Dipartimento di Scienze Economiche, Matematiche e Statistiche

Università degli Studi di Foggia

What Makes Small and Medium Enterprises Competitive

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Quaderno n. **18/2005**

Quaderno riprodotto al
Dipartimento di Scienze Economiche, Matematiche e Statistiche
nel mese di settembre 2005 e
depositato ai sensi di legge

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What Makes Small and Medium Enterprises Competitive

An investigation into the Italian manufacturing sector[♦*]

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ABSTRACT: This paper aims at understanding the determinants of Italian small- and medium-sized enterprises' competitiveness. Having in mind the fact that the Italian economic system relies substantially on small firms which have managed to stay competitive by adopting strategies such as the creation of well-integrated social and institutional clusters (the so-called *industrial districts*) or specialising in the production of quality goods (the so called *made in Italy*). However, the growing competing pressure coming from the Far East has rendered this production system vulnerable, challenging its internationally competitiveness. By developing a conceptual model we identify the sources of competitiveness of Italian SMEs. The model is tested using a unique database which collects data, for the year 2004, over a sample of 2,600 SMEs.

JEL classification: L1, O31, C24
Keywords: SMEs, competitiveness, innovation, interval regression, ordered probit

♦ This paper is the result of a joint work of the authors. However, sections 2 and 5 were written by Piergiuseppe Morone while sections 3 and 4 were written by Pina Testa. Other sections were written jointly.

* For their comments the authors are grateful to Cesare Imbriani, Gustavo Crespi and John Micklewright. The usual disclaimers apply.

1. Introduction

Small- and medium-sized enterprises (SMEs) play a major role in the Italian economic system. They account for nearly 99% of the national enterprises and among them the micro-enterprises (those with less than 10 employees) represent the wide majority. From a survey carried out by the National Institute of Statistics it emerges that the micro-enterprises represent 95.2% of the Italian entrepreneurial system and account for more than 30% of its overall turnover (ISTAT, 2003).

In a recent study it was pointed out that micro-enterprises represent almost 83% of the SMEs operating in the manufacturing sector (Unioncamere-Tagliacarne, 2005). Moreover, almost 65% of these micro-firms have an annual turnover that does not exceed €300,000. This figure contrasts with 7% of SMEs with 10 or more employees. With respect to the legal business structure, it is interesting to observe that approximately 60% of micro-firms adopt sole proprietorship, while such percentage does not exceed 30% in SMEs with 10 or more employees and is less than 5% for SMEs with 50 or more employees. Putting together all these structural characteristics of small firms we can notice that nearly half (42.68%) of the SMEs have a structure that we could define as "unicellular", characterised by a small number of employees, sole proprietorship business structure and an average turnover which does not exceed €300.000. Such enterprises operate mainly in traditional sectors (manufacture of food products, beverages and tobacco; manufacture of textiles and wearing apparel; tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear; manufacture of wood and furniture) which are typically low skill intensive and, therefore, particularly vulnerable to international competition of low income countries which rely on cheap labour force. The picture emerging from these preliminary observations is not promising and suggests a growing probability that Italian small firms will remain excluded from international markets and will be seriously challenged in the domestic market.

However, it is important to notice that from a theoretical point of view the typical small dimension of Italian firms operating in traditional fields has both positive aspects as well as points of weakness. Indeed, small dimension implies more flexibility and a faster ability to adapt to changing environments, though at the same time it might also represent an obstacle to achieve a critical dimension which allows performing R&D

activities and innovating. It is on this twofold nature of small firms' architecture that we shall base our analysis, developing first a conceptual model of SMEs competitiveness. Such model will subsequently be tested using a unique database which consists of data on a sample of 2,600 SMEs for the year 2004.

The paper is structured as follows: in the next section we will review some of the most recent literature on the determinants of long-term competitiveness. Then, in section 3 we will introduce the case study and describe the database employed. We shall define the estimated econometric model in section 4 and present our results in section 5. Finally, section 6 will provide the reader with some concluding remarks and some suggestions for further investigation.

