and Prusa, T.J., "The role of extensive and intensive margins and export growth", *Journal of Development Economics*, Vol. 96, 2011, pp. 371-379.

118 See, for example, Giordano, C. and Zollino, F., "Shedding light on price and non-price competitiveness determinants of foreign trade in the four largest euro-area countries", *Review of International Economics*, Vol. 24, No 3, 2016, pp. 604-634.

Chart 10

Labour productivity growth of new manufacturing exporters following entry into export markets and of non-exporters in the same sector within 16 EU countries

(annual growth rates of labour productivity in the year after entry of new exporters; percentages)



Source: ECB staff calculations based on CompNet data.
Note: The countries covered in this chart are the 16 EU countries mentioned in footnote 3.

Starting with the first channel, trade can alter within-firm productivity for the following main reasons: (i) exporters "learn by exporting", and (ii) exporters benefit from imports of cheaper and/or higher-quality intermediate goods. Regarding the first reason, empirical evidence documents that exporters are more likely to innovate, shift resources toward the most profitable products and broaden the scope of firm products.[119] As a result, the productivity gap relative to non-exporting firms tends to increase after entry into export markets. Indeed, on average in the sample of EU countries used here, the productivity growth of exporters a year after their entering foreign markets is higher than that of non-exporting firms (see Chart 10).[120] Hence, not only are the most productive firms those that enter into export markets, as discussed in Section 2.1, but export activity boosts their productivity further *after entry*. Turning to the second reason, importing intermediate goods is empirically found to foster within-firm productivity.[121] This is because importers have access to a broader range of more sophisticated inputs.[122] In particular, participation in global value chains (GVCs) acts as a mechanism of technology diffusion. Recent evidence based on CompNet data reveals, for example, that the productivity growth of the better-performing firms (so-called "national frontier firms") in 11 EU countries in central and eastern Europe closely mimics the productivity growth of national frontier firms in EU countries outside central and eastern Europe that supply inputs to the former (the so-called "GVC frontier"). Interestingly, the correlation between these two series is higher than that between productivity developments of national frontier firms

119 For theoretical and empirical evidence see, for example, Mayer, T., Melitz, M.J. and Ottaviano, G., "Market Size, Competition, and the Product Mix of Exporters", *The American Economic Review*, Vol. 104, No 2, 2014, pp. 495-536.

120 Note also that persistent exporters increase their productivity to a larger extent than non-exporting firms in the same sector.

121 Based on a panel of Indonesian firms, Amiti and Konings show that a 10 percentage point fall in input tariffs leads to a productivity gain of 12% for firms that import their inputs (see Amiti, M. and Konings, J., "Trade Liberalisation, Intermediate Inputs, and Productivity: Evidence from Indonesia", *The American Economic Review*, Vol. 97, No 5, 2007, pp. 1611-1638). Similarly, focusing on trade liberalisation in India, Topolova and Khandelwal show that access to better inputs, due to lower input tariffs, contributed to increasing firm-level productivity (see Topolova, P. and Khandelwal, A., "Trade Liberalisation and Firm Productivity: The Case of India", *Review of Economics and Statistics,* Vol. 93, No 3, 2011, pp. 995-1009).

