

Productivity and the international firm: Is it all about the use of inputs?

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Abstract

Better performances of multinational firms and exporters with respect to domestic firms have been widely documented in the literature, but the sources of these premia have largely remained a black box. Theoretical models considers them as the results of a random draw, but we know that firm productivity is the result of purposeful investments. In particular, recent empirical contributions have noted that productivity differences among firms can be explained by different managerial practices, I.T. and organizational capital. Using an original dataset on Italian firms, we find that the higher use of knowledge workers (such as R&D workers, as well as workers in managerial and clerical occupations) explain some of the TFP premium of exporters and multinational firms. However, our results suggests that is not only a matter of *which* inputs are used, but also *how* they are used. In fact, allowing for different returns to inputs (i.e. a different shape of the production function) between domestic and international firms, we explain all of the productivity premium and beyond. This is the result of the fact that international firms exhibit higher returns to production workers, and, among them, multinationals firms use capital and managers better than domestic firms. This is consistent with the idea that international firms have superior organizational capabilities and managerial practices.

JEL Classification: E22, L22, M2, O3

Key words: productivity, tfp, competition, management, mode of internationalization

1. Introduction

Recent theoretical and empirical literature has widely documented a superior performance of international firms: multinationals are more productive than exporters, which in turn outperform purely domestic firms.¹ The theoretical literature have left these premia in a black box and considered them as the result of a random draw, which assign different productivity to different firms, and thus induce the self-selection of some of them (the most productive) into export or FDI (Helpman, Melitz and Yeaple, 2004). This paper aims at exploring this black box. In particular, we test whether, and to what extent, heterogeneity in firms' TFP can be attributed to the fact that these firms are more innovative and use more knowledge workers (such as R&D workers, as well as workers in managerial and clerical occupations), or if this rather a matter of how they use their inputs. This hypothesis is linked to the fact that workers and capital in may be more productive in international firms, either because of their higher quality, or due to the firm superior managerial practices and organizational capital.

The superior managerial and organizational performance of international firms has been long recognized by the international business literature, which has stressed the role of such intangible assets as a source of the ownership advantage which motivates foreign expansion decisions (Dunning, 1993). Similarly, international trade scholars have argued that managerial practices and organizational capital are non-rival inputs which can be used in multiple plants, giving rise to firm-level economies of scale and thus fostering multinational production, as opposed to exports (Markusen, 2005). The role of firms' organizational capital and management capabilities independently from ownership in explaining TFP differentials among firms, have instead been attracted considerable interest of recent empirical studies, which have found evidence consistent with the existence of complementarities between the use of Information Technology (I.T.) and workplace and management practices and firms' productivity.²

Despite an extensive literature on the links between managerial and organizational capital and internationalization, between the mode of internationalization and productivity and between productivity and organization, very limited evidence has

¹ See Greenaway and Kneller, 2006 and especially section 2 for a review of the empirical literature supporting this ranking.

² Section 2 surveys the empirical evidence on these aspects.

been provided on the actual contribution of managerial and organizational capital and international firms productivity premia. To the best of our knowledge, only Bloom, Sadun and Van Reenen (2007) have tried to explain higher productivity of U.S. multinationals in the UK in terms of their organizational capital. They find that the higher TFP is mainly due to the higher returns to their I.T. capital, and claim that this pattern may be explained by the fact that the way US firms are organized allows them to use new technologies more efficiently.

Using an original dataset on Italian firms³, we show that not only international firms use more capital and knowledge workers (such as managers and clerical workers), but they use them better. Tfp premia for international firms shrink if we account for the higher use of knowledge workers in international firms. However, the TFP premium of internationalized firms can be the result of a misspecification of the production function: better organization and management may induce a higher return to capital and labor, which drives firms' internationalization, thus changing the shape of the production function, rather than shifting it upwards (as suggested by differences in TFP). Hence, we estimate a production function using detailed information on labour inputs, namely the number of managers, clerical and production workers. This allows us to estimate whether internationalized firms exhibit higher returns to management and capital inputs, and if this captures differences in TFP estimated using a standard approach, imposing common input elasticities across all firms. When we allow for different production function between domestic and international firms, we find that production workers are more productive in international firms and multinationals use capital and managers better than domestic firms.

The rest of the paper proceeds as follows: after a brief review of the different strands of the literature, in section 3 we set our empirical strategy. Section 4 describes the data. Section 5 presents the main results and section 6 concludes.

