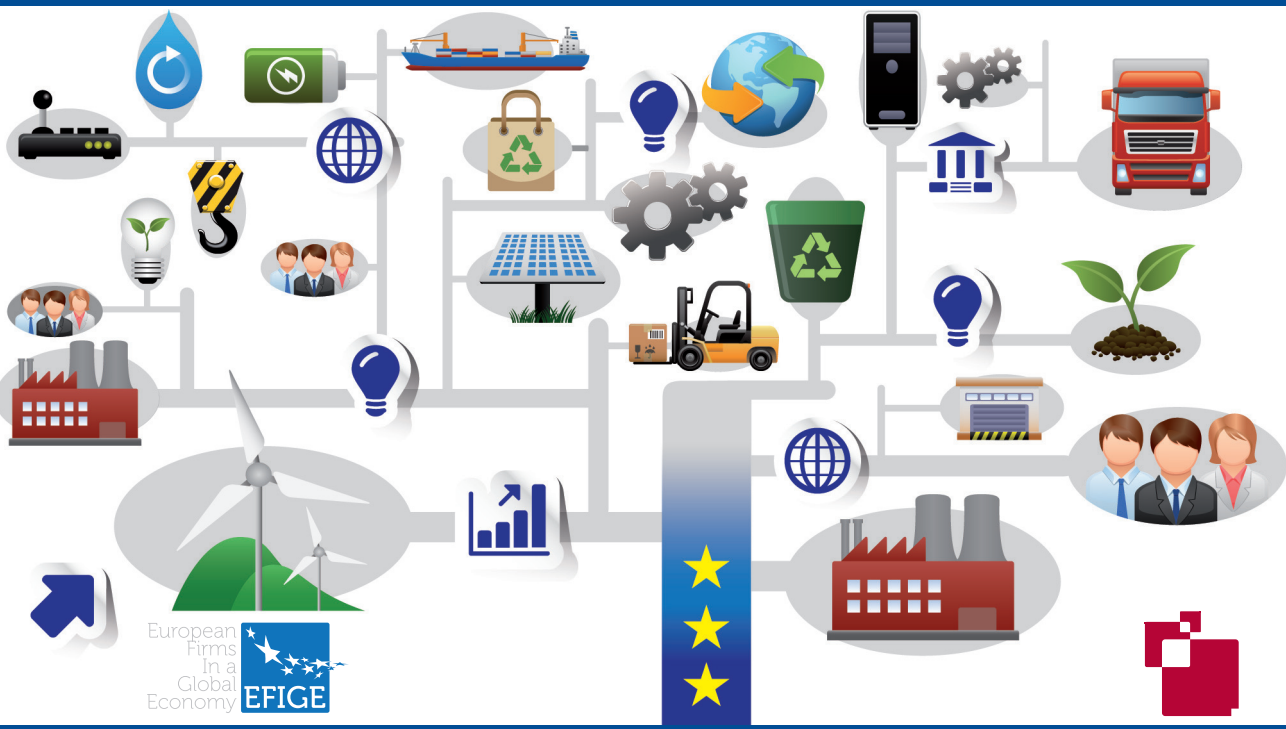
The triggers of competitiveness:

The EFIGE cross-country report

BY CARLO ALTOMONTE, TOMMASO AQUILANTE
AND GIANMARCO I.P. OTTAVIANO



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The triggers of competitiveness: the EFIGE cross-country report

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The leaders of the eight teams are: Gianmarco I.P. Ottaviano, Bocconi University, for Bruegel; Lionel Fontagné, PSE, University of Paris I, for CEPII; Karen Helene Ullveit-Moe, University of Oslo, for CEPR; László Halpern for the Hungarian Academy of Sciences; Giorgio Barba Navaretti, University of Milan, for Ld'A; Claudia Buch, University of Tübingen, for IAW; Andrea Brasili for UniCredit; Klaus Desmet for University Carlos III Madrid. Giorgio Barba Navaretti, Gianmarco I.P. Ottaviano and Thierry Mayer (PSE, CEPII and CEPR) coordinate the teams. Delphine Michel, Bruegel, is the project manager.

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Foreword

What are the factors that will trigger the competitiveness of European firms? The authors of this study have worked intensively for three years on the question, as part of a large, Bruegel-headed research project on the topic, called *European Firms in the Global Economy* – EFIGE – mostly funded by a European Commission research grant. In this framework, Bruegel has also commissioned a major survey covering 15,000 firms in seven European countries. The survey is the first comparable dataset of its kind in Europe, and as such it forms the basis of the research project. This study thus brings together a great deal of the evidence arising from EFIGE .

The debate on competitiveness has shifted significantly in recent years because of the massive crisis in the euro area. In fact competitiveness is now considered a key factor for the adjustment in the euro area. Macroeconomic data indeed shows that in the run-up to the crisis, huge capital flows fundamentally altered the structure of our economies with a significantly increased tradable sector in some countries and an overblown non-tradable sector in others. The sudden stop of these capital flows has left countries severely exposed and adjustment to a new growth model has been slow and fraught, with major increases in unemployment and relatively limited price and wage adjustment visible in the national account data. On the other hand, in some cases, export performance has been spectacular during the crisis years. For example, Spanish export performance has been one of the euro area's strongest. Yet, high unemployment testifies to the unfinished adjustment agenda in Spain.

Against this background, this study takes a fresh look by inquiring into the determinants of firm-level international performance, that is external competitiveness. In fact, in the competitiveness debate, it is of crucial importance to understand not only the macroeconomic challenge but also to search for the right policy response that will generate growth and exports. This can be found at the firm level. A number of new results emerge. Firm-level total factor productivity is clearly identified as a crucial determinant of growth and exports. Human capital, R&D, equity finance and performance-based incentives for employees also underpin the success of firms.

Moreover, size matters and large firms typically are much better exporters than their smaller counterparts.

A number of important policy conclusions can be drawn from the analysis. Central for the promotion of export growth is setting the right conditions for *firms* to grow and export. It is crucial to remove incentives for firms to stay small. Important factors hampering firm growth are taxes and social and labour regulation. But lack of access to finance also often limits growth. And indeed, one of the most dangerous side-effects of the current sovereign debt crisis is that the financial system in Europe is fragmenting, putting a break on credit as well as equity finance, in particular in crisis countries. Equity finance has always been weak in Europe compared to the United States and this may explain the less dynamic European corporate sector. Finally, all the standard recommendations about R&D and education are confirmed by this rich microeconometric research.

Adjustment in the euro area will require very comprehensive relative price changes. In the absence of nominal exchange rates, wage and product price inflation need to adjust to create conditions for jobs and growth. Yet, this study reminds us that lasting external competitiveness needs to be underpinned by the right policies for corporations. Microeconomic data sets and research of the kind employed in this study are crucial to define the right policy set. All too often, policy makers ignore the rich potential that microeconomic research offers them. I am therefore very grateful to the authors for this very timely, thought provoking and rich report, and I hope that the availability of larger and more comprehensive datasets of this kind will stimulate the debate in Europe and abroad.

Guntram B. Wolff, Deputy Director of Bruegel
July 2012

Executive summary

The ability to 'grow out' of the crisis is now widely recognised as the only long-term viable option for the sustainability of the European Union and its social market economy model. Enhanced 'competitiveness' at the EU level is required, which would allow the EU to capture growth currently taking place mainly in emerging markets.

While the consensus on the need to foster competitiveness is almost unanimous, the debate on how to define and measure it is still open, especially when the focus is kept at the country level. Different (often complementary) approaches are available and their relative advantages depend on several factors, in particular the level of detail at which data is available (eg country, industry or firm/product level).

Though aware of this debate, this Blueprint goes further than the existing set of competitiveness indicators, recognising from the outset that it is not really countries that exchange goods and services, but rather firms located in each country. We therefore look at the issue through the lens of firm performance. Driven by the policy debate, we also focus on a specific dimension of competitiveness, that is external or international competitiveness, defined as the ability to exchange the goods (and services) in which a country is abundant for the goods and services that in the same country are scarce.

We find that the external competitiveness of a country is indeed determined by the aggregate ability of individual firms to operate successfully in international markets: in other words, assessing the external competitiveness of the EU amounts to identifying what drives the ability of European firms to compete successfully in international markets.

As suggested by recent economic literature, our working hypothesis is that external competitiveness is an expression of high firm-level productivity. A growing body of evidence points to the fact that the aggregate performance of a country or an industry strongly depends on firm-level factors (size, organisation, technological capacity and their ability to successfully operate in international markets), which are ultimately related to firm-level productivity.

This Blueprint thus takes a 'bottom up' approach and discusses the ways in which international exposure and productivity interact at the firm level, eventually determining the external competitiveness of European countries. We capitalise on the first existing harmonised cross-country dataset (EFIGE) that measures the entire range of international activities (imports, exports, foreign direct investment (FDI), international outsourcing) of firms in seven European countries (Austria, France, Germany, Hungary, Italy, Spain, United Kingdom). We are also able to link these international activities to the same firms' balance-sheet data as retrieved from the Bureau Van Dijk's Amadeus dataset. Thus we can correlate measurements of productivity with firms' international exposure. In particular, we compare a number of firm-level productivity measures, namely total factor productivity (TFP), labour productivity (LP) and unit labour costs (ULC), with the latter being the measure typically used as the basis for the analysis of competitiveness at the country level.

After controlling for country and industry characteristics, we find that international exposure is indeed positively correlated with our measurements of productivity at the firm level. Moreover, when measured by labour productivity or TFP (as economic theory would suggest), productivity is also positively correlated with the complexity of firms' internationalisation strategies, with complex activities (FDI) more associated with higher productivity than simpler activities (imports or exports). Outsourcing, which typically involves an intermediate level of complexity, is associated with the middle of the productivity range.

Such a correlation, however, holds to a lesser extent when productivity is measured in terms of (the inverse of) ULC. The reason is that LP exhibits a strong positive correlation with TFP, whereas the correlation between the inverse of ULC and TFP, though positive, is much weaker, mainly due (at least in our data) to the different structure of labour costs in innovating firms, thus underlining the importance of quality and other non-price determinants for competitiveness. This finding suggests that while ULC measurements can be appropriately informative for an initial macro-policy assessment of a country's competitiveness, an in-depth study of the sources of competitiveness, and the resulting recommendations on how policy can tap those sources, requires an analysis of firm-level TFP dynamics similar to the one we put forward in this Blueprint.

In particular, starting from the finding that more complex internationalisation strategies generate higher costs, and thus require greater productivity for profits to be maintained, this Blueprint identifies the characteristics of those firms that are able, over time, to move from below to above the minimum performance threshold (or 'productivity cut-off') required to become active in the international environment. In

other words, we identify which firm-level factors matter more in driving the growth in the productivity of European firms in order to trigger their international activities.

The wealth of EFIGE data allows us to show that, even in diferent European countries, the ability of firms to grow above the productivity cut-off is triggered by similar 'growth-friendly' characteristics at the firm-level related to innovation (human capital and R&D intensity), finance (adequate capital in the form of equity), human resources and management (the use of performance-based salaries and a reduced presence of managers belonging to the family, if the firm is family owned), and ownership structures (affiliation to a foreign group).

Firms with the right balance of these characteristics are able to grow and become successful internationally. In doing so, they become larger than the average domestic firm (140 versus 31 employees in our sample). Firms that do not strike that balance remain small and domestic, thus not contributing to their country's external competitiveness. These findings are consistent in different countries and industries. They also hold for different productivity levels: all firms that become more productive share similar characteristics, irrespective of their starting point.

From a policymaking perspective, these findings have several implications:

- If the objective of policy is to foster a country's competitiveness, the ultimately firm-driven nature of this process is such that aggregate measures of competitiveness are subject to a number of biases that have to be appropriately taken into account when interpreting aggregate statistics: there is no 'average' firm, rather, firms are very heterogeneous within countries and industries. As a result, rather than formulating policies in an effort to increase the competitiveness of the average firm, it is much more efficient to stimulate competitiveness by fostering the reallocation of economic activities from less to more efficient firms.

- Among the comparable firm-level measures currently available thanks to EFIGE, the single best predictor of a firm's ability to successfully operate in international markets is its total factor productivity (TFP).

- Successful international companies invest in human capital and R&D, rely on equity finance, motivate their human resources through performance-based incentives, do not necessarily loathe family ownership but do draw a line between the family owner and the firm's management, and do not see foreign capital as an intrusion but rather thrive on the synergies it creates and the international opportunities it

opens up, via both imports and exports, and in general the participation in global value chains.

- Small is not beautiful *per se*. It is true that a significant part of employment and productivity growth comes from small firms. However, these are not any small firms. They are, instead, firms that start small and, in the process of getting bigger, become more productive and start to hire more employees. In this respect, the key question for policy aimed at small and medium-sized companies should not be how to help small firms to survive as they are, but should rather be how to help small firms adopt the right attributes that promote not only survival but also growth.

- In particular, this report suggests that specific incentives (both market- and government-based) should be created in the areas of innovation (eg tax credit schemes for R&D expenditures), finance (eg via the liberalisation and simplification of a cross-border pan European market for private equity and venture capital), human resources (eg promoting lifelong training programmes and securing an improvement in national education systems), management (eg via a better link between wages and productivity), and ownership (fostering the attraction of foreign investment and the participation of domestic firms in global value chains).

- More in general, the promotion of productivity growth and competitiveness can and should go beyond the traditional exercise of educated guesswork, targeting instead the specific structural aspects that make firms inclined to acquire the 'right' set of characteristics, beyond the worn-out generic mantra of 'flexibilities versus rigidities'. Such an approach, still popular in policy circles, is hardly justifiable in the era of firm-level data.

1 Introduction and overview of results

The ability to 'grow out' of the crisis is widely recognised as the only long-term viable option for the sustainability of the European Union and its model of social market economy. This requires enhanced 'competitiveness' at EU level, which in turn would allow the EU to 'capture' growth that is currently taking place, mainly in emerging markets.

While the consensus on the need to foster competitiveness is almost unanimous, the debate on how to define and measure it is still open, especially when the focus is kept at the country level. Different (often complementary) approaches are available and their relative advantages depend on several factors, such as the objective of the analysis (eg policy making, academic research) or on the level of detail at which data is available (eg country, industry or firm/product level). While aware of this debate, in this report we leave it in the background, and focus on a specific dimension of competitiveness, which we call *external competitiveness,* defined as a country's ability to exchange the goods (and services) in which it is abundant for goods and services that it lacks. This definition can be broadly connected to the international performance of a country, and thus linked to some of the aggregate competitiveness indicators (export share, current account, unit labour costs) used by the European institutions for the the screening of potential imbalances emerging across the EU[1].

With respect to this existing set of indicators, our report recognises from the outset that it is not really the country that exchanges those goods and services, but rather its firms. We, therefore, look at the issue through the lense of firm performance, knowing that the external competitivess of a country is determined by the aggregation of individual firms' ability to operate successfully in international markets. In other words, we try to identify what drives the ability of European firms to compete successfully in international markets.

1. The so-called Excessive Imbalances Procedure, based on Article 121.6 of the Treaty.

Building on the emerging consensus in academic and policy circles, our working hypothesis is that *external competitiveness is an expression of high firm-level productivity*. Indeed, recent economic literature has increasingly underlined and shown empirically that the aggregate performance of a country or an industry strongly depends on firm-level factors, such as size, organisation, technological capacity and other conditions that firms are confronted with in their specific environments, not least their ability to successfully operate on international markets[2]. These factors are themselves inherently related to firm-level productivity[3].

Our report takes a bottom-up approach and discusses the ways through which international exposure and productivity interact at the firm level, eventually determining the external competitiveness of European countries. In so doing, we capitalise on the EU-EFIGE/Bruegel-UniCredit dataset (from now on the EFIGE dataset), which has recently become available thanks to the EFIGE project, coordinated by Bruegel and financed by the European Commission and UniCredit within the EU's 7th Framework Programme[4]. This dataset is unique in that it allows for a comparison of firms' international activities, both across a large set of internationalisation activities *and* across key EU countries. Moreover, the EFIGE dataset can be matched with balance-sheet information available from the Amadeus dataset of Bureau van Dijk, thus allowing for the calculation of a number of productivity measures over time.

We exploit this wealth of information to correlate firm productivity with the entire range of firms' international activities (imports, exports, foreign direct investment (FDI), international outsourcing) in seven European countries (Austria, France, Germany, Hungary, Italy, Spain and the United Kingdom). In particular, we compare a number of firm-level productivity measures, namely total factor productivity (TFP), labour productivity (LP) and unit labour costs (ULC), with the latter being the measure typically used as the basis for analysis of 'competitiveness' at country level. Our aim is to check if and to what extent firms involved in the various types of internationalisation activities are more productive, however productivity is measured, compared to firms that are internationally inactive.