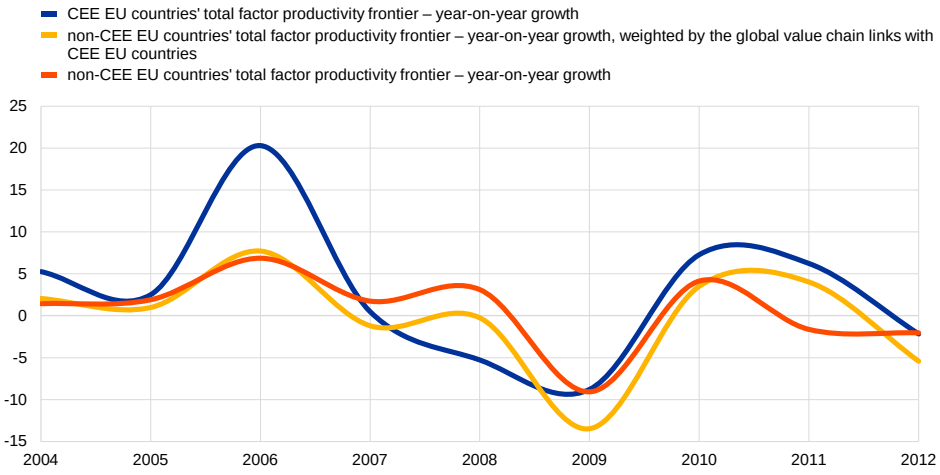
122 For example, based on a panel of French firms, Bas and Strauss-Kahn find that the average firm adds four types of imported inputs over the period, leading to an increase of 2.5% in total factor productivity (TFP). Similarly, they find that controlling for TFP, a 10% increase in the number of imported input varieties raises export product scope by 10.5% (see Bas, M. and Strauss-Kahn, V., "Does importing more inputs raise exports? Firm-level evidence from France", *Review of World Economics*, Vol. 150, No 2, 2014, pp. 241-475).

in central and eastern European EU countries and those of EU countries outside that region which do not have particular GVC links with them (see Chart 11).[123]

Chart 11

Productivity growth of the most productive ("frontier") firms and their global value chain partners in 11 central and eastern European EU countries and nine other EU countries

(annual growth rates of total factor productivity; percentages)



Sources: Chiacchio et al., 2016, based on CompNet and OECD data.
Notes: The total factor productivity frontier refers to the unweighted average annual total factor productivity growth of the top 20% of productive firms in each two-digit sector. The global value chain frontier is the weighted average of total factor productivity growth of the most productive firms in non-CEE EU countries, with weights based on the share of imported intermediates of each CEE country-sector pair from each non-CEE EU country. The CEE EU countries are Bulgaria, the Czech Republic, Estonia, Croatia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia and Slovakia; the non-CEE EU countries are Belgium, Denmark, Germany, Spain, France, Italy, Austria, Portugal and Finland.

Turning to the second channel through which trade can enhance aggregate productivity growth, exporting can also foster a better allocation of resources. When trade costs fall, the most productive, exporting firms are likely to expand to the detriment of the least productive firms, thereby improving the allocation of resources across firms (see Box 1 for the theoretical framework). The empirical literature has also found robust evidence that a shift of resources towards producers that are exposed to international trade can boost aggregate productivity. For example, based on US census data for 1983-92, around 40% of aggregate productivity growth was found to result from increasing output shares of the more productive, exporting firms.[124] Similarly, according to CompNet data referring to 14 EU countries, in the period from 1998 to 2011 an increase in export demand was associated with a rise in

123 Chiacchio, F., Gamberoni, E., Gradeva, K. and Lopez-Garcia, P., "The post-crisis total factor productivity growth slowdown in central and eastern European countries: exploring the role of global value chains", forthcoming.

124 Bernard, A.B. and Jensen, J.B., "Exporting and Productivity in the USA", *Oxford Review of Economic Policy,* Vol. 20, No 3, 2004, pp. 343-357.

total manufacturing productivity, about one-third of which accrued from within-sector labour reallocation.[125]

3 Allocative efficiency and aggregate productivity growth

In addition to trade boosting productivity via the two channels reviewed in the previous section, firm heterogeneity has other, more direct implications for competitiveness, understood as aggregate productivity growth. In the presence of firm heterogeneity, aggregate productivity growth will depend significantly on the degree of allocative efficiency.[126]

All other things being equal, aggregate productivity gains from resource reallocation will be the larger, the more dispersed is the distribution of productivity across firms. Chart 12 shows that the within-sector dispersion between the most and the least productive firms, measured by the ratio of productivity of the top 10% of firms relative to that of the bottom 10% of firms, is substantially larger than the difference in average productivity between firms in the non-tradable and tradable sectors. This fact holds for all countries and time periods.

