Export Participation and Misallocation after The Financial Crisis: Evidence from Italy

Sara Calligaris*
OECD and EIEF

Massimo Del Gatto#
"G. d'Annunzio" University and CRENoS

Fadi Hassand[δ]
Trinity College Dublin and CEP

Gianmarco I.P. Ottaviano[◊]
LSE, University of Bologna, CEP and CEPR

Fabiano Schivardi[♦]
LUISS, EIEF, and CEPR

We study the allocation of capital and labor in a representative sample of Italian manufacturers from 2001 to 2014, emphasizing the comparison between exporters and non-exporters before and after the global financial crisis. Both before and after 2008 factors are misallocated with inefficiently small exporters and inefficiently large non-exporters, but this pattern has become more pronounced after the crisis. This is due to frictions that disproportionately reduce product and factor market access for exporters. Investigating firm characteristics significantly associated with misallocation, we find that, controlling for the export status, finance, innovation and growth strategies play a significant role.
[JEL Classification: D22; D24; F1; O11; O47].

Keywords: misallocation; exports; productivity; Italy; global financial crisis.

* <*sara.calligaris@oecd.org*>,
# <*massimo.delgatto@gmail.com*>,
δ <*fhassan@tcd.ie*>,
◊ <*g.i.ottaviano@lse.ac.uk*>,
♦ <*fabiano.schivardi@gmail.com*>.

1. - Introduction

The dismal performance of the Italian economy in the last 25 years is a well-known fact. Hassan and Ottaviano (2013) and Calligaris *et* al. (2016) show how this is associated with a slowdown of "productivity" growth and an increase of resource "misallocation" between but, most of all, within sectors.

Against this general background, the aim of this paper is to zoom in on Italian exporters, documenting the corresponding patterns of "productivity" and "misallocation" in comparison with non-exporters. Following a methodology similar to Calligaris *et* al. (2016), we also want to identify the main firm characteristics associated with those patterns.

Graph 1 depicts the evolution of real aggregate exports since the 1990s. It reveals an overall positive trend, with a clear shock in 2008 due to the global financial crisis. However, looking at aggregate exports is not enough to get a sense of Italian export performance as one needs to take into account that: *i)* global trade has expanded greatly since 1990, with the share of trade over world GDP rising from 38% to 61% at the pre-crisis peak; and *ii)* the trade share of high-income countries such as Italy has decreased from 83% to 68%.

To account for these parallel developments, Graph 2 looks at the share of Italian exports over high-income OECD countries exports (excluding Italy). This graph shows a less comforting trend than Graph 1. There are three broad phases: *1)* during the 1990s Italian exports grew less than those of other peer countries, with the exception of a short-lived recovery after the 1992 devaluation, with the share of exports falling from 6.8% to 5.2%; *2)* in the early 2000s the negative trend reverted and, contrary to a common perception in Italy, this reversion coincided with the adoption of the Euro; *3)* with the global financial crisis, Italian exports lost competitiveness with their share stabilising at a lower level. All in all, the post-crisis average share has been 0.5 percentage points lower than the pre-crisis average share since the beginning of new millennium, corresponding to a significant decline in Italian exports of roughly 40bn. This paper focuses on the performance of Italian manufacturers in phases 2 and 3, analysing pre- vs. post-crisis patterns since the early 2000s with an emphasis on the relation between export participation and "productivity".

The concept of "productivity" we focus on is "Total Factor Productivity" (henceforth, simply "TFP"), which measures how effectively given amounts of productive factors (capital and labor) are used. Clearly the economy's aggregate TFP depends on its firms' TFP. This happens along two dimensions. On the one

hand, for given amounts of factors used by each firm, aggregate TFP grows when individual firm TFP grows, for example thanks to the adoption of better technologies and management practices. If market imperfections prevent firms from seizing these opportunities, the economy's productive apparatus is exposed to obsolescence and senescence with adverse effects on aggregate TFP.

On the other hand, for given individual firm TFP, aggregate TFP depends on how factors are allocated across firms. As long as market frictions "distort" the allocation of product demand and factor supply away from high TFP firms towards low TFP rivals, they lead to lower aggregate TFP than in an ideal situation of frictionless markets. Building on the distinction between physical TFP (*i.e.*, measured in terms of physical output) and revenue TFP (TFPR, *i.e.*, measured in terms of revenues) first introduced by Foster *et* al. (2008), Hsieh and Klenow (2009) construct a model of monopolistic competition in which, although firms can differ in their physical TFP, in the absence of frictions TFPR is is the same for all firms. The idea behind this result is simple: with no frictions, the marginal revenue product of inputs should be equalized across firms as factors move from from low marginal revenue to high marginal revenue firms. Hsieh and Klenow (2008) call deviations from a situation in which TFPR is equalized "misallocation", and propose a simple way to measure its consequences on aggregate TFP. This is also the definition of "misallocation" we adopt. It implies that the dispersion of TFPR across firms can be used to measure the extent of misallocation. It also implies that firms with a TFPR higher than the sectoral average are inefficiently small, while those with a TFPR below the sectoral average are inefficiently large. These are the two key implications of the misallocation literature that we use in this paper.

With these definitions in mind, we study a sample of firms representative of Italian manufacturers from 2001 to 2014 and find strong evidence of misallocation. Both before and after the crisis, exporters are inefficiently small whereas non-exporters are inefficiently large but this pattern has become more pronounced after the crisis. We interpret this feature within the framework of Hsieh and Klenow (2009) in terms of distortions that reduce product and factor markets access more for exporters than for non-exporters, and increasingly so after the crisis. While distortions that restrict capital market access are less severe for exporters than for non-exporters, they are not strong enough to fully compensate the differential severity of the other distortions. Misallocation also appears within the group of exporters, as firms earning a larger fraction of their revenues from exports are inefficiently smaller relative to those relying less on exports for their revenues.

Investigating firm characteristics significantly associated with misallocation, we find that finance, innovation and growth strategies play a significant role while this is is not the case for ownership structure, management style and labor force composition. In particular, we find that credit-constrained firms are inefficiently large with respect to their efficient size both before and after the crisis. Non-exporters with high involvement in product innovation, process innovation and R&D become inefficiently small while those with low involvement in these activities become inefficiently large after the crisis. The same applies to exporters with respect to process innovation, R&D and patents before the crisis; and only with respect to process innovation and patents after the crisis. In terms of growth strategies, among both exporters and non-exporters firms attributing their growth to the expansion of their distribution network are inefficiently large both before and after the crisis. The same applies before the crisis to non-exporters attributing their growth to increasing brand recognition and expanding after-sales networks as well as to exporters attributing their growth to lower production costs. It also applies, after the crisis, to both exporters and non-exporters suffering from demand constraints, and to exporters attributing their growth to lower production costs.