After controlling for country and industry characteristics[5], we find that international exposure is indeed positively correlated with our measures of productivity at firm level.

2. See, for instance, Behrens *et al* (2011) for a survey of the literature.
3. In this sense, 'competitiveness' is just 'a poetic way of saying productivity' (Krugman, 1997).
4. For additional details and updates on the project, see www.efige.org.
5. Throughout the paper, 'industry' refers to the manufacturing industries of NACE Rev. 1 classification at two-digit level of aggregation. The terms 'industry' and 'sector' are used interchangeably.

Moreover, when measured by TFP (as economic theory would suggest) or LP, productivity is also positively correlated with the complexity of firms' internationalisation strategies, with complex activities (FDI) being more associated with higher productivity than simpler activities (imports or exports). Outsourcing, which typically entails an intermediate level of complexity, is associated with the middle of the productivity range. There is less correlation, however, when productivity is measured in terms of (the inverse of) ULC. The reason is that LP exhibits a strong positive correlation with TFP, whereas the correlation between the inverse of ULC and TFP, though positive, is much weaker, mainly due (at least in our data) to the different structures of labour costs in innovating firms[6]. The latter finding suggests that while ULC measures can be appropriately informative for an initial macro-policy assessment of a country's competitiveness, an in-depth examination of the origin of this competitiveness, as well as the policy suggestions that might result, requires an analysis of firm-level TFP dynamics.

The positive correlation between firm productivity and international activity is in line with the general findings of the literature (see Behrens *et al*, 2011, for a survey) and the evidence on the 'happy few' internationalised firms already discussed in Mayer and Ottaviano (2007). This report both reinforces and enriches these findings and evidence, thanks to its novel analysis of harmonised cross-country data over a greater range of international activities. The new evidence provided in this report, of a systematic relationship between international complexity and productivity, has the same origins as the 'happy few' effect, namely that more complex internationalisation strategies entail higher costs. This confirms the existence of additional complexity-driven costs that internationalising firms have to face, with only firms that are sufficiently productive able to bear them. In this respect, internationalisation in its various forms, and thus the ability to successfully compete in international markets, requires firms to make a quantum leap in terms of productivity, overcoming a minimum performance threshold induced by the additional costs of internationalisation.

From a policy perspective, it is therefore crucial to identify the characteristics of those firms that are able, over time, to move from below to above the minimum performance threshold (or 'productivity cut-off'), which is required for them to become competitive in the international environment. In other words, it is important to identify which firm-level factors might matter more in driving the growth of productivity of European firms that will trigger their international activities. Such identification is only possible thanks to the wealth of the EFIGE dataset. Indeed, the analysis shows that the ability to grow

6. See Appendix 5 for a detailed analysis of firm-level ULCs vs. TFP and their relationship to external competitiveness.

above the productivity cut-off is triggered by precise firm characteristics. These are related to innovation (human capital and R&D intensity), finance (adequate capital in the form of equity), human resources and management (the use of performance-based salaries and a reduced presence of managers belonging to the family if owning the firm), and ownership structures (the affiliation to a foreign group). In our data, firms moving over time above the cut-off are relatively small (an average of 34 employees vs. a sample average of 126) but possess all the right attributes: they are more likely to be well capitalised, to undertake R&D, to pay workers on the basis of performance, to employ higher human capital, while they are less likely to be managed by family members and less likely to request credit from banks.

Hence, internationalisation is the outcome of productivity growth and productivity growth is itself triggered by striking the right balance among a well-defined set of factors concerning the way a firm is managed. Firms that strike the right balance grow and become successful international actors, along the way reaching a larger size than the average domestic firm (140 vs. 31 employees). Firms that do not strike that balance remain small and domestic, thus not contributing to their country's external competitiveness. These findings consistently hold across countries and industries. They also hold across productivity levels: all firms growing in productivity share similar characteristics irrespective of their starting level (see Appendix 4).

From a policy viewpoint, our findings have several implications.

First, while our focus on *external competitiveness* has left the general debate on how to best define and measure 'competitiveness' in the background, our findings still suggest that definitions and measures on which policymakers base their decisions have to be context-specific if those decisions have to be informed. In particular, our results show that, if the aim is to foster a country's ability to exchange goods and services in which a country is abundant against goods and services that are scarce in the same country, the ultimately firm-level driven nature of this process is such that aggregate measures of competitiveness are subject to a number of biases, and thus are likely to lead to imprecise policy prescriptions unless they are complemented by information on how firms actually work and react to incentives.

Second, and related to that, the single best predictor of a firm's ability to successfully operate in international markets is its Total Factor Productivity (TFP). Hence, firm productivity growth and not internationalisation *per se* (eg via export promotion policies) should be the bullseye of the policy dartboard.

Third, firm productivity growth is triggered by the combination of a precise set of firm characteristics relating to innovation, finance, human resources, management and ownership. More than others, firms that successfully grow to become international players invest in human capital and R&D intensity, rely on equity finance, motivate their human resources through performance-based incentives, do not necessarily loathe family ownership but do draw a line between the family owner and management, and do not see foreign capital as undesirable but rather thrive on the synergies it creates and the international opportunities it opens up, via both imports and exports, and in general via the participation in global value chains.

Fourth, small is not beautiful *per se*. It is true that a significant fraction of employment and productivity growth comes from small firms. However, these are not just any small firms. They are, instead, firms that start small and, in the process of getting bigger, become more productive and start hiring more employees. In this respect, the key question for SMEs policies should not be how to help small firms to survive as they are, but should rather be how to make small firms adopt the right attitudes that promote not only survival but also growth. In other words, small is beautiful if it grows, and this does not happen when small is not accompanied by the right set of growth-friendly attributes described above.

Fifth, policymakers should identify the specific institutional constraints that make their countries' firms shy away from the foregoing growth-friendly approach. If one takes firms' attitudes as immutable innate attributes, then the promotion of productivity growth and competitiveness can only be seen as a compensating mechanism against the side effects of an unfortunately merciless but still necessary process of Darwinian selection in the market, in which the 'weak' (both workers and firms) give ground to the 'strong' for the superior goal of the survival of the species. In reality the market is not deterministic: policy shapes the environment in which firms operate and firms react to policies (as their incentives are changed) by reoptimising their behavior, so their attitudes are not immutable. From this point of view, the promotion of productivity growth and competitiveness should go beyond the logic of mere compensation (subsidies), targeting instead the specific institutional aspects that make firms inclined to acquire the described right set of characteristics, beyond the worn-out generic mantra of 'flexibilities vs. rigidities'. In particular, this report suggests that specific incentives (both market- and government-based) should be created in the areas of innovation (eg tax credit schemes for R&D expenditures), finance (eg via the liberalisation and simplification of a cross-border pan European market for private equity and venture capital), human resources (eg promoting lifelong training programmes and an improvement of national education systems),

management (eg via a better link between wages and productivity), and ownership (fostering the attraction of foreign investment and the participation of domestic firms in global value chains). As cross-country comparisons are crucial for a better understanding of the extent to which a given set of laws and policies shapes the business environment so that they trigger a pro-competitive reaction on the part of firms, the systematic collection of harmonised cross-country datasets (such as the EFIGE dataset) is a pre-condition for these analyses.

Last but not least, a growing concern among European citizens and politicians is that society should have other objectives than the mere promotion of the ability to exchange goods and services and, in general, higher growth rates. Sometimes those other objectives (eg social cohesion) may create a temporary trade-off with productivity growth and competitiveness-related policies. The opportunity cost of those alternative objectives in terms of foregone productivity should nonetheless be evaluated in order to assess the relevant trade-offs in a transparent (and thus efficient) way. Hence, when societies pursue complex objectives, it is even more important for policymakers to complement the standard aggregate measures of productivity with more disaggregated measures that better capture the way people and firms actually behave and how they react to economic incentives.

In conclusion, this report shows that the promotion of firm productivity, so central to fostering competitiveness at the country level, can and should go beyond the traditional exercise of educated guesswork around a blackbox. Such an approach was perfectly justifiable when firm-level data was not available. But now firm-level data is available (and processable), the continuation of the traditional approach is a barrier to policymakers accessing a more comprehensive toolkit when promoting competitiveness. One of the most important lessons learned during the crisis is that the informational toolbox on which policymakers base their decisions is utterly outdated in terms of both data sources and data analysis. In particular, the ability to effectively exploit the newly available wealth of information has been hampered by inertia in the ongoing use of a restricted set of economic indicators, mostly designed when the richness and detail of available data was much less than today. This toolbox is particularly outdated when it comes to the analysis of micro data on the behaviour of firms, an analysis to which this report hopes to contribute.

The rest of this volume is organised as follows. Section 2 discusses the implications of measuring competitiveness at firm level, and the differences with respect to the use of aggregate statistics. Section 3 describes the EFIGE dataset and its construction. Section 4 provides a validation of our data with respect to official aggregate statistics

and assesses the correlation patterns between the entire range of international activities of firms across EU countries and their productivity (measured as both LP and TFP). It also discusses the correlation patterns between the range of international activities of firms and their ULCs, debating the relevance of this variable as a proxy for competitiveness. Section 5 crucially explores in detail the triggers of competitiveness, that is the characteristics (in terms of innovation, access to finance, training of the workforce, organisation, etc) of those firms that are able over time to move from beneath to above the minimum productivity cut-off required to become competitive in the international environment. Section 6 offers a summary of the main results of the paper and discusses their main policy implications for the EU.

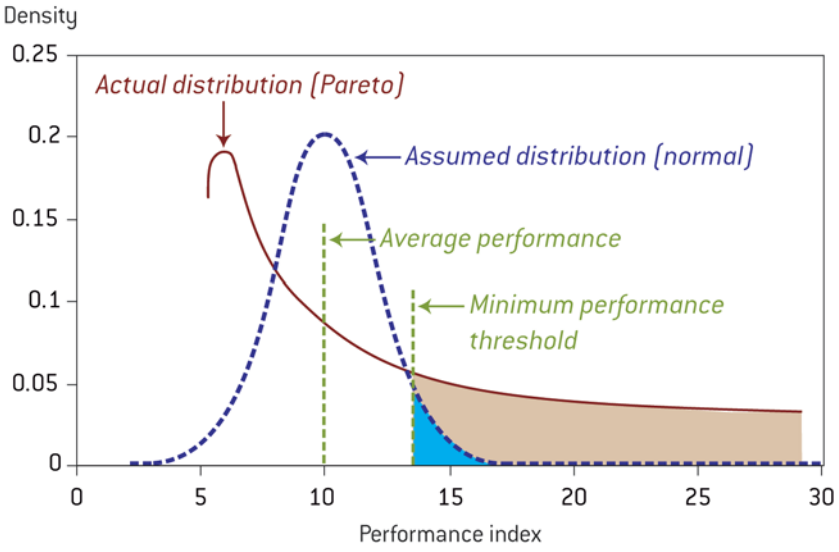
2 From country to firm-level measures of competitiveness

When discussing competitiveness in policy circles, the tendency is to measure it using aggregate country- or industry-level data, as these are easier to understand, calculate and communicate. However, since it is neither countries nor industries that produce, sell and export, but rather firms within countries and industries, in reality it is differences between firms that ultimately make up aggregate statistics. In other words, policy-relevant measures of competitiveness result from averages calculated from different firm performances in a given country or industry. The latter is potentially problematic.

Contrary to common belief, in fact, there is no 'average firm'. Rather, data shows that within narrowly defined (4-digit SIC) industries in any given country, the top 10 percent of best performing firms is typically much more productive than the bottom 10 percent. Taking an average sector in the US, for example, the best firms produce twice as much output with the same amount of input (ie their total factor productivity is twice as great) compared to the worst firms in the same sector (Syverson, 2004). In emerging economies, these intra-industry differences in performance are even greater, with the best firms producing to five times more than the worst firms, from the same inputs (Hsieh and Klenow, 2009).

More generally, a substantial empirical literature has revealed that when analysing firm-level performance, the shares of bad and good firms are not balanced in that, while there are many bad firms, there are only a handful of very good firms, no matter which specific measure of firm-level performance (employment, turnover, added value per worker, total factor productivity, wage, etc) is chosen. Indeed, within a sector or a country, firm performance is typically distributed as in Figure 1.

Figure 1: Actual (Pareto) vs. assumed (normal) distribution of firms' performances



Source: Altomonte *et al* (2011).

Figure 1 compares the standard assumed distribution of firm performance (normal, in blue) with the actual distribution (Pareto, in red), both yielding a similar average performance. It shows that the former underestimates the share of bad firms, because in reality bad firms are much more common than good firms (compare the red vs. blue area to the right of the two distributions). The figure also shows the *minimum performance threshold* required to compete internationally. Crucially, our data shows that this threshold is in general well above the average performance of firms in any given country or industry (specifically, from the seventh decile and above of the average TFP distribution, see Section 5). These facts have two major consequences for the policy relevance of aggregate measures of competitiveness.

The first consequence stems from the evidence (confirmed in our data) that intra-industry differences between firms are much greater than the difference in average firm performance measured across countries or industries. It then follows that the typically-used aggregate measures of competitiveness, which are an average derived from a very heterogeneous distribution, might have a limited informational content and thus lead to relatively inefficient policy prescriptions, a problem known as *aggregation bias*.

But even assuming that a correct measure of competitiveness can be retrieved and properly aggregated, policies that aim to raise the average performance of the firms in an industry or country – leaving unchanged the proportion of 'best' firms able to compete internationally (ie those above the minimum performance threshold) could be misguided. While successful in increasing the aggregate average performance, these policies would have limited effects on a country's competitiveness, since too few firms would actually perform above the required minimum threshold. In other words, in a situation characterised by strong underlying firm heterogeneity, competitiveness-enhancing policies should be assessed also against the *variation in dispersion* of the performance measure they generate (the change in the right tail of the distribution), not only the change in averages[7]. The latter, which can be referred to as a *dispersion bias*, is a second, important problem associated with the use of aggregate competitiveness measures without consideration of the underlying firm-level heterogeneity.

An example of both aggregation and dispersion bias in interpreting competitiveness data is the so-called 'Spanish paradox'. From 2000 to 2009, Spain displayed a constant worsening of its price competitiveness (as measured in terms of both ULC and export prices) in excess of 10-15 percent. Nevertheless, the Spanish share of world exports first increased (by some 10 percent in the mid 2000s) and then barely moved with respect to its initial levels. Antrás *et al* (2010) have explored this 'Spanish paradox', finding that when firm-level instead of aggregate-economy ULC developments are considered, Spain's experience is less paradoxical. They find that the ULCs of the largest firms in Spain have behaved best over the last decade and, in turn, the exports of those firms increased faster than those of other domestic firms. The different relative weights of large, performing firms versus smaller, under-performing firms in aggregate ULCs and in total exports may thus help to explain the 'Spanish paradox'.

Policy-makers should therefore be cautious when assessing competitiveness at the industry or country level on the basis of aggregate measures that do not take into account firm characteristics, as the chosen measure of performance might be loosely or spuriously related to the policy outcome (competitiveness) because of aggregation or dispersion biases, and can consequently lead to bad quality policy-making.

What really matters for enhancing competitiveness is the ability to reallocate resources so that firms move from below to above the relevant minimum performance cut-off[8].

7. See Altomonte *et al* (2011) for a detailed analysis of this argument.
8. A detailed discussion of the role of reallocations in shaping competitiveness at firm and industry level is provided in section 5.

In this respect, micro-level analysis can be very informative, because it reveals the firm-specific channels of competitiveness otherwise hidden by industry- or country-level aggregations. To undertake these analyses, however, appropriate firm-level comparable datasets have to be used, something so far not available for EU countries. The EFIGE project, introduced in the next section, aims to bridge this gap.

3 Why we need the EFIGE dataset

The previous section has shown that aggregate industrial performance depends heavily on firm-level factors (eg size, organisation, technological capacity), a finding also supported by a vast theoretical and empirical literature starting from Melitz (2003) and summarised by Behrens *et al* (2011). At the same time, the analysis of competitiveness based on firm-level measures calls for new and better data that is sometimes hard to obtain for several reasons. This is where the EFIGE dataset comes into play. It provides representative and comparable samples of manufacturing firms in seven European countries. It includes about 3,000 firms for each of Germany, France, Italy and Spain, more than 2,200 firms for the United Kingdom, and about 500 firms for each of Austria and Hungary (precise figures are reported in Table 1). The survey from which the dataset has been built excluded firms with fewer than 10 employees. As a result, internationally active firms should be over-represented in the sample, compared with the actual distribution of firms in a country, which is typically characterised by a large number of relatively small, domestic firms. Appendix 1 gives the distribution of the sample by industry and size class for each country[9].

