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Innovation, productivity and export Evidence from Italy

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Innovation, productivity and export
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Roberto Antonietti[1] and Giulio Cainelli[1,2]

Abstract

Recent developments in the new international trade theory stressed the relationship between firm heterogeneity and internationalization performance. The key prediction of these models is that firms with different levels of productivity – the main source of firm heterogeneity – will generally engage in different modes of internationalization depending on the level of sunk costs incurred in acquiring information on foreign markets, establishing distribution channels, and so on. However, in these theoretical models the sources of productivity are generally unexplained, considering firm heterogeneity as exogenous. A few papers try to open the 'black box' of firm heterogeneity and to show that internationalized firms are generally more innovative, use more knowledge-intensive workers, and are characterized by superior organizational and managerial practices. Using a large sample of over 3000 Italian manufacturing firms for the period 2001-2003, we contribute to this debate employing, and extending the basic Crépon, Duguet and Mairesse (CDM) model. We estimate a five-equation model which identifies the links (correlations) between innovation investment, innovation output, firm productivity and export performance.

Keywords: innovation, R&D, productivity, export, CDM-model

JEL: C24,C31, F10, L60, O31, O32

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1. Introduction

Recent developments in the new international trade theory have highlighted the relationship between firm heterogeneity and modes of internationalization (Melitz, 2003; Bernard and Jensen, 2004; Helpman *et al.*, 2004; Melitz and Ottaviano, 2008). The key prediction of these models is that firms with different levels of productivity – the main source of firm heterogeneity – will generally engage in different modes of internationalization depending on the different levels of the sunk costs involved in the acquisition of information on foreign markets, establishment of distribution channels, and so on. According to this prediction, multinationals would be expected to outperform exporting firms, which, in turn, would be expected to outperform domestic firms.

However, the sources of these productivity *premia* are generally not explained by these models which consider firm heterogeneity to be the result of a random draw. If no account is taken of the drivers of firms' heterogeneity – a simplifying theoretical hypothesis frequently adopted in recent international trade models – it is not possible to understand why firms differ. A few papers try to shed some light on the sources of firm heterogeneity and attempt to identify the drivers of different modes of internationalization. These studies show that international firms are more innovative, employ knowledge-intensive workers, and adopt superior organizational and managerial practices.

In this context, this paper contributes to the debate on the relationship between innovation, productivity and export performance and to open up the black box of firms heterogeneity. In contrast to the existing literature, we endogenize firm heterogeneity by making it dependent on the production of innovations, which, in turn, depends on the decision to invest and the extent of the investment in innovation-related activities.

We analyse these relationships within a unitary empirical framework employing, and extending the basic Crépon, Duguet and Mairesse (CDM hereafter) model, developed to summarize the complex process "that goes from the firm decision to engage in research activities to the use of innovations in its production activities" (Crepon, Duguet and Mairesse, 1998, p. 116). Specifically, we estimate an 'augmented' version of this model. We extend the CDM-model by adding to the four equations characterizing the original model – i.e., the "research" equations linking R&D to its main determinants, the "innovation" equation relating research to innovation output, and the "productivity" equation relating innovation output to value added per employee – a fifth relation that correlates productivity – i.e. our source of firms heterogeneity – to export performance.

This augmented CDM model is estimated using a large sample of more than 3,000 Italian manufacturing firms over the period 2001-2003.

The paper is organized as follows. Section 2 provides a review of the related literature; Section 3 describes the dataset (3.1), presents the modelling strategy (3.2) and discusses the main empirical results (4). Section 5 concludes the work.

2. Background literature

2.1. The role of innovation on productivity: the Schumpeterian view

Innovation and technological change are important factors in analyses of the determinants of long-term economic growth, and in firm or industry level investigations of the relationship between innovation and economic performance. The first analysis of innovation and technological change was conducted by Solow (1957). In this and subsequent contributions based on a theoretical framework originating in the aggregate production function, Solow tries to identify technical progress in the "residual" component of economic growth, which cannot be explained by the contribution of production factors such as labour and capital. This so-called "growth accounting" approach emphasize the relevance of technological change as the key factor to explaining the aggregate productivity of an economic system.