2. Brief review of the literature (to be completed)

We rely on two different strand of the literature which, to our knowledge, have not been explicitly put together. The first line is that on different productivity of firms with different degree of international involvement. Multinationals outperform export

³ The dataset is described in section 4 and, more in detail, in the data appendix.

oriented firms, which in turn dominate purely domestic firms. This ranking has been confirmed, for example, by Girma, Gorg and Strobl (2004) for Ireland; Girma, Kneller and Pisu (2003) for the U.K.; Arnold and Hussinger (2005) for Germany; Castellani and Zanfei (2007) for Italy. The productivity premium of exporters has been documented in a number of studies (see Wagner, 2007 for a review) and recently confirmed by comparative studies on many countries (ISGEP, 2007 and Mayer and Ottaviano, 2007). Although evidence is not as extensive as in the case of exports, there are also several empirical works documenting that multinationals tend to outperform firms with no investment abroad as in the case of Doms and Jensen (1998) for the US, Barba Navaretti and Castellani (2004) for Italy, Criscuolo and Martin (2003) for the UK, De Backer and Sleuwaegen (2003) for Belgium, Pfaffermayer and Bellak (2002) for Austria.

The second line of literature we refer to emphasizes the role of managerial capabilities and organizational capital in explaining differences in TFP for different firms. For example, Black and Lynch (2001) show that workplace practices and I.T. had a significant impact on TFP of a sample of US firms over the 1987-1993 period. Bloom and Van Reenen (2007) report a similar impact of management practices on productivity from 732 medium-sized manufacturing firms in the US, France, Germany and the UK. Bresnahan, Brynjolfsson and Hitt (2002) find positive effects of a measure of organizational capital (constructed from survey data as a linear combination of questions on team working and workers' authority) on productivity both directly and through its interaction with capital. Similarly, Brynjolfsson and Hitt (2002) find a positive and sizeable effect of information technology on productivity over long periods (5-7 years) in a sample of US firms and claim that the observed contribution of computerization is accompanied by relatively large and time-consuming investments in complementary inputs, such as organizational capital, that may be omitted in conventional calculations of productivity.

In what follows we put together these two strands to assess whether and to what extent the observed productivity differences of international firms can be attributed to different managerial capabilities and organizational capital.

3. Empirical modeling strategy

Our empirical modeling strategy follows four steps.

First, we estimate a standard production function (in logs), as in equation (1)

$$y_{it} = \alpha k_{it} + \beta l_{it} + u_{it} \quad (1)$$

where y , k and l denote respectively (the log of) value added, fixed capital and number of employees. We assume that the error term u_{it} takes the following form:

$$u_{it} = c + \delta M_i + \gamma X_i + \eta_j + \theta_p + \kappa_s + \nu_t + \varepsilon_{it} \quad (2)$$

where M is a dummy equal to one for multinational firms, X is a dummy for non-multinational exporters, η , θ , κ , and ν denote sector, province, size class and time fixed effects⁴, while ε , the usual disturbance term, is (the log of) total factor productivity (TFP).

By substituting (2) into (1) we get the production function (3), which we at first estimate by OLS

$$y_{it} = c + \alpha k_{it} + \beta l_{it} + \delta M_i + \gamma X_i + \eta_j + \theta_p + \kappa_s + \nu_t + \varepsilon_{it} \quad (3)$$

The coefficients δ and γ tell us whether, once controlling for sector, location, size and time effects, on average international firms get higher TFP than domestic firms, as documented by several (many) recent studies so far⁵.

Second, in order to capture the sources of any TFP premium on the international firm, we add to equation 3 a vector of firms' characteristics correlated with both TFP and internationalization status (Z),

$$y_{it} = c + \alpha k_{it} + \beta l_{it} + \delta M_i + \gamma X_i + \phi Z_{it} + \eta_j + \theta_p + \kappa_s + \nu_t + \varepsilon_{it} \quad (4)$$

By adding such controls, we expect that the TFP differentials would eventually vanish, since all differences between international and national firms would be accounted for by the additional regressors, so that δ and γ would become non-significantly different from zero. In other words, we assume that both the international and the national firms have the same shape of the production function, but the international firms (either exporters or multinationals) have some specific characteristics which shifts the production function upwards.

We then relax the assumption of a common production function for international and national firms and allow for different returns to capital and labor. In order to do so,

⁴ We account for these effects by introducing a vector of dummy variables. We also account for sectoral time trends, by interacting sector and time dummies.