Importantly, the EFIGE survey covers a broad array of questions that allow us to address several crucial issues related to competitiveness. Overall, the questionnaire contains both qualitative and quantitative data on firms' characteristics and activities, for a total of about 150 variables split into six sections[10]. Most questions relate to the year 2008, with some questions requesting information for 2009 and previous years

9. The representativeness of the sample with respect to the actual population of firms is discussed in Barba Navaretti *et al* (2011). The sampling design has been structured following a stratification by *industry* and *firm size*, with an oversampling of large firms. Throughout the analysis, we have applied a weighting in order to guarantee the representativeness of our results.
10. Proprietary structure of the firm; Structure of the workforce; Investment, technological innovation and R&D; Internationalisation; Finance; Market and pricing.

in order to build a picture of the effects of the crisis, and the dynamic evolution of firms' activities[11].

Table 1: EFIGE sample size, by country

Country	Number of firms
Austria	443
France	2,973
Germany	2,935
Hungary	488
Italy	3,021
Spain	2,832
UK	2,067
Total	14,759

Source: EFIGE Survey dataset. Note: Industry codes are not available for 316 firms.

An interesting characteristic of the EFIGE dataset is that, on top of the unique and comparable cross-country firm-level information contained in the survey, data can be matched with balance sheet figures. More precisely, EFIGE data has been integrated with balance-sheet data drawn from the Amadeus database managed by Bureau van Dijck, retrieving nine years of usable balance-sheet information for each surveyed firm, from 2001 to 2009. This data in particular enables the calculation of firm-specific measures of productivity and a number of financial indicators, measured over time.

The first use for the EFIGE dataset is to explore the correlation patterns between the various international activities of firms (imports, exports, foreign direct investment, international outsourcing) and firms' competitiveness, as measured by various proxies of productivity, across the countries surveyed. The information from the survey allows us to classify firms into seven non-mutually exclusive internationalisation categories. Firms are considered exporters if they reply 'yes, directly from the home country' to a question asking if the firm sold abroad some or all of its own products/services in 2008[12]. We follow the same procedure with imports, distinguishing between imports of materials and services. With respect to foreign direct investment (FDI) and international outsourcing (IO), we asked if firms were carrying out at least part of their

11. The questionnaire has been administered between January and April 2010 via either CATI (Computer Assisted Telephone Interview) or CAWI (Computer Assisted Web Interview) procedures. The complete questionnaire is available on the EFIGE web page, www.efige.org. A discussion of the dataset as well as preliminary evidence on the internationalisation modalities of firms is available in the 2nd EFIGE Policy Report by Barba Navaretti *et al* (2011). The 3rd EFIGE Policy Report by Békés *et al* (2011) discusses explicitly the reaction of firms to the crisis.

production activity in another country. Firms replying 'yes, through direct investment (ie foreign affiliates/controlled firms) ' are considered to be undertaking FDI, while firms replying 'yes, through contracts and arm's length agreements with local firms', are considered to be pursuing an active international outsourcing strategy[13]. We then looked at firms involved in international value chains, although not actively pursuing an internationalisation strategy, with a question asking if part of the firm's turnover was made up of sales generated by a specific order coming from a customer (produced-to-order goods). Firms replying positively, and indicating that their main customers for the production-to-order activity are other firms located abroad, are considered to be pursuing a passive outsourcing strategy. Hence, a passive outsourcer is the counterpart of an active outsourcer in an arm's length transaction. Finally, on the basis of a question that allows the identification of the main geographical areas of the exporting activity, we have identified 'global exporters', *ie* firms that export to countries outside the EU.

Table 2 provides some descriptive statistics for our seven categories of international firms, and for the residual category of local firms not active abroad. Appendix 1 provides additional information on the various international activities of firms across countries, including the average share of firms in each category (extensive margin), and to what extent each international activity on average contributes to a firm's total turnover (intensive margin). Appendix 1 also summarises in detail the relevant questions in the EFIGE survey associated with each international category used in this report, as well as the other variables used in the analysis.

12. In order to encompass the phenomenon of temporary traders (Békés and Murakozy, 2011), we have considered as exporter also a firm replying 'regularly/always' or 'sometimes' to the question 'Before 2008, has the firm exported any of its products?'. For importing firms, we combine the following questions: firms replying 'yes, from abroad' to 'In 2008 has the firm purchased any materials (services) for its domestic production?' and firms replying 'regularly/always' or 'sometimes' to 'Before 2008, did the firm purchase any materials (services) from abroad?'
13. Note that these firms are attributed to the country in which they are located and thus surveyed, although the 'nationality' of the group they possibly belong to may be different.

Table 2: International categories of firms – descriptive statistics (full sample), 2008

	No. of firms	Avg. turnover per firm (in €1,000s)	Avg. no. of employees	Avg. capital stock per employee (in €1,000s)
Non-active abroad	3,402	4,443.33	31.44	152.16
Active abroad	11,357	19,273.46	139.85	196.4
of which				
Exporter	9,849	20,494.21	151.42	199.03
Importer of services	3,449	38,659.98	332.12	223.57
Importer of materials	7,298	24,976.44	191.17	200.36
Global exporter	4,016	24,777.71	103.43	222.93
Passive outsourcer	5,799	17,052.42	83.96	204.98
Active outsourcer	590	24,657.11	119.55	225.28
FDI	719	77,637.20	334.13	239.55
Whole sample	14,759	15,589.29	114.52	186.59

Source: EFIGE dataset.

From Table 2, we can identify a clear ranking of firm characteristics with respect to the degree of involvement in international activities, in line with an enriched theory of self-selection of heterogeneous firms involved in international activities, as in Helpman *et al* (2004). In particular, Table 2 shows that internationally active firms tend to be larger, have higher sales and are more capital intensive[14]. The firm's turnover ranking tends to increase with the degree of complexity of international activities, from exporter, to importer of material/active outsourcing, to importer of services and FDI. Local firms involved in international value chains (ie the 'passive outsourcers') are somewhat smaller than average internationally active firms, but are larger than purely local firms[15].

14. As already stated, the fact that internationally active firms are more numerous in our sample than domestic firms derives from the truncation of the sample at 10 employees. A general validation of firms' characteristics as derived from the sample compared to official structural business statistics is provided in Section 4.1.
15. We do not control here for foreign ownership, that is, if a given firm is controlled by a foreign entity, while we account for the fact that a given firm controls an affiliate abroad (foreign investment).

4 Internationalisation and firm competitiveness

We can now assess the correlation between the degree of involvement in international activities and firm competitiveness. From a theoretical point of view, firm competitiveness is best captured by the concept of total factor productivity (TFP). This measures productive efficiency, that is how much output a firm can produce for any given amount of input. In other words, a firm has higher TFP than a competitor if it is able to produce more output with the same amount of input.

From the overlaid EFIGE and Amadeus data it is possible to calculate TFP for around 50 percent of the firms present in the dataset. To that end, we first assign our observational units to sectors (at NACE 2 digit levels) pooling firm-level data across countries and years, and then we run for each sector the Levinsohn and Petrin (2003) semi-parametric production function estimation algorithm, controlling for country and year fixed-effects. This allows us to overcome the simultaneity bias that affects standard estimates of firm-level productivity, and to derive TFP estimates from heterogeneous, industry-specific production functions, as explained in detail in Appendix 2 [16].

In terms of the variables included in the estimation of the production function, following standard practice in the literature output is proxied by added value, deflated using industry-specific (NACE rev 1.1) price indices retrieved from Eurostat (estimates using revenues as a proxy are fully comparable). The labour input is measured by the number of employees, while capital is proxied by the value of tangible fixed assets deflated using the GDP deflator. Material costs are instead deflated by average industry-specific PPIs (Producers Price Index) weighted by input-output table coefficients.

16. Using ordinary least squares when estimating productivity implies treating labour and other inputs as exogenous variables. However, profit-maximising firms adjust their inputs each time they observe a productivity shock, which means input levels are correlated with the same shocks. Since the latter are unobserved by the econometrician, inputs turn out to be correlated with the error, biasing the OLS estimates of production functions. Olley and Pakes (1996) and Levinsohn and Petrin (2003) have developed two similar semi-parametric estimation procedures to overcome this problem, using investment and material costs, respectively, as proxies for these unobservable shocks.

4.1 Descriptive statistics and validation of measures

Table 3 reports the average TFP of firms pursuing different international activities alongside the other firm characteristics already shown in Table 2, with the sample now limited to those firms for which it is possible to retrieve TFP. As can be seen, the resulting restricted sample does not show any particular bias in terms of representation by category of firm, nor in terms of overall ranking.

Table 3: International categories of firms – descriptive statistics (restricted sample), 2008

	No. of firms	Avg. turnover (in €1,000s)	Avg. no. of employees	Avg. capital stock per employee (in €1,000s)	Total Factor Productivity	Unit labour cost (in € per unit of added value)	Labour productivity (added value per employee in €1,000s)
Non active abroad	1,514	5,298.51	31.67	156.14	0.872	0.77	50.71
Active abroad	5,921	24,623.51	152	200.01	1.024	0.78	57.55
of which							
Exporter	5,201	26,104.12	164.41	203.19	1.033	0.77	58.09
Importer of services	1,900	50,004.76	372.81	230.61	1.159	0.84	61.81
Importer of materials	3,939	31,647.82	208.25	203.31	1.058	0.79	58.43
Global exporter	2,211	28,345.27	104.42	224.77	1.094	0.79	62.56
Passive outsourcer	2,965	20,763.66	84.31	208.06	1.06	0.79	59.86
Active outsourcer	306	32,991.62	127.39	224.94	1.066	0.76	56.03
FDI	387	98,554.23	359.7	238.08	1.293	1.05	63.35
Whole sample	7,435	20,303.82	125.6	190.39	0.991	0.78	56.05

Source : EFIGE dataset. Note: Numbers are weighted sample averages. TFP is the Solow residual of the production function.

Table 3 conveys a message that is very much in line with well-known results from the literature: internationally active firms are bigger, have higher turnovers, have large capital stocks and higher TFP.

Table 3 also reports two additional and commonly used measures of firm-level competitiveness, namely labour productivity (added value per employee, LP) and unit labour costs (total wage bill per unit of output, ULC). Importantly, ULC, at the firm level, is the building block of aggregate measures of competitiveness, and as such it is interesting to compare with our estimated TFP.

To this extent, the relative correlations between the retrieved measures of TFP, LP and ULC in our data are reported in Table 4. As can be seen, TFP and LP are positively and significantly correlated at 70 percent, in line with the findings of the literature. More surprising, however, are the relatively small (albeit correctly signed and significant) correlation coefficients between the two productivity measures and ULCs, which are below 30 percent. Such a low correlation requires a more in depth analysis, especially to the extent that aggregate measures of competitiveness are based on averages of firm-level ULCs (see below).

Table 4: Correlations between measures of firm competitiveness

	TFP	Labour productivity
Labour productivity	0.695***	
Unit labour cost	-0.277***	-0.267***

Source: Authors' calculations based on EFIGE and Amadeus datasets.
Note: ***denotes statistical significance at the 1 percent level.

To assess the representativeness of our restricted sample (ie the one containing those firms whose productivity was computable), in Table 5 we report the correlation between the Amadeus variables we have used to compute productivity and ULC, aggregated for each country-year, and the same variables from Eurostat Structural Business Statistics (for manufacturing firms with more than 10 employees). Correlations are overall high and significant.

Table 5: Correlations between Amadeus and Eurostat variables

Number of employees	0.61***
Revenues/production value	0.52***
Cost of employees/wages	0.71***
Labour productivity	0.84***

Note: Observations are country-year-specific averages (weighted in Amadeus sample). Eurostat data is derived from Structural Business Statistics, Manufacturing, more than 10 employees.
Note: ***denotes statistical significance at the 1 percent level.

In Table 6, we also report the correlations between official measures of ULC and those computed from Amadeus data by aggregating individual firm-level measures of ULC for each country-year. The correlation over the whole sample (0.48 and highly significant) is affected by the heterogeneous quality of balance-sheet data in different countries. In fact, the breakdown by country yields a negative (-0.25) though not significant correlation for Austria, and positive but insignificant correlations for Hungary

(0.56) and Germany (0.49). In contrast, France (0.93), Italy (0.91) and Spain (0.79) display high and strongly significant correlations between firm-level and aggregate ULC measures.

Table 6: Unit Labour Cost, correlations between Amadeus and Eurostat variables, by country[17]

Whole sample	0.48***
Austria	-0.25
France	0.93***
Germany	0.49
Italy	0.91***
Spain	0.79**
United Kingdom	—-
Hungary	0.56

Note: The correlation is computed between two indexes of ULC, which take value 100 in year 2005. Observations are country-year-specific averages (weighted in Amadeus sample). UK figures are not available in Eurostat.

Similar results are obtained in Table 7 which looks at the cost of employees in different countries: correlations are high and strongly significant for France (0.99), Germany (0.8), Italy (0.96), Spain (0.99) and the UK (0.88). Austria (0.2) and Hungary (-0.56) display insignificant correlations. The picture does not change much when looking at LP: negative and not significant for Austria (-0.88); high and strongly significant for France (0.99), Italy (0.85), Spain (0.97) and the UK (0.98); positive and not significant for Hungary (0.46).

Table 7: Correlations between Amadeus and Eurostat variables, by country

	Cost of employees/ wages	Labour productivity
Austria	0.2	-0.88
France	0.99***	0.99***
Germany	0.8*	-0.78
Italy	0.96***	0.85**
Spain	0.99***	0.97***
United Kingdom	0.88**	0.98***
Hungary	-0.56	0.46

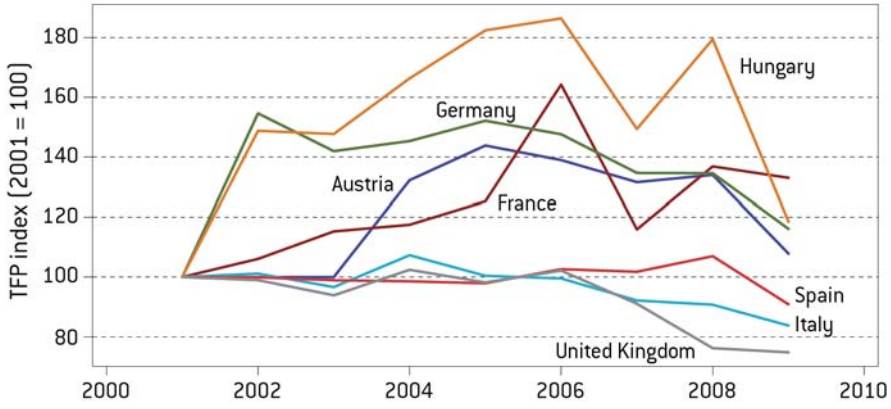
Note: Observations are country-year-specific averages (weighted in Amadeus sample).

17. Correlations for the UK were not computable.

The descriptive statistics we have shown so far yield a clear message: with respect to official statistics, measures are largely comparable for the whole sample but might be imprecise for some countries. For this reason, in what follows we will always control for country fixed effects when presenting our econometric results.

Based on the descriptive evidence reported so far, we stick to TFP as our preferred measure of firm-level competitiveness. Again, to test aggregation properties in terms of country representativeness, we exploit the firm-specific information in order to obtain a country-specific TFP index. Specifically, we first compute year/country/sector-specific weighted averages of firm-level productivity measures. Then we create an index setting the year-2001 TFP level equal to 100 for each country and sector. Finally, we retrieve the country/year-specific aggregate TFP as the mean across sectors of these indexed TFP measures. Figure 2 shows the results.

Figure 2: Aggregate TFP dynamics, by country, 2001-09



Source: Bruegel based on EFIGE and Amadeus datasets.

The dynamics of TFP aggregated from firm-level information are comparable to well-known results on aggregate country competitiveness, with Hungary, a transition economy under convergence, displaying the highest productivity gains in the early 2000s, followed by Germany, France and Austria. The stagnating productivity trends of Spain and Italy are also evident. Somehow surprising at first glance is the dismal performance of the UK, but this might be explained by the fact that we are looking at the manufacturing sector of an economy with a growing competitive advantage in services. Finally, all countries display a marked decrease in their productivity trend in 2009.