2. Small firms' competitiveness and globalisation: the conceptual framework

When referring to 'competitiveness', one should have a clear idea on the significance of the term. In some cases, for example, it is used interchangeably with the term comparative advantage, having in mind the economic cost of production of a good. It could also be used to mean the evaluation of the financial performance of firms, hence conferring to it a narrower meaning (Cockburn et al. 1998). 'Competitiveness', however, may also be used interchangeably with terms such as technical efficiency or productivity (Biggs and Raturi, 1997) or as a measuring tool to the overall economic performance of countries (World Economic Forum, various), localities (Kanter, 1995), or industries and firms within countries (Wangwe, 1995). Another meaning of the term competitiveness could be found in the management and business literature, where it refers to the capacity of firms to master various qualitative management concepts within the industry or within a broader cluster in which they operate (Porter 1990; Fairbanks and Lindsay 1997). This, in turn, acts upon labour productivity and, as many of these management concepts (which define the competitiveness paradigm), affects the human capital necessary for improving productivity (Salinger, 2001).

Building on this last definition of competitiveness, and combining it with the comparative advantage approach, we can point out the opportunities and threats that trade liberalisation presents to the Italian manufacturing industry. If, on the one hand, it is undoubtedly true that Italian firms' competitiveness is put under threat by the recently experienced fast growing penetration into international markets by countries like China

or India (which can rely on a much cheaper unskilled labour force), it is also true that the ongoing globalisation process offers new opportunities in terms of fast growing markets, shortening of physical distances and increasing cultural integration.

Italian firms, as much as other firms in high-cost countries, can follow several different strategies to be competitive in such a global environment: 1) they could reduce wages and other production costs sufficiently to compete with low-cost foreign producers; 2) they could change the capital-labour ratio in order to increase labour force productivity; 3) they could outsource the labour intensive segments of the supply chain to low-cost countries (OECD, 2000).

Clearly, these strategies have a rather short-term perspective as well as some 'painful' side effects as they will either increase the unemployment level or reduce the living standards of employees. It looks like developed countries face a trade-off between sacrificing wages to create new jobs, on the one hand, and reducing jobs demand to maintain wage levels and social safety-net, on the other (OECD, 2000). However, there is a forth possible strategy which requires a structural shift into knowledge-based economic activities. Several analysts and researchers have recently pointed out how empowering innovative capabilities through investments in knowledge creation and diffusion might be the only viable way for Northern firms to regain competitiveness in a long-term sustainable way. Such *knowledge-based approach* is grounded on the idea that the ability to create and transfer knowledge is a crucial component in sustaining competitive advantage through innovation and other value generating activities (Pinch et al., 2003; Forsman and Solitander, 2003). In other words, firms' long-term competitiveness crucially depends on their ability to innovate and learn continuously (Florida, 1995; Cooke, 2001; Malmberge and Maskell, 2002; Imbriani, 2004).

The production shift towards more knowledge-based activities is a reality with which the majority of developed countries, which cannot rely on low labour costs, will have to confront. This, in turn, has induced several scholars to maintain that small-firms' paradigm would be unable to cope with new production standards. Indeed, several small firms have suffered severely from the competition of low-cost countries as they proved unable to adjust to the new production paradigm. Nonetheless, the fact that the share of SMEs has increased in most developed countries, suggests that efficient

SMEs have been able to deploy new strategies to maintain or even enhance their competitiveness in a globalised economy (OECD, 2000).

As put by John Cantwell: "competitiveness derives from the creation of the locally differentiated capabilities needed to sustain growth in an internationally competitive selection environment" (Cantwell, 2003: 18). We shall now consider four possible strategies adopted by small- and medium-sized firms to enhance competitiveness through the definition of *locally differentiated capabilities*; these are: the innovation strategy, the ICT (information and communication technology) strategy, the internationalisation strategy and the network strategy. This analysis will provide a conceptual framework within which we will develop our empirical analysis in the following section.

2.1 Innovation strategy

Modern economic theory would suggest a positive correlation between size of the firm and propensity to innovate. In fact, the knowledge production function defines a functional relation between knowledge inputs (e.g. investments in R&D) and innovative outputs (actual innovations typically measured through patents) which underlines a structural weakness for small and medium firms, as they are less able to invest in knowledge inputs, typically characterised by a high degree of uncertainty.