The allocation of resources across firms within a sector is often not efficient; the most widely used, albeit imperfect, measure of resource misallocation is the dispersion in the marginal revenue productivity of capital and labour – MRPK(L) – across firms.[127] The idea behind this indicator is that in a given sector, if firms face the same marginal costs, labour and capital should flow across firms until the marginal return of hiring an extra unit of input is equalised across firms. However, the presence of different constraints that affect input allocation (e.g. differing access to financial resources, different degrees of exposure to regulation, etc.) could prevent such reallocation of resources and, therefore, induce firms to employ sub-optimal amounts of inputs compared to their productivity level. The result would be that marginal revenue productivities of inputs are not equalised across firms within a

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125 Berthou, A., Hyun Chung, J., Manova, K. and Sandoz, C., "Productivity, Misallocation and Trade", paper presented at the Annual Meeting of the American Economic Association, January 2017. The importance of the reallocation effect in boosting aggregate productivity via trade is not only limited to advanced economies. For example, in the aftermath of trade liberalisations in Chile, roughly two-thirds of the observed rise in aggregate productivity was found to be the result of reallocation from the least to the most efficient producers (see Pavcnik, N., "Trade liberalisation, exit and productivity improvement: Evidence from Chilean plants", *Review of Economic Studies,* Vol. 69, No 1, 2002, pp. 245-276).

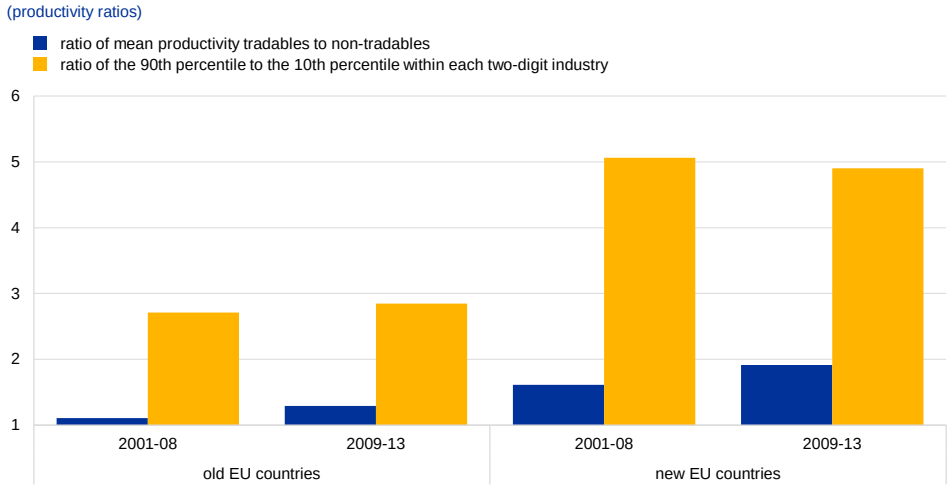
126 See, for example, Bartelsman, E., Haltiwanger, J. and Scarpetta, S., "Measuring and analyzing cross-country differences in firm dynamics", in Dunne, T., Bradford, J.B., and Roberts, M.J. (eds.), *Producer dynamics: New evidence from micro data*, University of Chicago Press, 2009, and Bartelsman, E., Haltiwanger, J. and Scarpetta, S., "Cross-country differences in productivity: the role of allocation and selection", *The American Economic Review*, Vol. 103, No 1, 2013, pp. 305-334.

