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Internationalization and innovation of firms: evidence and policy

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Abstract

Policy makers have traditionally attempted to encourage internationalization, with the implicit understanding that internationalization is associated with productivity growth and hence economic growth. Innovation is the channel through which productivity growth happens. In this paper we exploit the unique features of a recently released firm-level dataset on seven EU countries to look at whether and how manufacturers that are internationalized in different modes are actually innovating. Our results highlight a strong correlation between internationalization and innovation at the firm level, robust across countries and sectors combined, controlling for firms size and productivity. They suggest that internationalization and innovation policies should be better coordinated at both national and EU levels, thus mitigating the current paradox of 'largely uncorrelated policies for largely correlated outcomes'.

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1. INTRODUCTION AND MOTIVATION

Policy makers have traditionally attempted to encourage internationalization, with the implicit understanding that internationalization is associated with productivity growth and hence economic growth. Innovation is the channel through which productivity growth happens. In this paper we look at whether and how firms that are internationalized in different modes are actually innovating. Uncovering which international activities are associated with innovating will allow a more nuanced policy approach to encouraging productivity growth.

Our analysis targets European manufacturing firms exploiting the unique features of the recently released EU-EFIGE/Bruegel-UniCredit (henceforth, simply EFIGE) dataset. This survey dataset covers a representative and cross-country comparable sample of manufacturing firms across seven European countries (Austria, France, Germany, Hungary, Italy, Spain and UK) for the year 2008. In terms of internationalization, the dataset allows us to go beyond the standard dichotomy exporters vs. non-exporters, distinguishing instead between internationally inactive firms and various categories of internationally active firms. This is important as international activity is increasingly characterized not only by exports but also by FDI, imports and outsourcing within global value chains. Similarly, in terms of innovation, we go beyond R&D and embrace a broader concept of innovation, which allows us to investigate the role of a richer set of innovative activities, including those concerning information technology (IT).

The analysis of our dataset shows that some important firm-level facts so far unveiled only by country-specific studies also hold in the cross-section. In particular, firms active in international markets are bigger and more productive than firms that operate only in their domestic markets. They also invest more in innovation and eventually innovate more. However, the unique features of the dataset also allow us to refine these findings looking at the partition of firms into different internationalization modes. In so doing, not only we move away from the standard comparison exporter vs. non-exporter to cover a richer set of internationalization modes but we also look at how those interact with different innovation modes. In terms of internationalization, we cover all contractual modes: trade (export and import), fixed contract foreign sourcing (outsourcing and being an outsourcee) and ownership (foreign ownership and FDI maker). Regarding innovation modes, we also consider a broader approach allowed by our unique dataset: innovative effort yielding a patent, a design, a trademark or a copyright; various sources of R&D the firm has tapped; various types of IT product and process innovation.

On the one hand, we look at the number of different internationalization modes and the number of different innovation modes a firm adopts. We call the former

'internationalization intensity' and the latter 'innovation intensity'. We find that larger and more productive firms exhibit both higher internationalization intensity and higher innovation intensity. In the cross-section, we also find that in more innovative country-sector pairs (which we call 'milieus') there are more internationalized firms and in more internationalized 'milieus' firms are more likely to innovate.

On the other hand, we look at how firms sort across the different internationalization modes. We find that outsourcers and FDI makers tend to be larger and more productive than other internationally active firms, while outsourcees and exporters tend to be smaller and less productive than importers. We follow the literature in interpreting this ranking of internationalization modes as driven by an underlying ranking in terms of their *international complexity* as determined by the corresponding setup costs.

This leads us to uncover a positive and significant association between internationalization and innovation whose strength grows with the complexity of the internationalization mode adopted. Nonetheless, the fact that, though weaker, the association is still significant at low levels of internationalization complexity implies that, while large and more productive firms are clearly the main drivers of internationalization and innovation, these activities are not concentrated only in their elite group ('happy few'). Also a wide fringe of smaller and less productive firms is able to be active abroad through a mix of relatively simple international and innovation activities (our data cover a great deal of SMEs with 10 to 250 employees). In particular, below the 'happy few', our data reveal the existence of a pyramidal structure of smaller firms with different degrees of internationalization intensity, innovation intensity and international complexity. The number of these firms increases as intensity and complexity decrease, while their size and productivity change in the opposite direction.

Strengthening existing evidence, all these results highlight a strong correlation between internationalization and innovation at the firm level, robust across countries and sectors combined, controlling for firms size and productivity.

As a final step, we exploit the unique features of our dataset to see whether this correlation may be explained by the fact that firms use innovation and imports as sources of better inputs that boost their productivity and thus foster their internationalization. We indeed find that firms adopting relatively simple modes of internationalization (i.e. exports) use alternatively R&D or imports as sourcing strategy: for them R&D and imports appear to be substitutes. In the case of more complex internationalization modes (i.e. outsourcing or FDI), R&D and imports are, instead, complementary. Complementarity is weaker for outsourcers than for FDI makers, which suggests that the interaction of R&D and imports becomes more virtuous at higher levels of internationalization complexity.

We cannot interpret these relations as causal since the cross-sectional nature of our dataset does not allow us to solve endogeneity issues. We stress, instead, the fact that simple internationalization is associated with the dyads ‘export-innovation’ or ‘export-import’ whereas complex internationalization is associated with the triad ‘export-import-innovation’.

These findings call for stronger coordination of internationalization and innovation policies than currently achieved in the EU. Innovation policy pertains to DG Enterprise and Industry:

> "Innovation policy is about helping companies to perform better and contributing to wider social objectives such as growth, jobs and sustainability. There are many policy tools available to achieve this, ranging from establishing supportive framework conditions (e.g. human resources, an internal market, intellectual property) to facilitating access to finance, policy benchmarking and enabling collaboration or stimulating demand, for instance, through regulation, standards and public procurement. The rationale for European innovation policy is strongest where it is oriented toward addressing the most significant challenges facing society today. The main current European Union's innovation policy is the Innovation Union, Europe 2020 flagship initiative. Its aim is to boost Europe’s research and innovation performance by speeding up the process from ideas to markets."
> (Downloaded from: http://ec.europa.eu/enterprise/policies/innovation/policy/index_en.htm)

Internationalization policy has no common home in Brussels as trade facilitation is assigned to DG Trade while export/import promotion pertains, instead, to the governments of the member states with little involvement of EU institutions. Characteristically, the mandate of DG Trade on export/import promotion looks blurred:

> "The Directorate-General for Trade conducts the EU's common policy on trade with countries beyond the EU borders. This covers, among other things, Trade negotiations with countries outside the EU, improving market access for exporters and importers [!], ensuring that fair practices are applied to international trade and assessing the environmental and social impacts of trade. We often receive enquiries that fall outside the scope of our work, such as questions about trade between EU countries, export/import promotion [?], import duties and taxation, consumer protection or recruitment in the European Commission."
> (Downloaded from: http://ec.europa.eu/trade/contact/)

Against this background, our findings help shed light on why the evidence on the extent to which export/import promotion is effective is mixed at best (see, e.g., Wilkinson and Brouthers, 2006; Lederman, Olarreaga and Payton, 2007). Export promotion alone is unlikely to lead to sustainable internationalization because in the medium-to-long term internationalization requires vibrant innovation and access to

imported inputs. In particular, while simple internationalization modes can do with either innovation or imported inputs, complex innovation needs both. In this respect, our analysis suggests promotion should be extended from exports and imports to other internationalization modes, such as direct investment, outsourcing agreements, foreign ownership and participation as suppliers in global value chains.

The rest of the paper is organized in four sections. Section 2 presents our dataset and introduces some key definitions of variables and concepts. Section 3 studies the relation between innovation and internationalization emphasizing intensity and complexity. Country and sector specific differences are presented in Section 4. Section 5 zooms on the relation of internationalization complexity with R&D and imports as sources of better inputs for production. Section 6 concludes discussing policy implications.

2. DATA AND DEFINITIONS

Throughout the analysis, we will exploit the EFIGE dataset, a representative and cross-country comparable sample of manufacturing firms across seven European countries. The dataset includes 14,759 European firms, around 3,000 of which for Germany, France, Italy and Spain, some 2,200 firms for the UK, and around 500 firms for Austria and Hungary (precise figures are reported in the Appendix).[1] Importantly, the survey excludes firms smaller than 10 employees. As a result of this threshold, internationally active firms should be over-represented in our sample when compared with a country's universe of firms, being the latter typically characterized by a large number of relatively small, domestic entities.

Notably, the EFIGE survey spans over a large array of questions that allow us to address several crucial issues related to the link between internationalization and innovation. Overall, the questionnaire contains both qualitative and quantitative data on firms' characteristics and activities, for a total of around 150 different variables split into six different sections (Proprietary structure of the firm; Structure of the workforce; Investment, technological innovation and R&D; Internationalization; Finance; Market and pricing). All questions mainly concern the year 2008, with some questions asking

[1] See also the Appendix A1 for a breakdown of the sample by firm size and country and a complete list of the industries contained in the database. The sampling design has been structured following a stratification by industry, region and firm size. See http://www.bruegel.org/datasets/efigedataset for a detailed description.

information for 2009 and the previous years in order to have a picture of the effects of the crisis as well as the dynamic evolution of firms' activities.[2]

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 have been integrated with balance sheet data drawn from the Amadeus database managed by Bureau van Dijk, retrieving nine years of usable balance sheet information for each surveyed firm, from 2001 to 2009. These data can be exploited to further improve on the characterization of firms included in the survey, in particular by enabling the calculation of firm-specific measures of productivity. The quality of Amadeus data however varies by country, and often all the variables necessary to calculate firm-level productivity are not reported in firms' balance sheets. As a result, due to the presence of missing variables, EFIGE data matched with firm-level productivity are available for roughly 50% of firms in the sample. Altomonte et al. (2012) discuss in detail the characteristics of the restricted matched sample, finding no major differences with respect to the unrestricted one or its validation against aggregate statistics, but in country representativeness: Italy, France and Spain are the countries best covered in terms of data on firm-level productivity.