Within an analytical framework based on production functions, most industry or firm level analyses confirm the importance of investment in R&D, and of innovative activities more generally, in determining firms' competitive advantage and economic performance. The works of Griffith *et al.* 2004, Griliches 1979, 1980, 1986, 1994, Griliches and Mairesse 1985, 1995, Hall and Mairesse 1995, Harhoff 1998, Parisi, Schiantarelli and Sembenelli, 2006, Wakelin 2001, and Wang and Tsai 2003 are examples of such studies. They find a generally positive effect of technological innovations on productivity growth.

An alternative approach to analysing technological change is based on the fundamental contributions of Schumpeter (1939, 1943). Within this line of research, technological change is interpreted as a process of creative destruction. Although neo-Schumpeterian approaches such as the evolutionary theories of economic and technological change differ from the mainstream in terms of their theoretical framework, they agree about the impact of technological innovation on aggregate and firm-level performance (Cainelli *et al.*, 2006; Dosi 1988; Malerba and Orsenigo 1995; Metcalfe 1997, 1998).

2.2. The role of productivity on export performance: the new trade theory view

One of focuses of the new international trade theory is the relationship between firm heterogeneity and internationalization modes (Bernard and Jensen, 2004; Melitz, 2003; Helpman *et al.*, 2004; Melitz and Ottaviano, 2008). The key prediction of these models is that firms with different levels of productivity – the main source of firm heterogeneity – generally will engage in different modes of internationalization characterized by different sunk costs. Helpman *et al.* (2004) show that *ex-ante* productivity differentials, in particular, explain why firms choose different internationalization modes.

These theoretical models assume that "servicing a foreign market entails an entry (sunk) cost, due to the fact that, for example, firms need to acquire information on the foreign market, establish distribution channels and find the appropriate suppliers of goods and services" (Castellani and Zanfei, 2007, p. 4). In this sense, new international trade theory links firm productivity and export performance and internationalization modes, more generally (Bernard and Jensen, 1995 and 1999; Melitz, 2003). Thus, the least productive firms serve the domestic market only, firms with intermediate productivity export, and the most productive firms engage in horizontal foreign direct investment (FDI).

The key prediction in Helpman *et al.*'s (2004) paper – the link between firm heterogeneity and internationalization modes – has been tested empirically in several studies which show that more productive firms are more likely to have a higher propensity to export (Wagner, 2005). In other words, these studies find that exporters benefit from larger and more significant performance *premia* relative to non-exporting firms. Despite the relevance of these findings, the reasons behind firm heterogeneity are not investigated. As Castellani and Zanfei (2007, p. 159), emphasize "productivity levels are assumed to be drawn casually from a probability distribution, and firms' behaviour varies accordingly for any given level of trade costs and of fixed costs of operating abroad". The simplifying theoretical hypothesis frequently adopted in international trade models that ignores the drivers of firm heterogeneity does not provide any explanation for why firms differ.

A recent strand of the literature has attempted to open this black box. For example, using a dataset based on information from the Second Community Innovation

Survey (CIS-2) and the European Linkages and Ownership Structure (ELIOS), and adopting a "technological accumulation approach", Castellani and Zanfei (2007) find that Italian international firms are characterized by the highest productivity *premia* and the best innovative performance. In fact, R&D and product innovation strategies account for a significant share of firm heterogeneity. Using a large sample of Italian manufacturing firms for the period 1998-2003, Castellani and Giovannetti (2010) find that heterogeneity in firms' Total Factor Productivity (TFP) are related to greater innovativeness and greater employment of knowledge-intensive workers (managers and clerks). They find also that multinational firms have superior organizational and managerial practices. Lopez (2009) using plant-level data for Chile, finds that before firms begin to export, productivity increases. These findings suggest that firms self-select into foreign markets.

