Assessing competitiveness: how firm-level data can help

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European Firms In a Global Economy EFIGE

SEVENTH FRAMEWORK PROGRAMME

The EFIGE project is coordinated by Bruegel and involves the following partner organisations: Universidad Carlos III de Madrid, Centre for Economic Policy Research (CEPR), Institute of Economics Hungarian Academy of Sciences (IEHAS), Institut für Angewandte Wirtschafts-forschung (IAW), Centro Studi Luca D'Agliano (Ld'A), Unitcredit Group, Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).

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ASSESSING COMPETITIVENESS: HOW FIRM-LEVEL DATA CAN HELP

CARLO ALTOMONTE, GIORGIO BARBA NAVARETTI, FILIPPO DI MAURO AND GIANMARCO OTTAVIANO

THE DEBATE about how to define, measure and assess 'competitiveness' has recently taken an unexpected turn, which is easily understandable, but rather unwarranted. The recent literature on trade[1] has increasingly underlined and shown empirically that aggregate industrial performance depends strongly on firm-level factors, such as size, organisation, technological capacity, and other conditions firms are confronted with in the specific environment in which they operate. However, the policy debate in Europe increasingly focuses on macro factors, such as whole economy labour costs or current account dynamics, which are seen as the preponderant determinants of aggregate economic performance. Other factors, if any, are left to the domain of structural/non-price competitiveness matters, possibly to be tackled within the European Union's Europe 2020 reform agenda.

The prominent attention to macro factors relies squarely on the fact that – in the midst of a major fiscal crisis in the euro area – when referring to 'competitiveness', the emphasis is on macro and financial stability considerations. As a result, the indicators referred to most often are those that i) are easy to communicate, most notably unit labour cost differentials, and ii) are generally identified as being responsible for macro imbalances, which are to be quickly corrected. Against this background, however, there is a risk that sustainable growth considerations may be neglected or actually contradicted.

In this Policy Contribution we attempt to complement the (much debated) commonly used definition of 'competitiveness', mostly driven by considerations related to *macro stability*, with considerations more strictly related to the idea of *sustainable growth*. The two views are in fact often complementary, for instance regarding competitiveness rankings across countries, but firm-level considerations turn out to be essential when actual policies are set in place to address competitiveness issues. To do so, we suggest a definition of competitiveness together with a number of firm-level indicators, which could usefully and systematically be added to the set of macro indicators commonly used. In advocating the broadening of the scope of the firm-level analysis – from the present almost exclusive purpose of producing research papers, to a more systematic use in formulating policy – we also attempt to support the case for better and more complete data collection.

1 CONCEPTUAL UNDERPINNINGS OF FIRM-LEVEL ANALYSIS AND ITS ROLE FOR POLICY MAKING

To begin with, we define competitiveness as the ability of firms in a given country – not of the country itself – to mobilise and efficiently employ (also beyond the country's borders) the productive resources required to offer goods and services. The factors affecting this ability range from the firm-specific (such as the sector of activity, size, technology and so on) to the macro/institutional (eg price/cost structure, investment environment and so on). In this sense, we agree with Paul Krugman's idea of competitiveness being 'a poetic way of saying productivity' (Krugman, 1997).

Assessing country competitiveness should therefore result from the aggregation of the firm-level information. In doing so, however, it is essential

1. For information about the EFIGE project (European Firms in a Global Economy) see http://www.efige.org/.

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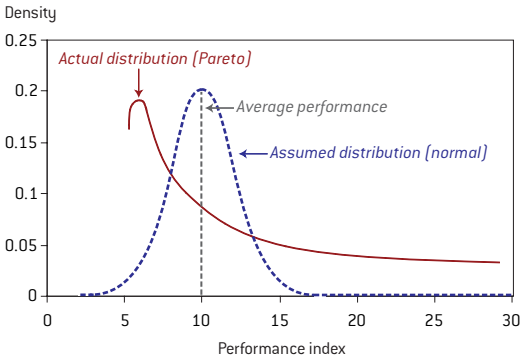
for policy purposes to consider not only the average outcomes (eg productivity), but also their distribution around the mean. We devote the remainder of this Policy Contribution to this issue.