In any case, in this paper we will use as a baseline the unrestricted EFIGE sample, reverting to the restricted sample only when performing analyses including firm-level productivity. Also, in the paper we will use the following definitions.

Countries, sectors and firms' size (see Appendix for detailed statistics)

Countries –Germany, France, Italy, Spain, UK, Austria and Hungary.

Sectors – 19 manufacturing sectors, defined by two digit NACE Rev. 1 codes.

Size – 4 category of firms' size by number of employees: micro (10-19), small (20-49), medium (50-249), large (250+).

International activities

The wealth of the EFIGE data allows us to analyze (and compare) a larger-than-usual set of international activities matched with detailed information on the innovation strategies of firms. In terms of international activities we can distinguish firms exporting goods, importing goods (or services), outsourcing abroad, being a supplier for a foreign

[2] 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.

producer, having undertaken a foreign direct investment (FDI) or being owned by foreigners. More specifically, we define these various modes of internationalization as follows:

- *exporter* if a firm has sold abroad, directly from its home country, some or all of its own products/services in 2008 and/or past years.
- *importer* if a firm has purchased at least part of its intermediate good from abroad in 2008 and earlier.
- *outsourcee* if a firm produces upon receiving an order from another non-domestic firm.
- *outsourcers* if a firm's turnover derives, at least in part, from production activities carried out through contracts and agreement in 2008, or if the firm has purchased services from abroad in 2008 and earlier. Unless otherwise specified, *outsourcers* refer to firms involved in *international* outsourcing. Firms involved in domestic outsourcing are thus excluded.
- *FDI maker* if a firm derives at least part of its turnover from production activities abroad carried out through FDI (foreign affiliates/controlled firms) in 2008, or if the firm has acquired (totally or partially) or incorporated other foreign firms between 2007 and 2009 or has at least a foreign affiliate (i.e. the FDI maker holds at least 10% of its shares).
- *foreign owned* if either the first or the second shareholder (in terms of share of capital) of a firm are foreign or the firm has been acquired/incorporated by other foreign firms over the period 2007-2009.

We then define *internationalization intensity* as the number of internationalization modes in which a firm is simultaneously involved ranging between 0 and 6 (Exporter, Importer, FDI maker, Outsourcer, Outsourcee, Foreign owned).

Innovation activities

In terms of innovation activities, the EFIGE survey has been constructed in line with the Community Innovation Survey, asking each firm whether it has generated product or process innovation over the last three years, the share of innovative products sold on the market, the number of innovations such as patents, trademarks or e-commerce solutions adopted, the share of R&D over total investment. A number of cross-check questions have also been inserted in the questionnaire to validate those answers, then used for the construction of an innovation-intensity index (see Table 1). We will use all this

information to distinguish different modes of innovation in our data, being then able to cross them with the different modes of international activities identified above. Such a feature is unique to EFIGE data. In this spirit, we define these various modes of innovation as follows

- *R&D maker* if a firm has invested in R&D on average in the last three years (2007-2009)
- *process innovator* if a firm has generated process innovation over the last three years,
- *product innovator* if a firm has generated product innovation over the last three years,

We then define *innovation intensity* as the number of innovation-related activity modes in which the firm is simultaneously involved. We consider three types of activities often related to product or process innovation, i.e. innovative effort yielding a patent, a design, a trademark or a copyright; the sources of R&D the firm has tapped; IT projects (as in Bloom et al. 2012). Overall, as summarized in Table 1, there are 10 possible innovation-related activities in which a firm can be involved.

Table 1. Innovation intensity

Questions	Possible answers
# of internet projects/e-solutions (0-3)	Internal information management (e.g. SAP / CMS) E-commerce (online purchasing / online sales) Management of sales/purchase network
# of successful innovations during the past 3 years (0-4)	Applied for a patent Registered an industrial design Registered a trade mark Claimed copyright
# of R&D sources undertaken during the past 3 years (0-3)	R&D activities carried out in-house R&D activities acquired from another firm in the Group R&D activities acquired from external sources

Source: EFIGE dataset.

Additional definitions

Throughout the paper we will also use additional definitions or variables.

Milieus - In order to better control for sector and country-specific effects, as well as their potential interaction, introduce the variable *milieus.* For every sector-country pairs,

we calculate the average internationalization and innovation intensity, respectively. We then denote high and low internationalization / innovation intensity milieus by cutting the sample below and above the median value. This creates four quadrants. For instance, a milieu [L, H] refers to a country-sector that is below median in terms of average internationalization intensity and above median in terms of average innovation intensity.

TFP – Total Factor Productivity (TFP) is the firm-level productivity calculated according to the Levinsohn and Petrin (2003) semi-parametric algorithm as reported in the Appendix A2

3. FIRM HETEROGENEITY, INTERNATIONALIZATION AND INNOVATION: KEY ISSUES

In this section we present some stylized facts on internationalization and innovation, as they emerge from our data. We consider for the time being internationalization and innovation activities as independent within the firm, and thus link them separately to the literature on firm heterogeneity. In the first part of the section, we replicate with our data the key findings of the trade literature: internationalized firms are bigger and more productive than non-internationalized firms, with their size and productivity premia following a stable ranking across internationalization modes. We confirm these findings both within the original EFIGE data as well as using the matched data in which we retrieve a measure of total factor productivity.

In the second part of the section we investigate whether a similar pattern exists in the case of innovative vs. non-innovative firms. We find that the pattern is indeed there, but only partially. In particular, whereas internationalized firms are larger and more productive than non-internationalized firms, innovative firms are larger but not necessarily more productive than non-innovative firms. Accordingly, internationalized firms seem to belong to a more selective club than innovative firms.

The key contribution of this section is a more detailed characterization of patterns across a richer set of internationalization and innovation modes than currently available in existing analyses. This is made possible by the unique features of our dataset that also uniquely allows for sensible cross-country comparison.

3.1. Modes of internationalization

Research and policy have focused greatly on the ability to exports as a marker of virtuous firm performance. A general result of the literature is that firms that export are different in size and performance than non-exporters, with exporters being larger in terms of output and employment, more capital intensive and more productive than non-exporters. This finding, first shown for the US by Bernard and Jensen (1999), was confirmed for several European countries by Wagner (2007). A great deal of recent advances in discussing internationalization is discussed by Bernard et al (2012)

Exports are clearly only one among several ways firms can become active in international markets. A relatively more recent literature has found that imports are instrumental in explaining company performance. A number of contributions clearly suggest the existence of a relation in which the importing activity of a firm leads to within-firm gains in TFP. In particular importing intermediate goods improves plant productivity[3]. There are at least three channels through which imports at the firm-level could directly affect a firm's TFP: a variety effect, in which the broader range of available intermediates contributes to production efficiency; a quality effect, induced by the fact that the same intermediates available abroad might be of better quality than local ones; a `learning' effect, in which importing firms acquire part of the technology incorporated in the imported goods. However, similarly to the case for exporters, importing firms are also ex-ante different: they are much bigger, more productive and more capital-intensive than non-importers. Further, both imports and exports are highly concentrated among few firms. [4]

Unlike importing, outsourcing and direct investment abroad both offer access to local inputs in a more controlled fashion, as these two modes allow for a greater oversight over the production process. Outsourcing in particular allows the parties to establish a contractual relationship in which some customization of the input can be jointly agreed upon, together with an agreement on the sharing of profits, provided that the implied transaction costs and contractual imperfections are not overwhelming. If instead transactions costs and contractual imperfections are too high, the firm may decide to undertake a direct investment (paying higher fixed setup costs) so as to internalize the entire decision process.[5] Of course, this *cost-saving* motive is not the only

[3] See Kasahara and Rodrigue (2008) for Chile, Halpern, Koren and Szeidl (2009) for Hungary and Amiti and Konings (2007) for Indonesia.

[4] See evidence provided by Bernard et al. (2007) for US or Muuls and Pisu (2007) for Belgium

[5] The decision on whether to organize production activities within or beyond the boundaries of the firm has been studied theoretically by Antràs and Helpman (2004), and empirically verified, among others, by Nunn and Trefler (2008). Helpman, Marin and Verdier (2008) for a comprehensive collection of essays on the organization of firms in the global economy.

reason why firms may decide to go multinational. Their decision may also be driven by a market-seeking motive as FDI also allows them to serve foreign markets locally without incurring the trade costs associated with exports. In this case the ensuing multinational structure makes it possible to internalize the foreign sales procedure (Helpman, 1984) with direct control on the whole process.

Considering more modes of internationalization allows for more subtle points to be made. In Ornelas and Turner (2008) contractual problems for a relationship-specific investment (outsourcing or FDI) lead to underinvestment when the buyer is located in a different country and that country has a tariff on imports of the intermediate good needed. In that context, trade liberalization enhances international trade through reduction of the cost of imported intermediate goods and it induces foreign suppliers to increase cost-reducing investments, and it may even prompt the formation of vertical multinational firms.

Imports and international outsourcing and FDI can also serve as hedging against demand shocks. As Békés et al (2011) showed using EFIGE data, during the great recession of 2009, firms that were importers or had outsourcing or controlled foreign affiliates suffered a smaller sales or employment decline than other firms. These modes apparently allowed European firms to push part of the pressure down the value chain.

When looking at this range of international activities in our data, on the extensive margin we find that 78% of firms have at least one mode of direct international relationships.[6] Table 2 compares the various modes of internationalization present in our data, showing that exporting is the most frequent mode, with 67% of firms that can be considered as exporters over the last three years. More specifically in 2008, 53% of firms are exporting, while 14% did not export in 2008 but undertook the activity in the previous years. Importing is the second most common international activity, with almost half of firms in our sample importing intermediate goods. In terms of outsourcing, 39% of firms act as suppliers to international customers (outsourcees) and 25% source from abroad (outsourcers). FDI is the least frequent activity, being undertaken only by 10% of the firms in our sample. Similarly, only 10% of firms are foreign owned.