3. Data and empirical methodology

3.1. Data

The dataset in this paper consists of a sample of Italian manufacturing firms drawn from the IX Survey of Manufacturing Firms (*Indagine sulle Imprese Manifatturiere*) conducted by Unicredit-Capitalia (formerly *Mediocredito Centrale*).[3] Interviews were conducted in 2004 to a representative sample of Italian manufacturing firms operating between 2001 and 2003. All firms with more than 500 employees are included in the dataset; the sample of firms with more than 11 and less than 500 employees is stratified by localization and industry.

The original dataset included 4,289 firms. We dropped observations with missing balance sheet data and missing or inconsistencies data in the labour force composition. We dropped observations with missing data on province and region of localization, and observations with zero or negative sales, value added or net material assets. Following Hall and Mairesse (1995) and Lööf and Heshmati (2002a), we also dropped observations where growth in value added or labour productivity for 2001-2003 exceeded 300%, or was less than -75%. Table 1 summarizes the structure of our final sample.

TABLE 1 HERE

[3] Although we do not use CIS data, our dataset can be considered as being based on an innovation survey (Mairesse and Mohnen, 2010).

The survey questionnaire asked for information on firms' research and innovation activities, labour force composition, internationalization modes, market strategies and financial activities. Thus, although the analysis in this paper does not rely on the whole set of CIS variables, our data allow us to link innovation and internationalization activities directly in a unified framework.

In contrast to previous work (Antonietti and Cainelli, 2010), we rely on a single three-year survey, which allows us to observe firms' R&D and innovation strategies over the three year period, or over a single a single year. We lose the longitudinal dimension enabled by a merged dataset, but have a larger, and more representative, sample of firms.

Table 2 presents some descriptive statistics on the relationship between innovation, productivity and export performance. Exporting firms, as expected, are larger, more productive and more profitable than non-exporting firms. Also, innovative firms – i.e. firms reporting a product and/or a process innovation – are also larger, more productive and more profitable in the international markets, although in terms of general profitability, the reverse is true.

TABLE 2 HERE

3.2. Specification and estimation of the CDM model

To model the structural relationships between firm R&D, innovation output, productivity and export performance, we extend the basic CDM exercise and estimate a multi-step structural model consisting of five equations, following Lööf and Heshmati (2002a, 2002b). We try to follow the OECD specification of the CDM model as closely as possible (OECD, 1998; Johansson and Lööf, 2009).

Following Lööf and Heshmati (2002a, 2002b) and Johansson and Lööf (2009), we specify the full CDM-model extended to include export, through the following five equations:

$$[1]\ g^* = \begin{cases} 1 \text{ if } g^* = \beta_0^1 + \sum_g \beta_g^1 X_g^1 + \varepsilon^1 > 0 \\ 0 \text{ if } \beta_0^1 + \sum_g \beta_g^1 X_g^1 + \varepsilon^1 \leq 0 \end{cases}$$

$$[2]\ k^* = \beta_0^2 + \sum_k \beta_k^2 X_k^2 + \varepsilon^2$$

[3] $t_{i,j} = \Phi\left(\beta_0^3 + \sum_t \beta_t^3 X_t^3 + \varepsilon^3\right)$ with j = product, process

[4] $y_i = \beta_0^4 + \sum_y \beta_y^4 X_y^4 + \varepsilon^4$ if $g^* = 1$

[5] $x_i = \beta_0^5 + \sum_x \beta_x^5 X_x^5 + \varepsilon^5$ if $g^* = 1$.

Our empirical exercise involves the following steps. First, firms decide whether or not to engage in innovation-related activities (selection equation), then innovative firms decide how much to spend on these activities (outcome equation). This is specified through a Heckman (1976, 1979) selection model (equations 1-2).