Our work relates to a number of studies that have used the framework of Hsieh and Klenow (2009) to measure the extent of misallocation in various countries, such as Bellone and Mallen-Pisano (2013); Bollard *et* al. (2013); Ziebarth (2013); Chen and Irarrazabal (2014); Crespo and Segura-Cayuela (2014); Dias *et* al. (2014); Garcia-Santana *et* al. (2015), and Gopinath *et* al. (2015). Our paper is also related to studies that have analysed more specifically the issue of the Italian productivity slowdown since the 1990s, such as Faini and Sapir (2005); Barba-Navaretti *et* al. (2010); Bugamelli *et* al. (2010); Bugamelli *et* al. (2012); Lusinyan e Muir (2013); Michelacci and Schivardi (2013); Bandiera *et* al. (2014); De Nardis (2014); Lippi and Schivardi (2014); Pellegrino and Zingales (2014); Calligaris (2015); Daveri and Parisi (2015); and Calligaris *et* al. (2016). The contribution of this paper to the existing literature is the analysis of the patterns of misallocation for Italian manufacturers with a specific focus on the comparison between exporters and non-exporters, as well as on the firm-level characteristics associated with those patterns.

Though broadly used, the idea of Hsieh and Klenow (2009) of interpreting the observed dispersion of TFPR across firms as evidence of inefficiency has also been critized. Asker, Collard-Wexler and De Loecker (2014) argue that, in the presence of adjustment costs in investment, idiosyncratic TFP shocks across firms naturally generate dispersion of the marginal revenue product of capital

("MRPK"). In this case, as long as adjustment costs are determined by technological factors, the dispersion of MRPK is an efficient outcome and thus the observed gaps ("wedges") in MRPK should not be taken as evidence of any misallocation. In this respect, Hsieh and Klenow (2009) neglect the distinction between technology-driven adjustment costs (such as the natural time needed to build a new plant) and wasteful frictions (such the bureaucratic procedures of authorisation that may delay the construction and activation of a new plant). From a different angle, De Loecker and Goldberg (2014) and Haltiwanger (2016) argue that a reduction in the observed wedges does not necessarily imply more market efficiency. For example, if firms had the same TFP but different initial market power due to demand characteristics, convergence of market power to the top would reduce TFPR dispersion but could be hardly considered an improvement in efficiency. While we adopt the Hsieh and Klenow (2009) interpretation for ease of comparison with the bulk of the aforementioned literature, it should nonetheless be remembered that the changing wedges in marginal revenue products and TFPR we observe in the data could be due not only to changing wasteful frictions but also changing market power across firms, changing volatility of idiosyncratic shocks or changing (technology-driven) adjustment costs.

The rest of the paper is organized as follows. Section 2 introduces the methodological approach. Section 3 presents the main features of the database. Section 4 reports our aggregate findings on productivity and misallocation. Section 5 discusses the characteristics of firms affecting misallocation. Section 6 concludes.

2. - Measuring Misallocation

We follow Hsieh and Klenow (2009; henceforth HK) in defining "misallocation" as an inefficient allocation of productive factors (labor and capital) across firms with different TFP. Inefficiency is defined with respect to the ideal allocation of factors that would result in a world of frictionless product and factor markets where consumers are free to spend their income on the firms quoting the lowest prices and owners of productive factors are free to supply the firms offering the highest remunerations. In this ideal allocation the value of the marginal product ("marginal revenue product"; henceforth MRP) of each factor is equalized across firms so that the factor's remuneration is the same for all firms. This is an equilibrium as consumers have no incentive to change their spending decision,

firms have no incentive to change their production decisions and factor owners have no incentive to change the provision of their services. It is also a stable equilibrium as any exogenous shock creating gaps in a factor's MRP across firms would trigger a reallocation of that factor from low to high MRP firms until its remuneration is again equalized across all firms.

Shocks that can create such gaps are idiosyncratic shocks that increase the TFP of some firms relative to others. As firms with higher MRPs after the shocks are able to offer higher factor remunerations at the pre-shocks equilibrium allocation, they have the opportunity to expand their operations by attracting additional factor services away from less productive firms until convergence in factors' MRPs restores the equalisation of factor remuneration across firms in the new post-shocks equilibrium. In this respect, observed gaps in factors' MRPs across firms reveal a "distorted" factor allocation across them as factors are inefficiently used. This inefficient allocation of resources is what HK call "misallocation" and its extent can be measured by the width of the observed gaps ("wedges") in factors' MRPs between firms. It implies that, though offering higher remunerations, more productive firms are not able to attract the factors they would need to grow and thus remain inefficiently small. Vice versa, though offering lower remunerations, less productive firms are inefficiently large.

Specifically, consider firm in sector facing facing demand with constant elasticity and technology captured by the constant-return-to-scale Cobb-Douglas production function

$$Y_{si} = A_{si} K_{si}^{\alpha_s} L_{si}^{1-\alpha_s}, \alpha_s \in (0,1) \quad (1)$$

where Y_{si} is output, A_{si} is TFP, K_{si} is capital input and L_{si} is labor input. The firm faces two types of frictions. First, to sell a unit of output, the firm has to produce $1/(1-\tau_{si}^{Y})$ units, where τ_{si}^{Y} is an "output distortion" creating a gap between quantity produced Y_{si} and quantity sold $(1-\tau_{si}^{Y})Y_{si}$ at delivered price P_i. Second, to usefully employ a unit of capital, the firm has to hire $(1+\tau_{si}^{K})$ units, where τ_{si}^{K} is a "capital distortion" creating a gap between capital hired $(1+\tau_{si}^{K})K_{si}$ at rental rate R and capital employed K_{si}. Examples of output distortions include government restrictions on size, transportation costs or public output subsidies or taxes. Example of capital distortions include various types of credit constraints. While there is no specific friction for labor, the output friction can be equivalently in-

terpreted as a friction that affects access to capital and labor proportionately while the capital friction can be equivalently interpreted as a friction that affects access to capital disproportionately.[1]

Due to these distortions, the firm maximizes profit

$$\pi_{si} = P_{si}\left(1-\tau_{si}^{Y}\right)Y_{si} - WL_{si} - R\left(1+\tau_{si}^{K}\right)K_{si}$$

where L_{si} is labor hired and employed at wage W. Considering the production function *(1)* and the constant demand elasticity σ, profit maximization with respect to capital and labor requires the "before-tax" marginal revenue products of capital

$$MRPK_{si} \equiv \frac{\partial\left(P_{si}Y_{si}\right)}{\partial K_{si}} = P_{si}\left(1-\frac{1}{\sigma}\right)\alpha_{s}\frac{Y_{si}}{K_{si}}$$

and labor

$$MRPL_{si} \equiv \frac{\partial\left(P_{si}Y_{si}\right)}{\partial L_{si}} = P_{si}\left(1-\frac{1}{\sigma}\right)\left(1-\alpha_{s}\right)\frac{Y_{si}}{L_{si}}$$

to satisfy

(2)
$$MRPK_{si} = \alpha_{s}\frac{\sigma-1}{\sigma}\frac{P_{si}Y_{si}}{K_{si}} = R\frac{1+\tau_{si}^{K}}{1-\tau_{si}^{Y}}$$

and

(3)
$$MRPL_{si} = \left(1-\alpha_{s}\right)\frac{\sigma-1}{\sigma}\frac{P_{si}Y_{si}}{L_{si}} = W\frac{1}{1-\tau_{si}^{Y}}$$

respectively. Expressions *(2)* and *(3)* show that, in the efficient benchmark without distortions ($\tau_{si}^{Y} = \tau_{si}^{K} = 0\ \forall \in s$), the marginal revenue products of the two fac-

[1] See *(2)* and *(3)* below.

tors are equalized across firms. Hence, at the efficient allocation the within-sector distributions of $MRPK_{si}$ and $MRPL_{si}$ exhibit zero dispersion around the means $\overline{MRPK_s}$ and $\overline{MRPL_s}$. Equalization fails, instead, in the presence of distortions, with dispersion growing with their size. Intuitively, the "after-tax" marginal revenue products are equalized across firms whereas the "before-tax" marginal revenue products may be higher for firms that face disincentives, and lower for firms that face incentives. The more so, the larger the distortions. The dispersion of $MRPL_{si}$ can thus be used as a measure of the output distortion while the (differential) dispersion of $MRPK_{si}$ can be used as a measure of the (differential) capital distortion.