Looking at size and performance (as proxied here by sales per employee), it is also clear that a rank emerges in terms of size/performance of firms. In particular, Table 2 shows that outsourcers and FDI makers tend to be larger than other internationally active

[6] High internationalization shares in our sample are consequence of the employment threshold of 10 employees. National datasets suggest that very small firms (i.e. below 10 employees) are unlikely to be engaged in direct trade or foreign investments. Clearly, firms can be involved indirectly – e.g. buying imported tools in a domestic DIY store, or selling to a domestically based wholesaler, who would later export it.

firms, while outsourcees and exporters tend to be smaller than importers. An analogous ranking comes out when looking at sales per employee.[7]

Table 2. Modes of Internationalization (descriptive statistics), 2008.

	# of firms	Share of firms	avg. sales	avg. # of employees	Sales per employees
Non Active abroad	3315	22%	5.24	31	0.162
Active abroad	11444	78%	17.92	79	0.261
of which					
Exporters	9849	67%	18.72	82	0.238
Importers	7298	49%	21.66	96	0.249
Outsourcee	5799	39%	19.34	80	0.245
Outsourcer	3750	25%	30.44	139	0.271
FDI maker	1514	10%	59.38	235	0.307
Foreign owned	1561	11%	47.76	177	0.359
Whole sample	**14759**		**14.72**	**67**	**0.220**

Notes:
[a] Modes of internationalization are non-mutually exclusive.
[b] Sales are in millions of Euros and are generated from the following turnover ranges' midpoints: 0.5m, 1.5m, 6m, 12.5m, 32.m5, 150m, 500m.
Source: Authors' elaboration on EFIGE data.

The literature has explained results such as those presented in Table 2 in terms of 'self-selection'. The already quoted paper of Bernard and Jensen (1999) was the first to postulate that the superior performance of exporting firms with respect to purely domestic firms should be attributed to self-selection: due to fixed (sunk) trade costs, only the most productive firms self-select into export markets.[8] Altomonte and Békés (2010) look at the potential self-selection effect of importers, relating the sunk cost of importing to contract-specific investments and the cost of transferring the technology embedded into it.

Helpman, Melitz and Yeaple (2004) show that FDI is more selective than export for US firms and explain their finding in terms of higher setup costs of FDI with respect to export relations. The results in Criscuolo and Martin (2009) for the UK support that explanation. In the case of acquisition or privatization, a key additional driver is the selection of the already better performing firms, or cherry picking by foreign firms while acquisition leads to increased performance as well (see Arnold and Javorcik (2009) for Indonesian plants).

[7] Altomonte et al. (2012) show that the ranking is confirmed also in terms of TFP.
[8] Békés and Muraközy (2012a) emphasize that such differences are mostly related to sunk cost intensive trade technologies, where firms build up long-term relationships.

Outsourcing production abroad, either at arm's length (identifying and contracting an outsourcee) or setting up (or acquiring and integrating) a new company abroad, also requires substantial ex-ante investment (Antràs and Helpman, 2004) Using data on Germany, Wagner (2011) finds that, compared to firms that do not outsource abroad, those who do are indeed larger and more productive, with a higher share of exports in total sales. For Japanese firms, Tmiura (2007) finds firms active in FDI or in multiple globalization modes to be more productive than foreign outsourcers and plain exporters.

All these results suggest that the ranking of internationalization modes in terms of corresponding firm performance can be interpreted as driven by an underlying ranking in terms of their *international complexity* as determined by the corresponding setup costs. We adopt this interpretation henceforth, associating exporters, outsources, importers, outsourcers, foreign owned firms and FDI makers with increasingly higher international complexity.

The EFIGE data also allow us to go beyond the standard comparisons across internationalization modes that treat each mode separately and compares it to firms not active in that mode. As each mode requires some separate fixed cost (while there may be overlaps, such as language or IT skills), firms engaged in more than one activity are expected to be more productive that those engaged in only one. Altomonte and Békés (2010) find evidence on this for exports and imports; Becker et al (2009) consider the complementarity for outsourcing tasks.

Nesting together the various international modes of firms, rather than considering them separately as above, we can build on the measure of *internationalization intensity* defined in Section 2 as the number of internationalization modes in which a firm is simultaneously involved (Exporter, Importer, FDI maker, Outsourcer, Outsourcee, Foreign owned). Notice that, although related, the concept of international intensity is different from the notion of international complexity defined above. A firm is more internationally complex if it is involved in more selective activities (e.g. exporting firms are less complex than FDI makers). A firm is instead more international intensive if it cumulates a larger number of international modes, which might not necessarily be the more complex ones.

Looking at frequency, we find that there is a fairly equal (18%-22%) split among firms with 0, 1, 2, 3, 4-6 activities. However, out of the last group, we find that just 6% of firms are able to undertake more than 5 modes of internationalization. This is reminiscent of the notion of 'Happy few' (Mayer and Ottaviano, 2007), i.e. the fact that

only very few, very large and very productive firms happen to be deeply integrated in the global economy.

There are two potential explanations for this result. First, the already discussed argument of self-selection: Table 3 below shows how the 6% of firms simultaneously involved in five or more internationalization modes are vastly larger (double in size and sales) and some 40% more productive (in terms of sales per employee) than firms involved in only four simultaneous international activities. Second, complementarities among various modes of internationalization may also be important. For example, Yasar and Paul (2007), using data from Ireland and focusing on services imports, argue that there are potential positive effects from such an international outsourcing, but these benefits only accrue to firms that are also exporting.

Table 3. Internationalization Intensity and Firm Characteristics (the "Happy Few" reloaded)

# of internationalization activities	# of firms	Share of firms	avg. sales	avg. # of employees	Sales per employees
0	3315	22%	5.24	31	0.161
1	2639	18%	8.23	41	0.209
2	3070	21%	11.09	47	0.225
3	2976	20%	15.55	81	0.235
4	1874	13%	30.56	125	0.266
5-6	885	6%	68.74	266	0.359

Notes:
[a] Sales are in millions of Euros and are generated from the following turnover ranges' midpoints: 0.5m, 1.5m, 6m, 12.5m, 32.m5, 150m, 500m.
[b] # of internationalization activities is the sum of any of these modes: Exporter, Importer, FDI maker, Outsourcer, Outsourcee or Foreign owned.
Source: Authors' elaboration on EFIGE and AMDEUS data.

Figure 1 validates these results in terms of total factor productivity, plotting the TFP distribution for firms with low and high internationalization intensity. It shows that the latter stochastically dominates the former (Tests available on requests).

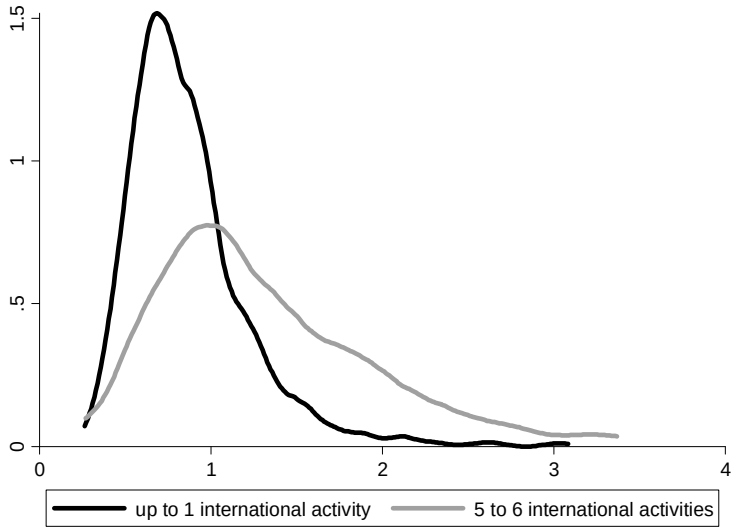


Figure 1. Internationalization intensity and TFP

Source: Authors' elaboration on EFIGE and AMADEUS data.

Note: Due to the presence of missing values for the variable TFP, distributions are drawn using data only for Italy, France and Spain, that is the countries for which more than 50% of the firm-level observations on TFP are non-missing.

3.2. Modes of innovation

Thanks to the richness of the EFIGE data, we can replicate the previous analysis on internationalization modes in the case of innovation modes, linking firms' performance to their innovation patterns. We will then try to cross the two dimensions in order to explore the type of relation existing between innovation and internationalization.

Table 4 replicates Table 2 for innovation activities, emphasizing three categories of involvement in innovation: product innovation, process innovation, both product and process innovation, and their relationship with firms' size and sales per employee.

Table 4. Modes of innovation (descriptive statistics)

	# of firms	Share of firms	avg. sales	avg. # of employees	average sales per employee
Non Innovative	5179	35%	10	45	0.218
Innovative	9580	65%	17	79	0.223

of which					
Product only	3087	21%	14	59	0.215
Process only	2335	16%	14	61	0.237
Both	4158	28%	22	107	0.219
Whole sample	**14759**		**15**	**67**	**0.221**

Notes:
[a] Sales are in millions of Euros and are generated from the following turnover ranges' midpoints: 0.5m, 1.5m, 6m, 12.5m, 32.m5, 150m, 500m.
Source: Authors' elaboration on EFIGE and AMDEUS data.

About a third of firms (35%) do not innovate, a bit more than a third do either product or process innovation (38%) while less than third (28%) are engaged in both innovation activities. Innovative firms tend to be bigger and exhibit higher turnover than non-innovative ones. However, there is no difference in terms of size and sales among those which perform product vs. process innovation only. Still, firms which undertake both activities are bigger and report higher turnover than those doing either. Contrary to internationalization activities, however, sales per employee do not seem to display here any particular ranking across the different innovation modes. [9]

To further elaborate, in line with what already done in terms of internationalization intensity, we can build on the measure of innovation intensity defined in section 2 as the number of innovation-related activity modes in which the firm is simultaneously involved. Table 5 shows that a clear ranking of firms' performance in terms of innovation intensity: more innovative firms are larger and more productive. They are also fewer, in line with existing studies that document positive selection as in the case of internationalization .