Productivity dynamics obtained from Amadeus can also be formally validated against official figures, always exploiting the link between our representative sample and balance-sheet data. In particular, for those countries for which we have relatively complete time series at the firm-level (France, Italy and Spain) over the entire period, it is possible to directly match the productivity dynamics of the Amadeus sample firms with similar aggregate statistics, in this case retrieved from the OECD's STAN dataset[18]. This match is reported in Table 8.

Table 8 – Labour productivity growth, Comparison between EFIGE (merged with Amadeus) and OECD- STAN

Country	Year	STAN (not deflated) deflated)	Amadeus-EFIGE (not (deflated)	STAN manufacturing (deflator)	Amadeus-EFIGE, manufacturing	Amadeus-EFIGE (2-digit (deflator)
France	Δ(2008-2001)	9.80	10.24	12.63	12.62	14.14
Spain	Δ(2008-2001)	9.57	9.66	1.55	1.13	-0.11
Italy	Δ(2008-2001)	6.38	7.95	-2.00	-0.51	-1.51

Source: Barba Navaretti *et al* (2012). Note: France and Spain do not have information on employees for 2008 in the OECD-STAN database: the aggregate values refer to 2007.

Based on these results and on the robustness of our productivity measures, a standard method of showing selection into different internationalisation activities is to draw the kernel density estimates of the productivity distribution for firms involved in each of these activities, and compare it with those of firms that are internationally inactive. A kernel density shows the shares of firms ('density') that attain each productivity level, that is, the probability of picking a firm with a certain productivity level when the firm is randomly drawn from each category of activities. The comparisons are shown in Figure 3. It should be kept in mind that internationalisation categories are not mutually exclusive because firms can be engaged in more than one international activity at a time (see Table 2 for details), while the category of firms that are non-active abroad is constant for Figure 3 panels (a) and (b).

Both panels of Figure 3 send the same message: a randomly drawn firm that is active internationally is likely to be more productive than a randomly drawn firm that is inactive internationally.

18. For the other countries in the sample, the availability of TFP-related variables at the firm-level varies across the years, thus preventing us from properly evaluate the robustness of our TFP measures vs. official statistics across the entire time span.

The fact that productivity densities vary across internationalisation categories suggests that the costs associated with international operations might vary across the different activities. To deepen the investigation of this issue, we analyse next how the probability that a firm is active in each international activity is associated with the observed level of productivity. In particular, Figure 4 shows the 'extensive margin' (share of active firms over total number of firms) of each internationalisation activity by decile of productivity.

The first thing to notice in Figure 4 is the overall upward slope of the histograms when moving from left to right, that is from low to high productivity deciles. In line with the literature, the higher the productivity deciles, the more likely it is for firms to be involved in some international activity. In other words, more productive firms self-select into internationalisation status. However, the richness of information in our dataset allows us to go further than that, distinguishing the various internationalisation activities in terms of selectivity.

To see this, let us focus on the most productive 10 percent of all firms. The top right graph in panel (a) of Figure 4 shows that among the firms in that decile, slightly more than 90 percent are internationally active one way or another. Nonetheless, the categories of internationalisation activity vary greatly: slightly less than 85 percent of firms are exporters; two thirds are importers of materials; almost 50 percent are importers of services or passive outsourcers; just below 45 percent are global exporters; less than 15 percent are involved in FDI; and just above 5 percent are active outsourcers.

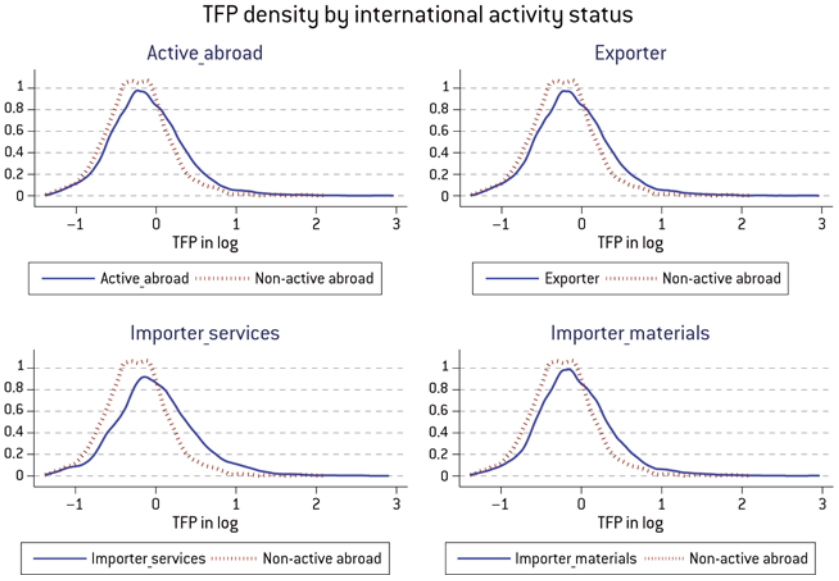
These findings reveal a clear ranking of internationalisation activities from low selectivity (exporting) to high selectivity (FDI / active outsourcing) that hint at a growing degree of complexity when moving from exporting to FDI and active outsourcing. Thus, more competitive firms have access to a greater range of more complex options when it comes to designing their international operations. Greater competitiveness, as proxied by higher productivity, thus implies having the possibility to exploit a richer toolbox to deal with the challenges and seize the opportunities of globalisation.

4.2 Econometric evidence

These relationships between firm competitiveness and internationalisation activities can be further investigated by a cross-sectional econometric estimation, in which we regress the TFP of each firm, as measured in 2008 against the different categories of internationalisation activities, adding country and sector fixed effects. In this way we

Figure 3: TFP and internationalisation

(a) All internationalisers and traders



(b) Offshorers and outsourcers

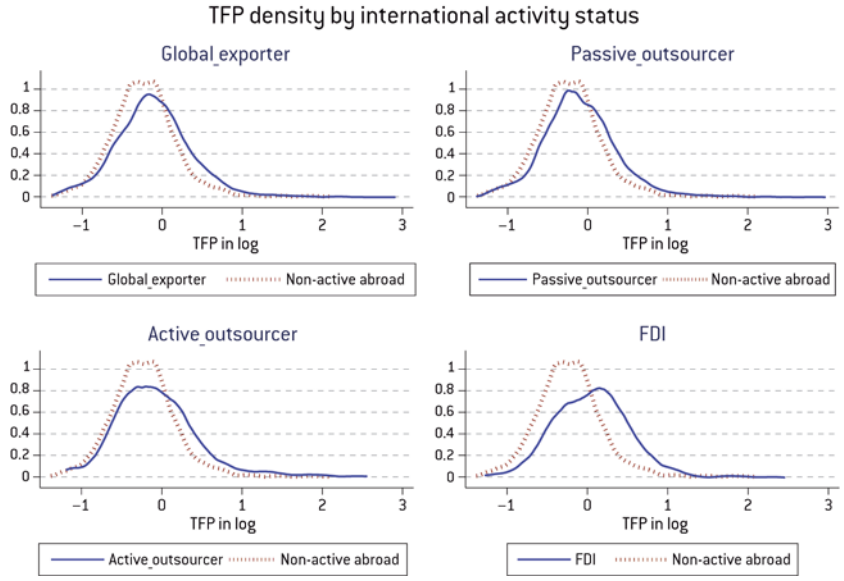
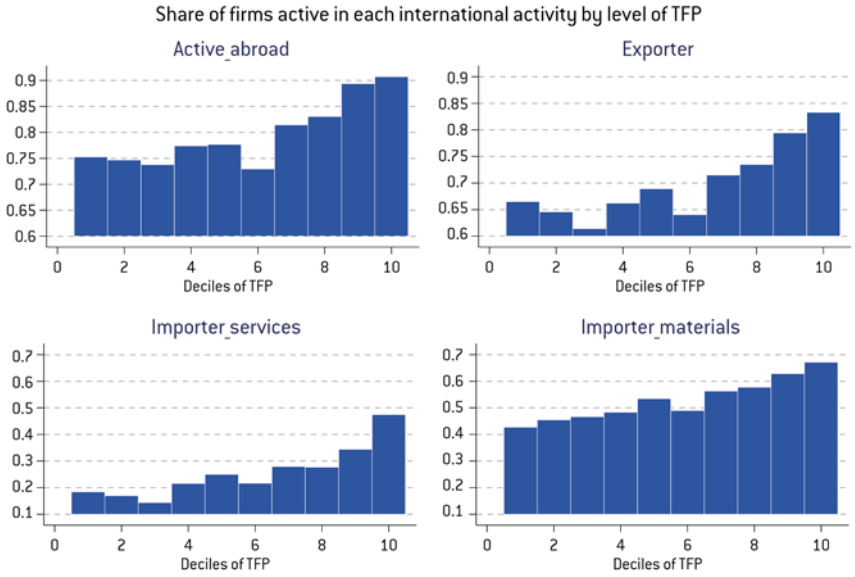
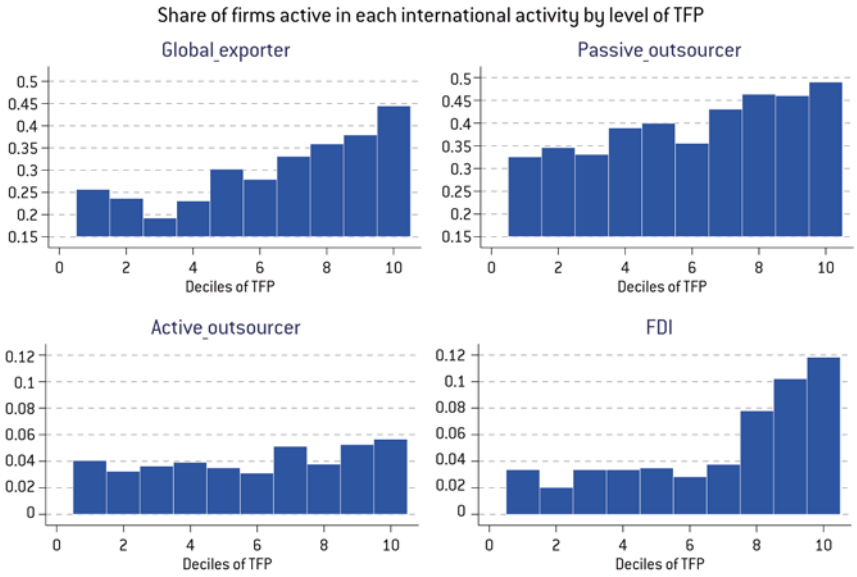


Figure 4: TFP and internationalisation

(a) All internationalisers and traders



(b) Offshorers and outsourcers



can confirm our findings by excluding possible compositional effects (ie particular sectors or countries) from driving the descriptive statistics previously discussed.

OLS results are reported in Column (1) of Table 9. As expected, all coefficients are positive and significant, while the 'productivity premium' increases with the complexity of internationalisation activities. FDI and the import of services are associated with the highest TFP premia, followed by outsourcing activities and finally simple import and export strategies. Not surprisingly, however, 'complex' export strategies, as proxied by the ability of firms to export beyond the EU, are associated with higher premia, comparable to those derived from outsourcing. Indeed, this ranking is already visible in Figure 3, where the more complex internalisation categories exhibit thicker density at higher TFP levels.

Table 9: International status and TFP premium

Dep. variable: TFP	(1) OLS	(2) OLS	(3) O.Probit	N
Active abroad	0.0906***	0.0353***	0.261***	7,259
	(0.0132)	(0.0128)	(0.0290)	
Exporter	0.0999***	0.0399***	0.272***	6,563
	(0.0136)	(0.0131)	(0.0298)	
Importer of services	0.171***	0.0626***	0.620***	3,334
	(0.0171)	(0.0171)	(0.0531)	
Importer of materials	0.118***	0.0449***	0.394***	5,320
	(0.0142)	(0.0138)	(0.0332)	
FDI	0.257***	0.0980***	0.750***	1,862
	(0.0329)	(0.0357)	(0.0750)	
Passive outsourcer	0.122***	0.0558***	0.329***	4,372
	(0.0151)	(0.0150)	(0.0342)	
Active outsourcer	0.134***	0.0477	0.364***	1,777
	(0.0309)	(0.0306)	(0.0755)	
Global exporter	0.156***	0.0699***	0.425***	3,652
	(0.0168)	(0.0167)	(0.0368)	
Country fixed effects	Yes	Yes	Yes	–
Sector fixed effects	Yes	Yes	Yes	–
Firm size	No	Yes	No	–

Note: Standard errors in parentheses. *** denotes statistical significance at the 1 percent level. One cross-sectional regression for each internationalisation characteristic, with sector and country dummies. Column 2 controls also for the size class of firms (10-19; 20-49; 50-249; >=250 employees). The number of observations is given by the number of inactive firms plus the number of firms active in the selected international activity. All regressions control for country and industry fixed effects. Coefficients of the firm size effects included in column (2) are reported in Table 6.

In column (2) of Table 9, in addition to country and sector fixed effects, we also control for firm-specific characteristics, in particular the size classes of firms measured in terms of number of employees. While the TFP premia associated with the various internationalisation activities are significantly reduced, their ranking is confirmed. The role of firm size is further investigated in Table 10, which reports the magnitude of the fixed effects associated with each size class for the different internationalisation statuses in the regression of Table 9, column (2). As can be seen, coefficients tend to grow larger with firm size because more productive firms manage to grow larger than their less productive counterparts. However, for a given size class of firm, the size premium tends to be smaller in more complex international activities such as FDI or outsourcing. This is further evidence of tougher selectivity at the top, as more complex activities are chosen by firms which have TFPs above already quite high thresholds. In other words, size matters more for relatively less-complex international activities.

Table 10: Firm size effects on TFP across internationalisation activities

Dependent variable: TFP	(1) Active abroad	(2) Exporter	(3) Imp. of service	(4) Imp. of mat.	(5) FDI	(6) Pass out.	(7) Act out.	(8) Global exp.
Small firms								
(20-49 employees)	0.162***	0.156***	0.168***	0.160***	0.144***	0.154***	0.137***	0.180***
	(0.0118)	(0.0124)	(0.0179)	(0.0140)	(0.0228)	(0.0150)	(0.0209)	(0.0170)
Medium-sized firms								
(50-249 employees)	0.343***	0.346***	0.376***	0.336***	0.253***	0.309***	0.341***	0.332***
	(0.0157)	(0.0165)	(0.0240)	(0.0182)	(0.0363)	(0.0199)	(0.0344)	(0.0227)
Large firms (over								
250 employees)	0.639***	0.635***	0.647***	0.634***	0.572***	0.553***	0.576***	0.644***
	(0.0271)	(0.02-83)	(0.0365)	(0.0302)	(0.0562)	(0.0352)	(0.0671)	(0.0374)

Note: Standard errors in parentheses. *** denotes statistical significance at the 1 percent level. The coefficients of the internationalisation variables are reported in column (2) of Table 5 and are not repeated here.

We have also checked for the robustness of the OLS results by estimating an ordered probit model, in which the internationalisation status is regressed across the decile categories (from the first to the tenth) of TFP analysed in Figure 3. The results are reported in column (3) of Table 9. The interpretation of the coefficient is slightly different here, but the results are quite consistent: the higher the productivity deciles, the more likely that a firm will be involved in some internationalisation activity. This is true for all activities though the effect is strongest for FDI, followed by importers of services, and is weakest for exporters that are only active within Europe.

Summing up these preliminary results, we thus find that productivity rankings are broadly consistent with previous results in the literature that consider individual countries and specific internationalisation activities. Importantly, the EFIGE dataset gives more scope for analysis compared to the existing literature by providing comparable information on the internationalisation choices of firms across a wide range of international activities and across countries, within a homogenous analytical framework. Productivity premia are thus fully comparable. In particular the analysis confirms two well-known self-selection effects: 1) the productivity threshold above which firms tend to be active internationally is highest for FDI (Helpman *et al*, 2004); 2) self-selection is strong and present also for importing activities (see, eg, Altomonte and Békés, 2010, and Bernard *et al*, 2011). The analysis also reveals two (previously unnoticed) additional features in the internationalisation-competitiveness relationship: 3) participating in global value chains (both active and passive outsourcing in our definition) is associated with higher productivity-premia; 4) firms that import services exhibit a high TFP premium, possibly due to the complementarity between complex internationalisation strategies and sophisticated services exported by selected providers.

The cross-country comparability of the EFIGE dataset also allows us to investigate if firms from different countries, though involved in the same international activities, exhibit different productivity behaviours. To do that, we ran the same OLS specification as that reported in Table 9, adding an interaction term (on top of country fixed effects) between a given country and the international status of the firms. We consider here Italy, Germany and France.