127 In the presence of output distortions, Hsieh and Klenow show that: $MRPL_{si} = w_s \frac{1}{1-\tau_{Ysi}}$, i.e. firm *i*'s marginal revenue product of labour is not equal to the average wage of the sector *s* in which it operates (and therefore not equal to that of all other firms in the sector), but rather it is larger than the average wage. In particular, it is the higher, the higher the firm's output distortion. Similarly, $MRPK_{si} = r_s \frac{1+\tau_{Ksi}}{1-\tau_{Ysi}}$, i.e. the marginal revenue product of capital is equal to the average sector interest rate, adjusted by both the firm's capital and output distortions. This implies that MRPK is also not equalised across firms in the sector. A standard measure of within-sector dispersion of MRPK(L) across firms is the standard deviation of MRPK(L), which is indeed the measure of capital (labour) misallocation suggested by Hsieh and Klenow (see Hsieh, C.-T. and Klenow, P., "Misallocation and manufacturing TFP in China and India", *Quarterly Journal of Economics,* Vol. 124, No 4, 2009, pp. 1403-1448).

sector, leading to a dispersion in MRPK(L). The higher the dispersion, the higher is the misallocation of inputs.

Chart 12

Productivity differences across tradable and non-tradable sectors versus productivity differences within sectors in 15 EU countries



Source: ECB staff calculations based on CompNet data.
Notes: According to the AMECO classification, tradable sectors include: manufacturing, wholesale and retail trade, transportation and storage, and information and communications technology. Non-tradable sectors include: construction, hotels and restaurants, and professional and administrative services. The within-sector 90th percentile/10th percentile productivity ratio is aggregated to the country level using sector shares in total value added. The "old" EU countries are Belgium, Denmark, France, Italy, Portugal and Finland. The "new" EU countries are the Czech Republic, Estonia, Croatia, Latvia, Lithuania, Hungary, Romania, Slovenia and Slovakia.

Different empirical studies using this indicator have found that capital misallocation has been trending upwards since at least the early 2000s, while developments in labour misallocation have been flatter. Recent cross-country research by ECB staff based on CompNet data has found that capital misallocation, measured by the aforementioned indicator, has been on an upward trend throughout the period from 2002 to 2013 in Belgium, Spain, France and Italy (see Chart 13).[128] Country-specific studies on Spain, Italy and Portugal that are based on different data sources also point to similar results.[129] The rise in capital misallocation has been particularly apparent in services. This could be related to the fact that the tertiary sector is more regulated and less exposed to international competition than, for example, manufacturing, as well as to the fact that it is more dependent on external finance, which increases its exposure to credit constraints. Labour misallocation has

[128] Gamberoni, E., Giordano, C. and Lopez-Garcia, P., "Capital and labour (mis)allocation in the euro area: some stylized facts and determinants", *Working Paper Series*, No 1981, ECB, 2016. The study also includes Germany and shows that capital misallocation in Germany increased up to 2006, but then declined until 2012 (the last year for which German data are available, which is why this country has not been included in Charts 13 and 14). The recent drop was driven by the decrease in allocative inefficiency observed in Germany's large manufacturing sector, whereas capital misallocation continued to rise in service sectors.

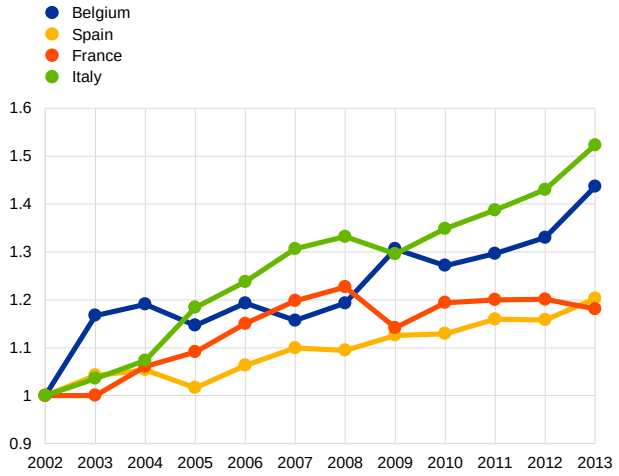
[129] See Calligaris, S., "Misallocation and Total Factor Productivity in Italy: Evidence from Firm-Level Data", *Labour*, Vol. 29, No 4, 2015, pp. 367-393; Dias, D., Robalo Marques, C. and Richmond, C., "Misallocation and productivity in the lead up to the Eurozone crisis", *Journal of Macroeconomics*, Vol. 49, 2016, pp. 46-70; Garcia-Santana, M., Moral-Benito, E., Pijoan-Mas, J. and Ramos, R., "Growing like Spain: 1995-2007", *CEPR Discussion Papers*, No 11144, Centre for Economic Policy Research, 2016.