However, as proved by several studies "[o]ne of the important sources of competitiveness for SMEs has been to serve as agent of change, as the engine for new idea generation and innovative activity" (OECD, 2000: 73). This is especially true if we consider the role of small firms in newly emerging sectors like biotechnology and computer software (Audretsch, 1995).

In fact, small firms with little or no in-house R&D get the knowledge input from two major sources: knowledge *spillovers*, which are acquired through cooperation with other larger firms or with research institutions such as universities, and through qualified labour force *spin-offs*. As pointed out by Audretsch (1995), the movement and constant re-qualification of scientists, engineers and other knowledge workers both represent key factors of economic knowledge flows into small firms. The knowledge embedded into skilled workers is appropriated by small firms and utilised to innovate.

Hence, in this perspective qualified workers are not used to produce knowledge but are the direct drivers of innovations.

2.2 ICT strategy

Another strategy which can be used to improve SMEs' competitiveness is the adoption of modern information and communication technologies as they have an intrinsic potential to reduce costs. The introduction of ICT has affected small firms production system at least at three different levels: first, there was an organisational effect generated by the possibility of handling huge amounts of data using a small amount of resources (both in terms of labour force and capital assets); second, the introduction of powerful and cheap personal computers has enhanced the potential of SMEs to carry out in-house innovation and adaptation; finally, the introduction of new technologies, such as the Internet and the microprocessor, has effectively reduced the adverse impact of scale economies over small business.

This last point played a major role in promoting small business activities. As observed by Porter (2001), the Internet can be a critical factor in enhancing a small and medium firm's market reach as well as their operational efficiency. In other words, "Internet based technologies provide small firms the opportunity to overcome the limitations of size and compete more effectively and/or in larger markets with bigger sized establishments" (Dholakia and Kshetri: 311). In the literature there is some evidence to suggest that the Internet has increased international opportunities for SMEs (Hamill and Gregory, 1997; Lituchy and Rail, 2000). According to Hsieh and Lin (1998), there are many advantages in doing business on the Internet for SMEs, the major ones are the following: (1) all sites on the Internet are equal, where SMEs have as much space as large corporations; (2) the Internet enables the small business to maintain full-scale 'after sale customer service' at relatively cheap cost and to maintain contact with dispersed customers for all aspects of business activities; (3) it is the most cost-effective way to demonstrate a company's products/services in multimedia format; (4) it allows small businesses to establish an effective inter-business collaboration.

In other words, as maintained by several authors, the introduction and quick diffusion of ICT has created unprecedented opportunities for SMEs, which have virtually got access to the same capabilities as large businesses, and are technically able

to engage in national and international marketing operations which otherwise would have been unaffordable due to the huge amount of resources required (Fariselli, et al., 1999; Haynes et al., 1998; Lederer and Maupin, 1997; Pollard and Hayne, 1995; Poon and Jevons, 1997).

2.3 Internationalisation strategy

Most of the benefits related to the introduction and diffusion of ICTs spur from the increasing internationalisation opportunities provided by the digital economy to small business. This leads us to the third strategy adopted by small and medium firms to be competitive and cope with growing global pressure.

As discussed earlier, small and medium firms all over the world must confront international markets and start competing actively in global markets in various sectors. Even small businesses are progressively realising the potential of selling to faraway countries (Johansson, 2000). In this perspective, the internationalisation strategy of small and medium firms has attracted growing attention over the last few years.

This growing attention has not produced, however, one general definition to internationalisation. Two competing models divided the academia. On the one hand many researchers agree that companies' international expansion follows a sequential process (see among others: Bilkey and Tesar, 1977; Johanson and Vahlne, 1977, 1990; Cavusgil, 1980; Johansson, 2000), which start from the most basic international operation for a small firm which is buying foreign goods from local and foreign suppliers. Subsequently, small and medium firms might also engage in indirect exporting as an intermediate step to reach direct exporting. The final step, for the most efficient firms, would be establishing foreign sales subsidiaries and producing goods which are sold directly to customers abroad (Johansson, 2000).

On the other hand, the notion that firms go global gradually has been challenged by several scholars (see among others: Johanson and Wiedersheim-Paul, 1975; Bilkey and Tesar, 1977; Czinkota, 1982) who maintain that some firms follow an internationalisation strategy right from the start and conceive immediately the world as one global market. These firms have been labelled "born globals" (Johansson, 2000).