The coefficients of the interaction terms for the three countries are reported in the first three columns of Table 11. The average patterns are confirmed in the cases of Italy and Germany as most coefficients are not statistically significant. The only exception concerns importers of materials, whose productivity difference with respect to internationally inactive (domestic) firms is greater in Italy and France than in other countries. France seems to be different when looking at other international activities: the productivity difference between its internationally active and inactive firms is larger than in other countries. This feature holds for traders for all the categories (exporters, importers of materials or services, global exporters).

Table 11: Productivity and internationalisation: country and industry effects

Dep. var.: TFP	ITA	FRA	GER	Low wage sector
Active abroad	0.0209	0.0818**	0.0681	-0.00581
	(0.0290)	(0.0410)	(0.0591)	(0.0264)
Exporter	0.0128	0.0971**	0.0450	-0.00688
	(0.0295)	(0.0422)	(0.0596)	(0.0270)
Importer of services	0.0405	0.101**	0.0371	-0.0612*
	(0.0374)	(0.0499)	(0.0669)	(0.0336)
Importer of materials	0.0642**	0.0928**	0.0877	-0.0178
	(0.0306)	(0.0419)	(0.0613)	(0.0281)
FDI	-0.0281	0.0918	-0.113	-0.227***
	(0.0808)	(0.0987)	(0.0934)	(0.0600)
Passive outsourcer	-0.00690	0.0698	0.0373	0.00487
	(0.0334)	(0.0450)	(0.0628)	(0.0295)
Active outsourcer	0.0620	0.151	-0.00996	0.0616
	(0.0784)	(0.0929)	(0.111)	(0.0608)
Global exporter	0.0406	0.169***	0.0738	-0.0233
	(0.0364)	(0.0513)	(0.0668)	(0.0330)

Note: Standard errors in parentheses. ***, ** and * denote statistical significance at the 1, 5 and 10 percent levels. The table reports the coefficients of interaction terms between internationalisation status and country dummy (or low-wage sector dummy). The results are obtained by including these interaction terms into the OLS model of Table 5, column 1.

Going from a country to an industry perspective, we have combined the internationalisation status of firms with an sector-specific dummy taking a value of 1 if the industry is characterised by competition from low-wage countries (fourth column of Table 11)[19]. Negative coefficients show that the productivity difference with respect to internationally inactive firms of the same country and sector (as shown in Table 9, column 1) is smaller for internationally active firms in low-wage industries; even more when they undertake FDI or import services. This is striking because we have seen that in general these two activities are the most selective, and are associated with the highest productivity premia. The negative and significant coefficients might indicate that European firms use those complementary activities to face tough competition from low-wage countries. The difference is indeed not present for other internationalisation categories, where firms operating in low-wage industries do not display

19. Following Bugamelli *et al* (2010) we consider as being affected from low-wage competition those industries in which the world market share of Chinese exports is above the median world market share of Chinese exports.

a significantly different TFP premium for international activity compared to firms from other industries.

As a further check, we regress two other competitiveness measures (LP and ULC) against the international activities we have analysed so far. Table 12 reports the results of the latter specifications together with those we have obtained using TFP as performance indicator.

Table 12: International status and alternative competitiveness measures

	TFP		Labour productivity		Unit labour cost	
Variables	OLS	N	OLS	N	OLS	N
Active abroad	0.0906***	7,259	0.135***	7,260	-0.0570***	9,230
	(0.0132)		(0.0145)		(0.00960)	
Exporter	0.0999***	6,563	0.141***	6,564	-0.0545***	8,281
	(0.0136)		(0.0149)		(0.00991)	
Importer of services	0.171***	3,334	0.202***	3,334	-0.0682***	4,246
	(0.0171)		(0.0188)		(0.0121)	
Importer of materials	0.118***	5,320	0.162***	5,321	-0.0703***	6,800
	(0.0142)		(0.0155)		(0.0101)	
FDI	0.257***	1,862	0.226***	1,862	-0.0927***	2,392
	(0.0329)		(0.0373)		(0.0253)	
Passive outsourcer	0.122***	4,372	0.158***	4,372	-0.0630***	5,672
	(0.0151)		(0.0169)		(0.0111)	
Active outsourcer	0.134***	1,777	0.182***	1,777	-0.0666***	2,330
	(0.0309)		(0.0359)		(0.0212)	
Global exporter	0.156***	3,652	0.198***	3,652	-0.0631***	4,588
	(0.0168)		(0.0184)		(0.0122)	

Note: Standard errors in parentheses. *** denotes statistical significance at the 1 percent level. One cross-sectional regression for each internationalisation characteristic, with sector and country dummies. The number of observations is given by the number of inactive firms plus the number of firms active in the selected international activity.

Table 12 shows that TFP and LP premia are fully comparable across international statuses. This is the case both in terms of magnitude (with premia ranging between 10 and 25 percent relative to internationally inactive firms) and in terms of ranking (with FDI always being associated with the most productive category of firms, followed by importers of services, outsourcers, importers of materials and simple exporters). These findings are not surprising in light of the relatively high correlation between the two measures of productivity (Table 4).

Not unexpectedly, given the low correlation with TFP, ULCs convey a slightly different message. Internationalisation premia are still there and significant, showing that internationally active firms have lower ULCs compared to local firms. However, magnitudes are smaller as premia range between 5 and 9 percent *vis-à-vis* internationally inactive firms. The ranking also changes. While firms undertaking FDI are still the most competitive, firms importing material goods are closing in on them. Hence, although ULCs seem to capture elements of competitiveness different from productivity, the fact that all coefficients are significantly negative sends a message of overall consistency across measures of competitiveness. To this extent, Appendix 5 explores the potential divergence between ULC and TFP in greater detail, relating ULC to the quality of labour force at the firm level. Preliminary evidence suggests that using ULC-based measures of competitiveness might be inappropriate when an increase in the cost of employees affects R&D-intensive firms. In particular, the effect of ULC on the probability of exporting is less significant for those firms involved in R&D activities. Or, in other words, once we control for quality (as proxied by R&D), the significance of ULC as a predictor of the probability of being an exporter is restored. When using TFP as a proxy of competitiveness, R&D activities at the firm level do not seem to affect the ability of TFP to predict the export status of a firm.

In short, for firms with R&D activities, an increase in their unit labour costs does not necessarily affect their ability to export (their competitiveness does not depend exclusively on the competitive price of the goods sold), whereas for those firms that do not undertake R&D activities, an increase in ULC translates more strongly into a reduction of the probability of exporting, confirming the idea that quality matters. These distortions are not present when using TFP as a proxy for competitiveness.

Because in aggregate we are typically unable to distinguish R&D activities when deriving average ULCs across firms, we therefore conclude that while ULC measures can be appropriately informative for broad macro-policy assessments of a country's competitiveness, an analysis of firm-level TFP dynamics is what one should look at for more in-depth analyses, and resulting policies to enhance competitiveness.

The difficulty of using price/cost indicators when assessing competitiveness is also reflected by other studies. It has been shown that looking at ULC, in the case of Spain, is a way to get trapped in the so-called 'Spanish competitiveness paradox'. That is, even though Spanish ULC during the decade starting in 2000 grew more quickly than in the main developed economies, Spanish export shares did not fall by as much as those of the same countries, with the sole exception of Germany (Rodríguez Crespo *et al*, 2012). Again, this suggests that ULC measures not only competitiveness.

5 What triggers competitiveness?

The findings outlined so far suggest that, within industries and countries, firms self-select into international activities, with only the most productive firms able to compete internationally. In other words, there exists a minimum performance threshold of productivity above which firms can be considered competitive in international markets[20]. We have also learned that such a threshold is quite stable across countries, but varies between international activities, with more complex (costly) activities (outsourcing and FDI) reserved for the top group of the most productive firms. In light of this evidence, it is interesting to identify more precisely the minimum threshold of performance above which the presence of a firm on international markets is triggered, and, most interestingly, the firms' characteristics (endowments, strategy, organisation) typically associated with the reaching such a performance threshold.

Taking TFP as our preferred proxy of firm performance, we develop *a three-step procedure* to explore what triggers competitiveness. First, we identify the cut-off above which firms are able to maintain an international presence. In particular, we define such a threshold as the percentile in the TFP distribution (eg top 20 percent, top 30 percent or so) that firms in our sample have to achieve to have at least a 95 percent probability of being active abroad. Once the cut-off has been identified, we then proceed to isolate those firms that between 2002-07 and 2008-09 switched from below to above the threshold. Those firms able to reallocate their productivity above the identified level are called *switchers*. We finally combine balance-sheet and EFIGE data in order to identify the firm characteristics that have an impact on the probability of switching.

5.1 Minimum performance cut-off and switchers

To identify what level of productivity triggers internationalisation activity, we ran a simple probit model regressing the international status of each firm (whether active

20. For a detailed discussion of this point see Altomonte *et al* (2011).

internationally or not) against a system of dummies positioning each firm in its 2008 deciles of TFP, controlling for country and industry fixed effects. We then tested the joint hypothesis that any given combination of these dummies (ie deciles of productivity) was significantly associated to at least a 95 percent probability of being active abroad. Results, reported in column 1 of Table 13, shows that all firms that are at least in the seventh deciles in the TFP distribution have a significant probability of being active abroad.

Table 13: Critical cut-off of TFP

Ho: Pct_7=0, Pct_8=0, Pct_9=0, Pct_10=0				
	Active abroad		Exporter	
	(1)	(2)	(1)	(2)
chi2(4)	75.39	22.97	57.37	11.38
Prob > chi2	0.0000	0.0001	0.0000	0.0226

Note: joint probability that a decile of TFP above or equal to the 7th is significantly associated with a given international status, controlling for industry, country (1) and firm-size (2) fixed effects.

The latter finding holds if a specific control for firm-size is added (column 2) or if the exercise is repeated with the export status vs. the generic active abroad status (columns 3 and 4).

Once the relevant cut-off has been identified, we then classified firms according to their positioning in the TFP distribution before and after 2008[21]. This allows us to sort firms into four categories: those that remain always below the critical cut-off for the entire time span of our sample (2001 to 2008); those 'superstar' firms that remain always above it; those firms losing out in competitiveness and moving from above to below the cut-off; and finally those 'switching' firms able to climb the competitiveness ladder and pass the cut-off in 2008.

Table 14 provides the usual descriptive statistics for the four categories of firms. We see how firms that remain or drop below the seventh deciles of TFP have lower average turnover, tend to be smaller, have smaller capital stock, lower LP and higher ULC with respect to the average firm in the whole sample. We also see that the 942 firms that moved above the critical cut-off tend to be relatively small (34 employees vs. a sample average of 126) but relatively well capitalised (above average). This indicates that

21. To avoid dealing with missing data and attrition bias, we have considered average TFP in the 2001-07 vs. 2008-09 periods.

other factors than size and turnover help trigger the ability of firms to rise above the minimum performance cut-off for international activity. We will explore these additional firm characteristics in the next section, after a robustness check of our definition of switchers.

The four categories of firms have been sorted with respect to a well-defined performance threshold (the seventh decile of TFP distribution in 2008). However, this definition might rule out some firms whose productivity has increased steadily over the time span considered, but whose final level of productivity in 2008 was not high enough to qualify them as a switcher. This is because the productivity cut-off could move over time, since it depends on the distribution of TFP observed in a given period.

Table 14: Characteristics of firms with respect to their TFP dynamics

Change in TFP w.r. to the cut-off (7th TFP decile)	No. of firms	Avg. turnover per firm (in €1,000s)	Avg. no. of employee	Avg. Capital stock per employee (in €1,000s)	Total Factor Productivity	Unit labour cost (in € per unit of value added)	Labour productivity (value added per employee)
Remain below	3823	146.1	27	157.9	0.653	0.845	39.346
Move below	1010	12271.1	66.5	188.5	0.821	0.886	48.652
Move above (switcher)	**942**	**7805.9**	**34**	**202.4**	**1.129**	**0.65**	**68.755**
Remain above	2856	53921.1	341.9	248.8	1.546	0.649	79.394
Total	8631	19462.2	126.3	193.1	0.989	0.772	55.441

For these reasons, we have introduced a measure of 'absolute' productivity growth, by computing the difference in the firm-specific average TFP between the periods 2006-09 vs. 2001-05, thus creating a dummy variable that takes a value of one for those firms whose difference lays in the last quartile of the resulting distribution[22].

Table 15 shows that 1,811 firms, out of the 8,631 analysed, display a significant absolute growth in productivity (as defined above). However, these firms are not necessarily only those switchers able to overcome the performance cut-off. We find a significant upward growth in productivity taking place also in lower TFP deciles (555 firms record such a performance even though they stay below the critical performance threshold), while only some 57 percent of switching firms record a significant absolute

22. In other words, we do not simply consider firms experiencing a positive growth of productivity between 2001-05 and 2006-09, but rather the top 25 percent of firms experiencing positive productivity growth.

increase in productivity (for those firms already in the fifth or sixth TFP deciles it is enough to register a moderate increase in TFP to overcome the critical performance cut-off).

Table 15: Absolute TFP growth vs. TFP cut-off

	TFP growth		Total
Firms' performance vs. cut-off	0	1	
Remain below	3,268	555	3,823
Move below	981	29	1,010
Move above (switcher)	**405**	**537**	**942**
Remain above	2,166	690	2,856
Total	6,820	1,811	8,631

We will use this information as a robustness check when analysing the relationship between such performance in TFP (ability to overcome the cut-off or significant absolute productivity growth) and a number of structural firm characteristics (financial, organisational, etc), to which we now turn.

5.2 Financial characteristics of firms

To assess the impact of firms' financial characteristics on their performance, we construct six financial indicators retrieved from Amadeus balance-sheet data and related to traditional financial ratios, together with two additional indicators retrieved directly from the EFIGE survey, aimed at measuring the extent to which firms are credit constrained.

The Financial Independence Index (FII) indicator is a proxy for the long-term financial stability of a firm:

$$FII = \frac{Capital + Cash\ Flows}{Total\ Assets}$$

It evaluates the extent to which a firm is self-financing its economic activity. The optimal ratio is fixed at greater than or equal to 0.33, meaning that at least one third of the firm's assets must be financed (covered) by internal resources[23].

23. See, for instance, Brealey and Myers (2002).

The second indicator is a traditional cash ratio (CashR), measuring the firm's chances of paying off short-term debts without the need for additional external funds:

$$CashR = \frac{Cash\ Flows}{Current\ Liabilities}$$

If the index is greater than 1, a firm possesses sufficient resources to face the daily cost of production[24].

Third, the IFP (Index of Financial Pressure) index is the ratio between interest payments and the sum of profit before tax, depreciation and interest payments:

$$IFP = \frac{Interest\ Payments}{\text{Pr}ofits\ Before\ Taxes + Depreciation + Interest\ Payments}$$

It is bounded between 0 and 1, with a higher value indicating greater financial pressure[25].

A fourth index is the current ratio (CurrR), or working capital of a company, which relates current liquidity to current liabilities as:

$$CurrR = \frac{Current\ Assets}{Current\ Liabilities}$$

The index signals a firm's ability to cope with short-term liabilities (current liabilities, and debts to be paid within 12 months) through activities to be carried out in the short term (current assets that are available, such as cash and securities that can be immediately cashed in). Traditionally, a CurrR greater than (or equal to) 1 usually leads to a positive assessment of the company's liquidity[26].

The liquidity ratio (LR) and the leverage ratio (LevR) both take a more structural view of a company's financial position. The former is computed as follows:

24. See Schiantarelli (1996), Blundell *et al* (1996), Kaplan and Zingales (1997), Hubbard (1998) and Claessens and Tzioumis (2006) on the importance of sensitivity of investments to cash flow in characterising firms' financial soundness.
25. See Nickell and Nicolitsas (1999) for a complete description of the index.
26. See Forlani (2010) for a detailed discussion.

$$LR = \frac{Current\ Assets - Current\ Liabilities}{Total\ Assets}$$

The numerator expresses the shape the company is in, in monetary terms. If it is positive, the company is considered able to cope with short-term liabilities using its current assets. That is, it is able to repay imminent debts with cash. A negative LR indicates that the firm has difficulty meeting short-term liabilities. Clearly, the ability (or inability) is more or less serious depending on the extent of the eventual imbalance with respect to the total assets of the company (the denominator). A large negative LR thus expresses not only a liquidity problem, but more in general the potential insolvency of the company. Finally, the leverage ratio (LevR) indicates how much a company depends on external financial sources:

$$LevR = \frac{Total\ Debt}{Capital}$$

The index compares the financial resources available to the company in the form of debt and those available as internal equity. It can take any positive value[27].