The dispersions of marginal revenue products map into the dispersion of "revenue TFP". This is defined as revenue per unit of the (Cobb-Douglas) input composite

$$TFPR_{si} = P_{si}A_{si}\frac{P_{si}Y_{si}}{K_{si}^{\alpha_s}L_{si}^{1-\alpha_s}} = P\left(\frac{Y_{si}}{K_{si}}\right)^{\alpha_s}\left(\frac{Y_{si}}{L_{si}}\right)^{-\alpha_s} \tag{4}$$

in the same way as TFP represents output per unit of the (Cobb-Douglas) input composite

$$TFPR_{si} = A_{si} = \frac{Y_{si}}{K_{si}^{\alpha_s}L_{si}^{1-\alpha_s}} = \left(\frac{Y_{si}}{K_{si}}\right)^{\alpha_s}\left(\frac{Y_{si}}{L_{si}}\right)^{-\alpha_s} \tag{5}$$

Then, using *(2)* and *(3)* to substitute for Y_{si}/K_{si} and Y_{si}/L_{si} in *(4)*, one obtains

$$TFPR_{si} = \frac{\sigma}{\sigma-1}\left(\alpha_s\right)^{-\alpha_s}\left(1-\alpha_s\right)^{-(1-\alpha_s)}R^{\alpha_s}W^{1-\alpha_s}\frac{\left(1+\tau_{si}^{K}\right)}{1-\tau_{si}^{Y}}$$

or equivalently

$$TFPR_{si} = \frac{\sigma}{\sigma-1}\left(\alpha_s\right)^{-\alpha_s}\left(1-\alpha_s\right)^{-(1-\alpha_s)}\left(MRPK_{si}\right)^{\alpha_s}\left(MRPL_{si}\right)^{1-\alpha_s}$$

Hence, in the absence of distortions also $TFPR_{si}$ is the same for all firms, and its dispersion around the mean $\overline{TFPR_s}$ can be used as a measure of the overall frictions jontly due to output and capital distortions.

Under the HK assumptions, more dispersion is, in turn, associated with more inefficient allocation and lower welfare ("misallocation").[2] At the level of an individual firm *i*, $TFPR_{si}/\overline{TFPR_s} = 1$ implies that the firm is inefficiently small and should be allocated more inputs in order to be able to increase its output and decrease its price until . Conversely, $TFPR_{si}/\overline{TFPR_s} < 1$ implies that the firm is inefficiently large and should be allocated less inputs in order to be able to decrease its output and increase its price until $TFPR_{si}/\overline{TFPR_s} = 1$.

3. - Dataset Description

Our empirical analysis is based on a sample of Italian manufacturing firms drawn from the EU-EFIGE/Bruegel-UniCredit dataset (*http://bruegel.org/publications/datasets/efige/*; henceforth, simply "EFIGE dataset"). This dataset surveys the international activities of almost 15,000 firms in seven European economies (Austria, France, Germany, Hungary, Italy, Spain, United Kingdom). The survey was run in 2010 covering the period 2007-2009. For each country the sample is representative of firms above 10 employees. EFIGE researchers also combined the survey data with balance sheet information from the Amadeus database of Bureau van Dijk (itself covering the period 2001-2014), which is needed to compute MRPK, MRPL and TFPR.[3]

We restrict the analysis to Italian firms. For firm *i* in sector *s*, $MRPK_{si}$, $MRPL_{si}$ and $TFPR_{si}$ are determined according to the definitions in *(2)*, *(3)* and *(4)*. $P_{si}Y_{si}$ is measured by value added to net out intermediates that are not considered in *(4)*. The labour coefficient $(1-\alpha_s)$ is computed as the sectoral average of the firm-level ratio of total cost of labour (*i.e.* costs of employees) to value added. The capital coefficient (α_s) is the corresponding complement to one. The demand elasticity σ is set to 3 based on the median estimate reported by Head and Mayer

[2] As discussed in the Introduction, this is not necessarily the case when markups vary across firms (ASKER J., COLLARD-WEXLER A., DE LOECKER J., 2014), or firms incur adjustment costs in reacting to idiosyncratic shocks (DE LOECKER J. and GOLDBERG P., 2014; HALTIWANGER D., 2016).

[3] As firms below 10 employees are not considered, the EFIGE dataset is not representative of smaller firms. See ALTOMONTE C. and AQUILANTE T. (2012) for detailed information on the dataset and its representativeness.

(2014). All variables have been deflated using Eurostat deflators. We have trimmed the tails of the TFPR distribution, as well as firms with missing or zero labour force (18 firms), value added (15 firms), total assets (3 firms) and cost of employees (4 firms). After this data cleaning, we are left with the 2,945 firms. Summary statics across firms and sectors are described in Table 1 and 2 respectively. The former table distinguishes between two periods before and after the global financial crisis, 2001-2007 and 2008-2014. The latter table groups firms into 21 2-digit sectors according to the Nace Rev. 1.1 classification.[4]

4. - Export and Misallocation

Graph 3 depicts the distributions of log TFPR averaging across years before and after the crisis. Not all density is concentrated at the mean and, given the log transformation of TFPR, the symmetry of the distribution reveals that the share of firms with below average TFPR is substantially larger than the share of firms with above average TFPR. According to HK, this is clear evidence of misallocation, with some firms being too small and other too large relative to the optimal size. Taking into account that in our data firm size tends to increase with TFPR, the graph suggests that it is large firms that tend to be too small and small firms that tend to be too large. While this pattern holds both before and after the crisis, the leftward shift of the distribution after 2008 shows that the share of firms with below average TFPR, and therefore too large, has increased after 2008.

Graph 4 looks at the same patterns distinguishing between exporters and non-exporters. While the leftward shift is evident in both cases, it is more pronounced for non-exporters, with the differential shift driven by a drop in the fraction of firms with TFPR above the pre-crisis mean. This explains why in Graph 5 the distribution of exporters clearly dominates that of non-exporters after the crisis whereas it is very similar before the crisis.

[4] The manufacturing sectors are: "Food products and beverage"; "Textiles"; "Wearing apparel"; "Leather and leather products"; "Wood and wood products"; "Pulp, paper and paper products"; "Publishing and printing"; "Printing and reproduction of recorded media"; "Coke, refined petroleum products and nuclear fuel"; "Chemicals, chemical products"; "Rubber and plastic products"; "Other non-metallic mineral products"; "Basic metals", "Fabricated metal products"; "Machinery and equipment n.e.c."; "Manufacture of computer, electronic and optical products"; "Manufacture of electrical equipment"; "Other manufacturing"; "Repair and installation of machinery and equipment"; "Motor vehicles, trailers and semi-trailers"; "Other transport equipment"; "Furniture".