⁵ See Section 2 for a review

we modify equation (3), to account for the interaction of l and k with the international status dummies:

$$y_{it} = c + \alpha k_{it} + \alpha_1(k_{it} * M_i) + \alpha_2(k_{it} * X_i) + \beta l_{it} + \beta_1(l_{it} * M_i) + \beta_2(l_{it} * X_i) + \delta M_i + \gamma X_i + \eta_j + \theta_p + \kappa_s + \nu_t + \varepsilon_{it} \quad (5)$$

The estimated parameters α_1 and α_2 capture the differential return to capital of respectively multinational firms and non-multinational exporters relative to the return to capital of national firms. Similarly, β_1 and β_2 measure the differential returns to labor of international firms. The coefficients δ and γ will then measure any difference in TFP between multinational firms, exporters and national firms, once differences in the shape of the production function are accounted for.

Finally, we take into account additional unobserved heterogeneity, which may bias the coefficients of the production function, by applying the within-group transformation to equation (5). Unfortunately, this will not allow us to estimate δ and γ , since, in our data, M and X are time invariant.

4. Data

Our empirical analysis is carried out on an original dataset obtained by matching and merging data from the 8th and 9th waves of a survey carried out by Capitalia and the ICE-Reprint dataset.

The two Capitalia surveys cover respectively years 1998-2000 and 2001-2003 and provide detailed qualitative and quantitative information on a large sample of Italian manufacturing firms. In this paper we exploit partially the information contained in the data, by focusing on firms' characteristics such as the innovativeness⁶, investment in machinery and equipment as well as in ICT, R&D intensity, the educational profile of the workforce⁷, and the occupational profile (managers, clerks and production workers). Balance sheet information are also available (with some missing data) for the 1998-2003 sample period. If we confine attention to 2001-2003, we have information for the 4,277 firms included in the 9th survey; out of this sample, 2,097 firms are also in the previous survey (the one covering the period 1998-2000) and can thus be observed over

⁶ Innovativeness is captured by three dummies taking value 1 if firms carried out product, process and organizational innovation over the past three years

⁷ The survey has data on the share of workers with a bachelor degree 'laurea' or with a secondary school diploma

a six-year period. As shown in Table 1, due to missing values and cleaning procedures⁸, we end up with up to 16,227 firm-year observations (10,549 when considering only firms included in both surveys).

INSERT TABLE 1 HERE

The Capitalia Survey however only allows us to disentangle domestic firms from firms selling part of the production abroad through exports but does not provide data on the extent of the internationalization of production. Hence, we extract further information from the ICE- Reprint dataset which allows us to identify Italian multinationals⁹. Both indicator of international status (i.e. being an exporter and/or being a multinational firm) are referred to 2001¹⁰.

INSERT TABLE 2 HERE

As illustrated in Table 2, on average, about 10% of firms are multinationals, 65% are non-multinational exporters, while one-fourth of the firms are not international (purely domestic firms). Table 3 provides information on some basic characteristics of our sample, according to the international status of the firms.

INSERT TABLE 3 HERE

These descriptive statistics confirm that, in many dimensions, firms rank according to their degree of internationalization: multinationals are the largest, the most productive, have a higher capital intensity, are the most likely to be limited company (Ltd), to introduce innovations, to invest in machinery, equipment and ICT, have the

⁸ We have dropped ‘anomalous’ firm-year observations. ‘Anomalous’ observations have been defined as values for inputs and output which exceeded the median for each firm by three times or where lower than one-third the median. We perform robustness checks by excluding potential outliers, defined as firm-year observations in the 1st and 99th percentile.

⁹ See the Data Appendix for a description of the ICE-Reprint dataset.

¹⁰ For the sub-sample of firms included both in the 8th and 9th survey, information on the export status in 1998 was also available. Given the high degree of persistence in exporting (92% of firms exporting in the 8th survey are exporters also in the 9th), we choose to use a time invariant indicator for the export status. Therefore, we identify the international status of the sample firms in 2001 and assume it as time-invariant throughout the period.

highest share of workers engaged in R&D, and employ more managers and clerks. Non-international (domestic) firms, on the other hand, have lower values for all of these characteristics, while non-multinational exporters stand in between. Hence, the international status seems to be correlated with productivity and with a number of other characteristics. In the following, we test whether differences in productivity associated with a different international status persist once sector, region, size and time effects are accounted for. Furthermore, we investigate whether differences in innovation, investment behaviour, legal status, R&D and managerial intensity can explain such productivity premia.