Table 16 reports the firms' financial scores measured in our sample for 2008, along with some of the usual descriptive statistics. No specific pattern emerges, but it is clear that the number of firms for which we have financial information results from a selection of our original sample, and is relatively biased towards large firms (average firm size of those firms for which we can measure financial indexes ranges from 125 to 137 employees). This, of course, induces a potential selection bias in the data which could distort our analysis. We will deal with this problem when discussing our results.

Finally, from the EFIGE dataset, we compute two additional dummies relative to the degree to which firms are credit constrained. The variable *credit_req* equals 1 if the firm has asked for credit, while the variable *credit_ob* takes values of 1 if the firm has been granted credit[28].

27. Some examples of papers that use LR and LevR to assess the liquidity and the dependence on external financial means of a company are Whited (1992), Fazzari and Peterson (1993), Greenaway, Guariglia and Kneller (2007).
28. See Minetti and Zhu (2011) for a use of similar variables in their analysis of Italian exporters.

Table 16: Financial indexes and firm descriptive statistics

Variable	No. of firms	Avg. turnover per firm (in €1,000s)	Avg. no. of employees	Avg. capital stock per employee (in €1,000s)	TFP	Unit labour cost (in € per unit of added value)	Labour productivity (added value per employee)	% of active abroad	% of exporter
FII	8,422	18,881.48	135.07	192.53	0.98	0.74	55.69	78%	69%
CashR	8,425	17,884.95	130.96	194.81	0.95	0.73	55.26	78%	68%
IFP	7,934	18,120.02	137.50	188.04	1.00	0.73	56.56	78%	69%
CurrR	10,653	17,351.76	126.37	188.27	0.97	0.77	54.88	77%	67%
LR	11,246	16,977.78	124.89	188.11	0.97	0.76	55.18	76%	67%
LevR	11,487	16,998.94	125.66	192.43	1.00	0.75	56.54	76%	67%
Whole sample	14,759	15,589.29	114.52	186.59	0.99	0.77	55.02	74%	65%

5.3 Structural characteristics of firms

The literature has emphasised the role of managerial structure and practices in shaping firm competitiveness, information that is unobservable from balance-sheet data but is available via EFIGE. In particular, to take into account the role of families in the management of companies, we have constructed two dummies: the first (*fam_managed*) takes value 1 if the share of executives (including middle management) who are related to the family that owns the company is higher than the national average of the family-owned firms in the sample; the second (*fam_ceo*) equals 1 if the CEO of the firm is a member of the family that owns the company[29].

We also control for some general characteristics of the managerial style of the firm, via a dummy (*decentr_manag*) equal to 1 if the firm reports adopting a mostly decentralised decision-making structure. Finally, we have generated a binary variable equal to 1 if the firm's employees have salaries partially linked to their performances (ie *productivity-based bonus*).

29. These variables stem from the notion that family management, rather than family ownership, matters more in affecting the performance of a given firm vs. a corporation (Michelacci and Schivardi, 2011; Bugamelli *et al*, 2011). In any case, as we can measure these dummies only for those firms that are family-owned (the control group refers to non-family-owned firms plus those family-owned firms with below average family influence in management), our dummies are also implicitly correlated to family ownership.

The EFIGE survey also provides data on firms' innovation strategies. We exploit that information to compute a variable proxying the endowment of *human capital*, taking value 1 if the share of graduate workers employed by the firm is greater than the average of those employed by other national firms. The dummy *R_D* takes value 1 if there are workers directly involved in R&D activities, while three variables signal if firms have engaged in *product*, *process* and *market innovation*, respectively.

Table 17: Structural characteristics of firms by country

Country	R&D	Established before 1975	Product innovator	Process innovator	Market innovator	Organisational innovator	High human capital	Use of flexible labour contracts
Austria	0.59	0.47	0.59	0.58	0.44	0.51	0.25	0.78
France	0.59	0.41	0.44	0.38	0.3	0.27	0.32	0.74
Germany	0.71	0.48	0.50	0.40	0.29	0.43	0.22	0.78
Hungary	0.28	0.06	0.44	0.34	0.27	0.19	0.24	0.62
Italy	0.54	0.33	0.49	0.45	0.34	0.3	0.32	0.8
Spain	0.61	0.25	0.46	0.51	0.22	0.32	0.29	0.99
UK	0.61	0.34	0.58	0.47	0.44	0.24	0.23	0.82
Whole sample	0.6	0.36	0.49	0.44	0.31	0.32	0.28	0.81

	Family managed	Family CEO	Foreign group	Decentralised management	Performance-based bonus	Quality certification	Credit requested	Credit obtained
Austria	0.28	0.71	0.14	0.32	0.48	0.52	0.11	0.10
France	0.18	0.49	0.12	0.23	0.44	0.53	0.06	0.04
Germany	0.26	0.73	0.06	0.32	0.49	0.65	0.08	0.07
Hungary	0.26	0.43	0.14	0.15	0.45	0.73	0.09	0.06
Italy	0.38	0.7	0.04	0.15	0.18	0.57	0.20	0.12
Spain	0.25	0.65	0.05	0.38	0.25	0.60	0.27	0.19
UK	0.13	0.54	0.17	0.37	0.47	0.63	0.07	0.06
Whole sample	0.25	0.62	0.09	0.28	0.37	0.60	0.14	0.10

Source: EFIGE dataset.

Finally, we exploit EFIGE data to compute the following additional variables: *size class*, *age* (ie a dummy equal to 1 if the firm was established after 1975 and 0 otherwise), *foreign ownership* (which is 1 if firms belong to foreign groups), *competition* (ie a

binary variable which equals 1 if firms charge different prices in markets with different degrees of competition), and use of *flexible contracts* or *quality certificates*. Appendix 1 provides a complete description of the identified variables, while Table 18 reports for each country the share of firms in which a given characteristic is present.

5.4 Econometric evidence

Summing up, our analysis has shown that the ability of firms to compete successfully in foreign markets crucially depends on their attaining a minimum performance threshold in productivity, given the costs associated with international activities. To this extent we have identified a good number of firms in our sample that, over the time span considered in the analysis, have been able to either consistently remain above such a critical threshold (some 2,850 large and well-capitalised firms), or to rise above it it after 2008. In particular we have identified about 940 'switchers', ie relatively small (34 employees vs. a sample average of 126) but relatively well-capitalised firms rising above the minimum performance threshold. We can now finally combine the retrieved firms' characteristics with the analysis of switching firms, in order to identify the specific features of those firms (in terms of innovation, financial structure, skills of the workforce, organisation, etc) that are more likely to attain a sustained competitive position on international markets. Or, in terms of our analysis, what firm characteristics are significantly associated with firms whose productivity dynamics are such that they rise above the minimum performance threshold and thus become internationally competitive.

To this extent, it is first important to deal with potential self-selection resulting from the fact that not every characteristic is observable for every firm. In particular, when analysing the financial performance of firms using the EFIGE data, we have noted that some indexes, in particular financial variables, were computable only for part of the whole sample (mainly relatively large firms). This might induce a sample selection that could bias our results. To deal with this, before moving to the regression analysis, we have run a 2-step Heckman selection model where the (lagged) financial variable acts as a predictor of the internationalisation status, controlling for (lagged) productivity as well as fixed effects (country, industry and firm size) in the first stage. Detailed results are reported in Appendix 3, and allow us to retain as significant only the *FII* and the *CashR* financial variables, ruling out the others because they are not significantly associated with internationalisation after controlling for productivity in the selection equation. In any case, we will also present results where those financial variables are not included in the estimation and are substituted by proxies of credit constraints.

Table 18 summarises the main regression results. The dependent variable is *switch*, a dummy equal to 1 for our 942 previously identified switching firms. As a robustness check, the 0 in the switch dummy, ie the control group, is defined for two sets of firms: the combined set of the 3,823 firms remaining below the critical cut-off plus the 1,010 firms that have moved below it over time; and only the set of firms remaining below the cut-off. We then ran a probit specification on this dependent variable, exploring the probability that a given firm characteristic is significantly associated with the fact of being a switching firm vs. a non-switcher. As can be seen, we do not explicitly include the internationalisation status in the estimation, as this is already endogenously captured by the dependent variable *switch* through productivity growth from below to above the critical internationalisation cut-off (see Table 13). It then follows that our estimates are not plagued by a blatant endogeneity problem when linking firms' characteristics to their ability to compete internationally.

In specifications from (1) to (4), we include the financial indexes (FII and CashR) that have survived the Heckman selection model, reported in Appendix 3. We find that firms that invest in R&D, that are in better financial shape, with respect to both of the indicators considered, and that belong to a foreign group, have a higher probability of switching in all the specifications. Notice that we do not include both financial indicators in the same specification in order to avoid multicollinearity problems. Specifications (5) and (6) do not include financial indexes and the financial component is taken into account by including the credit variables obtained from the EFIGE dataset (ie *credit_req* and *credit_obt*). In this case too, firms that invest more in R&D and have a quality certification have a greater propensity to switch in both specifications. Those that are family managed and required more credit have a lower probability of rising above the critical performance cut-off. A higher probability of switching is also associated to more human capital, to being part of a foreign group and having productivity-based salaries (as shown in Table 18 column 6, using the restricted control group). Finally, specifications (7) and (8) are estimated by substituting R&D activities (the input of the innovation function) with the three indicators of innovation output (*product_innov*, *process_innov* and *mkt_innov*). As was the case for the previous specifications, firms that have requested more credit or are family managed are less likely to be switchers, while those that are able to generate process innovation or have asked for quality certification are more likely to be switchers. The same is true for firms that are part of foreign group and link part of their salaries to the performance of employees (only in last specification, with the restricted control group).

As a last robustness check, we have run the set of regressions presented in Table 18 against the 1,811 firms, identified in Table 15, that display significant growth rates,

Table 18: Firms' characteristics and switching probability

Variables	(1) Move up=1 remain/ drop below=0	(2) Move up=1 remain below=0	(3) Move up=1 remain/ drop below=0	(4) Move up=1 remain below=0	(5) Move up=1 remain/ drop below=0	(6) Move up=1 remain below=0	(7) Move up=1 remain/ drop below=0	(8) Move up=1 remain below=0
r_d	0.135***	0.142***	0.149***	0.152***	0.128***	0.139***		
	(0.0500)	(0.0529)	(0.0501)	(0.0529)	(0.0459)	(0.0485)		
age	-0.0579	-0.0355	-0.0424	0.00304	-0.0260	0.0269	-0.0270	0.0254
	(0.0512)	(0.0548)	(0.0512)	(0.0547)	(0.0472)	(0.0504)	(0.0472)	(0.0504)
hk	0.0596	0.0791	0.0457	0.0591	0.0598	0.0845*	0.0714	0.0992**
	(0.0509)	(0.0543)	(0.0514)	(0.0549)	(0.0473)	(0.0505)	(0.0473)	(0.0505)
labour_flex	-0.0421	-0.0521	-0.00824	-0.0245	-0.00658	-0.0183	-0.00468	-0.0153
	(0.0653)	(0.0693)	(0.0661)	(0.0703)	(0.0601)	(0.0639)	(0.0601)	(0.0638)
FII	0.238**	0.535***						
	(0.114)	(0.124)						
CashR			1.322***	1.583***				
			(0.134)	(0.146)				
fam_managed	-0.0768	-0.0917	-0.118**	-0.142**	-0.115**	-0.129**	-0.114**	-0.130**
	(0.0570)	(0.0597)	(0.0574)	(0.0601)	(0.0530)	(0.0555)	(0.0529)	(0.0554)
fam_ceo	-0.0699	-0.0847	-0.0714	-0.0947*	-0.0570	-0.0823	-0.0576	-0.0823
	(0.0524)	(0.0558)	(0.0527)	(0.0560)	(0.0481)	(0.0511)	(0.0482)	(0.0511)
for_group	0.211*	0.310**	0.268**	0.363***	0.154	0.244**	0.148	0.238**
	(0.113)	(0.129)	(0.113)	(0.129)	(0.0989)	(0.112)	(0.0989)	(0.112)
decentr_manag	-0.00840	0.0211	0.000900	0.0138	-0.00883	0.00512	-0.00331	0.0121
	(0.0552)	(0.0593)	(0.0556)	(0.0595)	(0.0508)	(0.0544)	(0.0507)	(0.0542)
bonus	0.0614	0.0853	0.0363	0.0603	0.0738	0.115**	0.0744	0.116**
	(0.0537)	(0.0579)	(0.0542)	(0.0583)	(0.0495)	(0.0532)	(0.0497)	(0.0535)
qual_cert	0.0721	0.100*	0.0831*	0.114**	0.0769*	0.103**	0.0815*	0.109**
	(0.0494)	(0.0519)	(0.0496)	(0.0520)	(0.0457)	(0.0480)	(0.0458)	(0.0481)
comp	-0.0431	-0.0174	-0.0234	8.88e-05	-0.0420	-0.0242	-0.0319	-0.0131
	(0.0492)	(0.0523)	(0.0494)	(0.0525)	(0.0455)	(0.0483)	(0.0453)	(0.0482)
credit_req					-0.231**	-0.278***	-0.225**	-0.274***
					(0.0989)	(0.104)	(0.0988)	(0.104)
credit_obt					0.140	0.156	0.131	0.146
					(0.113)	(0.119)	(0.113)	(0.119)
product_innov							0.0641	0.0810
							(0.0579)	(0.0616)
process_innov							0.0801*	0.0824*
							(0.0445)	(0.0475)
mkt_innov							-0.0815	-0.109
							(0.0632)	(0.0675)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,718	3,912	4,815	4,036	5,626	4,651	5,626	4,651

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

irrespective of their switching status. Results are reported in Appendix 4 and show that, despite some foreseeable changes in significance, no major qualitative differences emerge between these specifications and the baseline presented above.

6 Conclusions and policy implications

What triggers competitiveness? This report has taken a systematic approach to addressing this question. *External competitiveness* can be better explored through analysis of firm-level data, because aggregate measures of competitiveness are typically plagued by a number of potential biases that affect their use as the basis for policy conclusions.

When exploring competitiveness at the firm-level, we have shown how self-selection into the various internationalisation statuses implies that international production sharing is a signal of greater competitiveness both at firm and sector levels. To this extent, we have argued that total factor productivity (TFP) is a better measure of competitiveness than unit labour cost (ULC), often used in policy contexts (see Appendix 5 for a detailed discussion). From the viewpoint of firms, greater competitiveness gives access to a larger number of more complex options when it comes to the design of international operations. From the viewpoint of industries, greater competitiveness arises from the possibility to reallocate resources from less to more productive firms. For both firms and industries, greater competitiveness arises from the possibility to exploit a richer set of internationalisation strategies to deal with the challenges and the opportunities of globalisation.

The report has also shown that firms become competitive in international markets when their TFP rises above a minimum threshold (ie competitiveness requires a *quantum leap*) that tends to be stable across countries but varies for different international activities. Exploiting the richness of a novel dataset (EFIGE), we have also found that this quantum leap is triggered by specific firm characteristics related to innovation (human capital and R&D intensity), finance (adequate capital in the form of equity), managerial style (the use of performance-based salaries and a reduced presence of managers belonging to the family if the firm is family owned), and affiliation to a foreign group. Moreover, we have shown that, although the firms that are able to move over time above the minimum productivity threshold are relatively

small (an average of 34 employees vs. a sample average of 126), it is not size *per se* that triggers competitiveness, but rather the ability to become more productive: relatively small firms, if endowed with certain characteristics, are more likely to grow, and for these reasons are picked up by our exercise. Through time, these firms will however reach the size of their already large and internationally competitive counterparts, thus ending up larger than the average domestic firm (140 vs. 31 employees). The latter will remain small and relatively less competitive precisely because they are not endowed with the characteristics that enable them to become more productive.

Finally, the report has shown that these effects do not necessarily depend on specific countries or industries, as they are typically related to systematic features of firm characteristics that are in general ignored in the policy debate on competitiveness. Countries and sectors might certainly display differences in competitiveness to the extent that firms within them are relatively more or less endowed with those specific characteristics identified in this report, leading to greater productivity growth and hence greater external competitiveness.

From a policy viewpoint, our findings have several implications:

- Definitions and measures of competitiveness on which policymakers base their decisions have to be context-specific. In particular, we show that, if the aim of policies is to foster a country's ability to exchange the goods and services in which a country is abundant for the goods and services that in the same country are scarce, the ultimately firm-driven nature of this process is such that traditional aggregate measures of competitiveness are subject to a number of biases and are thus likely to lead to imprecise policies, unless they are complemented by more disaggregated information on how firms actually work and react to incentives.