Figure 2 validates this finding in terms of total factor productivity as already done for internationalization intensity. Comparing the TFP distributions of firms with low and high intensity of innovation activities, it shows that the latter stochastically dominates the former.

Table 5. Innovation Intensity and Firm Characteristics

# of innovation activities	# of firms	avg. sales by midpoints	avg. # of employees	avg. sales per employee (AMDEUS)

[9] Similar, albeit even less clear, findings are also present when we use an input (R&D) rather than an output (product/process) variable for innovation.

0	1910	5.59	31	166.4
1	4195	8.26	40	198.4
2	3359	11.56	50	231.3
3	2465	17.96	78	248.2
4	1407	22.52	117	248.4
5	744	37.01	134	275.0
6-10	679	53.47	252	255.9

Source: EFIGE dataset

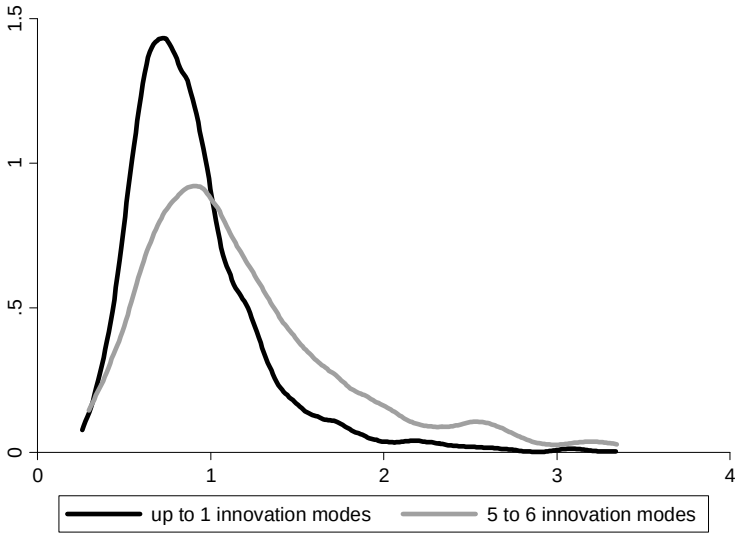


Figure 2. Innovation intensity and TFP

Source: Authors' elaboration on EFIGE and AMADEUS data.

Note: Due to the presence of missing values for the variable TFP, distributions are drawn using data only for Italy, France and Spain, that is the countries for which more than 50% of the observations were non-missing (73%, 84% and 52% respectively).

3.3. Innovation and internationalization

We have shown that both internationalization and innovation activities are related to firm performance. It is thus natural to look at them jointly, as the literature has already started to do.

The most widely studied aspect is the link between exports and product innovation. Constantini and Melitz (2008) posit that both innovation and export result from endogenous choices of firms. They are, therefore, inextricably linked as firms could start either one or the other strategy depending on the situation. Firms will carry out innovation activity when

hoping for a shift to exports or will start exporting after successfully innovating. In this case, innovation is part of window-dressing as firms prepare for a jump into exports, which gives rise to an observed self-selection effect. Bustos (2011) finds supportive evidence for this effect in the case of Argentina and Mercosur. Aw et al. (2011) find that the marginal benefit of jointly exporting and innovating increases with productivity with self-selection driving a large part of the complementarity[10].

Innovation has been related not only to exports but also to imports. On Argentinean data, Ottaviano and Volpe Martincus find that exporting probability is increased both by sourcing from abroad and investment in product improvement. Bøler, Moxnes and Ulltveit-Moe (2012) look at the relationship among R&D investments, innovation and trade in the case of Norwegian firms. They find that among innovating firms or firms investing in R&D, almost all firms import and more innovative firms source more foreign products. Indeed, there is a positive correlation between R&D investment and import participation, as well as import share, number of imported products and productivity. Moreover, firms that start to innovate see an increase in their import share. Amiti and Khandelwal (2012) show that there is a significant relationship between import tariffs and product innovation (quality upgrading) and its direction depends on how far the product is from the world quality frontier. For products close to the frontier, low tariffs encourage innovation in quality upgrading but for products that are far from this frontier, low import costs discourage quality upgrading.

In regards with outsourcing, Naghavi and Ottaviano (2010) emphasize incomplete contracts and posit that outsourced upstream production contributes to the emergence of innovation networks by creating a demand for upstream R&D.

Finally, innovation has been related to FDI. Firms who *already* do innovation and have innovative products compare different modes of internationalization based on the relative costs of defending their property rights. When a considerable amount of knowledge is embedded in the exported product, contractual imperfections shift the balance towards internalization (Békés and Muraközy 2012).

Finally let us point out some explicit discussion of policy. For example, In Haaland and Kind (2008), firms invest in R&D, and a government may grant subsidies, and it is optimal for a government to provide higher R&D subsidies when trade costs are lower and hence additional benefits are higher. Looking from the opposite direction, Desmet et al

[10] The innovation – export link is confirmed for Belgium by Van Beveren and Vandenbussche (2009) who control for simultaneity, causality (persistence in exporting activities) and anticipation of future new market entries and for Hungary Halpern and Muraközy (2012) find that both the probability of exporting and the export share are significantly positively correlated with the innovative activity of firms. These pieces of evidence also underline the need to treat innovation in a broad context. On channels, see Bratti and Felice (2011) and Cassiman et al (2010)..

(2012) show that a reduction in trade costs may stimulate innovation intensity. The reason is that better access to foreign customers and suppliers may allow firms to become bigger and thus better able to bear the fixed costs associated with the different innovation modes.

Inspired by this growing literature, let us present some evidence on the observed correlation of internationalization and innovation. Consistently with the foregoing literature, also our analysis has already hinted at a possible interplay between internationalization and innovation, as both are positively associated to firm performance. This is confirmed in Table 6, in which we correlate internationalization intensity and innovation intensity. Moving along the diagonal in the table (i.e. increasing both the number of internationalization modes and the number of innovation modes simultaneously adopted) leads to a drop in the number of firms (upper panel) but at the same time to a significant increase in average firm size (average employment in the lower panel), in line with the 'Happy few' idea. In particular, comparing the top left cell (firms that do not undertake any innovation or internationalization activity) with the bottom right cell (firms that have the highest level of both internationalization and innovation intensity) in the bottom panel of Table 6, highly internationalized and innovative firms have an average size (639 employees) that is around 25 times larger than the corresponding figure for non-innovating, non-internationalized firms (25 employees).

The evolution of firm size is remarkably symmetric across internationalization and innovation intensities. For example, the average size of firms with one innovation activity is 40 employees, with size increasing across the different international activities from 30 (no international intensity) to 105 (maximum international intensity). But also the average size of firms with one international activity is similar (41 employees), with size increasing from 29 employees (for non-innovating firms) to 100 (maximum innovation intensity). Similar patterns are found controlling respectively for symmetric numbers of innovation or internationalization activities. Hence, innovation and internationalization seem to be inextricably intertwined with successful firm performance.

Table 6. Internationalization vs. Innovation intensity

Number of firms

	Innovation intensity							
	0	1	2	3	4	5	6-10	Total

(International Intensity)	0	736	1352	655	410	114	28	20	3315
	1	460	864	630	380	175	89	41	2639
	2	334	856	828	512	293	146	101	3070
	3	248	673	694	585	408	198	170	2976
	4	110	342	408	397	280	164	173	1874
	5-6	22	108	144	181	137	119	174	885
	Total	***1910***	***4195***	***3359***	***2465***	***1407***	***744***	***679***	***14759***

Average employment

		Innovation intensity							
		0	1	2	3	4	5	6-10	Total
(International Intensity)	0	25	30	34	39	48	40	46	31
	1	29	31	39	50	50	116	100	41
	2	33	35	41	65	65	64	80	47
	3	41	49	55	113	119	92	146	81
	4	51	92	85	84	218	186	222	125
	5-6	75	105	148	167	228	288	639	266
	Total	***31***	***40***	***50***	***78***	***117***	***134***	***252***	***67***

Source: Authors' elaboration on EFIGE data.

Figure 3 translates the information contained in the two panels of Table 6 to two corresponding graphs with the aim of teasing out the distribution of the firms (upper panel A) and their share (lower panel B) of employment across innovation and internationalization intensity cells. Both panels exhibit a pyramidal structure but with reversed patterns. In panel A, the peak of the distribution is for the lower levels of innovation and internationalization intensities. In panel B, the peak corresponds, instead, to high intensities. Most firms engage appear to engage in very few internationalization or innovation modes but the bulk of employment is accounted for by firms engaged with several internationalization and innovation modes. Still, a non-negligible fraction of firms simultaneously engages with some internationalization and innovation modes. Among them, there is some bias towards a larger number of internationalization modes and a lower number of innovation modes.

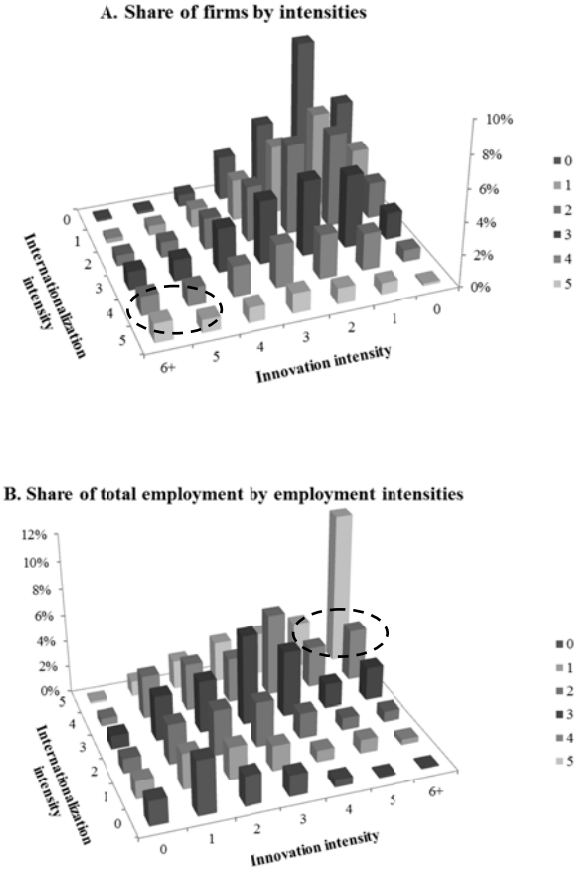


Figure 3. Distributions of firms across innovation and internationalization intensities.