5. Results

We estimate an augmented production function, as in equation (3) and (4), where output is measured by the log of value added (deflated using 2-digit production price indexes) and inputs are the log of tangible fixed assets (net of depreciation and deflated using the price index of machinery and equipment) and the log of the number of employees. We allow different average TFP for international and non international firms, by estimating different intercepts for multinational firms and non-multinational exporters (relative to the baseline category of non exporting firms). Results are reported in Table 4.

INSERT TABLE 4 HERE

The estimates reported in column (1) are consistent with the descriptive statistics of Table 3, and support the idea that Italian multinationals and non-multinational exporters are more productive (in terms of TFP) than domestic firms, after controlling for sector, region, size and time differences. We then control for further sources of heterogeneity in productivity, which, mentioned above, we claim to be correlated with the international status and report the results in columns (2)-(5). As can be easily seen (column 2), differences in the innovative and investing behaviour are not statistically significant and do not help explaining differences in productivity between firms with

different degrees of international engagement¹¹. The numerical values of coefficients on the multinational firm and non-multinational exporter dummies are virtually unchanged, after accounting for product, process or organizational innovation, and investment (either in machinery and equipment or in ICT).¹² The legal status (captured by a dummy equal to 1 for limited liability companies) and the share of workers engaged in R&D, on the other hand, are positively associated with firm productivity, and their inclusion allows to explain some of the productivity premia of international firms, which drop by some 20% when one of the two variables is added (column (3) and (4)). However, the key variables in explaining the differences in productivity between international and non-international firms have to do with the presence of knowledge workers and the organization of the firm. In fact, once differences in the share of managers and clerks are accounted for, the TFP premia slide by 50% (column 5). In the case of exporters, after controlling for the share of managers and clerks in total employment, the productivity premium with respect to non-international firm drops to 2.5% and becomes barely significantly different from zero. The TFP premium of multinational firms, on the other hand, even if its numerical value is substantially lower, remain sizeable (around 6.5%).

Robustness checks confirm that significant productivity premia for international firms are found also in the sub-sample of firms included both in the 8th and 9th survey (column (6)), or confining our attention to 2001-2003 period, and dropping observations with the highest/lowest values in output and inputs.

The idea that differences in the use of knowledge workers helps explaining productivity differences between international and non-international firms is confirmed in Table 5, where we split the labour inputs into three components: managers, clerks and production workers. Column (1) shows that, by allowing different returns to the different type of workers, multinational firms are about 7% more productive than non international firms, while non-multinational exporters are not significantly more productive than the baseline group. In other words, results are consistent with the idea that the higher use of managers and other non-production workers in exporting versus non-exporting firms is strongly associated with the productivity premium for the latter.

¹¹ This result contrasts with some previous empirical finding.

¹² Since it is likely that all these dummies are strongly correlated, we also run regressions with one dummy at the time (available upon request), but results do not change.

This does not hold for multinational firms, which, even accounting for their higher use of non-production workers, are more productive than exporters and non-international firms. We claim that this productivity premium has to do with the ‘quality’ of inputs used and the way they are organized. To test this hypothesis, we allow the output elasticity of labour and capital inputs vary across international and non-international firms, as illustrated in equation (5). In other words, while above we tested to what extent the higher intensity in the use of knowledge workers in international firms may shift production function upwards, therefore explaining TFP differences, we now test whether the shape of the production function is different in international firms.

We first estimate equation 5 by OLS, controlling for sector, time, region and size effects. This allows us to estimate the conditional productivity differences for the international firms; however the production function coefficients may be biased due to the correlation of input use and productivity. To correct for this possible bias, we re-estimate equation (5) using a within-group estimator (fixed-effect model). Unfortunately, this does not allow us to estimate the coefficients associated to the (time-invariant) international status dummies.