These visual patterns are confirmed in Table 3, which reports the results of a regression of log $TFPR_{si}/\overline{TFPR_s}$ on firm exporter status with sector and time fixed effects. The table shows that the TFPR ratio is larger for exporters than non-exporters and the exporter premium grows after the crisis. This implies that both before and after the crisis there is a significant misallocation of resources in favor of non-exporters (which are too large) and to the detriment of exporters (which are too small) but this misallocation between exporters and non-exporters has become more pronounced after the crisis.

To understand whether it is more output or capital distortions that underly these findings, Tables 4 and 5 respectively report the results from regressing the logs of the marginal revenue product ratios $MRPK_{si}/\overline{MRPK_{si}}$ and $MRPL_{si}/\overline{MRPL_{si}}$ on firm exporter status with sector and time fixed effects. As the exporter premium is negative in Table 4 and positive in Table 5, the inefficiently small size of exporters is due to more severe output distortions for them than for non-exporters, with less severe differential capital distortions only partially compensating. Moreover, as the impact of the latter distortions has remained virtually unchanged after the crisis, it is actually the former that are responsible for the suboptimal size of exporters becoming even more pronounced after the crisis. As we discussed, an equivalent interpretation is that frictions affecting the access to capital and labor proportionately are more severe for exporters while frictions affecting access to capital disproportionately are more severe for non-exporters, and these features have become starker after the crisis.

Finally, it is also interesting to see whether there is any misallocation *within exporters*. We check this by regressing log $TFPR_{si}/\overline{TFPR_{si}}$ on firm *i*'s revenue share of exports ("export intensity"), number of products exported and an indicator of whether the firm exports to "tough" (*i.e.* large and distant) destinations like China and India, controlling once more for sector and time fixed effects. The results of these regressions, before and after the crisis as well as overall, are reported in Table 6. None of the regressors significantly affects log $TFPR_{si}/\overline{TFPR_s}$ before the crisis. Differently, after the crisis the relation between log $TFPR_{si}/\overline{TFPR_s}$ and export intensity becomes significantly positive (and this relation is strong enough to engender an analogous positive relation over the entire period of observation). This reveals a higher degree of misallocation with the group of exporters after the crisis whereby firms obtaining a larger fraction of their revenues from exports are inefficiently smaller.

5. - Markers of Misallocation

In the previous section we have investigated how exporter status affects a firm's relative TFPR (log $TFPR_{si}/\overline{TFPR_s}$) and, conditional on exporter status, how export intensity, the number of products exported and exporting to tough destinations further affects the firm's relative TFPR. In this section we take a different perspective and investigate, instead, the relations between log log $TFPR_{si}/\overline{TFPR}$ and key firms' characteristics ("markers"), checking whether these relations are affected by exporter status and change after the crisis.

Specifically, for each potential marker Z_{sit}, we extend the regression of relative TFPR on exporter status underlying Table 3 as follows:

$$\begin{aligned} \log \frac{TFPR_{sit}}{\overline{TFPR}_{st}} &= \beta_0 + \beta_1 Exporter_{si} + \beta_2 Exporter_{si} * Post08 + \\ &+ \beta_3 Z_{sit} + \beta_4 Exporter_{sit} * Z_{sit} + \beta_5 Z_{sit} * Post08 + \\ &+ \beta_6 Exporter_{sit} * Z_{sit} * Post08 + \gamma_t + \gamma_s + \varepsilon_{sit} \end{aligned} \qquad (6)$$

where: i, s and t refer to firm, sector and year respectively; $TFPR_{sit}$ is the TFPR of firm i in sector s at time t; $\overline{TFPR_{st}}$ is average TFPR in sector s at time t; $Exporter_{si}$ is a dummy variable equal to 1 if firm i is exporting in 2008 or has been exporting before 2008, and 0 otherwise; $Post08$ is a dummy equal to 0 until 2007 and 1 from 2009; γ_t is a year dummy capturing common shocks to all firms in year t; γ_s is a sector fixed effect controlling for time-invariant sector characteristics that may influence the effect of the marker; ε_{sit} is the error term.[5]

In equation *(6)* the main variable of interest is marker Z_{sit}. Its coefficient β_3 could be zero in two different scenarios. First, it would be zero if the allocation of resources were efficient, as $TFPR_{si}/\overline{TFPR_s} = 1$ would hold for all firms. As we have already seen, this is not the case in our data. Second, even if the allocation of resources were not efficient, β_3 would be zero if Z_{sit} did not directly affect relative TFPR. In the end, only the second scenario is relevant, so we can conclude

[5] For robustness, in the regression we also enter the marker raised to the second power to allow for possible non-linearity.

[6] The export status and the markers come from the survey collected in 2008. TFPR is constructed from balance sheets data, available for 2001-2014. Both the export status and the markers are therefore treated as fixed firm characteristics, measured in 2008, while TFPR varies over time. This is likely to introduce some measurement error, possibly biasing our estimates towards zero.

that a non-zero estimate for β_3 reveals that the marker increases misallocation.[7] In particular, larger (smaller) values of the marker lead to more misallocation for positive (negative) estimated . In other words, if the estimated β_3 is positive, firms with relatively large (small) Z_{sit} are inefficiently small (large); vice versa, if the estimated β_3 is negative, firms with relatively large (small) Z_{sit} are inefficiently large (small).

In addition to the estimated coefficient β_3 of the marker (and, as before, the estimated coefficients β_1 and β_2 of exporter status before and after the crisis), we are also interested in the estimated coefficient β_4, β_5 and β_6 of the interactions involving the marker. Each interaction measures the differential combined effect associated with the corresponding variables with respect to the benchmark consisting of non-exporters in the pre-crisis period. Accordingly, the estimated β_4 tells us how the effect of marker Z_{sit} differs between exporters and non-exporters before the crisis; the estimated β_5 tells us how the effect of the marker differs before and after the crisis; coefficient β_6 tells us how any differential effect of the marker between exporters and non-exporters changes after the crisis.

We have studied several markers, from firm ownership structure to management style, from labor force composition to access to credit and internal funding, from innovation to growth factors. We have not found any significant evidence of a relation between relative TFPR on the one side and either labor force composition, ownership structure or management style on the other.[8] Hence, in what follows we focus on the remaining markers.[9]

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[7] In CALLIGARIS S. *et* AL. (2016) we show that a marker could still be linked to misallocation even if β_3 is zero, if it is related to the dispersion of the residuals of equation *(6)*. We have checked whether this is the case and found no evidence, which implies that $\beta_3 \neq 0$ is the necessary and sufficient condition for a marker to induce misallocation. We omit these results for parsimony but they are available from the authors on request.

[8] The variables we have used are: skill intensity of blue collars; share of white collars; share of people with fixed term contract; whether the firm's manager is a family member; whether the firm is family owned. Note that this does not necessarily imply that these factors are not related misallocation in general: in fact, our regressions are conditional on export status and on the pre-post crisis interactions. The results are omitted for parsimony but are available from the authors on request.