- The single best predictor of a firm's ability to successfully compete in international markets is its total factor productivity. Hence, firm productivity growth and not internationalisation *per se* should be the main policy objective.

- The promotion of firm productivity should go beyond the traditional exercise of educated guesswork around a black box. In this respect, we have shown that firm productivity growth is triggered by the combination of very precise firm attributes relating to innovation, finance, human resources, management and ownership. These attributes can be nurtured, for example, through the design of incentives for R&D, of more direct links between wages and productivity within national wage-

bargaining systems, of capital markets less dependent on banking finance and more favourable to the development of equity finance, and the availability of adequate skills in the workforce.

- Small is not beautiful *per se*. Small is beautiful if it grows, and growth does not happen when smallness is not accompanied by the right set of other firm characteristics. In this respect, the key question for SME policy should not be how to help small firms survive, but rather how to make small firms adopt the right attitudes towards innovation, finance, human resources, management and ownership, promoting not only their survival but also their growth.

- Firms' attitudes are not immutable but are rather shaped by policies. Hence, the promotion of productivity growth and competitiveness should go beyond the logic of mere compensation (subsidies), targeting instead the specific institutional aspects that make firms inclined to acquire the 'right' set of characteristics, beyond the worn-out generic mantra of 'flexibilities vs. rigidities'.

- Last but not least, a growing concern among European citizens and politicians is that society should have other objectives beyond the mere promotion of the ability to exchange goods and services. Sometimes these other objectives (eg social cohesion) may create a temporary trade-off with productivity growth and competitiveness-related policies. When that is the case, the opportunity cost of those alternative objectives in terms of foregone productivity should be evaluated in order to assess the relevant trade-offs in a transparent (and thus efficient) way. When societies pursue complex objectives, it is even more important for the policymaker to complement the standard aggregate measures of productivity with more disaggregated measures that better capture the way people and firms actually behave and react to economic (dis)incentives.

To summarise, because competitiveness is the cause rather than the consequence of firm internationalisation, EU policies promoting internationalisation *per se* would hardly affect competitiveness. However, policies that artificially reduce the ability of competitive firms to trade, outsource and invest abroad would also reduce their ability to reach their full potential. As a result, rather than focusing on the internationalisation of firms, successful policies should instead foster an economic environment in which firms have the incentive to acquire the characteristics that, as we have shown, are associated with productivity growth.

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Appendix 1: Additional data and variable description

Distribution of firms by country and size class

Class size	AUT	FRA	GER	HUN	ITA	SPA	UK	Total
Employees (10-19)	132	1,001	701	149	1,040	1,036	635	4,694
Employees (20-49)	168	1,150	1,135	176	1,407	1,244	805	6,085
Employees (50-249)	97	608	793	118	429	406	519	2,970
Employees(over250)	46	214	306	45	145	146	108	1,010
Total	443	2,973	2,935	488	3,021	2,832	2,067	14,759

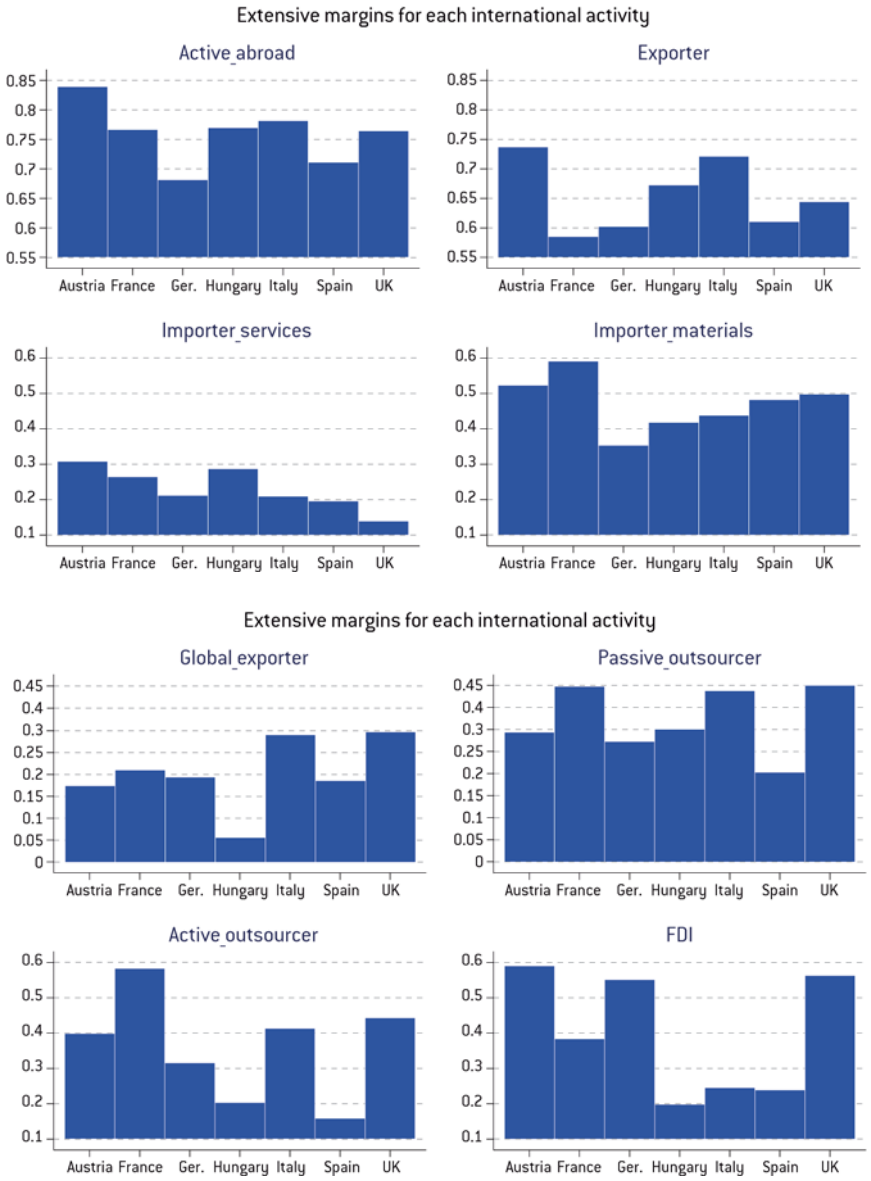
Distribution of firms by country and sector

Sector	AUT	FRA	GER	HUN	ITA	SPA	UK	Total
15	32	212	350	62	238	463	147	1,504
17	8	118	77	7	196	46	52	504
18	5	55	17	17	109	50	42	295
19	0	32	13	4	115	47	10	221
20	21	93	103	17	88	212	89	623
21	10	83	62	16	71	27	47	316
22	34	148	215	27	105	100	208	837
24	5	102	95	20	108	121	104	555
25	22	226	192	40	169	148	122	919
26	18	153	94	30	167	163	56	681
27	13	68	58	7	76	68	54	344
28	70	839	510	101	611	580	301	3,012
29	48	249	503	68	381	305	208	1,762
31	20	121	134	19	152	66	124	636
32	5	94	56	9	49	25	101	339
33	15	58	192	6	71	25	80	447
34	6	73	41	11	47	64	33	275
35	2	16	20	3	33	42	21	137
36	5	16	172	18	211	258	258	938
Total	339	2,756	2,904	482	2,997	2,810	2,057	14,345

Note: Sector 15 is merged with sector 16. Sector 31 is merged with sector 30.

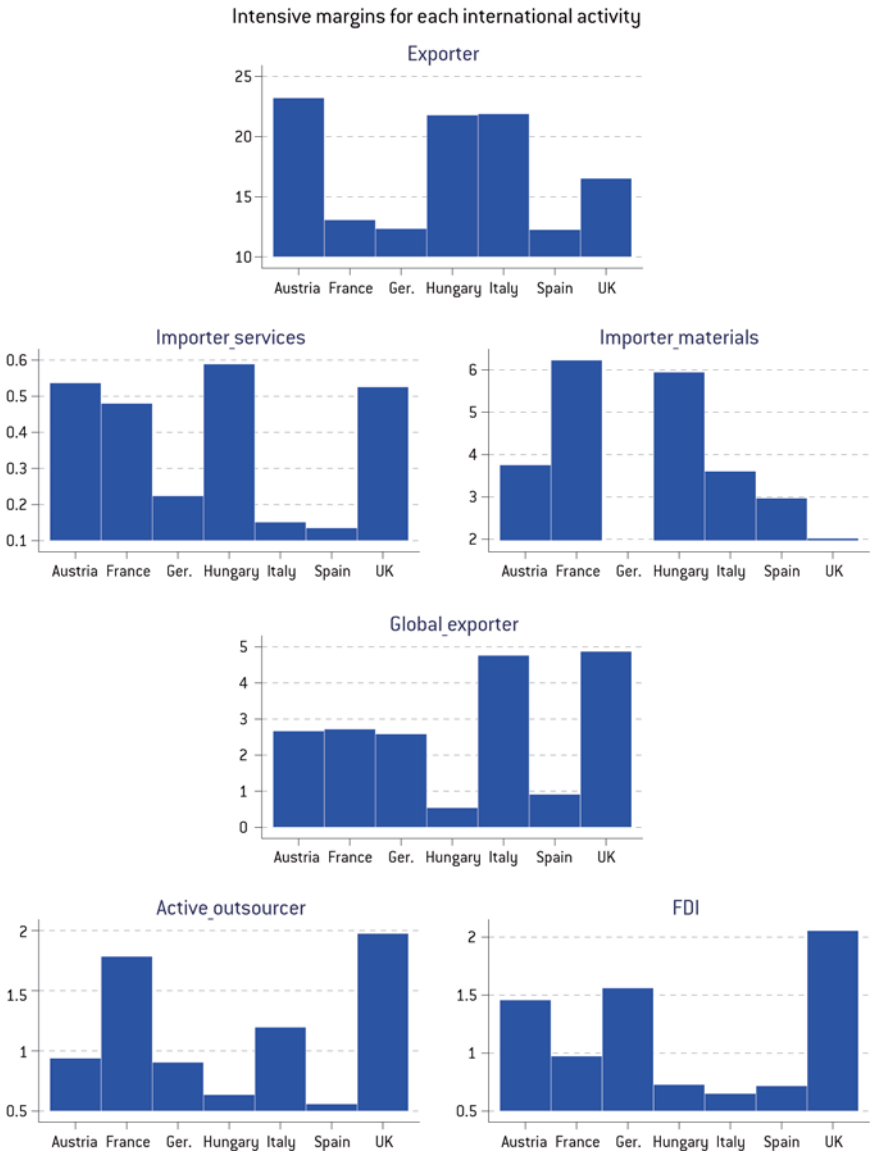
Margins of trade across international activities and countries

A) Extensive margin



Note: share of firms active in a given international status over total number of firms.

B) Intensive margin



Note: percentage of each firm's turnover derived by a given international activity.

Definition of variables used in the regressions

Variable used	Definition
Exporter	Dummy for exporter - wide definition: firm is direct exporter in 2008 or has been actively exporting in years before 2008.
Importer of materials	Dummy for importer of intermediate goods in 2008 or before.
Importer of services	Dummy for importer of services in 2008 or before.
Active outsourcer	Dummy for the firm that has production activity contracts and agreements abroad.
Passive outsourcer	Dummy for the firm that has sold some produced-to-order goods to foreign clients.
FDI	Dummy for firm running at least part of its production activity in another country via direct investments.
Global exporter	Dummy for firm exporting to China or India or other Asian countries or USA or Canada or Central or South America.
Active abroad	At least one of the above variables takes value 1.
Total factor productivity (TFP)	Solow residual of a Cobb-Douglas production function estimated following the semi-parametric algorithm proposed by Levinsohn and Petrin (2003), at the firm level, 2002-2008
Labour productivity	Added value per employee, at the firm level, 2002-08 (Amadeus)
Unit labour cost	Labour compensation over added value, at the firm level, 2002-08 (Amadeus)
Vertical share (Vs)	Ratio of the value of intermediate goods imported from abroad over the value of total output for each industry, based on country-specific I/O tables, 2001-07 (Eurostat)
r_d	Dummy for R&D: firm employs more than 0 employees to R&D activities
age	Dummy for firms established before or in 1975
product_innov	Dummy for firms that carried out any product innovation in years 2007-09
process_innov	Dummy for firms that carried out any process innovation in years 2007-09
mkt_innov	Dummy for firms that carried out new to the market innovation
organisational_innov	Dummy for firms where product/process innovation implied organisational innovation
ln_k_l	Capital intensity as natural logarithm of capital labour ratio
hk	Dummy for human capital: firm has a higher share of graduate employees with respect to the national average share of graduates
labour_flex	Dummy for labour flexibility: firm uses part-time employment or fixed-term contracts
credit_req	Dummy for credit request: firm requested some more credit in the last year
credit_obt	Dummy for credit obtained: firm requested and obtained extra credit in the last year

fam_managed	Dummy for family managed: firm share of managers related to the controlling family is higher than the national average
fam_ceo	Dummy for family CEO: the CEO is the individual who controls the firm or a member of the controlling family
for_group	Dummy for foreign group: firm belongs to a foreign group
decentr_management	Dummy for decentralised management: managers can take autonomous decisions in some business areas
bonus	Dummy for bonus: the managers are rewarded with bonus
qual_cert	Dummy for quality certification: the firm has gone through any quality certification process during the last year
comp	Dummy for competition from abroad: the firm has competitors abroad
switch	Dummy for switcher firms: firm's average TFP was below the cut-off (7th decile) in period 2001-07, and above the cut-off in 2008-09
Dyn	Four productivity dynamics with respect to cut-off: remain below, move below, move above (switch), remain above.
TFP growth	Dummy variable identifying those firms whose difference in the average TFP between the time spans 2006-09 and 2001-05 lays in the fourth quartile of the resulting distribution.

Appendix 2: Levinsohn and Petrin estimation technique

Let y_t denote (the log of) a firm's output in a Cobb-Douglas production function of the form

$$y_t = \beta_0 + \beta_l l_t + \beta_l k_t + \beta_m m_t + \omega_t + \delta_t \qquad (*)$$

where l_t and m_t denote the (freely available) labour and intermediate inputs in logs, respectively, and k_t is the logarithm of the state variable capital. The error term has two components: δ_t, which is uncorrelated with input choices, and ω_t, a productivity shock unobserved by the econometrician, but observed by the firm. Since the firm adapts its input choice as soon as it observes ω_t, inputs turn out to be correlated with the error term of the regression, and thus OLS estimates of production functions yield inconsistent results.

To correct for this problem, (Levinsohn and Petrin, 2003), from now on LP, assume the demand for intermediate inputs m_t (eg material costs) depends on the firm's capital k_t and productivity ω_t, and show that the same demand is monotonically increasing in ω_t. Thus, it is possible for them to write ω_t as $\omega_t = \omega_t(k_t;m_t)$, expressing the unobserved productivity shock ω_t as a function of two observables, k_t and m_t.

To allow for identification of ω_t, LP follow Olley and Pakes (1996) and assume it to follow a Markov process of the form $\omega_t = E[\omega_t | E[\delta_t + \vartheta_t | k_t] = 0] + \vartheta_t$ where $\vartheta_t$is a change in productivity uncorrelated with k_t. Through these assumptions it is then possible to rewrite equation (*) as

$$y_t = \beta_l l_t + \varphi(k_t;m_t) + \delta_t \qquad (**)$$

where $\varphi(k_t;m_t) = \beta_0 + \widehat{\beta_l k_t} + \beta_m m_t + \omega_t(k_t;m_t)$. By substituting a third-order polynomial approximation in k_t and m_t in place of $\omega_t(k_t;m_t)$, LP show that it is possible to consistently estimate the parameter $\widehat{\varphi_t}$ and $\widehat{\beta}_t$ in equation (**).

For any candidate value β_k^* and β_m^*, one can then predict ω_t for all periods t, since $\widehat{\omega_t} = \widehat{\varphi_t} - \beta_k^* k_t - \beta_m^* m_t$ and hence, using these predicted values, estimate $E[\omega_t|\widehat{\omega_{t-1}}]$. It then follows that the residual generated by β_k^* and β_m^* with respect to y_t can be written as

$$\delta_t + \widehat{\vartheta_t} = y_t - \widehat{\beta} l_t - \beta_k^* k_t - \beta_m^* m_t - E[\omega_t|\widehat{\omega_{t-1}}] \qquad (***)$$

Equation (***) can then be used to identify β_k^* and β_m^* using the following two instruments: if the capital stock k_t is determined by the previous period's investment decision, it then does not respond to productivity shocks at time t and thus $E[\delta_t + \vartheta_t|k_t] = 0$; also, if the last period's level of intermediate inputs m_t is uncorrelated with the error period at time t (which is plausible if for instance one takes material costs as a proxy for intermediate inputs), then $E[\delta_t + \vartheta_t|m_{t-1}] = 0$.