The results reported in column (2) are striking. Once we allow for different production functions for Italian multinationals, non-multinational exporters and non-internationalized firms, we find that TFP in international firms is (significantly) lower than in non-international ones. This suggests that the different shape of the production function is responsible for the higher observed TFP of exporters and multinational firms. In other words, it is not only that international firms use more capital and more knowledge workers, but they pick and use them better. Columns (3) and (4) shed further light on this, by allowing different returns on the labor and capital inputs, respectively. Results support the idea that allowing different returns to labor alone would make the TFP premium of international firms not significantly different from zero, while once we take into account that capital may be more productive in Italian multinationals and exporters, TFP premium turns negative and significant.¹³ It is worth mentioning, however, that considering the higher size and capital intensity which characterizes, on

¹³ This result is consistent with Bloom, Sadun and Van Reenen (2007) who find that, once controlling for the higher productivity in the use of IT capital, multinational firms (and U.S. multinationals in particular) are not more productive than U.K national firms.

average, the international firms, the net effect is generally still positive.¹⁴ If we consider the sign of the capital and labour coefficients for international firms, as opposed to non-international ones, OLS estimates suggest that capital is relatively more productive in both Italian multinationals and exporters, while managers and non-production workers appear to be less productive. These results may be affected by correlation between the use of inputs in international firms and their TFP levels, which in fact is the error term in our regression. Under these circumstances the estimated coefficients may well be biased. The within-group transformation should allow us to overcome, at least partially, this problem, by wiping out individual time-invariant heterogeneity in TFP levels. In fact, results from the fixed effects estimation are significantly different from the ones obtained with OLS. In particular, we find that non-production workers are more productive both in Italian multinational firms and non-multinational exporters, capital and managers are more productive in multinationals, while clerks are more productive in non-multinational exporters.¹⁵ These results are in line with our prior expectations. The higher productivity of non-production workers in international firms is consistent with the idea that these firms have higher quality products and more sophisticated production processes which require relatively more skilled (and thus more productive) blue-collar workers. The higher productivity of capital and management in Italian multinational firms is consistent with their superior organizational and managerial ability. This is part of a so-called “ownership advantage”, since knowledge can be transferred at relatively low-cost within the firms and across national borders to foreign affiliates. At this stage, we cannot ascertain to what extent this higher productivity is due a better selection of managers and to more technologically advanced capital, or to a better organization, which integrates capital and managers more efficiently (for example, creating an organizational structure and incentive schemes which provides higher motivation to the managers). Bloom et al. (2007), explaining why the return to

¹⁴ For example, computations based on column 4 of Table 4 reveal that for only 15% of multinationals and 30% of non-multinational exporters predicted TFP would actually be lower than the average domestic firm.

¹⁵ Robustness checks reported in columns (7)-(9) of Table 4 suggest that results remain fairly stable if we restrict our analysis to the firms which were included in both the 8th and 9th Capitalia survey (7) and if we drop outliers (9), while some differences emerge when using data from 2001 onward. However, this can be explained by the fact the time dimension of the panel reduces to at most 3 years, which makes the estimation of the parameter associated with variables which have a limited variability over short time periods, as is the case of the number managers, clerks and production workers, rather inaccurate.

I.T. capital of U.S. multinationals in the U.K. is higher than in national firms, argue that this is due to some organizational factor, which make them use their I.T. better.

6. Concluding remarks

Using data on a large sample of Italian manufacturing firms over the 1998-2003 period, we estimate the TFP premia of international firms. We find that, even after controlling for sector, region and time effects, as well as other firms' characteristics (such as the innovative and investing behaviour, the legal status and the R&D intensity), the share of managers and clerical workers have a significant effect on firms' TFP. We also find that TFP premia for international firms shrink once we account for the fact that these firms employ a higher share of knowledge workers. However, the different intensity in the use of some factors of production does not explain all of the TFP differential. Instead, the use of a different production function, where capital and labor have different returns for international and domestic firms explains all of the TFP differences and beyond. In particular, our results support the fact that production workers are more productive in international firms and that, among those firms, multinationals use capital and managers better than exporters and domestic firms. This is consistent with the idea that multinationals have a better organizational capital. However, we should interpret our results with some caution, since they can be affected by measurement and specification errors. In particular, the lack of firm-specific prices indexes may induce an upward biased estimation of TFP premia, to the extent that international firms have higher market power. Furthermore, our estimation does not tackle the issue of possible self selection of better managed and organized firms into internationalization (through higher productivity) nor, whether exposure to higher competition in foreign markets, as well as learning from foreign customers and suppliers, induces an improvement in international firms' management and organizational practices.

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Table 1 – Sample size, by year

	Sample I	Sample I	Sample II	Sample I
	Pooled	Merged	Pooled	Merged
1998	1,682	1,682	1,643	1,643
1999	1,771	1,771	1,725	1,725
2000	1,786	1,786	1,746	1,746
2001	3,673	1,805	3,547	1,742
2002	3,724	1,800	3,583	1,739
2003	3,591	1,705	3,485	1,666
Total	16,227	10,549	15,729	10,261

Note:

Merged sample include observations from all firms surveyed both in the 8th and 9th Capitalia Survey, while the pooled sample included combines the merged sample with all other firms in the 9th Capitalia Survey.