Empirical evidence for both the United States (Bernard *et al*, 2011) and a number of EU countries (Mayer and Ottaviano, 2007) has shown that in general firm-level data on a given performance index (eg productivity) is typically distributed as shown in Figure 1 (a distribution proxied by what is known as a 'Pareto' distribution) versus an assumed standard normal distribution. In Figure 1, both distributions are assumed to have the same average value of the performance index. The latter is not surprising, as this type of distribution is frequent in natural and social phenomena: the length of rivers in the world, or the size of cities, are roughly Pareto-distributed, with a large number of relatively short rivers (or small cities), and few very long rivers (or very large cities). The performance of firms is no exception. Rather than having many firms centered around an 'average' performance level, with few very bad or very good firms symmetrically distributed around the mean in equal numbers (as in normal distributions), in reality, within a given industry or country, there is a large heterogeneity of firms (larger than generally assumed), with many relatively 'bad' firms performing below the mean, but also a certain number (although less numerous, and hence the asymmetry, or skewed nature, of the distribution) of particularly good firms, as depicted by the relatively long right-hand tail of the distribution (Figure 1).

The **first policy implication** associated with the above finding is linked to the accuracy with which we are able to measure competitiveness. In general, performance indicators (retrieved by statistical offices) starting from firm-level observations are derived as *averages* over the available individual observations. Comparing the two distributions in Figure 1, we immediately understand that the same averages in fact synthesise very different distributions in the characteristics of the underlying populations. Consequently an aggregate performance measure calculated at the mean is probably biased, thus delivering a distorted picture of the real underlying competitive position of a given industry or country. This calls for using

Figure 1: Pareto versus normal distributions



Source: Bruegel.

aggregation functions that correctly weight individual observations based on their actual representativeness in the sample when deriving aggregate statistics; or, at least, for using *median* rather than average values when discussing aggregate indicators for policy-making. Moreover, if different industries or countries are characterised by different underlying distributions of the measured performance, aggregation across industries (eg to retrieve country averages) or across countries (eg to retrieve EU-wide averages) may introduce a further bias and generate a distorted message, if weighting is not appropriately taken into account.

A **second policy implication** is linked to the effectiveness of a given policy action in enhancing competitiveness. The empirical literature on international trade has shown that, in the context of increasing trade openness and economic integration, and thus tougher competition, the 'minimum' level of performance (ie productivity, size, etc) at which firms are able to compete on global markets (the so-called 'performance cut-off') has increased over time, something that is shown in Figure 2 on the next page by a shift to the right of the cut-off point (conventionally set at the beginning of the mean of the distribution). In fact a very large share of the exports of any country is accounted for by a relatively small share of large and competitive firms.

The conceptual underpinning and empirical findings described above lead to a critical economic policy conclusion. Assume that we have two states of the world: 1) a pre-global market and 2) a globalised market environment. Assume now that in state 1 the two distributions depicted in the

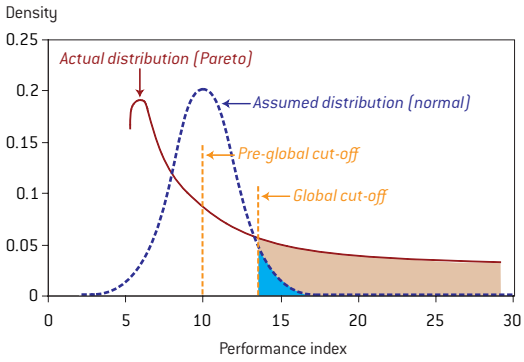
graph are characterised by the same average performance index, around 10.

Suppose now that, when we move to state 2, the new performance threshold that identifies the 'champions' able to successfully compete on global markets increases to 14. In this case, a policy that aims at raising the average performance of the firms in the sector or country– leaving unchanged the density of the firms around the new performance threshold – could be misguided. While successful in increasing the average performance of the sector above – but possibly only marginally – the performance index of 10, the policy would have limited effects on the country's competitiveness, since too few firms would actually perform over the required threshold of 14. As a result, while the few firms with performances (productivity, size) above the new, higher threshold will thrive, those firms characterised by 'average' performance indices will likely experience difficulties in the new competitive environment and will eventually be forced to exit.

In this context, a vast and growing empirical literature – some results of which we will report in the final section – has shown that firms react very differently to shocks depending on their specific characteristics; most notably size, industrial organisation, technology/research content, market conditions, entry/exit barriers and trade frictions in the main sectors of specialisation.