Second step, we specify and estimate an innovation output equation (knowledge production function), which includes the inverse Mill's ratio and the predicted value from the second-step outcome equation. Our innovation output variables are given by two dummies which are equal to 1 if, between 2001 and 2003, firms introduced a product and/or a process innovation. Since many (761) firms developed both types of innovation, we estimate the knowledge production function through a bivariate probit model, which allows us to control for correlation between the error terms in the two equations (Antonietti and Cainelli, 2010; Conte, 2009).

Third, we estimate the productivity and the export performance equations simultaneously as a system on the subset of innovative firms. In so doing, we correct for possible inconsistent coefficient estimates due to endogenous regressors by accounting for the selectivity hypothesis, i.e. the impact of productivity on export performance, and the learning by exporting hypothesis, i.e. the feed-back effect from export to productivity.

Firm productivity is estimated through Two-Stage-Least-Squares (2SLS) including, among the regressors, the inverse Mill's ratio, the predicted values of product and process innovations, and export sales per employee. Firm export performance is simultaneously estimated including the inverse Mill's ratio, and the level of productivity, as the main proxy for firm heterogeneity.

Equation 1 in the model estimates the propensity to innovate. In the following, we consider the firm to be innovative if it reports both innovation investments (i.e.

expenditures on R&D, marketing of new products and workforce training) and innovation output (i.e. introduction of a new product and/or a new process). This identifies 1,305 innovative firms or the 41.4% of the whole sample. To estimate equations 1-3, we start with 3,151 observations, and then restrict the sample to the 1,305 innovative firms in order to estimate equations 4 and 5. Due to the inclusion of predicted values in the estimations of equations 3-5, all standard errors are bootstrapped as in Antonietti and Cainelli (2010).

In line with the OECD (2008) framework, we include as regressors: a dummy indicating whether the firm belongs to a business group (GROUP); the natural logarithm of 2001 employment as a proxy for firm size (lnE); and a dummy indicating whether the firm operates in foreign markets (FM) by exporting or through other commercial operations. Unlike studies that use CIS data, we do not have information on the factors hampering innovation activities; thus, we try to control for external factors favouring innovation activities by including a dummy for whether the firm benefits from public incentives to perform R&D or conduct innovation activities (INCENT). Finally, we include a set of 13 two-digits 2001 industry dummies and the inverted Mill's ratio in order to control for selection bias.

For firms defined as innovative, equation 2 uses the natural logarithm of observed 2003 R&D and other innovation expenditure per employee, as the dependent variable (lnI/E), and is estimated using a Tobit specification. As explanatory variables, we include group membership (GROUP), the foreign market dummy (FM) and a dummy providing information on whether the firm collaborates externally on innovation-related activities (EXT_COOP). Finally, we include a set of 13 industry dummies.

Equation 3 in our extended CDM-model is the knowledge production function, which identifies the drivers of innovation output, measured as the propensity to create a new product or a new process in the period 2001-2003. In line with OECD (2008), we include the following explanatory variables: the GROUP dummy; firm size (lnE); the share of skilled workers (i.e. knowledge intensive labour) as given by the 2001 employment share of middle managers, executives and administrative staff (SKILL); the natural logarithm of 2001 physical investments per employee (lnK/E); the predicted value of innovation input (lnI/E); a set of external cooperation dummies for cooperation with universities (COOP_UNIV), with research centres (COOP_RES), with other firms (COOP_FIRM), and with other partners (COOP_OTHER). The bivariate probit estimation again includes 13 industry-specific dummies and a constant term.

Equation 4 is related to labour productivity (LnY/E), which we measure as real 2003 net sales per employee.[4] In x_4 we include: the predicted values of innovation output (i.e. product and process innovation respectively); firm size (lnE); physical capital per employee (lnK/E); share of knowledge intensive labour (SKILL); the dummy GROUP; the natural logarithm of 2003 export sales per employee (lnEXP/E); a dummy equal to 1 if the firm is located in a large urban zone (LUZ)[5], in order to capture possible urbanization economies; the inverse Mill's ratio; and the 13 industry-specific dummies.