Sample I (TS I): missing and “anomalous” values in output (value added) and inputs (number of employees, number of managers, clerks and production workers) are excluded. Values of output and inputs are considered “anomalous” when a firm-year value is more than three times or less than one-third the median value for each firm.

Sample II (TS I): in addition to the condition of TS I, values of output and inputs below the 1st percentile and above the 99th percentiles are dropped (since they are considered outliers)

Table 2 – Sample size, by international status

	All firms				Sample I				Sample II			
	pooled		merged		pooled		merged		pooled		merged	
		%		%		%		%		%		%
Non internationalised	1,053	24.6	666	31.8	1,017	24.5	522	31.0	994	24.8	512	31.2
Non-multinational exporters	2,781	65.0	1,292	61.7	2,708	65.2	1,049	62.4	2,630	65.7	1,032	62.8
Multinational firms	443	10.3	136	6.5	426	10.3	111	6.6	378	9.5	99	6.0
Total	4,277	100	2,094	100	4,151	100	1,682	100	4,002	100	1,643	100

Note: as in Table 1

Table 3 – Characteristics of the sample firms, by international status

	Non internationalised	Non- multinational exporters	Multinational firms	Total
Value added per worker	46,332	50,067	63,367	50,271
Capital per worker	49,355	42,963	54,438	45,690
N. employees	50.2	108.0	397.6	118.8
<i>Share of firms</i>				
Ltd.	20.6%	41.5%	76.7%	39.1%
Innovating products	19.1%	40.9%	52.1%	36.1%
Innovating processes	35.6%	42.2%	52.3%	41.4%
Innovating organization	17.4%	26.8%	40.2%	25.5%
Investing in machinery and eq.	85.0%	89.3%	94.3%	88.6%
Investing in ICT	63.2%	73.3%	86.9%	71.8%
<i>Share of workers</i>				
Employed in R&D	1.8%	3.8%	4.0%	3.3%
Employed as managers	2.8%	3.6%	4.7%	3.5%
Employed as clerks	20.1%	24.4%	31.1%	23.9%
Employed in production	69.1%	66.6%	62.5%	66.9%

Note: statistics are computed based on the sample I, as defined in Table 1

Table 4 – Productivity premia of exporters and multinational firms, OLS regressions

Sample	TS I	TS I	TS I	TS I	TS I	TS I & MERGE	TS I & >2000	TS II
Multinational firms	0.147*** (0.027)	0.149*** (0.027)	0.124*** (0.026)	0.119*** (0.026)	0.065*** (0.024)	0.091** (0.038)	0.061** (0.025)	0.054** (0.024)
Non-MN exporters	0.055*** (0.015)	0.058*** (0.016)	0.046*** (0.015)	0.043*** (0.015)	0.024* (0.014)	0.023 (0.017)	0.022 (0.016)	0.028** (0.014)
Capital	0.161*** (0.015)	0.161*** (0.015)	0.153*** (0.015)	0.153*** (0.015)	0.155*** (0.015)	0.143*** (0.018)	0.163*** (0.018)	0.167*** (0.007)
N. Employees	0.787*** (0.023)	0.787*** (0.023)	0.775*** (0.023)	0.778*** (0.023)	0.794*** (0.022)	0.779*** (0.029)	0.818*** (0.026)	0.775*** (0.019)
Product inno		-0.019 (0.013)	-0.022* (0.012)	-0.031** (0.013)	-0.030** (0.012)	-0.016 (0.016)	-0.040*** (0.013)	-0.025** (0.011)
Process inno		-0.008 (0.012)	-0.008 (0.012)	-0.010 (0.012)	-0.001 (0.011)	-0.012 (0.014)	0.004 (0.014)	0.007 (0.011)
Organizational inno		0.002 (0.014)	0.001 (0.014)	-0.002 (0.014)	-0.011 (0.013)	-0.015 (0.019)	-0.011 (0.014)	-0.010 (0.013)
Invest in machinery		-0.015 (0.022)	-0.011 (0.022)	-0.011 (0.022)	0.004 (0.020)	0.028 (0.025)	0.001 (0.023)	0.014 (0.020)
Invest in ICT		0.012 (0.014)	0.011 (0.014)	0.009 (0.014)	-0.009 (0.013)	-0.013 (0.016)	-0.002 (0.016)	-0.008 (0.013)
Ltd.			0.133*** (0.016)	0.132*** (0.016)	0.096*** (0.015)	0.094*** (0.023)	0.091*** (0.015)	0.096*** (0.014)
Share of R&D empl.				0.313*** (0.080)	-0.023 (0.077)	0.065 (0.098)	-0.050 (0.078)	-0.021 (0.078)
Share of managers					0.972*** (0.121)	0.735*** (0.152)	1.239*** (0.133)	0.931*** (0.120)
Share of clerks					0.785*** (0.044)	0.765*** (0.059)	0.782*** (0.047)	0.765*** (0.044)
R-squared	.892	.892	.894	.894	.904	.897	.898	.895
N. obs	16227	16227	16227	16227	16227	10549	10988	15729
N. firms	4151	4151	4151	4151	4151	2061	4086	4036