[9] Regressions are weighted by the ratio of the population-to-sample ration of the number of firms in a given industry and size class pair. The weights are included in the EFIGE dataset. For their construction, the sample was split into 33 cells, by 11 NACE-CLIO industries and 4 size classes (10-19; 20-49; 50-250; more than 250 employees) on which the stratification was carried out.

Credit and Funding

In Table 7 we study how relative TFPR is related to being financially constrained and to tapping internal or external sources of funding for investments.

The variable *Credit Constrained* is defined as equal to if in 2008 the firm was willing to increase its borrowing even at a higher interest rate and applied for more credit but was refused. The estimated coefficients in column 1 suggest that credit constraints firms are inefficiently large and less resources should be allocated to them. In this respect, the fact that they are denied more credit is efficiency enhancing. This result holds for both exporters and non-exporters and it gets stronger for the latter after 2008. This implies that after the crisis exporters denied credit are the ones with lower relative TFPR.

Turning to internal and external sources of finance, the variable *Internal Funding* and *External Funding* are defined as the percentage of investments in machines, equipment etc. financed through internal sources (intra-group included) and external sources (venture capital, bank credit, leasing and factoring) respectively over the period 2007-2009. The coefficients of *Internal Funding* and *External Funding* (β_3 in columns 2 and 3 respectively) have opposite signs (and similar magnitudes). Both signs point at misallocation: firms with a high (low) share of internally financed investment have high (low) relative TFPR and should expand, while firms with a high (low) share of externally financed investment have low (high) relative TFPR and should shrink (expand). However, despite the statistical significance of the coefficients in columns 2 and 3, their magnitude is very close to zero. These features do not differ between exporters and non-exporters and have not changed significantly after the crisis.

Innovation

The EFIGE dataset reports a number of indicators related to firms' innovation activities. In Table 8, we focus on key dimensions of innovation. First, we consider whether firms carried out any product (variable Product Inn.), process (variable Process Inn.), market (variable Mkt Inn.) or organizational (variable Organ. Inn.) innovation in the years 2007-2009. We then consider whether over the same period firms have undertaken R&D activities (variable R&D). Finally, we consider whether in the same period the firm applied for a patent, registered an industrial design or trade mark, or claimed copyright (variable *Patents*).

The results in Table 8 show no significant relation between all these markers and misallocation for the benchmark group of non-exporters in the pre-crisis pe-

riod. The exception is patents for which the negative coefficient hints at inefficiently large (small) size for applicants (non applicants). For the group of non-exporters misallocation materializes only after 2008. In particular, after the crisis non-exporters with high (low) involvement in product innovation, process innovation and R&D are inefficiently small (large). The same holds for exporters with respect to process innovation, R&D and patents before the crisis; and only with respect to process innovation and patents after the crisis. Differently, market and organisational innovations do not appear to have any relation with relative TFPR both before and after the crisis.

Growth Factors

Table 9 analyses the relation between misallocation and several "growth factors". These are markers that consider whether a firm declared it suffered from demand constraints (variable Demand Constr.), and whether it attributed its growth to: reducing production costs (variable Prod. Costs); improving product quality (variable Prod. Quality); broadening the range of products (variable Prod. Range); increasing brand recognition (variable Brand); expanding the after-sales support network (variable After-sale); or expanding the distribution network (variable Distribution).[10]

A consistent finding across types of firms and periods is the significant negative coefficient of the distribution variable: firms that attribute their growth to expanding their distribution network are inefficiently large. This holds also: before the crisis, for non-exporters attributing their growth to increasing their brand recognition and expanding their after-sales network as well as for exporters attributing their growth to reducing production costs; after the crisis, for both non-exporters and exporters suffering from demand constraints costs as well as for exporters attributing their growth to reducing production costs. Another consistent finding across firm types and periods is the lack of any relation of relative TFPR with quality and product range variables.

[10] Firms' answers to what determine their growth might depend on the market condition in which they operate ("exogenous factor") and the way they decide to compete and place themselves on the market ("endogenous factor"). Sector fixed effects partially control for the former, although the 2-digit level of aggregation might not fully capture that dimension. Nevertheless, the results are informative of the relation between the way firms compete and misallocation.

6. - Conclusion

After the decline Italian exports suffered during the 1990s relative to those of other advanced economies, there had been a significant relative recovery at the beginning of the new millennium. This positive development stopped abruptly with the global financial crisis and has not regained momentum since then.

Within this broad framework, we have analysed the evolution of productivity of Italian manufacturing firms since the early 2000s, emphasising the comparison between exporters and non-exporters. After documenting a productivity decline for both exporters, and especially non-exporters after the crisis, we have focused on the evolution of the allocation of resources across firms with different productivity and its inefficiency ("misallocation"). Our analysis of misallocation suggests that both before and after the crisis exporters, were inefficiently small whereas non-exporters were inefficiently large. This is due to distortions that reduce product and factor market access more for exporters than for non-exporters. Distortions that restrict capital more than labor market access are less severe for exporters than for non-exporters but their effects are still not strong enough to offset those of the differential severity of overall distortions. There is evidence of misallocation also within the group of exporters with firms earning a larger fraction of their revenues from exports being inefficiently smaller with respect to those relying less on foreign sales.

We have then investigated which firm characteristics ("markers") are significantly associated with misallocation comparing exporters and non-exporters pre- and post-crisis. When it comes to access to finance, we have found evidence that credit-constrained firms are too large with respect to their efficient size, so in this sense it is would seem appropriate that they are not getting funded. This finding holds for both exporters and non-exporters and it gets stronger for the latter after the crisis. As for innovation, in the case of non-exporters misallocation materializes only after 2008 when firms with high involvement in product innovation, process innovation and R&D become inefficiently small while those with low involvement in these activities become inefficiently large. The same holds for exporters with respect to process innovation, R&D and patents before the crisis, and only with respect to process innovation and patents after the crisis. Finally, turning to the perceived growth drivers, a consistent finding across types of firms and periods is that firms attributing their growth to expanding their distribution network are inefficiently large. The same holds before the crisis for non-exporters attributing their growth to increasing their brand recognition and expanding their

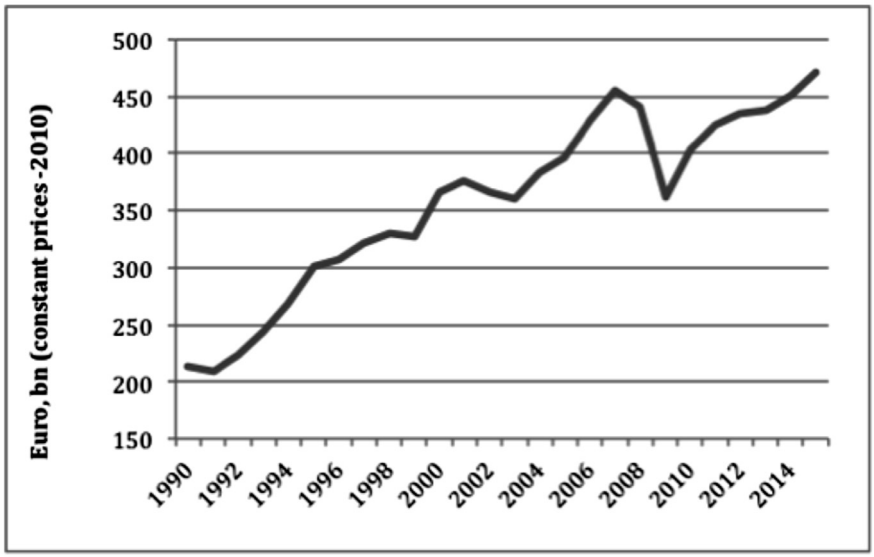
after-sales network as well as for exporters attributing their growth to reducing production costs. It also holds after the crisis for both non-exporters and exporters suffering from demand constraints as well as for exporters attributing their growth to reducing production costs.