2.4 Network strategy

The ability of SMEs social networks to establish themselves as important and dynamic players within international markets was evident in numerous cases all over the world. Extensive literature pointed out how such clusters manage to respond to global competition challenges by capitalising on local opportunities and collective competitive advantage (UNIDO, 2001).

Networking enables small firms to establish formal and informal co-operation, which may take many forms: a mere knowledge exchange or commercial relationships or a more articulated web of relations which might also involve different actors such as formal and informal institutional players. As acknowledge by the literature, a key role in such complex networks is played by universities, research centres, local institutions and several others, which provide external support in many stages of the production as well as in innovating activities (Dubini and Aldrich, 1991; Storey, 1994; Drucker, 1984, 1985; Pavitt, Robson and Townsend, 1987; Acs and Audretsch, 1988).

Typically, firms' networks are most effective when combined with geographical proximity due to the intrinsic tacit nature of some knowledge which can, therefore, be exchanged solely through direct repeated contacts.

Such geographical networks provide, in turn, access to skilled and highly educated labour force and pooled business services. These opportunities permit them to specialise, build technological capability, adapt and innovate, and they facilitate tacit knowledge exchange and learning processes through interaction (UNCTAD, 1998).

There are many examples of small and medium firms' networks which managed gaining benefits that, usually, small producers can rarely attain on their own. As argued by Porter (1990), "all around the world, in country after country, the focus of competitive success is increasingly local"; hence, the ability to create a unique concentration of local skills, local technology, local infrastructure, and local suppliers in the relevant fields seems to provide the needed strategic ingredients for competitive success.

The Italian industrial districts (ID) are a typical example of successful development of SMEs collective efficiency and co-operative competition. Such clusters have evolved, through the intensification of industrial and social interdependence, into webs of social relations, which serve as the basis for a work structure characterised by social

cohesion as well as collaborative and participative principles. These relational networks also encourage trust and reciprocity, two elements essential for a smooth functioning of networks through formal and informal agreements (Becattini, 1990). In addition, through the creation of links between firms providing economies of scale and scope, such clusters showed a great ability to raise their competitive potential.

3. The survey

Our analysis is based on a survey on small and medium firms' competitiveness which was made available by the Unioncamere - Tagliacarne (a research centre affiliated to the national Chamber of commerce) in November 2004.

The reference population is a weighted sample of about 2600 firms: it encompasses firms operating in the manufacturing sector, located within Italy, with a number of employees not greater than 250. The sample is stratified by geographical locations, sectors and firms size.

During the month of April 2004, a questionnaire composed of five sections was submitted to sampled firms. Some preliminary questions aimed at defining the main characteristics of the firms (e.g. size, sector, age, legal structure of the firm) were initially posed. The first section was then devoted to describe the economic situation of SMEs; for this purpose, data on turnover, changes in turnover and changes in employment levels were collected.

The second section was concerned with the nature and the structure of the firms, including questions on the nature of subcontractor and the nature of firms' clients. The third section meant to capture the intensity of inter-firms relationship; in particular, the attitude of SMEs towards foreign markets and their engagement in collaborative projects with other firms and with specialised organisations. The fourth section dealt with the innovating capabilities of small and medium firms. It aimed at obtaining information on the factors that motivate firms to perform innovative activities, on the relevance and penetration of information and communication technologies and on the role played by suppliers, customers and several formal and informal institutions for innovation adoption. Finally, the fifth section was dedicated to capital markets and possible constrains faced by SMEs in funding their activities.

Although the questionnaire was quite detailed and comprehensive, it posed some problems which were mainly related to its structure in respect to some indicators like innovation and collaborative arrangements. For instance, the whole section on innovation was directed only to those firms which had introduced at least one innovation over the years 2001-2002. Similarly, the third section on inter-firms relationship was directed only to those firms which in the year 2003 were involved in some kind of collaborative agreement or were going to initiate one. Such constrains limited our analysis in many ways, and induced us to consider separately the whole sample as well as a sub sample of innovating firms.

3.1 Some descriptive results

Before reporting the main results of our econometric exercise, it is worth presenting a descriptive analysis of our data. While it will allow us to collect information on several aspects of firms' activities, it is worth bearing in mind that the qualitative structure of the responses in the survey limits the use of standard statistic indicators like mean and standard deviations.