Through these two moment conditions, it is then possible to find a consistent and unbiased for β_k^* and β_m^* by solving the following problem

$$\min_{(\beta_k^*, \beta_m^*)} \equiv \Sigma_h[\Sigma_t(\delta_t + \widehat{\vartheta_t})Z_{ht}]^2 \qquad (****)$$

with $Z_t \equiv (k_t + m_{t-1})$ and h indexing the elements of Z_t.

Appendix 3: Financial variables and internationalisation

Heckman selection model

Variables	(1) Active abroad	(2) Exporter
L_FII	0.0675**	0.0671**
	(0.0316)	(0.0303)
L_tfp_va	0.295***	0.325***
	(0.0456)	(0.0472)
L_CashR	0.0682*	0.298***
	(0.0403)	(0.0480)
L_tfp_va	0.258***	0.325***
	(0.0461)	(0.0472)
L_IFP	0.000291	0.00161
	(0.0289)	(0.0272)
L_tfp_va	0.343***	0.384***
	(0.0456)	(0.0474)
L_CurrR	0.0111	0.0117
	(0.00785)	(0.00757)
L_tfp_va	0.242***	0.271***
	(0.0426)	(0.0443)
L_LR	0.0239	0.0252
	(0.0281)	(0.0271)
L_tfp_va	0.256***	0.289***
	(0.0425)	(0.0444)
L_LevR	-0.00175	-0.00142
	(0.00553)	(0.00541)
L_tfp_va	0.311***	0.336***
	(0.0429)	(0.0445)

NOTE: first stage (not reported) uses lagged TFP + fixed effects; second stage uses lagged financial variable + residual of first stage + fixed effects. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Appendix 4: TFP growth and firm characteristics

Variables	(1) TFP growth Grow=1 Remain/ drop below=0	(2) TFP growth Grow=1 Remain below=0	(3) TFP growth Grow=1 Remain/ drop below=0	(4) TFP growth Grow=1 Remain below=0	(5) TFP growth Grow=1 Remain/ drop below=0	(6) TFP growth Grow=1 Remain below=0	(7) TFP growth Grow=1 Remain/ drop below=0	(8) TFP growth Grow=1 Remain below=0
r_d	0.0858*	0.0954*	0.111**	0.122**	0.109**	0.130***		
	(0.0470)	(0.0495)	(0.0463)	(0.0487)	(0.0433)	(0.0455)		
age	-0.245***	-0.249***	-0.241***	-0.229***	-0.252***	-0.236***	-0.249***	-0.232***
	(0.0503)	(0.0536)	(0.0496)	(0.0528)	(0.0463)	(0.0493)	(0.0463)	(0.0494)
hk	0.0620	0.0781	0.0548	0.0614	0.0516	0.0664	0.0533	0.0670
	(0.0485)	(0.0515)	(0.0482)	(0.0511)	(0.0451)	(0.0480)	(0.0450)	(0.0480)
labour_flex	-0.0121	-0.00845	0.0116	0.00126	-0.0129	-0.00753	-0.00987	-0.00240
	(0.0629)	(0.0666)	(0.0625)	(0.0661)	(0.0579)	(0.0614)	(0.0579)	(0.0614)
FII	-0.301***	-0.111						
	(0.109)	(0.118)						
CashR			0.678***	0.788***				
			(0.130)	(0.140)				
fam_managed	-0.0130	-0.0104	-0.0574	-0.0620	-0.0446	-0.0408	-0.0474	-0.0431
	(0.0525)	(0.0549)	(0.0519)	(0.0542)	(0.0487)	(0.0509)	(0.0487)	(0.0509)
fam_ceo	-0.0958*	-0.127**	-0.120**	-0.151***	-0.103**	-0.122**	-0.103**	-0.123**
	(0.0501)	(0.0529)	(0.0494)	(0.0521)	(0.0460)	(0.0486)	(0.0460)	(0.0486)
for_group	0.132	0.209	0.177	0.282**	0.0999	0.164	0.0976	0.161
	(0.117)	(0.133)	(0.117)	(0.132)	(0.104)	(0.117)	(0.104)	(0.117)
decentr_manag	0.0413	0.0743	0.0509	0.0750	0.0699	0.0940*	0.0753	0.0998*
	(0.0528)	(0.0563)	(0.0522)	(0.0554)	(0.0483)	(0.0515)	(0.0482)	(0.0514)
bonus	0.0402	0.0716	0.0271	0.0621	0.0297	0.0609	0.0263	0.0559
	(0.0528)	(0.0565)	(0.0524)	(0.0559)	(0.0488)	(0.0523)	(0.0490)	(0.0525)
qual_cert	0.0137	0.0442	-0.00417	0.0249	0.00905	0.0372	0.00777	0.0355
	(0.0469)	(0.0492)	(0.0462)	(0.0485)	(0.0433)	(0.0455)	(0.0434)	(0.0457)
comp	-0.0545	-0.0205	-0.0434	-0.0147	-0.0531	-0.0276	-0.0509	-0.0254
	(0.0469)	(0.0495)	(0.0464)	(0.0489)	(0.0434)	(0.0459)	(0.0433)	(0.0458)
credit_req					-0.0483	-0.0921	-0.0432	-0.0869
					(0.0876)	(0.0921)	(0.0876)	(0.0921)
credit_obt					-0.0169	-0.0157	-0.0248	-0.0252
					(0.101)	(0.107)	(0.101)	(0.107)
product_innov							0.00263	0.0158
							(0.0564)	(0.0597)
process_innov							0.0401	0.0452
							(0.0424)	(0.0451)
mkt_innov							0.123**	0.136**
							(0.0611)	(0.0649)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,718	3,912	4,815	4,036	5,626	4,651	5,626	4,651

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix 5: ULC and its limits

Measures of TFP are generally considered the most appropriate indicator of firm performance by researchers, because they tend to be correlated with profits, markups and size. However, as TFP measures are computationally intensive to calculate, and suffer from a potentially significant aggregation biases when calculated at the industry or country level, policy-related papers tend to use ULC-based measures when assessing competitiveness, especially at the aggregate level. We recall that ULC at time *t* for firm *i* is easily derived as:

$$ULC_{it} = \frac{Cost\ of\ Employees_{it}}{Added\ Value_{it}}$$

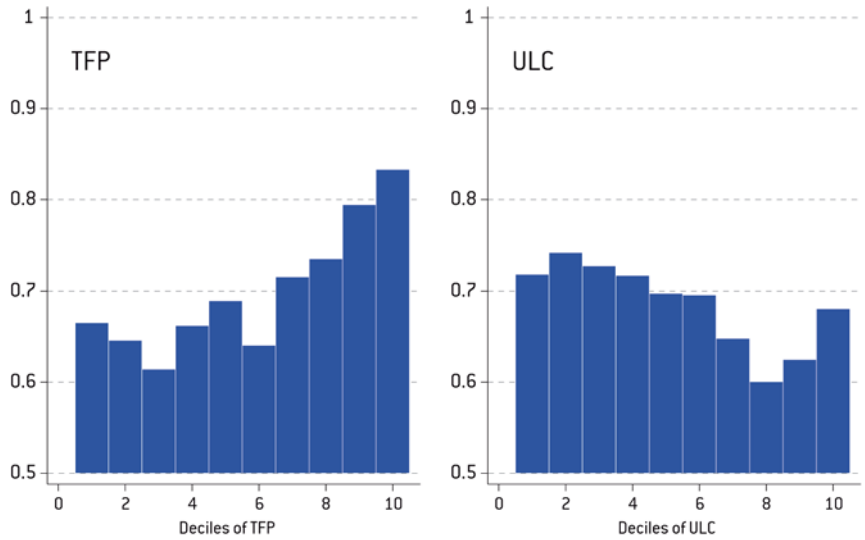
As a result, as for TFP, the ULC measure is such that any increase in added value would translate into a higher level firm competitiveness[30]. However, an increase in the cost of employees would reduce a firm's competitiveness measured via ULC, while TFP-based measures would be unaffected (TFP depends on the number of employees, not on their cost).

Now, imagine that a given firm produces higher quality products thanks to a different workforce organisation (eg workers spend more time on research and development activities, or simply are more skilled). In terms of TFP, the unobserved (higher) quality would likely result in higher firm-level prices, and hence in a positive bias in (deflated) added value, which would go in the same direction as the estimated TFP. In terms of ULC, however, things are less straightforward: the different organisation of the workforce of the 'high-quality' firm might be associated with a higher total wage bill and thus, to the extent that this is not perfectly reflected in total added value, in a higher (rather than lower) unit labour cost.

30. As previously discussed, TFP is retrieved as the Solow residual from the estimation of a production function: hence, the higher the (deflated) value-added keeping constant inputs, the higher the TFP.

This idea is consistent with the results reported in Table 12, where TFP and ULC premia were compared for different internationalisation activities. Further evidence is also provided by Figure A5.1, showing how the relationship between TFP deciles and the probability of exporting is relatively more linear with respect to the one observed between the latter and ULC deciles.

Figure A5.1: Distribution of exporters by productivity deciles



In order to provide some evidence supporting our claim that unobserved (higher) quality might bias the relationship between ULC and export probabilities, we have exploited the wealth of information existing in EFIGE and have proxied 'quality' at the firm-level with R&D activities (see Grossman and Helpman, 1991; Ang and Madsen, 2011). We have then empirically tested the following model at the firm level:

$$Export_i = \alpha + \beta R\ \&\ D_i + \gamma ULC_i + \delta ULC * R\ \&\ D_i + \overline{\eta_i} FE + \varepsilon_i$$

Where $Export$ is a dummy variable taking value 1 if firm i exported in 2008 or before; $R\ \&\ D_i$ is a dummy indicating whether the firm allocated at least one employee to R&D activities in 2008; ULC is the natural logarithm of ULC; and $ULC{*}R\ \&\ D_i$ is an interaction term between the two variables; FE is a matrix of country and sector fixed effects. The coefficient of interest is δ: if significant, it indicates a different effect of an increase in ULC on the probability of exporting for the sub-samples of firms that do

R&D (our proxy for 'high-quality' firms) vs. those that do not. Column 2 of Table A5.1 shows the results of a probit estimation of equation (1), whereas column 1 provides the results on the model estimated without the interaction term; columns 3 and 4 report the results of robustness checks, in which ULC has been replaced by TFP.

Table A5.1: Probit on exporting

Variables	(1) Exporter	(2) Exporter	(3) Exporter	(4) Exporter
R&D	0.606***	0.691***	0.584***	0.586***
	(0.0301)	(0.0442)	(0.0339)	(0.0353)
ULC	-0.281***	-0.420***		
	(0.0513)	(0.0738)		
ULC*R&D		0.264***		
		(0.101)		
TFP			0.254***	0.248***
			(0.0360)	(0.0529)
TFP*R&D				0.0102
				(0.0673)
Constant	0.446	0.404	0.505	0.503
	(0.399)	(0.401)	(0.396)	(0.396)
Observations	9,053	9,053	7,259	7,259
Country FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes

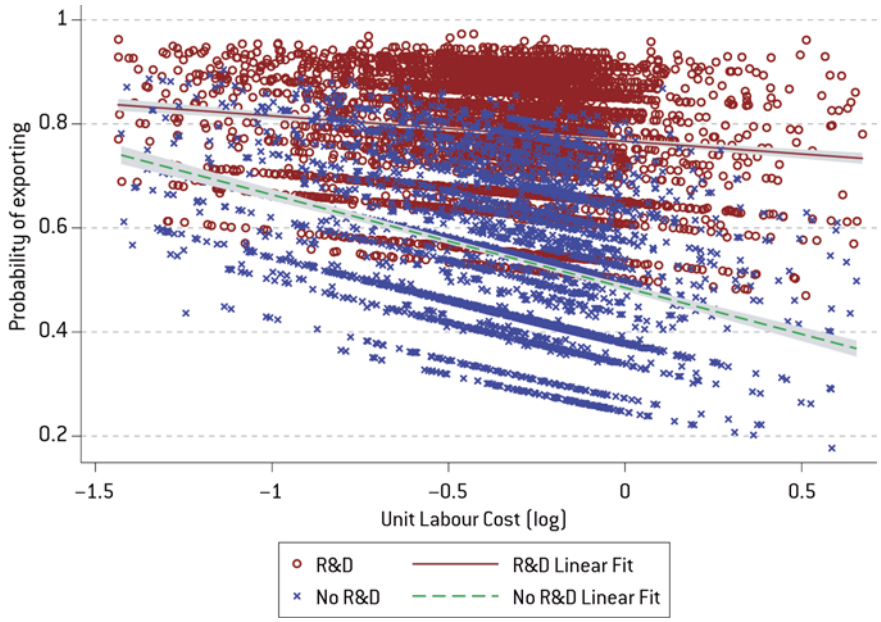
Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

As expected, and in line with the literature, in both specifications (1) and (2) ULC affects negatively the probability of exporting, while R&D activity is associated with a greater likelihood of exporting. The interaction term in column (2), instead, exhibits a positive and significant coefficient, indicating a less negative net effect[31] of ULC on the probability of exporting for those firms involved in R&D activities. Or, in other words, once 'purged' from the effect of quality (as proxied by R&D), the sign and significance of ULC as a predictor of the probability of export increases dramatically (from 0.28 to 0.42). The role of R&D instead, while remaining significant, does not seem to affect, as expected, the ability of TFP to predict the export status of a firm (columns 3 and 4 of Table A5.1).

31. Obtained as the sum of the coefficients estimated respectively for ULC and for the interaction term.

Figure A5.2 provides a visual representation of the analysis conducted above. We plot the probability of exporting (estimated as described above) alongside the natural logarithm of ULC. The two slopes highlighted illustrate the coefficients estimated for the firms with R&D activities, higher and flatter, and for those that do not, lower and steeper. This confirms the idea for that for firms with R&D activities, an increase in the ULC is not necessarily affecting their ability of exporting (their competitiveness does not depend exclusively on the competitive price of the goods sold), whereas for those firms with no R&D activities, an increase in ULC translates more strongly into a reduction in the probability of exporting, confirming the idea that quality indeed matters[32].

Figure A5.2: Relationship between ULC and export by R&D activity



Of course, one may argue that R&D is only part of the broader concept of 'quality'; other measures could capture a similar pattern. We have thus estimated the model using different indicators of 'quality'. More precisely, we used indicators of human capital (a dummy taking value 1 for those firms with a share of graduates above the national average), perceived quality (considering those firms that indicate that they are in the

32. Our results are coherent with Wakelin (1997), who shows that innovating firms export higher quality goods and are thus less likely to be adversly affected by a high unit labour cost.

top decile in terms of quality of the goods sold in the respective markets), innovation and training of employees. However, the results do not hold, with the coefficient of the interaction term being not significant in the majority of cases. The reason for this can be twofold. First, R&D data in our database is of a better quality than the information available to construct the other indicators we mentioned. Second, R&D could be indeed capturing a different attitude of the managers of the firm, less related to the specificities of firms and sectors.

By and large, the above evidence indicates that ULC is not only a measure of a firm's efficiency but might also be related to the 'quality' of the labour force. The same issue does not affect TFP, which captures only firm efficiency. As such, the latter should be considered a 'cleaner' measure of firm performance, especially when external dimensions of competitiveness (internationalisation) are considered.

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The triggers of competitiveness: The EFIGE cross-country report

There is a pressing need for Europe to grow out of the crisis, meaning that Europe needs to become more competitive, enabling it to capture growth currently taking place mainly in emerging markets. But what are the triggers of competitiveness? The EFIGE project, led by Bruegel, takes a fresh look by inquiring into the determinants of firm-level international performance – focusing on external competitiveness. In the competitiveness debate, it is crucial to understand not only the macroeconomic challenge, but also to find the right micro-level triggers that will generate growth and exports.

The authors identify firm-level total factor productivity as a major determinant of growth and exports. Human capital, research, equity finance and performance-based incentives for employees also play their parts. Moreover, size matters and large firms typically are much better exporters than their smaller counterparts. This report builds on previous EFIGE research and studies in depth firm performance in seven countries (Austria, France, Germany, Hungary, Italy, Spain and the United Kingdom) to identify the triggers of competitiveness.

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EFIGE (European Firms in a Global Economy) is a project to examine the pattern of internationalisation of European firms. The research leading to this report has received funding from the European Union's Seventh Framework Programme, and from UniCredit Group.

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