Policies that set the incentives to balance all these firm-level features of misallocation could provide support to a recovery of Italian productivity and exports.

GRAPHS and TABLES

GRAPH 1

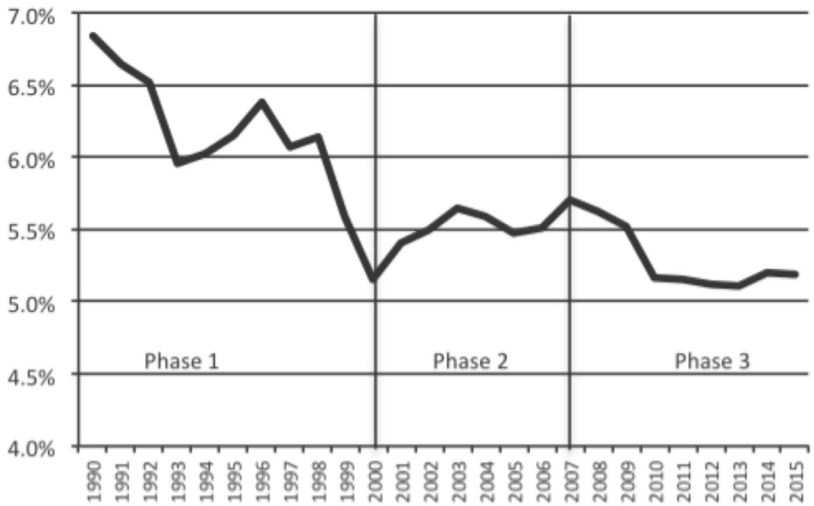
REAL EXPORTS 1990-2015
(2010 constant prices)



Source: UN-COMTRADE.

GRAPH 2

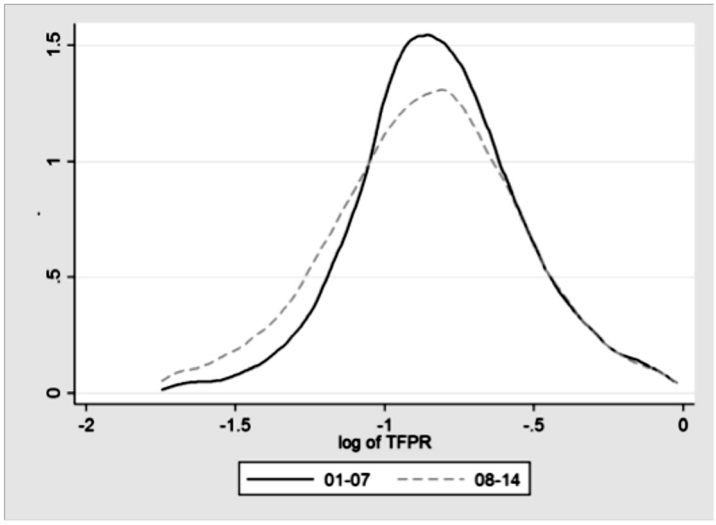
ITALIAN EXPORTS AS A SHARE OF HIGH-INCOME OECD COUNTRIES EXPORTS
1990-2015



Source: UN-COMTRADE.

GRAPH 3

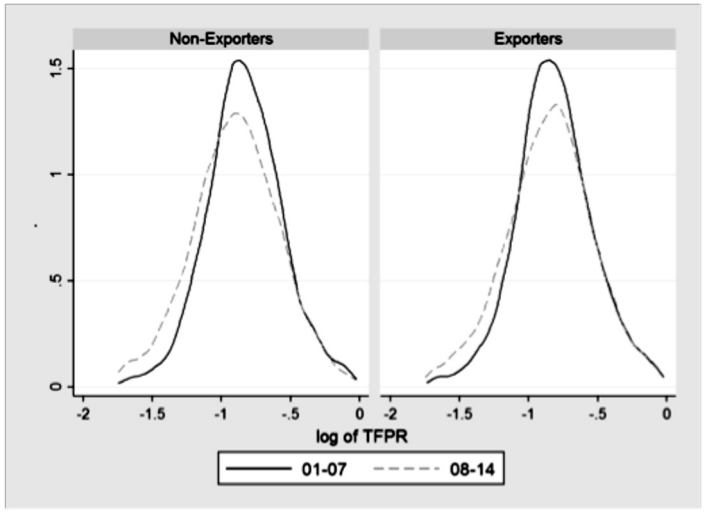
PRODUCTIVITY DISTRIBUTION OF FIRMS, AVERAGE *PRE- vs. POST*-2008



Source: EFIGE dataset.

GRAPH 4

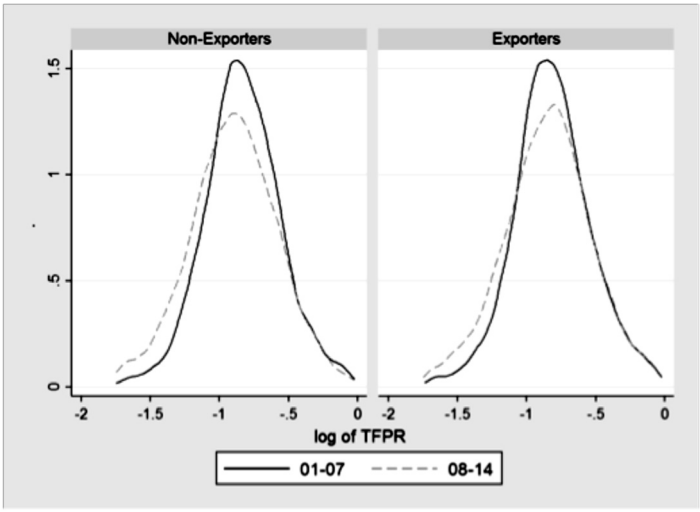
PRODUCTIVITY DISTRIBUTION OF FIRMS BY EXPORT STATUS, AVERAGE *PRE- vs. POST*-2008



Source: EFIGE dataset.

GRAPH 5

PRODUCTIVITY DISTRIBUTION OF FIRMS BY PERIOD, EXPORTERS *vs.* NON-EXPORTERS



Source: EFIGE dataset.

TABLE 1

DESCRIPTIVE STATISTICS

	Value added	Capital stock	N. employees	N. firms	Obs.
Overall	26.25	106.05	43.79	2,945	23,825
Non-exporters	13.59	49.94	26.31	775	5,865
(% of total)	12.7%	11.6%	14.8%	26.3%	
Exporters	30.39	124.37	49.49	2,170	17,960
(% of total)	87.3%	88.4%	85.2%	73.7%	
2002-2007	28.044	106.995	46.424	2,855	11,691
(% of total)	0.524	0.495	0.52	0.9694	
2009-2014	24.528	105.14	41.247	2,689	12134
(% of total)	0.476	0.505	0.48	0.9131	

Note: Main variables expressed both in absolute values and in percentages of the total. Absolute values of value added and Capital stock per employee are expressed in thousand of 2010 euros.