Source: Authors' elaboration on EFIGE and AMADEUS data.

Note: in both panels, circle denotes the "Happy Few". In panel B, share of total employment is the sum of employment of firms by intensities.

The patterns shown in Table 6 and Figure 3 are actually reinforced when we impose more structure on the analysis and estimate simple regressions models. Results are collected in Table 7, which shows that higher innovation intensity is strongly associated with higher internationalization intensity and vice versa. The latter relation holds bilaterally controlling for country, size and sector, and shows that one additional step in innovation intensity is associated with 0.3 additional modes of internationalization, and vice versa. Interestingly, it also holds when controlling for the total factor productivity of individual firms, on top of sector, country and size effects (Column 3).

Table 7: International and Innovation Intensity (Linear Probability)

PANEL A	***Internationalization Intensity***		
	(1)	(2)	(3)
Innovation Intensity	0.337***	0.265***	0.268***
	(0.007)	(0.007)	(0.013)
TFP			0.226***
			(0.045)
Country Dummies	No	Yes	Yes
Sector Dummies	No	Yes	Yes
Size Dummies	No	Yes	Yes
R^2	0.137	0.270	0.289
PANEL B	***Innovation Intensity***		
	(4)	(5)	(6)
International Intensity	0.408***	0.308***	0.262***
	(0.008)	(0.009)	(0.013)
TFP			0.089**
			(0.045)
Country Dummies	No	Yes	Yes
Sector Dummies	No	Yes	Yes
Size Dummies	No	Yes	Yes
R^2	0.137	0.295	0.235
Observations	14,759	14,443	6,026

Notes:

[a] * denotes significance at the 10% level, ** 5% level, and *** 1%. s.e. are in parentheses.

[b] The dependent variable is International Intensity for the top panel (models (1), (2) and (3)) and Innovation Intensity ((4), (5) and (6)) for the panel at the bottom of the table. International Intensity takes values from 0 to 6, while Innovation Intensity takes values from 0 to 10. Specifications (1), (2), (4) and (5) are obtained on the full EFIGE sample and country dummies refer to Germany, France, Italy, Spain, United Kingdom, Hungary and Austria. Models (3) and (6) are run using only data for France, Spain and Italy and country Dummies are included only for the latter countries. Specifications (2), (3), (5) and (6) include NACE 2 digit dummies for sectors as well as dummies to control for size. Size classes of firms are: 10-19; 20-49; 50-249; more than 250 employees.

[c] The methodology for the calculation of TFP is discussed in Annex.

Source: Authors' elaboration on EFIGE and AMADEUS data.

The fact that the association between higher innovation intensity and higher internationalization intensity holds also controlling for firm TFP suggests that it is not the result of a spurious correlation driven by unobserved firm heterogeneity related to firm performance, but rather the outcome of firms' strategies in which internationalization and

innovation are jointly (though not necessary sequentially) developed over time. To further investigate this issue we abandon the concepts of innovation and internationalization intensities that treat all modes symmetrically and look at whether different internationalization modes match with different innovation strategies. Table 8 reports the results of a linear probability model in which each internationalization mode is statistically associated to the probability that firms have of being in a given innovation status, controlling for country, sector and size fixed effects. We have run two sets of estimates, with different control groups. In column (1), (2) and (3) of Table 8 results are obtained on the unconstrained EFIGE sample, in which a given internationalization status is compared against all the remaining firms. Columns (1.1), (2.1) and (3.1) report instead the results obtained by restricting the control group to firms that are not active abroad.

As a result, the interpretation of the coefficient changes: the unconstrained models report the correlation that each international mode has at the margin with innovation (as the control group includes the other international modes), with the coefficient for the general category of firms 'active abroad' representing the correlation between the average international mode and innovation; the constrained model, in which the constant control group of firms non active abroad is used, reports instead the overall correlation of each international mode with innovation.[11]

Starting with the constrained model, columns (1.1), (2.1) and (3.1) show a positive and significant association between internationalization and innovation modes, with a coefficient that increases with the complexity of the internationalization mode undertaken. In other words, firms undertaking FDI are more likely to end up doing innovation activities than exporting firms (e.g. 0.21 vs. 0.16 in the case of product innovation), when both groups are compared to firms not active abroad. This is consistent with the positive correlation between internationalization and innovation activities previously discussed. It is also in line with some form of self-selection driving internationalization and innovation choices.

Looking instead at the results of the unconstrained model reported in columns (1), (2) and (3), the coefficients are again positive and statistically significant, but the correlation between internationalization modes and innovation decreases at the margin with the increase in the complexity of the internationalization mode. Exporting or importing modes are associated to a roughly 15 per cent higher chance to undertake product or process innovation with respect to the average of all other firms, but the same treatment applied to more complex international modes (such as outsourcing or FDI) displays a correlation which is

[11] Clearly in this case the coefficients for the generic international mode 'active abroad' coincide with the one of the unconstrained control group.

still positive and significant, but 50% lower, as in this case the control group already incorporates exporters and importers that display a good propensity to innovate.

Hence, while large firms are clearly the main drivers of internationalization and innovation, these activities are not concentrated only in the 'happy few': also a wide fringe of smaller firms is able to penetrate foreign markets through a mix of relatively simple international and innovation activities.

Table 8. International complexity and Innovation modes (linear probability)

	Product Innovation		Process Innovation		R&D	
	(1)	(1.1)	(2)	(2.2)	(3)	(3.3)
Active Abroad	0.140***	0.140***	0.086***	0.086***	0.177***	0.177***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
R^2	0.123	0.123	0.107	0.107	0.137	0.137
Exporter	0.168***	0.164***	0.091***	0.096***	0.228***	0.212***
	(0.008)	(0.007)	(0.008)	(0.007)	(0.008)	(0.007)
R^2	0.142	0.154	0.121	0.133	0.164	0.173
Importer	0.142***	0.190***	0.100***	0.119***	0.166***	0.236***
	(0.008)	(0.009)	(0.008)	(0.009)	(0.008)	(0.009)
R^2	0.128	0.201	0.119	0.179	0.134	0.219
Outsourcee	0.121***	0.205***	0.084***	0.125***	0.169***	0.266***
	(0.008)	(0.009)	(0.008)	(0.009)	(0.008)	(0.009)
R^2	0.123	0.253	0.115	0.228	0.135	0.277
Outsourcer	0.083***	0.223***	0.050***	0.135***	0.107***	0.291***
	(0.007)	(0.011)	(0.007)	(0.011)	(0.007)	(0.011)
R^2	0.100	0.277	0.095	0.250	0.105	0.305
FDI maker	0.052***	0.207***	0.018***	0.102***	0.050***	0.249***
	(0.005)	(0.011)	(0.005)	(0.011)	(0.005)	(0.011)
R^2	0.161	0.477	0.155	0.446	0.160	0.492
Foreign owned	0.010**	0.156***	0.008*	0.083***	-0.001	0.177***
	(0.005	(0.011)	(0.005)	(0.011)	(0.005)	(0.012)
R^2	0.117	0.409	0.117	0.393	0.117	0.414

Notes:

[a] * denotes significance at the 10% level, ** 5% level, and *** 1%. s.e. are in parentheses.

[b] The dependent variables are the different modes of internationalization (they equal 1 if the firm is internationalized through the mode included in the regression and 0 otherwise). Each dependent (dummy) variable is separately regressed on 3 modes of innovation: process innovation, product innovation and R&D. International categories and innovation modes are not mutually exclusive. Each specification include NACE 2 digit dummies for sectors, dummies to control for size (size classes of firms are: 10-19; 20-49; 50-249; more than 250 employees) and country dummies (Germany, France, Italy, Spain, United Kingdom , Hungary, Austria). Estimates in column (1), (2) and (3) are obtained on the unconstrained EFIGE sample, with the control group not forced to be constant, and thus with a constant sample size of 14443 firms (we

cannot attribute industry classification to 316 firms). Column (1.1), (2.1) and (3.1) report the results obtained by restricting the control group to non-international firms. In this case the sample size changes according to the internationalization category considered (Active abroad, 14443; Exporter, 12896; Importer, 10377; Outsourcee, 8922; Outsourcer, 6906; FDI maker, 4735; Foreign owned, 4772).
Source: Authors' elaboration on EFIGE data.

Another result emerging from Table 8 is that the correlation between internationalization and innovation tends to be stronger through the input channel (R&D) than the output channel (product or process innovation), although subject to the same patterns discussed above. This finding is quite striking considering that often R&D activities are used in the literature as an instrument for innovation outcomes, given the high correlation that they tend to display with product/process innovation.[12]

Analogously to what we have done in the previous analysis of internationalization and innovation intensities, in Appendix A4 we replicate the analysis of Table 8 using TFP to control for firm size instead of the size class: results are robust in both directions (with and without constant control group), thus once again excluding that the detected relation between internationalization and innovation modes is driven by some unobserved firm heterogeneity that leads to a spurious correlation between the two activities.

4. INNOVATION AND INTERNATIONALIZATION ACROSS COUNTRIES AND MILIEUS

So far all exercises have been carried out on the whole sample of firms, using country dummies to control for possible differences across countries. In this section we explicitly control for potential cross-country differences, thus providing at the same time an implicit control for the robustness of our results. To further explore these sources of potential heterogeneity, we will also look at the relationship between innovation intensity and internationalization intensity across milieus.

The share of firms active in the different internationalization and innovation modes on a country by country basis are reported in Tables 9 and 10.