The last equation 5 is for the export performance of Italian manufacturing firms (lnEXP/E), where x_5 includes: firm size (lnE); a dummy equal to 1if the firm is foreign-owned (FOREIGN); the propensity to invest in information and communication technology (ICT); a dummy for whether the firm belongs to an export consortium (CONS_EXPORT); labour productivity as the main source of firm heterogeneity; 13 industry dummies and a constant term.[6]

4. Empirical results

Tables 3, 4 and 5 report the main results of our empirical analysis. Table 3 presents the Heckman selection estimates related to the two equations for innovation input; Table 4 presents the bivariate probit estimates for the innovation output function; Table 5 presents the simultaneous estimations of labour productivity and export sales per employee.

Table 3 shows that being member of a business group increases the propensity of the firms to invest in innovation-related activities by an average 17%, while operating in foreign markets increases the propensity to innovate by 54.5%. It shows also that public incentives for innovation have a positive effect on firm investment, of 49.8% on average.[7]

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[4] To check for robustness, we also used the 2003 value added per employee as a proxy for labour productivity. The results, which are available on request, confirms those obtained using net sales per employee.

[5] Eurostat defines larger urban zones (LUZ) as cities with populations of at least 0.5 million. The concept of a LUZ is an attempt to harmonize the idea of metropolitan area and to make it more compatible with the concept of a "functional urban region", both of which are defined by the high share of the resident community that commutes to the city for work. The ISTAT classifies Rome, Milan, Naples, Turin, Bologna, Genoa, Florence, Bari, Padua, Catania, Verona, Messina, Venice as LUZ.

[6] In order to avoid including casual exporters, we consider firms to be exporters only if they report a share of export sales higher than 5%.

[7] These results are in line with those in OECD (2008) and similar to those obtained by Johansson and Lööf (2009) for Sweden.

The effect of foreign market penetration and group membership in the context of engagement in innovation activity seems to be balanced by the extent of innovation investments. As expected, however, there is a strong positive correlation with external cooperation. Table 3 shows that the use of the Heckman selection model is motivated by the significant correlation between the error terms of the two equations, as shown by the χ^2 statistic.

Table 4 reports the results of the estimations of the two innovation output equations. First, we note that innovation input (i.e. the predicted value of innovation investments per employee) is positively and strongly correlated to both product and process innovations, with a larger marginal effect associated with the former than the latter. While the propensity to introduce a new product is positively affected by the share of knowledge labour and the external cooperation with other firms, process innovation is correlated with firm size and investments in new machinery. These results are not surprising and are in line with previous findings on the determinants of Italian manufacturing firms' innovative performance (Parisi, Schiantarelli and Sembenelli, 2006).

The results of the 2SLS estimates for productivity and export performance are interesting. In this final step, first we separately investigate the impact of (predicted) product and process innovations on firm productivity, while simultaneously controlling for the reciprocal effects of productivity and export performance. We proceed by including the predicted values of product and process innovation in the instrumental variable estimation.

The labour productivity estimates show that the impact of process innovation (0.26) is higher than the impact of product innovations (0.21). However, if we estimate them together, product innovation is the only variable that is positively and significantly related to productivity (0.78): the estimated coefficient of process innovation is negative and not significant, which is consistent with Cainelli (2008).

Group membership and investments in physical capital are also positively correlated with higher levels of labour productivity, with elasticities of 0.18 and 0.10 respectively. Firm size, somewhat surprisingly, is negatively correlated to productivity (-0.12). This could be due to positive correlation to innovation output (process innovation), resulting in the productivity effect of size captured by the effect of innovation output on productivity.