TABLE 2

DESCRIPTIVE STATISTICS, BY SECTOR

	Value added	Capital stock	N. employees	N. firms	Obs.
Overall	26.25	106.05	43.79	2,945	23,825
Food products and beverages	21.78	116.99	33.37	234	2,084
(% of total)	7.3%	9.6%	6.7%	7.9%	
Textiles	22.15	91.19	42.71	192	1,564
(% of total)	5.5%	5.6%	6.4%	6.5%	
Leather and leather products	13.051	54.876	34.351	108	756
(% of total)	0.016	0.016	0.025	3.7%	
Leather and leat	13.633	55.137	30.431	113	839
(% of total)	0.018	0.018	0.024	3.8%	
Wood and wood products	12.99	59.83	28.07	87	638
(% of total)	1.3%	1.5%	1.7%	3.0%	
Pulp, paper and paper products	36.81	164.71	46.85	70	566
(% of total)	3.3%	3.7%	2.5%	2.4%	
Printing and reproduction of recorded material	16.586	56.629	30.593	102	566
(% of total)	0.02	0.017	0.022	3.5%	
Coke, refined petroleum products	160.881	1344.453	81.5	7	60
(% of total)	0.015	0.032	0.005	0.2%	
Chemicals, chemical products	67.87	306.51	88.76	104	906
(% of total)	9.8%	11.0%	7.7%	3.5%	
Rubber and plastic products	29.02	107.96	50.96	166	1,412
(% of total)	6.6%	6.0%	6.9%	5.6%	
Other non-metallic mineral products	23.829	101.694	40.372	165	1,289
(% of total)	0.049	0.052	0.05	5.6%	
Basic metals	75.733	319.68	98.505	74	638
(% of total)	0.077	0.081	0.06	2.5%	
Fabricated metal products	17.20	58.41	30.72	603	4,852
(% of total)	13.3%	11.2%	14.3%	20.5%	
Computer, electronic and optical products	31.70	94.84	55.94	56	439
(% of total)	2.2%	1.6%	2.4%	1.9%	
Electrical equipment	28.204	100.463	48.581	142	1,139
(% of total)	0.051	0.045	0.053	4.8%	
Machinery and equipment n.e.c.	29.86	106.799	49.055	371	3,106
(% of total)	0.148	0.131	0.146	12.6%	
Motor vehicles, trailer	31.61	115.56	56.67	43	331
(% of total)	1.7%	1.5%	1.8%	1.5%	
Other transport equipment	33.00	153.04	60.15	31	331
(% of total)	1.3%	1.5%	1.4%	1.1%	

./.

continued TABLE 2

	Value added	Capital stock	N. employees	N. firms	Obs.
Other manufacturing	19.688	78.903	41.412	209	1,604
(% of total)	0.05	0.05	0.064	7.1%	
Repair and installation of machinery	31.68	98.024	57.578	68	590
(% of total)	0.03	0.023	0.033	2.3%	

Note: Main variables expressed both in absolute values and in percentages of the total. Absolute values of value added and Capital stock per employee are expressed in thousand of 2010 euros.

TABLE 3

RELATIVE TFPR AND EXPORT STATUS

	(1) Whole period	*(2)* *Pre*-2008	*(3)* *Post*-2008
Exporter	0.0294***	0.0169*	0.0409***
	(0.00917)	(0.00944)	(0.0115)
Observations	27,751	13,541	14,210
R-squared	0.003	0.002	0.004
Sector FE	YES	YES	YES
Year FE	YES	YES	YES

Note: Dependent Variable: Relative TFPR (log). ***, **, * significant values at 99, 95, 90%. Clustered (by firm) standard errors in parenthesis.

TABLE 4

RELATIVE MRPK AND EXPORT STATUS

	(1) Whole period	*(2)* *Pre*-2008	*(3)* *Post*-2008
Exporter	-0.178***	-0.182***	-0.175***
	(0.0225)	(0.0236)	(0.0253)
Observations	27,751	13,541	14,210
R-squared	0.030	0.034	0.027
Sector FE	YES	YES	YES
Year FE	YES	YES	YES

Note: Dependent Variable: Relative MRPK (log). ***, **, * significant values at 99, 95, 90%. Clustered (by firm) standard errors in parenthesis.

TABLE 5

RELATIVE MRPL AND EXPORT STATUS

	(1) Whole period	*(2)* *Pre*-2008	*(3)* *Post*-2008
Exporter	0.108***	0.0920***	0.123***
	(0.0135)	(0.0133)	(0.0164)
Observations	27,751	13,541	14,210
R-squared	0.018	0.016	0.020
Sector FE	YES	YES	YES
Year FE	YES	YES	YES

Note: Dependent Variable: Relative MRPL (log). ***, **, * significant values at 99, 95, 90%. Clustered (by firm) standard errors in parenthesis.

TABLE 6

WITHIN EXPORTERS RELATIVE TFPR

	(1) Whole period	*(2)* *Pre*-2008	*(3)* *Post*-2008
Export Intensity	0.000483**	0.000123	0.000834***
	(0.000194)	(0.000201)	(0.000248)
Number of products	0.00106	0.00488	-0.00279
	(0.00474)	(0.00500)	(0.00601)
Export to China/India	0.000494	-9.93e-05	0.00107*
	(0.000524)	(0.000496)	(0.000640)
Observations	17,667	8,740	8,927
R-squared	0.008	0.006	0.013
Sector FE	YES	YES	YES
Year FE	YES	YES	YES

Note: Dependent Variable: Relative TFPR (log). ***, **, * significant values at 99, 95, 90%. Clustered (by firm) standard errors in parenthesis.

TABLE 7

MARKERS OF RELATIVE TFPR: CREDIT AND FUNDING

Marker Variable *(Z):*	*(1)* Credit Constrained	*(2)* Internal Funding	*(3)* External Funding
Non-exporters, *pre*-2008 (β_3)	-0.0940***	0.0006642***	-0.000552***
	(0.0175)	(0.000206)	(0.000203)
Non-exporters, *post*-2008 ($\beta_3 + \beta_5$)	-0.0635*	0.0010662***	-0.000965***
	(0.0225)	(0.000254)	(0.0002548)
Exporters, *pre*-2008 ($\beta_3 + \beta_4$)	-0.0736***	0.0006473***	-0.0006076***
	(0.0103)	(0.0001177)	(0.0001185)
Exporters, *post*-2008 ($\beta_3 + \beta_4 + \beta_5 + \beta_6$)	-0.1029***	0.0006201***	-0.0005761***
	(0.0131)	(0.0001466)	(0.000147)
Non-exporters, *pre- vs. post*-2008 (β_5)	0.0305	0.000402*	-0.000413*
	(0.0212)	(0.000233)	(0.000233)
Exporters, *pre- vs. post*-2008 ($\beta_5 + \beta_6$)	-0.0293**	-0.0000272	0.0000315
	(0.0122)	(0.0001297)	(0.0001295)
Exporters *vs.* non-exporters, pre-2008 (β_4)	0.0204	-.0000169	-.0000559
	(0.0203)	(0.000236)	(0.000233)
Exporters *vs.* non-exporters, post-2008 ($\beta_4 + \beta_6$)	-0.0394	-0.0004461	0.000389
	(0.0260)	(0.000292)	(0.0002929)
Change in exporters *vs.* non-exporters (β_6)	-0.0598**	-0.000429	0.000445*
	(0.0244)	(0.000267)	(0.000267)
Observations	27,751	22,811	22,811
R-squared	0.020	0.015	0.013
Sector FE	YES	YES	YES
Year FE	YES	YES	YES

Source: EFIGE dataset.
Note: Dependent Variable: Relative TFPR (log). ***, **, * significant values at 99, 95, 90%; clustered (by firm) standard errors in parenthesis.