[12] This is the case also in our sample where R&D displays a positive correlation both with product innovation (37%) and process innovation (22%).

Table 9 Modes of Internationalization (shares of firms), by country

	Germany	France	Italy	Spain	UK	Hungary	Austria
Non Active abroad	27.1	19.3	20.2	26.7	20.8	18.4	13.1
Active abroad	72.9	80.7	79.8	73.3	79.2	81.6	86.9
Total # of firms	***2935***	***2973***	***3021***	***2832***	***2067***	***488***	***443***
of which							
Exporters	64.8	62.6	73.8	63.4	66.6	70.1	77.2
Importers	38.1	62.2	46.1	49.5	52.0	45.3	54.2
Outsourcee	34.5	48.3	45.3	24.3	46.1	37.3	35.7
Outsourcer	26.0	31.5	25.3	21.5	17.4	32.8	35.7
FDI maker	14.1	9.6	8.0	6.9	12.8	5.9	18.7
Foreign owned	8.6	13.8	6.2	6.0	17.2	24.0	15.1

Note:
[a] Modes of internationalization are not mutually exclusive.
Source: Authors' elaboration on EFIGE data.

Table 10 Shares of innovative firms by country.

	Germany	France	Italy	Spain	UK	Hungary	Austria
Non Innovator	35.4	43.7	32.5	30.4	32.8	44.3	24.2
Innovator	64.6	56.3	67.5	69.6	67.2	55.7	75.8
of which							
Product Innovator	50.0	44.3	49.2	45.6	58.5	43.9	59.1
Process Innovator	40.2	37.6	44.8	51.4	46.6	33.6	58.2

Note:
[a] Modes of internationalization are not mutually exclusive.
Source: Authors' elaboration on EFIGE data.

The overall figures suggest that all countries are more or less homogeneously open in terms of trade, frequently active in direct supplier-customer contacts (outsourcing) but differ more in terms of foreign direct investment, with Germany and Austria recording the highest share of firms investing abroad, while Hungary is the country with the highest share of foreign presence.

A similar message can be derived in terms of innovative activities, with all countries having a share of firms undertaking some form of product or process innovation above 50% in our sample. This feature is in line with the relatively high international openness of firms determined by the minimum threshold of 10 employees used in the

analysis. Hungary has the lowest share of innovating firms, while Austria has the highest. Product innovation is more frequent than process innovation with the exception of Austrian firms.

The strong and large correlation between internationalization and innovation intensities at country level is also statistically confirmed in Table 11, which replicates on a country-by-country basis Panel A of Table 7. After controlling for sector and size effects, innovation intensity is highly positively correlated with the number of internationalization modes undertaken by firms. This is in line with the idea that not only countries' but also firms' characteristics matter a lot in driving the pattern of phenomena, such as internationalization and innovation, ultimately related to the capability of individual firms.

Table 11. Internationalization and innovation intensity, by country (Linear Probability)

	Hungary	UK	France	Austria	Spain	Germany	Italy
Innovation intensity	0.184***	0.237***	0.245***	0.259***	0.270***	0.279***	0.311***
	(0.053)	(0.017)	(0.017)	(0.040)	(0.020)	(0.015)	(0.019)
Sector Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	486	2.067	2.759	343	2.832	2.935	3.021
R-squared	0.247	0.262	0.294	0.283	0.267	0.285	0.260

Notes:
[a] * denotes significance at the 10% level, ** 5% level, and *** 1%. s.e. are in parentheses.
[b] The dependent variable is International Intensity.
Source: Authors' elaboration on EFIGE data.

A further dimension of heterogeneity worth exploring is at the crossroad between countries and sectors. To this end, we build on the variable 'milieus' introduced in Section 2, which classifies every sector-country pair according to its high vs. low internationalization / innovation with respect to a median value. Appendix A3 offers details.

In terms of the innovation intensity index, Hungary has all the worst five milieus, such as wood, textiles and clothing or furniture industries. Other below average innovation intensity milieus include French wood and fabricated metal industries, Spanish clothing and non-minerals, German leather, or Austrian furniture industries. Regarding internationalization intensity index, the worst milieus may be found in UK wood industry and Spanish non-minerals and fabricated metals, as well as in most publishing and food

sectors – a natural feature of those industries. In addition, poor milieus represent German leather, Italian non-minerals, Spanish wood or Hungarian furniture.

The highest innovation intensity milieus are Italian leather and equipment industries, German chemicals, and Austrian basic metals and equipment sectors. This is followed by most UK sector, as well as Austrian paper and machinery. Highest internationalization intensity may be enjoyed in a rather diverse set of milieus: Austrian textiles, French leather, chemicals, furniture, Hungarian vehicles and UK leather industries. This is followed by Austrian metals, machinery and equipment, French machinery, Hungarian leather and Italian chemicals.

One use of this distinction is to see its effect on the activity of firms operating in low versus high intensity milieus. Panel A of Table 12 compares the share of exporters (and further on, importers, FDI makers and outsourcers) across low and high innovative intensity milieus. The results confirm our correlation under a different dimension: in more innovative milieus, there are more internationalized firms. The difference is particularly strong for FDI, in line with the stronger association between this activity and the propensity to innovate detected in the previous section. Also striking is the fact that more than 70% of firms operating in high innovation intensity milieus in our sample are also exporters. Panel B looks at the same correlation from the opposite angle, cutting the sample into high and low internationalization intensity milieus. Again, in more internationalized milieus, firms are more likely to innovate. This is especially true considering innovation from the input side (R&D).

Table 12. International vs Innovative Milieus

PANEL A

Milieu	*Exporter*	*Importer*	*FDI Maker*	*Outsourcer*
Low Innovation intensity	0.58	0.47	0.06	0.23
High Innovation intensity	0.73	0.51	0.13	0.27
Difference between high and low innovation intensity	0.15	0.05	0.07	0.04

PANEL B

Milieu	*Product Innovator*	*Process Innovator*	*R&D*
Low internationalization intensity	0.42	0.44	0.41
High internationalization intensity	0.57	0.44	0.60

Difference between high and low Internationalization intensity	0.15	0.01	0.20

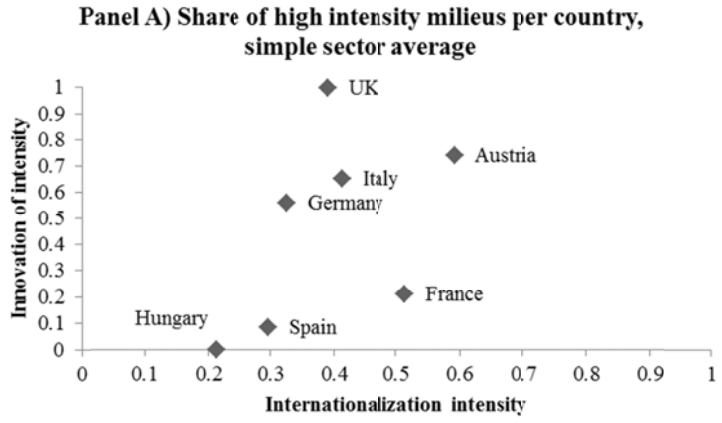
Note:.

[a] Figures represent the share of exporters, importers, FDI makers and outsourcers by low and high innovation intensity milieus (i.e. sector and country pairs) as well as product innovators, process innovators and R&D makers by high and low internationalization milieus.

Source: Authors' elaboration on EFIGE data.

It is also interesting to map milieus by sectors and countries. This is done in Appendix A3, where, to increase reliability, we have merged food and tobacco, textile and clothing sectors as well as all equipment sectors, and dropped coke and recycling.

It is tempting to use the information of Table A3 to capture the propensity of countries to be involved in innovation and internationalization activities. This is done in Figure 4, which plots countries' average innovation intensity against their average internationalization intensity across sectors, unweighted (panel A) and weighted by the number of firms per sector (panel B). Though the slope is steeper in the latter case, both panels reveal a positive correlation, with countries with high internationalization intensity also showing high innovation intensity. Hungary and Spain are the laggards, but Hungary reveals a strong propensity towards internalization with weighting.



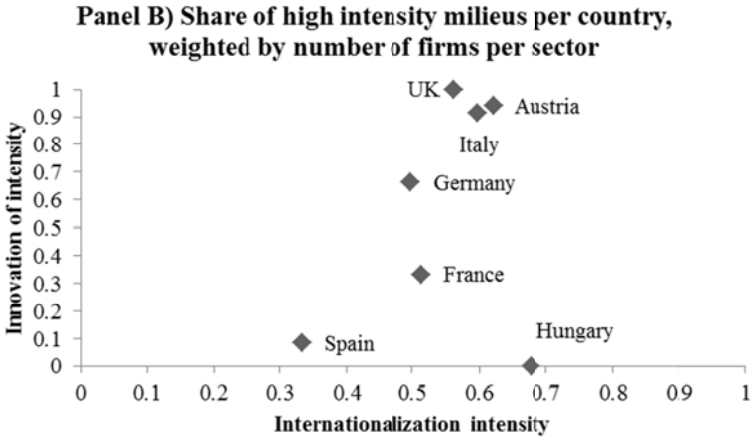


Figure 4. Share of high intensity milieus by country.

Source: Authors' elaboration on EFIGE and AMADEUS data.

To summarize, all these results highlight a strong correlation between internationalization and innovation, robust across countries and sectors combined, controlling for firms size and productivity. In the next section we argue that this correlation can be explained by the fact that firms use innovation and imports as sources of better inputs that boost their productivity and thus foster their internationalization.

5. SOURCES OF PERFORMANCE: IMPORTS AND R&D

The literature previously discussed already points out that, among firms undertaking R&D, a large part of them also import. It goes on to suggest that R&D and imports are complementary ways to source new inputs and create new products.