This calls for a new set of policies able to foster the dynamic transition of firms already above the industry average towards even higher performance. Hence, rather than just working on the 'average' performance of the sector, a successful policy for competitiveness should aim at generating a 'thicker' right-hand tail of the distribution over time. In this sense, policies aimed at fostering the internal growth of firms via more efficient product and factor markets (cross-firm competition and agglomeration, removal of financial constraints and better access to capital, wage-setting mechanisms more in line with individual firms' productivity) are instrumental in reallocating resources towards better performing firms and thus increasing the aggregate level of competitiveness. Instead, policies aimed at supporting weaker firms, such as those targeted towards small and

Figure 2: International operations and performance cut-offs



Source: Bruegel.

medium enterprises, may result in barriers to growth and the thickening of the upper tail of the performance distribution.

2 FIRM-LEVEL INDICATORS: A SAMPLE OF RESULTS OF USE IN ROUTINE COMPETITIVENESS ANALYSIS

Despite its obvious superiority for assessing competitiveness, firm-level analysis is hampered by two sets of problems. First, data availability remains an issue, as the data – when available – is in general not homogenous and comparable across countries (see Appendix). Second, the analysis at present is not systematic. The focus tends to be mainly on research/case studies with an emphasis on the limitations of the data currently available. Little attention is given to the ways in which available data could be used for policy analysis. The result is that in policy environments, firm-level analysis is considered possibly promising, but of little practical use.

Against this background, in the remainder of this Policy Contribution we mention a number of practical results arising from existing studies, which provide useful insights for routine competitiveness assessment. These results support the argument that micro data is essential for competitiveness analysis.

2.1 Trade-off performance's average vis-à-vis dispersion

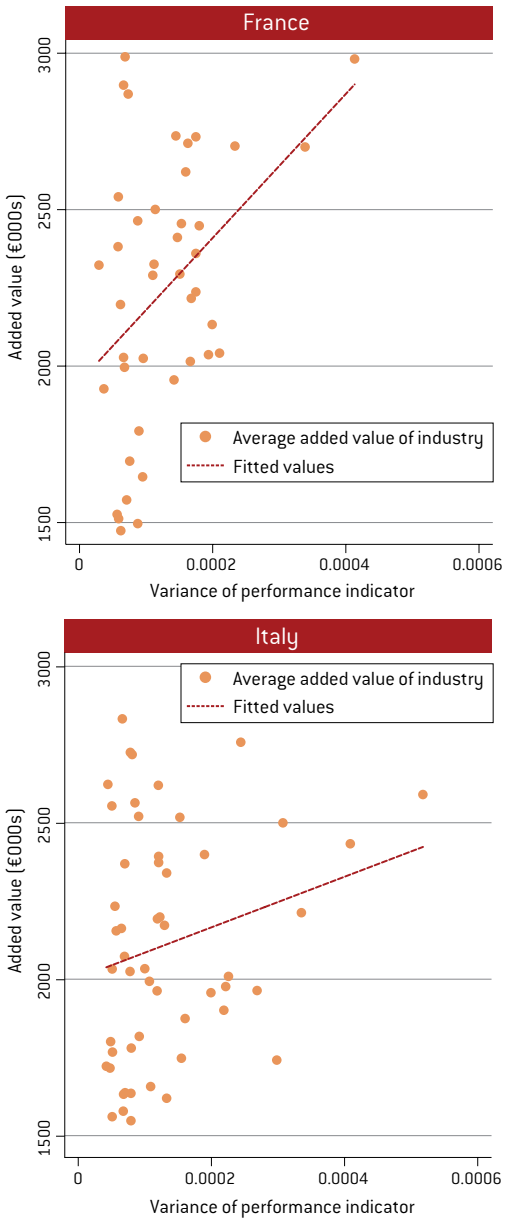
Consistent with the discussion in section 1.1, there is a conceptual interaction between overall industry performance and firm heterogeneity. We

present here two applications with rich policy implications:

2.1.1 More dispersion, higher average performance

If a sector has a higher average performance than another, does this mean that all of its firms are better than those in the weaker sector? Not necessarily; it can mean the opposite because average performance improves if the heterogeneity of firm characteristics grows. Figure 3 shows that the average sector added value is positively correlated to its variance, the within-industry dispersion of firms' performance, for both France and Italy[2]. This is because the greater the variance of firms performance, the greater the share of high performing firms, ie the thicker the right hand tail of the distribution in Figure 1 and consequently the higher the average sector performance[3]. The intuition behind this result is that the more a sector is populated by firms with different performances – which in turn can be related to different individual characteristics, such as size, product differentiation, organisation, and so on – the more there is scope for market forces to reallocate productive resources from worse to better performing firms within the sector. As sectors become more competitive, the gap between the best and worst performers increases.