instead risen less steeply over the period 2002-13 or has, in the case of Spain, even decreased after the crisis (see Chart 14). Similar capital and labour misallocation trends are also present in other non-euro area EU countries, such as those in central and eastern Europe,[130] as well as in other mature economies such as the United States.[131]

Chart 13

Developments in *capital* misallocation in Belgium, Spain, France and Italy in the period 2002-13

(weighted averages of dispersion in the marginal revenue product of capital across firms within a given sector; 2002=1)

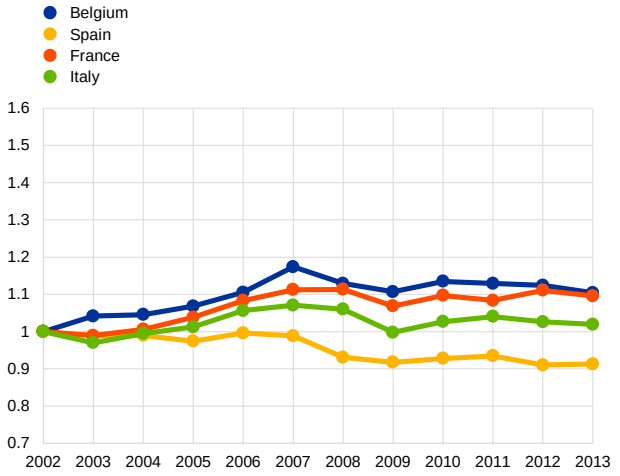


Source: ECB staff calculations based on CompNet data.

Chart 14

Developments in *labour* misallocation in Belgium, Spain, France and Italy in the period 2002-13

(weighted averages of dispersion in the marginal revenue product of labour across firms within a given sector; 2002=1)



Source: ECB staff calculations based on CompNet data.

Although the factors behind these trends are not clear-cut, several studies have found that cross-country and sector differences in the misallocation of capital and labour are associated with product and labour market regulation. In the presence of *high barriers to entry*, unproductive firms can survive more easily, and thus retain productive resources which could otherwise be shifted to the most efficient firms in a given sector.[132] Furthermore, *employment regulation* that is too stringent may prevent firms from adjusting their workforce to optimal levels, especially in sectors with a higher natural rate of "job churning" (i.e. the ongoing process of job leavers being replaced with new hires) due to their technological characteristics.[133] This is illustrated in Chart 15 for Belgium, Spain, France and Italy.

130 The only exception is Slovakia, where capital misallocation declined moderately over the period from 2002 to 2013.

131 For evidence on non-euro area EU countries, see Gamberoni, E., Gartner, C., Giordano, C. and Lopez-Garcia, P., "Is corruption efficiency-enhancing? A case study of nine Central and Eastern European countries", *Working Paper Series*, No 1590, ECB, 2016. For US evidence, see Hsieh and Klenow, op. cit. The latter study also shows that in emerging economies such as China and India, resource misallocation is very large, but on a downward trend.

132 See, for example, Andrews, D. and Cingano, F., "Public policy and resource allocation: evidence from firms in OECD countries", *Economic Policy*, Vol. 29, No 78, 2014, pp. 253-296, and Restuccia, D. and Rogerson, R., "Misallocation and productivity", *Review of Economic Dynamics*, Vol. 16, No 1, 2013, pp. 1-10.

133 See Haltiwanger, J., Scarpetta, S. and Schweiger, H., "Cross country differences in job reallocation: the role of industry, firm size and regulations", *Labour Economics*, Vol. 26, 2014, pp. 11-25, and Bartelsman, E.J., Gautier, P.A. and de Wind, J., "Employment protection, technology choice, and worker allocation", *DNB Working Papers*, No 295, De Nederlandsche Bank, 2011.