In our sample we indeed find that R&D activities are significantly associated with both product and process innovation (controlling for country and industry fixed effects), consistent with the idea that R&D is a way for generating new products. Moreover, also in line with the results in the literature, we find a positive and significant correlation between R&D and import activities, again controlling for country and industry fixed effects.[13] The correlation continues to hold after controlling for firm size (its strength actually increases with the size of firms). However, not much can be inferred from the former relation in terms of the reasons behind the positive correlation between internationalization and innovation,

[13] While R&D and import are activities undertaken by some 50% of firms in our sample, around 61% of the firms undertaking R&D activities also import.

as what we observe in our sample are the outcomes of past choices of surviving firms that might have undertaken both import and R&D activities.

To properly identify in the relation between internationalization and innovation the component induced by the use of R&D and imports as source of better quality inputs, we check whether imports and R&D interact differently across international modes of different complexity. Different patterns across different modes would suggest that import and R&D choices, and the ensuing correlation, are related to specific development strategies pursued by firms. If, instead, the relation between imports and R&D revealed no discernible variation across international modes, then the source of the correlation would have to be found in some unobserved heterogeneity at the firm level to be yet identified.

Table 13 reports the results for a linear probability model (with country and sector fixed effects) that compares the extent to which import and R&D activities are correlated to the probability of internationalizing through exports, FDI or outsourcing. We also allow for an interaction between import and R&D activities in order to check for possible complementarity/substitutability.

The first three columns of the table point at the idea that firms adopting relatively simple modes of internationalization (i.e. exports) use alternatively R&D or imports as sourcing strategy. Hence, for them R&D and imports appear to be substitutes (negative and significant interaction). In the case of more complex internationalization modes (i.e. outsourcing or FDI), the R&D and imports become complementary (positive and significant interaction).[14] Complementarity is weaker for outsourcers than for FDI makers, which suggests that interaction of R&D and imports becomes more virtuous at higher internationalization complexity.[15] [16]

[14] This result is also consistent with our findings in Table 8 that correlations with innovation activities seem to be relatively higher for simpler internationalization modes. Note in fact how the individual correlation of both R&D and imports is higher with the export mode than with FDI mode.

[15] When we pool firms across international modes, on average we instead get a negative substitution effect between R&D and Import, which is understandable being exporters much more numerous in the sample.

[16] In a related work, Bøler et al. (2012) look at the relationship among R&D investments, innovation and trade in the case of Norwegian firms. They find a strong correlation between innovation and importing, especially for firms investing in R&D.

Table 13. International modes and sourcing (linear probability)

	Exporter	Outsourcer	FDI Maker	Exporter	Outsourcer	FDI Maker
Importer	0.302***	0.216***	0.027***	0.296***	0.194***	0.021***
	(0.010)	(0.010)	(0.007)	(0.011)	(0.010)	(0.007)
R&D	0.240***	0.057***	0.018***	0.224***	0.043***	0.005
	(0.010)	(0.010)	(0.007)	(0.010)	(0.010)	(0.007)
R&D x Import	-0.109***	0.025*	0.047***	-0.113***	0.011	0.038***
	(0.014)	(0.014)	(0.09)	(0.014)	(0.014)	(0.010)
Differentiated Goods				0.013	0.092***	0.030***
				(0.011)	(0.010)	(0.007)
High share of graduates				0.053***	0.033***	0.010**
				(0.008)	(0.008)	(0.005)
R&D incentive				0.038***	0.047***	0.053***
				(0.011)	(0.010)	(0.007)
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Sector Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Size Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14443	14443	14443	14443	14443	14443
R^2	0.227	0.165	0.168	0.230	0.172	0.172

Notes:
[a] * denotes significance at the 10% level, ** 5% level, and *** 1% level. s.e. are in parentheses.
[b] The dependent variables are the different 3 modes of internationalization (Exporter, Outsourcer and FDI maker). All the estimates are obtained on the unconstrained sample of 14443 observations.

Source: Authors' elaboration on EFIGE data.

A critical issue for the above analysis is, however, related to the possibility that import and R&D are activities pertaining to completely different parts of the production process. Hence, rather than being the result of specific strategic choices of firms, their correlation may just be the spurious outcome of unrelated firms' choices. To control for this potential unobserved heterogeneity, we provide two robustness checks trying to control for potential differences in the production function.

A first set of controls is presented in the fourth to sixth columns of Table 11. There, on top of country, sector and size fixed effects, we exploit the wealth of information present in our dataset to incorporate three additional variables that might independently affect the choice of a firm to start import or R&D activities. First, we control for the relative endowment of skilled labor of each firm, employing a dummy of human capital that takes value 1 if the firm reports a number of graduate workers (over total employment) higher than the country average.[17] Second, we control for the type of imports of each firm, with a dummy that takes value 1 if a firm has imported customized (i.e. differentiated) intermediates, rather than standardized (i.e. homogeneous) intermediates or raw materials. Third, we control whether a firm has taken advantage of any R&D subsidy. While these variables are correctly signed and significant (they tend to be positively associated with the international activities of firms), they do not affect the main result in Table 11: the interaction between R&D and imports still moves from negative to positive as firms undertake increasingly complex international activities.[18]

A second set of controls exploits our country-industry variation in the definition of innovation and internationalization intensity milieus. In Table 13, columns (1) to (4) look at the behavior of exporters while columns (5) to (8) look at FDI makers, with regressions run by different milieus. Results suggest that for exporters and FDI makers, innovation and imports both matter, in all types of environments, in line with our previous results. In terms of the interaction between R&D and imports, the latter is negative signed for exporters, and positively signed for FDI, but often not significant.

[17] Based on the information in the sample, we first create the country weighted average share of graduates over total employment, and then set dummy human capital to1 if the share of graduates employed by the firm is higher than the national average.

[18] We have also tried to control for credit constraints at the firm level through the use of the Whited-Wu index, constructed starting from balance sheet information. As for the case of TFP, the index induces self-selection in the sample, but the main result of a changing sign in the interaction between R&D and imports is confirmed.

Table 13. International modes and sourcing across milieus (Linear Probability)

	Exporters				***FDI Makers***			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Milieus	T:Low I:Low	T:High I: Low	T: Low I:High	T: High I: High	T:Low I:Low	T:High I: Low	T: Low I:High	T: High I: High
Importer	0.322***	0.282***	0.265***	0.273***	0.026***	0.045**	0.053***	0.029**
	(0.017)	(0.035)	(0.037)	(0.020)	(0.007)	(0.019)	(0.020)	(0.012)
R&D	0.204***	0.132***	0.218***	0.272***	0.016**	0.023	-0.001	0.033***
	(0.018)	(0.050)	(0.031)	(0.019)	(0.007)	(0.026)	(0.013)	(0.011)
Importer x R&D	-0.073***	-0.037	-0.018	-0.135***	0.040***	0.017	0.072**	0.041**
	(0.025)	(0.057)	(0.047)	(0.023)	(0.014)	(0.038)	(0.028)	(0.016)
	0.322***	0.282***	0.265***	0.273***	0.026***	0.045**	0.053***	0.029**
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,701	974	1,677	5,960	5,701	974	1,677	5,960
R-squared	0.188	0.195	0.178	0.173	0.097	0.090	0.114	0.137

Notes:

[a] * denotes significance at the 10% level, ** 5% level, and *** 1% level. s.e. are in parentheses.

[b] The dependent variable is exporter dummy for columns 1-4 and FDI maker dummy for columns 5-8. All regression includes sector and country dummies. Milieus (T,I) denote internationalization and innovation intensity categories.,

6. CONCLUSIONS AND POLICY IMPLICATIONS

6.1. Summary of findings

We have exploited the unique features of the recently released EFIGE dataset to investigate the association of the internationalization and innovation activities of a representative and cross-country comparable sample of manufacturing firms across seven European countries (Austria, France, Germany, Hungary, Italy, Spain and UK) for the year 2008.

First, our analysis has uncovered a strong positive correlation between internationalization and innovation at the firm level, robust across countries and sectors combined, controlling for firms size and productivity.

Second, the strength of this positive and significant association grows with the complexity of the internationalization mode adopted. It is stronger for outsourcers and FDI makers, which tend to be larger and more productive, than for importers, outsourcees and exporters, which tend to be smaller and less productive.

Third, though weaker, the correlation is still significant at low levels of internationalization complexity. Hence, while at the aggregate level internationalization and innovation are mainly driven by large and more productive firms, also smaller and less productive firms are able to be active abroad through a mix of relatively simple international and innovation activities.

Fourth, we have found that simple internationalization is associated with the dyads 'export-innovation' or 'export-import' whereas complex internationalization is associated with the triad 'export-import-innovation'.

Clearly, these relations cannot be interpreted as causal given that the cross-sectional nature of our dataset does not allow us to solve endogeneity issues. At the same time, they suggest that internationalization and innovation are inextricably connected within firms.

6.2. Policy implications

Our findings imply that EU trade promotion and innovation policies should be better coordinated, mitigating the current paradox of 'largely uncorrelated policies for largely correlated outcomes'.

As discussed in the introduction, trade promotion falls in the home turf of member states, whose governments are mostly concerned with export promotion as testified by the recent proliferation of Export Promotion Agencies. However, the extent to which export promotion is effective in fostering internationalization is mixed at best. Our analysis suggests that export promotion per se is indeed unlikely to lead to sustainable internationalization because internationalization is much more than export. Firms, especially SMEs, can internationalize if they find their place in the global networks of innovation and production, which does not necessarily require them to be exporters as several other modes are viable.

Our analysis also suggests that export promotion per se is unlikely to lead to sustainable internationalization because in the medium-to-long term internationalization is associated with innovation and access to imported inputs. In particular, while simple internationalization modes can do with either innovation or imported inputs, complex

innovation needs both. The problem is that, as highlighted in the introduction, innovation policy is the concern of DG Enterprise and Industry with little interaction with DG Trade and, a fortiori, with the national Export Promotion Agencies.

The first step towards improving the status quo would require the different policy makers to become aware of the reciprocal spillovers their individual actions may have; for instance, reduction in trade costs may stimulate innovation intensity or R&D incentives can have a positive effect on the probability of internationalization. This is a valid point at national as well as EU levels.