Figure 3: More variance, more average industry added value, France and Italy

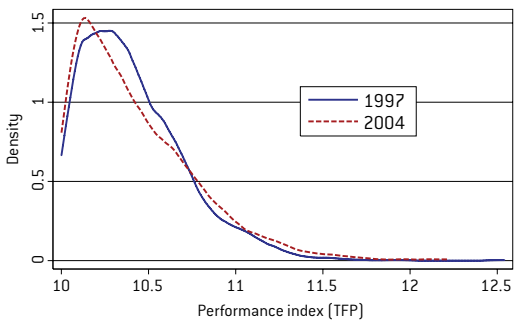


Source: Bruegel based on EFIGE/AMADEUS data.

2.1.2 Trade shocks and the happy few

What is the effect of a trade shock on firms' productivity and competitiveness? It can be shown that the effect is heterogeneous across the distribution of firms' performance. If the shock goes in the direction of reducing trade barriers, it will raise dispersion and the share of high performers. As an example, examine how the productivity of a representative sample of Italian machinery producers changed following the introduction of the euro. Figure 4 shows the evolution of the (Pareto-shaped) distribution of their productivity levels between 1997 and 2004[4]. Its salient feature is that the distribution had 'fatter tails' in 2004 than in 1997 with a relative hollowing out of the intermediate range of productivity levels. Based on the

Figure 4: Introduction of the euro and changes in firm-level productivity distributions, machinery industry in Italy



Source: Bruegel based on AMADEUS data.

2. Means and averages are computed from firm level data from the EFIGE and Amadeus databases.

3. The positive correlation between the variance and the average value of a given measure is a statistical property of Pareto distributions. The relationship reported in Figure 3 is robust across a range of European countries and industries, even if outlier observations are excluded.

4. The sample is derived from the Amadeus dataset.

'Larger firms are more likely to compete successfully on global markets, by expanding their international operations. Firm-level characteristics are paramount, relative to overall country conditions, in explaining competitiveness.'

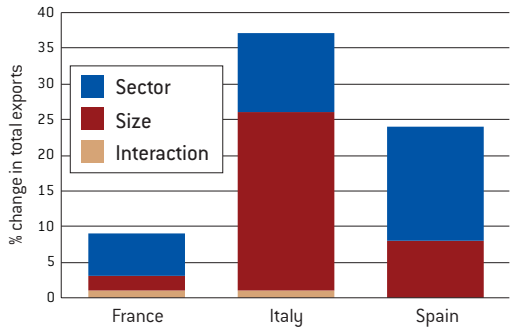
insights gained in section 2.1.1, this is good news as 'fatter tails' promote higher added value. It also means that the proportion of firms above the performance threshold at which firms become competitive on global markets has likely increased (see section 1).

These two examples show – once again – that policies aimed at improving industry performance should not focus only on the average firm but should also pay specific attention to the thickness of the 'tails' of the distribution of firm-level performance. Along these lines, appropriate competitiveness indicators would need to be constructed taking into consideration both the average as well as the variance of the distribution. At the very least, policymakers should be made aware of both dimensions to provide a complete picture of underlying competitiveness.

2.2 The role of firm size

The role of firm size in fostering business performance as measured by productivity or export performance is by now well established in the literature (see Mayer and Ottaviano, 2007). Larger firms are generally more efficient and more likely to compete successfully in global markets, through an expansion of their international operations. Barba Navaretti *et al* (2011), in their comparative study of European firms, show that firm-level characteristics are of paramount importance, relative to overall country conditions, in explaining competitiveness. In particular, according to Barba Navaretti *et al*, if Italian firms had the same size distribution as German firms (keeping their sector specialisation constant), the value of Italian exports would have increased by some 25 percent. The same exercise for Spain would yield an increase of some 10 percent. This suggests the vital role of the size distributions in determining aggregate performance. The effect of country characteristics on performance are critically filtered through their effects on the entire distribution of firm-level performance (see also Di Mauro *et al*, 2009).