In this chart, country-sectors are split into two groups each year, depending on whether their exposure to regulation is above or below the median regulation indicator across all countries and sectors considered – the "tighter regulation" and the "looser regulation" group respectively. The indicator of factor misallocation is then computed for both sub-groups of country-sectors. The chart shows that capital misallocation in the post-crisis period dropped in the country-sectors with more flexible product market regulation (such as manufacturing, construction and distribution), as a result of the exit of less productive firms and an expansion of more productive ones. In country-sectors with stricter regulation, by contrast, the crisis did not have a similar cleansing effect.

Capital misallocation dynamics are also found to be correlated with demand uncertainty and credit market frictions. In addition to product market regulation, *demand uncertainty*[134] is found to be strongly correlated with the observed changes in capital misallocation, as illustrated in Chart 16 by using the same methodology and referring to the same euro area countries as in the previous chart. While it is well-known that demand uncertainty reduces investment, recent empirical evidence documents that it may also affect capital allocation across firms, and thus aggregate productivity dynamics. Heightened uncertainty is indeed conducive to all firms adopting a "wait-and-see strategy", which means that high-productivity firms do not expand and low-productivity firms do not downsize, thereby stalling efficiency-enhancing reallocation and leading to higher resource misallocation.[135] Moreover, higher uncertainty tends to reduce the productivity growth of firms that are relatively more dependent on external finance, generally small firms, irrespective of their level of productivity, thereby possibly leading to a more inefficient input allocation.[136] *Credit market frictions* are also associated with an increase in capital misallocation. Indeed, in country-sectors with a cost of credit above the median (see Chart 17) and tighter credit supply standards (see Chart 18), capital misallocation increased significantly more over the whole period considered than in country-sectors with a lower credit cost and looser credit standards. This supports the idea that the existence of frictions in the financial markets may prevent productive firms from obtaining the resources needed to expand, so that input choices differ systematically across firms in ways that are unrelated to their productivity.[137]

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134 Here, demand uncertainty is measured as the dispersion in the expectations of firms interviewed in the European Commission's monthly business surveys, when replying to questions such as (depending on the sector) "expectations of the demand over the next three months", "order expectations over the next three months" and "production expectations for the months ahead".

135 Bloom, N., "The impact of uncertainty shocks", *NBER Working Papers*, No 13385, National Bureau of Economic Research, 2007.

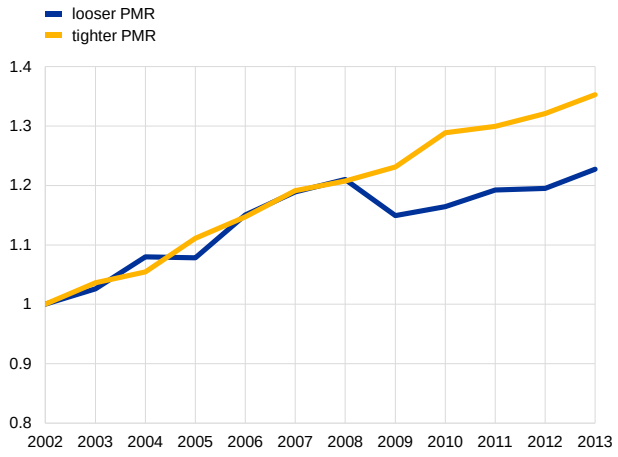
136 Choi, S., Furceri, D., Huang, Y. and Loungani, P., "Aggregate uncertainty and sectoral productivity growth: The role of credit constraints", *IMF Working Papers*, No 174, International Monetary Fund, 2016, and Ghosal, V. and Loungani, P., "The differential impact of uncertainty on investment in small and large businesses", *The Review of Economics and Statistics*, Vol. 82, No 2, 2000, pp. 338-343. The negative impact of uncertainty on capital allocation is also found in Gamberoni et al., op. cit.