Note: each regression include sector, time, sector-time, region and size class dummies

Table 5 – Productivity premia and returns to inputs of exporters and multinational firms, OLS and Fixed-effects regressions

Method	OLS	OLS	OLS	OLS	OLS	FE	FE	FE	FE
Sample	TS I	TS I	TS I	TS I	TS I	TS I	TS I & MERGE	TS I & MERGE	TS II
		-							
Multinational firm	0.069** (0.028)	1.932*** (0.413)	0.103 (0.142)	-1.275*** (0.322)	-1.887*** (0.411)	--	--	--	--
Non-MN exporter	0.013 (0.015)	-0.634** (0.251)	0.071 (0.061)	-0.460** (0.226)	-0.596** (0.248)	--	--	--	--
Capital (log)	0.162*** (0.015)	0.116*** (0.021)	0.162*** (0.015)	0.138*** (0.020)	0.113*** (0.021)	0.099*** (0.011)	0.092*** (0.013)	0.082*** (0.019)	0.113*** (0.013)
N. managers (log)	0.134*** (0.010)	0.168*** (0.018)	0.153*** (0.017)	0.132*** (0.009)	0.166*** (0.018)	0.010 (0.011)	0.008 (0.012)	0.044 (0.047)	0.016 (0.011)
N. clerks (log)	0.350*** (0.013)	0.350*** (0.020)	0.333*** (0.019)	0.348*** (0.013)	0.343*** (0.020)	0.104*** (0.014)	0.100*** (0.015)	0.149*** (0.049)	0.099*** (0.014)
N. prod. workers (log)	0.205*** (0.021)	0.257*** (0.028)	0.227*** (0.025)	0.198*** (0.021)	0.257*** (0.028)	0.167*** (0.015)	0.160*** (0.016)	0.392*** (0.045)	0.196*** (0.016)
Multinational firm x									
Capital (log)		0.181*** (0.039)		0.090*** (0.022)	0.176*** (0.039)	0.073*** (0.025)	0.050 (0.031)	0.145*** (0.034)	0.048* (0.027)
N. managers (log)		-0.048 (0.037)	0.011 (0.039)		-0.045 (0.037)	0.048** (0.022)	0.069*** (0.024)	-0.086 (0.066)	0.048** (0.024)
N. clerks (log)		-0.060 (0.048)	-0.006 (0.056)		-0.058 (0.048)	-0.040* (0.024)	-0.035 (0.026)	-0.073 (0.085)	0.065 (0.047)
N. prod. workers (log)		-0.115* (0.064)	-0.012 (0.059)		-0.113* (0.064)	0.138*** (0.035)	0.125*** (0.042)	-0.038 (0.072)	0.081** (0.039)
Non-MN exporter firm									
X									
Capital (log)		0.065*** (0.024)		0.035** (0.016)	0.062*** (0.023)	0.006 (0.014)	0.015 (0.016)	0.008 (0.022)	-0.011 (0.015)
N. managers (log)		-0.049** (0.021)	-0.031 (0.020)		-0.049** (0.021)	0.010 (0.013)	0.010 (0.014)	0.025 (0.052)	0.002 (0.013)
N. clerks (log)		0.009 (0.024)	0.032 (0.022)		0.012 (0.024)	0.039** (0.018)	0.040** (0.020)	-0.011 (0.056)	0.045** (0.019)
N. prod. workers (log)		-0.074** (0.031)	-0.032 (0.024)		-0.074** (0.030)	0.085*** (0.020)	0.080*** (0.021)	-0.069 (0.052)	0.059*** (0.021)
Other controls	No	No	No	No	Yes	No	No	No	No
R-squared	.893	.895	.893	.894	.896	-.169	-.0739	-.42	-.169
N. obs	16227	16227	16227	16227	16227	16227	10549	10988	15729
N. firms	4151	4151	4151	4151	4151	4151	2061	4086	4036