Figure 5: Percentage change in the value of exports using German size-sector employment distribution with constant total employment

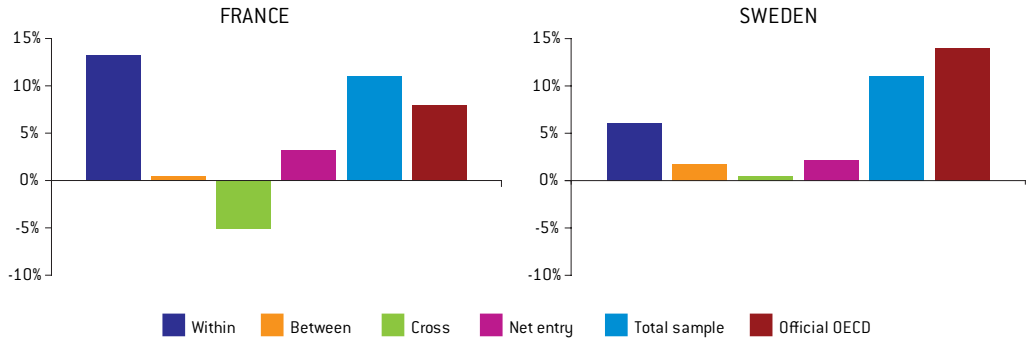


Source: Bruegel based on the EU-EFIGE/Bruegel-UniCredit dataset.

2.3 Changes in productivity and labour reallocation

In the following application, firm-level data is used to enrich the analysis of productivity changes at the aggregate level. Using a representative sample of French and Swedish firms, changes in productivity between 2000 and 2008 are computed at the country level (blue bars). As a control, the red bars – which represent the OECD macro official figures – yield similar aggregated results. We use firm-level data to decompose the total productivity increases into changes i) taking place *within* firms (for a given market share), ii) resulting from the reallocation of workers *between* existing firms (switch of market shares between firms, keeping productivity constant), iii) resulting from the net entry of new firms, and iv) from *cross*-firm changes (because of overall market adjustments in size and productivity). The effect on aggregate productivity crucially depends on the ability of the labour market to reallocate resources across firms. Note that in France, where most of the adjustment is driven by within-firm effects, total productivity increases less than in Sweden, where labour reallocation is a more important driver (Figure 6 on the next page). Once again, examining firm-specific patterns is fundamental for policies aimed at enhancing competitiveness.

Figure 6: Decomposition of aggregate productivity growth across countries



Source: Altomonte (2010).

3 TOWARDS A FIRM-LEVEL TOOL FOR ASSESSING COMPETITIVENESS

Taking a firm-level view is key if the various factors lying at the root of competitiveness are to be appropriately disentangled. Since firms are very different from each other, however, the issue of fostering competitiveness boils down to the dynamic problem of moulding the distribution of firms across different performance levels in order to thicken the tail of better performing firms. Deepening the analysis of firm-level data provides critical information for the design of appriopriate competitiveness-enhancing policies that will complement traditional macro analysis.

To do so, however, we need to substantially strengthen the firm-level databases already available. This implies, first, making them comparable across countries using well-designed surveys that are homogenous and sufficiently detailed. The EFIGE project coordinated by Bruegel offers a critical benchmark in this respect (see www.efige.org).

Equally, there is a need to develop new synthetic indicators able to translate the distributions of firms' characteristics into measures of competitiveness. In this short note we have argued that the variance of the distributions already conveys important additional information, complementing standard averages. However further work is necessary.

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APPENDIX: AVAILABILITY OF FIRM-LEVEL DATA

In terms of data availability, the ability to perform a cross-country exercise based on firm-level data can vary across the EU because of at least three possible situations: 1) detailed and comprehensive firm-level data exists within national statistical offices and is generally available to researchers; 2) firm-level data exists within national statistical offices but is protected by non-standardised or strict and impractical access procedures, so is difficult, if not impossible, to obtain and use for trans-national teams of researchers; 3) firm-level data does not exist within national statistical offices, or the data that does exist has a very narrow scope/quality.

Even assuming that detailed and comprehensive firm-level data exists and is accessible, however, cross-country analyses risk being limited in scope. An assessment has to be made of the comparability of data, as there might be a limited set of overlapping variables, or the thresholds on which the sample of firms have been constructed might differ. Moreover, while the results might be only partially informative (only for certain variables and only for a subset of countries) the coordination of efforts can be substantial.

One alternative route taken by some statistical offices or national central banks in order to overcome the limitations of existing firm-level data is to deepen the scope of the analysis in terms of surveyed variables through the set up of 'specialised' surveys. These exercises, the most famous being the *Community Innovation Survey* (CIS), have the advantage of covering in detail one particular aspect of firm-level activity (innovation, in this case). To compensate for the larger number of surveyed items, the collection of data is however restricted to a representative sample of firms. The exercise is then replicated, with the same questionnaire, across a number of countries.