The second step is to increase the role of EU-wide institutions. Policy makers should start thinking in terms of improving firm performance integrated into international networks of production, innovation and exchange of goods and services. For example, according to DG Trade, 87% of international sourcing for car manufacturing takes place within the EU. Hence, the EU would provide a natural framework within which to think coordinated internationalization and innovation policies by the EU and the governments of its member states. Within this framework, apparently disparate policies, such as the reduction of barriers to innovation through the introduction of a one-stop-shop for EU-wide patents and the reduction of behind-the-borders obstacles to trade through more agile custom procedures as well as more harmonized quality standards, would immediately appear as necessary items of a coordinated agenda, as they indeed should be perceived.[19]

In line with these arguments, awareness of the reciprocal spillovers between different policy areas should be accompanied by a shift in the paradigm used to make sense of the resulting policy impacts. Our analysis recommends coordination and integration of internationalization and innovation policies under one roof at both national and EU levels with an enhanced coordinating role for EU institutions.

[19] Indeed, van Pottelsberghe (2010) argues that the absence of a one-stop-shop for EU-wide patents acts as a tax on innovation and poses serious challenges to SMEs in the face of global competition..

APPENDIX

A1: ADDITIONAL DATA ON EFIGE CHARACTERISTICS

Table A1: Distribution of firms by country and size class

Class size	AT	FR	DE	HU	IT	ES	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 (over 250)	46	214	306	45	145	146	108	1.010
Total	**443**	**2.973**	**2.935**	**488**	**3.021**	**2.832**	**2.067**	**14.759**

Table A2: Distribution of firms by country and sector

Sector	AT	FR	DE	HU	IT	ES	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:
[a]Sector 15 is merged with sector 16. Sector 31 is merged with sector 30.

A2: PRODUCTIVITY ESTIMATION

Total Factor Productivity has been retrieved from EFIGE and AMADEUS data for around 50% of the sample of firms (for the rest of the firms, balance sheet data from AMADEUS were missing). As discussed in text, the resulting restricted sample is unbiased with respect to the main variables of interest (internationalization and innovation) but biased in terms of country representativeness, with Italy, France and Spain being over-represented.

To calculate TFP, we have assigned our observational units to sectors (at NACE 2 digit levels) pooling firm-level data across countries and years. We have then run for each sector the Levinsohn and Petrin (2003) semi-parametric production function estimation algorithm, controlling for country and year fixed-effects. More details on the result of the estimation, as well as a benchmark against other productivity measures (labor productivity, unit labor costs) are reported for EFIGE data in Altomonte et al. (2012).

Output is proxied by added value, deflated using industry-specific (NACE rev. 1.1) price indices obtained from Eurostat (using revenues to ensure full comparability). The labor 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 deflated by average industry-specific PPIs (Producers Price Index) weighted by input-output table coefficients.

A3. INNOVATION AND INTERNATIONALIZATION INTENSITIES BY SECTORS AND COUNTRIES

Panel A: Innovation intensity by sector

Sector	AT	FR	DE	HU	IT	ES	UK	Simple avg.
Food, tobacco	2.19	1.55	1.73	1.11	2.36	1.82	3.04	1.97
Textiles, clothing	2.77	1.84	2.35	0.54	2.36	1.65	2.80	2.04
Leather		2.13	1.77	1.75	2.21	1.62	3.90	2.23
Wood	1.52	1.05	1.69	0.59	1.99	1.48	2.28	1.52
Paper	3.00	1.81	2.26	0.75	2.14	1.93	3.34	2.17
Publishing	2.21	1.36	2.16	1.22	2.09	1.88	2.86	1.97
Chemicals	3.80	2.69	3.53	1.55	2.85	2.25	3.30	2.85
Rubber, plastic	2.73	2.02	2.66	1.00	2.32	1.70	3.23	2.24
Non-minerals	2.06	1.63	2.03	0.77	1.93	1.55	3.02	1.86
Basic metals	3.46	1.47	2.34	0.86	2.21	1.85	3.06	2.18
Fabricated metals	2.01	1.17	1.97	0.85	2.06	1.54	2.58	1.74
Machinery	2.96	2.18	2.54	1.04	2.56	1.90	3.24	2.35

Equipment, nec	3.55	2.43	2.81	1.06	2.77	2.28	3.63	2.65
Vehicles	2.63	2.01	2.52	1.71	2.56	1.88	3.26	2.37
Furniture	1.40	2.06	2.51	0.72	2.45	1.79	3.02	1.99
Simple avg. Innovation	2.59	1.83	2.33	1.04	2.32	1.81	3.10	2.14
Weighted avg.	2.45	1.70	2.31	0.98	2.33	1.75	3.06	

Panel B: Internationalization intensity by sector

Sector	AT	FR	DE	HU	IT	ES	UK	Simple avg.
Food, tobacco	1.41	1.44	0.94	1.32	1.55	1.30	1.48	1.35
Textiles, clothing	3.08	2.60	2.32	2.42	2.22	1.84	2.06	2.36
Leather		3.03	1.54	2.75	2.14	2.17	3.00	2.44
Wood	2.10	1.51	1.59	1.76	1.78	1.40	1.00	1.59
Paper	2.30	2.17	2.05	2.06	2.06	2.15	1.85	2.09
Publishing	1.91	1.28	1.13	1.30	1.36	0.93	1.34	1.32
Chemicals	2.80	3.00	2.62	2.15	2.81	2.34	2.40	2.59
Rubber, plastic	2.36	2.48	2.09	2.03	2.25	2.13	2.33	2.24
Non-minerals	2.11	1.75	1.56	1.70	1.38	1.25	1.66	1.63
Basic metals	2.77	2.69	1.98	2.71	2.36	2.18	1.74	2.35
Fabricated metals	2.30	1.76	1.62	2.00	1.62	1.32	1.66	1.75
Machinery	2.77	2.88	2.18	1.99	2.48	2.36	2.36	2.43
Equipment, nec	2.85	2.69	2.01	2.32	2.08	2.30	2.49	2.39
Vehicles	2.00	2.49	2.26	2.93	2.40	1.94	2.20	2.32
Furniture	2.00	3.00	1.94	1.50	2.09	1.67	2.02	2.03
Simple avg. Innovation	2.34	2.32	1.86	2.06	2.04	1.82	1.97	2.06
Weighted avg.	2.11	2.14	1.78	1.91	1.99	1.66	1.95	

A4: ROBUSTNESS TESTS

Table A5. using TFP as a proxy for size (Italy France and Spain)

	Product Innovation		Process Innovation		R&D	
	(1)	(1.1)	(2)	(2.2)	(3)	(3.3)
Active Abroad	0.137***	0.137***	0.063***	0.063***	0.156***	0.156***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)
TFP	0.048***	0.048***	0.043***	0.043***	0.041***	0.041***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
R^2	0.127	0.127	0.107	0.107	0.133	0.133

Exporter	0.147***	0.153***	0.066***	0.068***	0.204***	0.186***
	(0.012)	(0.011)	(0.012)	(0.011)	(0.012)	(0.011)
TFP	0.057***	0.059***	0.052***	0.054***	0.049***	0.053***
	(0.016)	(0.015)	(0.016)	(0.016)	(0.016)	(0.015)
R^2	0.148	0.157	0.130	0.134	0.168	0.170
Importer	0.140***	0.181***	0.085***	0.092***	0.146***	0.205***
	(0.012)	(0.013)	(0.012)	(0.013)	(0.013)	(0.013)
TFP	0.059***	0.058***	0.053***	0.054***	0.053***	0.051***
	(0.017)	(0.017)	(0.017)	(0.018)	(0.017)	(0.017)
R^2	0.145	0.200	0.133	0.174	0.146	0.209
Outsourcee	0.117***	0.197***	0.057***	0.086***	0.156***	0.243***
	(0.012)	(0.014)	(0.012)	(0.014)	(0.012)	(0.014)
TFP	0.032**	0.078***	0.028*	0.072***	0.026	0.066***
	(0.016)	(0.020)	(0.016)	(0.020)	(0.016)	(0.019)
R^2	0.162	0.284	0.152	0.254	0.172	0.301
Outsourcer	0.069***	0.204***	0.027**	0.094***	0.102***	0.264***
	(0.011)	(0.017)	(0.011)	(0.017)	(0.011)	(0.017)
TFP	0.084***	0.104***	0.082***	0.106***	0.080***	0.101***
	(0.015)	(0.022)	(0.015)	(0.022)	(0.015)	(0.021)
R^2	0.118	0.303	0.113	0.274	0.124	0.326
FDI maker	0.039***	0.188***	-0.001	0.048***	0.037***	0.197***
	(0.007)	(0.016)	(0.007)	(0.015)	(0.007)	(0.016)
TFP	0.038***	0.114***	0.038***	0.120***	0.037***	0.111***
	(0.009)	(0.021)	(0.009)	(0.022)	(0.009)	(0.021)
R^2	0.154	0.519	0.149	0.484	0.153	0.521
Foreign owned	0.014**	0.147***	-0.005	0.031*	-0.010	0.119***
	(0.007)	(0.017)	(0.007)	(0.016)	(0.007)	(0.017)
TFP	0.089***	0.194***	0.089***	0.197***	0.089***	0.196***
	(0.009)	(0.021)	(0.009)	(0.021)	(0.009)	(0.021)
R^2	0.132	0.476	0.132	0.455	0.132	0.468
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes:

[a] * denotes significance at the 10% level, ** 5% level, and *** 1% level.

[b]The dependent variables are the different modes of internationalization. All estimates in column (1), (2) and (3) are obtained on 6026 observations with the control group not forced to be constant. Column (1.1), (2.1) and (3.1) reports the results obtained by keeping constant the control group. Sample size changes according to the internationalization category considered (Active abroad, 6026; Exporter, 5407; Importer, 4465; Outsourcee, 3632; Outsourcer, 2876; FDI maker,1805; Foreign owned, 1847)

Source: Authors' elaboration on EFIGE data.

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