TABLE 8

MARKERS OF RELATIVE TFPR: INNOVATION ACTIVITIES

Marker Variable *(Z):*	*(1)* Product Inn.	*(2)* Process Inn.	*(3)* Mkt Inn.	*(4)* Organ. Inn.	*(5)* R&D	*(6)* Patents
Non-exporters, *pre*-2008 (β_3)	0.0177	0.0225	-0.0296	-0.0242	0.0131	-0.0493*
	(0.0182)	(0.0165)	(0.0195)	(0.0192)	(0.0178)	(0.0300)
Non-exporters, *post*-2008 ($\beta_3 + \beta_5$)	0.0519**	0.0679***	0.0370	0.0153	0.0670***	0.0272
	(0.0218)	(0.0194)	(0.0254)	(0.0213)	(0.0205)	(0.0312)
Exporters, *pre*-2008 ($\beta_3 + \beta_4$)	-0.0017	0.0333***	0.0003473	0.0041	0.0253***	0.0216**
	(0.0116)	(0.0092)	(0.0094762)	(0.0098)	(0.0097)	(0.0101)
Exporters, *post*-2008 ($\beta_3 + \beta_4 + \beta_5 + \beta_6$)	0.0012	0.0335**	0.0021	0.0119	0.0365**	0.0160
	(0.0232)	(0.0113)	(0.0114)	(0.0118)	(0.0120)	(0.0123)
Non-exporters, *pre- vs. post*-2008 (β_5)	0.0342*	0.0455**	0.0666***	0.0395**	0.0540***	0.0765**
	(0.0201)	(0.0178)	(0.0232)	(0.0197)	(0.0188)	(0.0326)
Exporters, *pre- vs. post*-2008 ($\beta_5 + \beta_6$)	0.0029	0.00017	0.0017	0.0078	0.0113	-0.0055
	(0.0103)	(0.01027)	(0.0105)	(0.0109)	(0.0105)	(0.0112)
Exporters *vs.* non-exporters, pre-2008 (β_4)	-0.0194	0.0108	0.0300	0.0283	0.0122	0.0709**
	(0.0204)	(0.0188)	(0.0216)	(0.0215)	(0.0201)	(0.0314)
Exporters *vs.* non-exporters, post-2008 ($\beta_4 + \beta_6$)	-0.0507**	-0.0344	-0.0350	-0.0034	-0.0305	-0.0112
	(0.0246)	(0.0224)	(0.0278)	(0.0243)	(0.0237)	(0.0334)
Change in exporters *vs.* non-exporters (β_6)	-0.0312	-0.0453**	-0.0649**	-0.0317	-0.0427**	-0.0820**
	(0.0225)	(0.0206)	(0.0255)	(0.0225)	(0.0215)	(0.0345)
Observations	27,751	27,751	27,751	27,751	27,751	27,751
R-squared	0.004	0.008	0.004	0.004	0.007	0.004
Sector FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Source: EFIGE dataset.
Note: Dependent Variable: Relative TFPR (log). ***, **, * significant values at 99, 95, 90%; Clustered (by firm) standard errors in parenthesis.

TABLE 9

MARKERS OF RELATIVE TFPR: GROWTH FACTORS (BASED ON FIRMS' PERCEPTION)

Marker Variable *(Z):*	(1) Demand Constr.	(2) Prod. Costs	(3) Prod. Quality	(4) Prod. Range	(5) Brand	(6) After-sale	(7) Distribution
Non-exporters, *pre*-2008 (β_3)	-0.0152	-0.0186	-0.00257	-0.0198	-0.0842***	-0.0473*	-0.0503***
	(0.0165)	(0.0168)	(0.0160)	(0.0178)	(0.0222)	(0.0242)	(0.0165)
Non-exporters, *post*-2008 ($\beta_3 + \beta_5$)	-0.0384*	-0.0012	0.0044	-0.0052	-0.0151	-0.0416	-0.0440**
	(0.0198)	(0.0207)	(0.0196)	(0.0210)	(0.0263)	(0.0314)	(0.0217)
Exporters, *pre*-2008 ($\beta_3 + \beta_4$)	-0.0109	-0.0216**	0.0078	0.0051	-0.0021	-0.0050	-0.0228**
	(0.0096)	(0.0100)	(0.0094)	(0.0094)	(0.0104)	(0.0115)	(0.0093)
Exporters, *post*-2008 ($\beta_3 + \beta_4 + \beta_5 + \beta_6$)	-0.0472***	-0.0364***	0.0073	0.0020	-0.0175	-0.0334**	-0.0427***
	(0.0115)	(0.0120)	(0.0117)	(0.0117)	(0.0131)	(0.0161)	(0.0113)
Non-exporters, *pre- vs. post*-2008 (β_5)	-0.0232	0.0174	0.00697	0.0146	0.0691***	0.00562	0.00628
	(0.0184)	(0.0186)	(0.0180)	(0.0195)	(0.0254)	(0.0264)	(0.0198)
Exporters, *pre- vs. post*-2008 ($\beta_5 + \beta_6$)	-0.0364***	-0.0147	-0.0005	-0.0031	-0.0153	-0.0284*	-0.0199*
	(0.0103)	(0.0108)	(0.0105)	(0.0104)	(0.0111)	(0.0146)	(0.0102)
Exporters *vs.* non-exporters, pre-2008 (β_4)	0.00434	-0.00300	0.0104	0.0249	0.0821***	0.0423	0.0275
	(0.0191)	(0.0195)	(0.0185)	(0.0202)	(0.0244)	(0.0267)	(0.0189)
Exporters *vs.* non-exporters, post-2008 ($\beta_4 + \beta_6$)	-0.0088	-0.0351	0.0029	0.0072	-0.0024	0.0082	0.0013
	(0.0229)	(0.0239)	(0.0229)	(0.0240)	(0.0292)	(0.0352)	(0.0245)
Change in exporters *vs.* non-exporters (β_6)	-0.0132	-0.0321	-0.00745	-0.0177	-0.0845***	-0.0340	-0.0262
	(0.0211)	(0.0215)	(0.0208)	(0.0221)	(0.0277)	(0.0301)	(0.0223)
Observations	26,831	27,737	27,737	27,737	27,737	27,737	27,737
R-squared	0.007	0.006	0.004	0.004	0.005	0.005	0.008
Sector FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES

Note: Dependent Variable: Relative TFPR (log). ***, **, * significant values at 99, 95, 90%; Clustered (by firm) standard errors in parenthesis.

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