The last three columns in Table 5 reports the results for the coefficient estimates in the export performance equation. As expected, larger and foreign-owned firms perform better in foreign markets, with elasticities of 0.13, and 0.22 respectively. Foreign ownership, on the one hand, may allow firms to benefit from a easier access to international markets, or easier transfer in of external knowledge. The positive effect of firm size is in line with new international trade theory which links the survival and performance of firms in foreign markets to their capacity to bear the sunk costs related to internationalization activities.

The most interesting result, however, is related to the correlation between productivity and export. Our estimates show that productivity and export have reciprocal effects: more productive firms do show higher export performance, and firms performing better in the international markets are also more productive at home. However, the impact of productivity on export is much higher than the impact of export on productivity, which means that the self-selection and the learning-by-exporting hypotheses can coexist and do not exclude each other. However, our empirical exercise shows that the former seems to prevail over the latter, since the impact of export sales on productivity is three times lower than the impact of productivity on exports.

To sum up, we have identified a sequence of steps and feedback effects starting from the decision to invest in innovation activity, through the creation of a new product or new production process, passing through improvements in productivity due to innovation output and experience in international markets, and ending with the sale of goods outside national boundaries. In line with previous studies on Italy (Becchetti and Rossi, 2000; Castellani and Zanfei, 2007; Benfratello and Razzolini, 2008) we find evidence of the role played by firm heterogeneity in driving the internationalization performance of firms, and of the feedback effects of exports on productivity (Castellani, 2002; Casaburi, Gattai and Minerva, 2007; Greenaway and Kneller, 2007; Crespi, Criscuolo and Haskel, 2008). However, unlike previous studies, we endogenize firm heterogeneity by making it dependent on innovations, which, in turn, depends on the decision to invest, and the level of investment in innovation-related activities. Our findings confirm Cassiman, Golovko and Martinez-Rios's (2010) results that the export-productivity link is related strictly to firms' innovation decisions, and, in particular, to decision about product innovation.

TABLES 3, 4 AND 5 HERE

5. Conclusions

The international trade theory literature has begun to study the relationship between firms' economic performance and internationalization strategies. The key prediction of these models is that firms with higher levels – or growth rates – of productivity will generally engage in different internationalization modes or will benefit from higher survival rates and superior performance in foreign markets, thanks to their greater capacity to bear the sunk costs of accessing foreign markets.

However, the sources of these productivity *premia* are generally not explained and firm heterogeneity is assumed to be random (Castellani and Zanfei, 2007). Neglecting the sources of firm heterogeneity does not enable an understanding of the role of factors such as innovation and agglomeration forces in explaining why firms differ.

Following a recent stream of literature on firm heterogeneity, and using a large sample of Italian manufacturing firms, we estimate an extended version of the CDM-model of R&D, innovation and productivity, by including export performance. We combine the Schumpeterian literature on the sources of technological innovation with new international trade theory, which links productivity to firms' internationalization modes, and with the recent literature on the learning-by-exporting hypothesis.

The most interesting finding is related to the nature of the relationship between productivity and export. We show that productivity and export have reciprocal effects. However, the impact of productivity on export is much higher than the impact of export on productivity, which means that the self-selection and learning-by-exporting hypotheses can coexist.

In a more general sense, the main contribution of this paper is to provide a better understanding of the relationships between innovation, productivity and export performance, and to throw light on firms heterogeneity in order to enable a better understanding of the determinants of firms' internationalization strategies.

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Table 1. Sample structure

Size (employment class)	**Before cleaning**	**After cleaning**
11-20	22.1	22.2
21-50	29.6	31.7
51-250	36.9	37.5
251-500	5.3	4.2
> 500	6.1	4.4
Area		
North West	35.9	33.0
North East	30.2	32.8
Center	17.6	20.4
South	16.3	13.8
Industry (Pavitt classification)		
Supplier dominated	51.9	52.5
Scale intensive	16.8	17.4
Specialized suppliers	26.7	26.4
Science based	4.6	3.7
Num. Obs.	**4289**	**3151**