Note: each regression include sector, time, sector-time, region and size class dummies. Other controls are: innovation and investment dummies, legal status (limited vs. non-limited liability company), share of R&D workers

Data Appendix

We match and merge two different datasets: Capitalia's Observatory on Small and Medium Size Firms, a survey on a representative sample of over 4000 Italian firms, and ICE-Reprint, the census of foreign affiliates of Italian firms.

More specifically, we use detailed firm-level data from two Capitalia surveys for the periods 1998-2000 and 2001-2003. Each survey is based on a stratified sample of about 5,000 Italian firms with more than 11 employees, while the sample resulting from the intersection of the two surveys, consist of a panel of approximately 2,000 firms with data from 1998 to 2003. The survey provides information on firms' characteristics, ranging from balance sheet data, to labor composition by worker type (e.g. managers, clerks and production workers) and education attainment, the innovative behaviour (including binary indicators on the realization of process, product and organizational innovation, the engagement and investment in R&D), the investment behaviour (including investment in ICT), the internationalization mode.

We matched the Capitalia Suvery data with the census of multinational firms in Italy (ICE-Reprint dataset)¹⁶,. We label those firms with affiliates abroad in 2001 "Italian multinationals" and we assume that multinational status did not change throughout the period 1998-2003.

Our consolidated dataset provides information on firms' processes of internationalization, economic performance, innovative capacity and growth for up to over 4000 manufacturing firms (depending on the sample used and described in the text this results in between 10000 and 16000 firms-year observations).

Variables definition:

¹⁶ The merge of the 2001 version of Reprint with the Capitalia survey is the result of a collaborative effort between ICE and the Centro Europa Ricerche (Cer). Reprint is the directory of Italian multinationals sponsored by ICE (Istituto per il Commercio Estero/Italian Institute for External Trade) and maintained by the Polytechnic of Milan.

Table A.1 – Production function estimates – robustness checks

Method	Sample*	N.		Production function coefficients				Dummies**
		obs.	N. firms	Prod.				
				Managers	Clerks	work	Capital	
OLS	ALL	16227	4151	0.165***	0.454***	0.304***	0.168***	No
OLS	ALL	16227	4151	0.136***	0.354***	0.206***	0.163***	yes
LP	ALL	16227	4151	0.089***	0.273***	0.230***	0.098***	No
FE	ALL	16227	4151	0.023***	0.130***	0.235***	0.119***	No
FE	ALL	16227	4151	0.025***	0.114***	0.227***	0.110***	yes
OLS	EXP	10465	2708	0.146***	0.458***	0.288***	0.181***	No
OLS	MN	1465	426	0.152***	0.388***	0.203***	0.313***	No
OLS	NAT	4297	1017	0.197***	0.447***	0.354***	0.124***	No
OLS	EXP	10465	2708	0.123***	0.363***	0.192***	0.183***	yes
OLS	MN	1465	426	0.124***	0.277***	0.213***	0.258***	yes
OLS	NAT	4297	1017	0.146***	0.324***	0.240***	0.114***	yes
FE	EXP	10465	2708	0.021***	0.162***	0.262***	0.111***	No
FE	MN	1465	426	0.056***	0.070***	0.316***	0.183***	No
FE	NAT	4297	1017	0.003	0.118***	0.170***	0.111***	No
FE	EXP	10465	2708	0.019***	0.144***	0.254***	0.103***	yes
FE	MN	1465	426	0.056***	0.070***	0.316***	0.183***	yes
FE	NAT	4297	1017	0.012	0.101***	0.161***	0.100***	Yes
LP	EXP	10465	2708	0.096***	0.292***	0.236***	0.108***	No
LP	MN	1465	426	0.072***	0.240***	0.213***	0.237***	No
LP	NAT	4297	1017	0.081***	0.237***	0.246***	0.051**	No

* ALL: all firms; EXP: non-multinational exporters; MN: multinational firms; NAT: national non-exporting firms

** The vector of control dummies include: sector, time, sector-time, region and size class dummies for the OLS estimation and sector-time dummies for the FE.