137 See *Investment and investment finance in Europe. Financing productivity growth*, European Investment Bank, 2016, pp. 232-233. The European Investment Bank notes that a credit crunch tends to have a higher negative impact on the relatively smaller and younger firms within a given sector, which present low net worth, but may potentially be more productive. See also Buera, F., Fattal-Jaef, R. and Shin, Y., "Anatomy of a credit crunch: from capital to labour markets", *Review of Economic Dynamics*, Vol. 18, 2016, pp. 101-117.

Chart 15

Developments in capital misallocation within four euro area economies according to the tightness of *product market regulation*, 2002-13

(weighted averages of dispersion in the marginal revenue product of capital across firms within a given sector for country/sectors below and above the time-varying median of product market regulation (PMR); 2002=1)

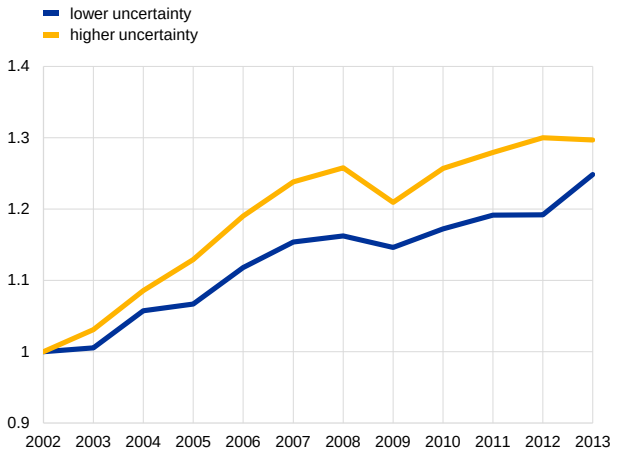


Sources: ECB staff calculations based on CompNet and OECD data.
Note: The euro area countries considered are Belgium, Spain, France and Italy.

Chart 16

Developments in capital misallocation within four euro area economies according to the *demand uncertainty* which firms face, 2002-13

(weighted averages of dispersion in the marginal revenue product of capital across firms within a given sector for country/sectors below and above the time-varying median of demand uncertainty; 2002=1)

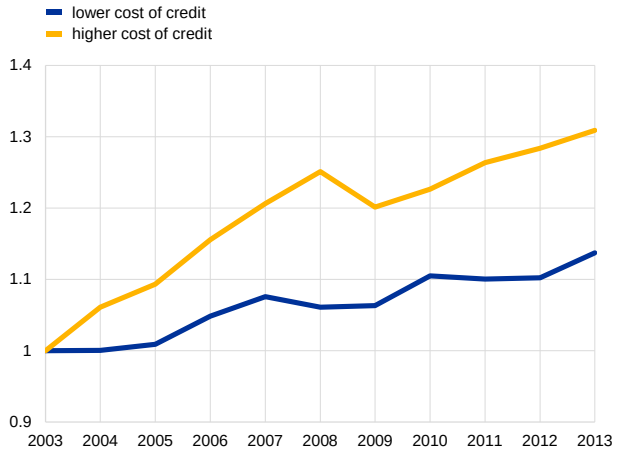


Sources: ECB staff calculations based on CompNet and European Commission data.
Notes: The euro area countries considered are Belgium, Spain, France and Italy. Demand uncertainty is computed as the dispersion in the responses on demand expectations of firms surveyed in the context of the European Commission's business surveys, as in Gamberoni et al., 2016.

Chart 17

Developments in capital misallocation within four euro area economies according to the *cost of credit*, 2003-13

(weighted averages of dispersion in the marginal revenue product of capital across firms within a given sector for country/sectors below and above the time-varying median of the cost of credit; 2003=1)