Table 2. Summary statistics on innovation, productivity and export performance

Average 2001-2003	**Exporter**	**Non exporter**
Sales per employee	255.65	244.75
Value added per employee	54.22	50.29
Size (n. employees)	135	76
Average 2001-2003	**Innovative**	**Non innovative**
Sales per employee	242.53	265.99
Value added per employee	54.26	51.07
Size (n. employees)	125	103
Export sales per employee$_{2003}$	100.79	97.41

Table 3. Heckman equation: probit and tobit parameter estimates

Variables	Selection	Outcome
lnE	0.018	
	(0.038)	
GROUP	0.171**	0.056
	(0.063)	(0.115)
FM	0.545***	-0.010
	(0.057)	(0.254)
INCENT	0.498***	
	(0.066)	
EXT_COOP		0.620***
		(0.091)
Industry dummies	Yes	Yes
N. Obs.	3151	1305
Uncensored Obs.	1305	
Mills Lambda	-1.227	
Prob $\rho > \chi^2$ (1)	0.0205	

Table 4. Innovation output equation: marginal probabilities

Variables	Product innovation	Process innovation
lnI/E (predicted)	0.311**	0.205*
	(0.106)	(0.087)
GROUP	-0.038	-0.035
	(0.021)	(0.021)
lnE	0.013	0.044***
	(0.012)	(0.008)
SKILL	0.156**	0.019
	(0.050)	(0.044)
lnK/E	0.008	0.031***
	(0.009)	(0.008)
COOP_UNIV	-0.007	0.008
	(0.049)	(0.053)
COOP_RES	0.043	0.091
	(0.074)	(0.057)
COOP_FIRM	0.148*	0.059
	(0.073)	(0.055)
COOP_OTHER	0.158*	0.038
	(0.080)	(0.049)
Inverted Mill's ratio	-0.376***	-0.256***
	(0.037)	(0.044)
Industry dummies	Yes	Yes
N. Obs.	3151	
ρ	0.368***	
	(0.023)	

Notes: bootstrapped standard errors in parentheses. * significant at 10% level; ** significant at 5% level; *** significant at 1% level. A constant term is also included.

Table 5. Productivity and export equations: 2SLS

Variables	Productivity	Productivity	Productivity	Export	Export	Export
Product (pred)	0.212*		0.777*			
	(0.095)		(0.375)			
Process (pred)		0.257*	-0.961			
		(0.125)	(0.580)			
lnEXP/E	0.344**	0.339*	0.346*			
	(0.129)	(0.148)	(0.165)			
lnY/E				1.001***	1.012***	0.994***
				(0.130)	(0.172)	(0.177)
GROUP	0.182***	0.184***	0.171***			
	(0.038)	(0.041)	(0.043)			
FOREIGN				0.226*	0.225*	0.228*
				(0.090)	(0.099)	(0.098)
lnE	-0.123***	-0.132***	-0.086*	0.131***	0.132***	0.131***
	(0.021)	(0.018)	(0.034)	(0.033)	(0.027)	(0.028)
SKILL	0.112	0.131	0.073			
	(0.160)	(0.164)	(0.143)			
lnK/E	0.101**	0.095**	0.125**			
	(0.029)	(0.034)	(0.039)			
LUZ	0.036	0.038	0.033			
	(0.032)	(0.033)	(0.030)			
CONS_EXPORT				-0.029	-0.027	-0.031
				(0.117)	(0.142)	(0.144)
ICT				0.053	0.053	0.053
				(0.082)	(0.080)	(0.077)
Inv. Mill's	0.624**	0.601*	0.582**	-1.44***	-1.44***	-1.44***
	(0.223)	(0.245)	(0.229)	(0.197)	(0.192)	(0.202)
Indus. dummies	Yes	Yes	Yes	Yes	Yes	Yes
N. Obs.	1305	1305	1305	1305	1305	1305

Notes: bootstrapped standard errors in parentheses. * Significant at 10% level; ** significant at 5% level; *** significant at 1% level. A constant term is also included.