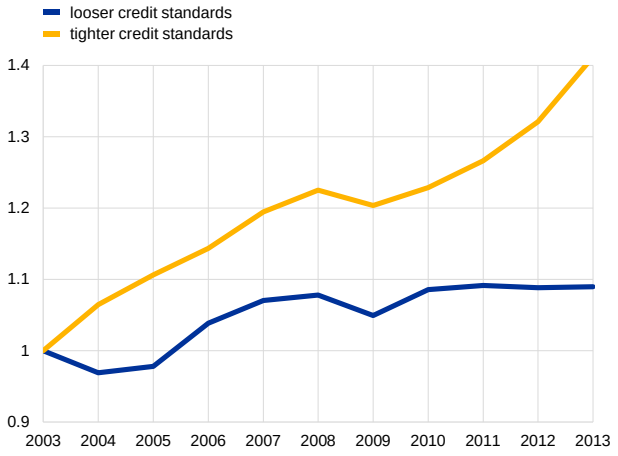


Sources: ECB staff calculations based on CompNet and ECB data.
Note: The euro area countries considered are Belgium, Spain, France and Italy.

Chart 18

Developments in capital misallocation within four euro area economies according to *credit tightness*, 2003-13

(weighted averages of dispersion in the marginal revenue product of capital across firms within a given sector for country/sectors below and above the time-varying median of the tightness of credit standards; 2003=1)



Sources: ECB staff calculations based on CompNet and ECB bank lending survey (BLS) data.
Notes: The euro area countries considered are Belgium, Spain, France and Italy. The credit standards indicator is the first component of a principal component analysis based on the diffusion indices of five BLS questions on credit standards, as in Gamberoni et al., 2016.

4 Policy implications

A core implication of the firm heterogeneity addressed in this article is that aggregate competitiveness outcomes vary depending on the distribution of productivity across firms in each economy. As, typically, only the relatively more productive firms are capable of exporting, the sector-specific density of high-productivity firms in a given country affects its international performance. Trade, in turn, positively affects aggregate productivity growth in a virtuous cycle; conversely, trade restrictions would lower productivity growth as a result of weaker productivity growth of individual firms, and of a less efficient input allocation across firms. The dispersion in the distribution of productivity across firms also determines the aggregate productivity gains of a reallocation of capital and labour. In light of this evidence, a set of broad policy recommendations can be identified which would help countries enhance their competitiveness.[138]

First, policy action aimed at lowering trade costs enhances the scope for export-related activities and firms' ability to switch between domestic and foreign markets. This means, among other things, reducing tariffs and non-tariff barriers, wherever needed. In some countries, it may also be helpful to enhance the activities of export-promotion agencies which provide networks and information to potential exporters and to reduce logistic and trade-related transport infrastructure costs.

Second, measures designed to support firm productivity make it easier for a larger set of firms to access international markets. Potential reforms include incentives for research and development, enhancing the link between (university) research and (firm) innovation, as well as the liberalisation of closed professions and certain closed sectors, which can have positive downstream effects on manufacturing firms.

Third, policies aimed at removing distortions that prevent a productivity-enhancing reallocation of capital and labour across firms can significantly increase aggregate productivity, and thus competitiveness. In order to boost aggregate productivity growth and fully reap the gains of international trade, structural reforms aimed at removing barriers to the flow of production inputs from the least to the most productive firms are warranted. Examples of allocative efficiency-enhancing measures include:

(i) in *product markets*, lowering the entry barriers for firms and promoting the creation of innovative start-ups, enhancing bankruptcy regulations that facilitate the exit of unproductive firms, removing obstacles that prevent firms from reaching their optimal size (e.g. by redesigning size-contingent regulations that set disincentives above a given employee threshold) and making further progress in the establishment of a fully fledged EU internal market for services;

[138] The specification of the ensuing policy measures would, in turn, hinge on a detailed analysis of institutions, governance and framework conditions, country by country, which falls outside the scope of this article.

(ii) in *labour markets*, avoiding excessively rigid employment protection legislation that prevents firms from adjusting their workforce to optimal levels, setting incentives for labour mobility (both within countries and intra-EU) and enhancing lifelong education to lower skill mismatches;

(iii) in *financial markets*, increasing the opportunities for small and medium-sized enterprises to turn to capital markets (e.g. by promoting equity financing and venture capital markets) and enhancing banks' selection and monitoring procedures in order to reduce forbearance and cut finance to "zombie" firms.