Qualitative variables		**%**
Size		
Micro	(employees <10)	83.00
Small	(10<=employees<50)	15.12
Medium	(50<=employees<250)	1.88
Age		
before 1960		5.77
1961-1970		9.80
1971-1980		22.23
1981-1990		28.79
1991-2000		28.02
after 2000		5.40
Sector		
Food & Beverage		12.39
Clothing		13,57
Footwear &Leather		3.96
Wood & Furniture		15.01
Chemical & plastic products		3.47
Non Metallic, mineral products		4.93
Metal products		18.80
Mechanical products		7.78
Electrical equipment, motor vehicle		11.00
Other sectors		9.10

Table 1: Basic SMEs characteristics

Table 1 provides a good description of the firms' main characteristics. The median firms are micro sized. This results in 83 per cent of all firms operating with less than 9 employees. With regard to age structure, we observe that nearly 29 per cent of the firms were constituted between 1981 and 1990, followed by those constituted over the following decade. Only 5.7 per cent of firms were constituted before 1960. It is also worth noting that metal product industry is the most represented sector, whereas more skill intensive sectors such as chemical and plastic products account for less than 3.5 per cent of the whole sample of small and medium firms. Undoubtedly, this is related to the intrinsic characteristics of such sectors which favour larger firms (which can better exploit scale economies).

Table 2 reports firms' turnover change over the period 2001-2003 as well as its level recorded in the year 2003. About 30 per cent of the respondent firms noted a growing turnover over the period 2001-2002, whereas nearly 22 per cent declared a decline in turnover change.[1] With regard to turnover level, 77 per cent of firms fell in the two lowest brackets.

Turnover change in %			
Decrease	Unaltered	Increase	Total
21.51	48.16	30.33	100.00

	Turnover level %
Equal to or less than €300,000	43.11
Between €301,000 and €1,000,000	33.91
Between €1,000,000 and €5,000,000	17.21
Between €5,000,000 and €10,000,000	3.12
More than €10,000,000	2.64

Table 2: Change in turnover and turnover level

More interesting are the differences in turnover change and level for firms in different size classes, ranging from very small firms to medium-sized (table 3). The main differences are clearly between the very small enterprises, on the one hand, and the medium enterprises on the other hand. To illustrate this we can observe how about 27 per cent of firms in the size class 50-249 marked a growing turnover compared to

[1] Note that a less than 5 per cent increase or decrease in turnover is considered as an unaltered turnover.

previous years. On the contrary, the same percentage of very small firms faced a decrease in their turnover change.

When we take a look at turnover level, we can note that it sharply increases with firm size: 65 per cent of very small firms have a turnover equal to or less than €300,000, while almost 40 per cent of medium firms declare a turnover higher than €10,000,000.

	Number of employees		
	<=9	10-49	50-249
Decrease in turnover	26.68	17.91	13.09
Unaltered turnover	54.64	52.39	60.17
Increase in turnover	18.68	29.70	26.74

	Number of employees		
	<=9	10-49	50-249
Equal to or less than €300,000	65.18	7.31	2.79
Between €301,000 and €1,000,000	26.11	41.79	3.62
Between €1,000,000 and €5,000,000	7.56	38.36	40.11
Between €5,000,000 and €10,000,000	0.70	8.51	14.76
More than €10,000,000	0.44	4.03	38.72

Table 3: Change in turnover and turnover level according to firms' size

Table 4 provides information regarding small and medium firms' competitive strategies. When firms were asked to identify the factors (the "sources") of their competitiveness, a common reply was "innovating behaviours". Table 4 highlights this fact: a large majority (almost 62 per cent) of firms put emphasis on innovative activities. Less relevant appeared to be firms' propensity to enter into collaborative partnerships (only 22 per cent) in the year 2003.

Competitive Strategies		
	Yes in %	No in %
Innovating behaviour	61.67	38.33
Collaborative arrangements	21.50	78.50

Table 4: SMEs' competitive strategies

This last table shows clearly how small and medium entrepreneurs are aware to the fact that innovation is important to be competitive in a globalised world markets.

3.2 Identifying the variables used in the model

Since the aim of our analysis is to describe the determinants of competitiveness, we shall now clarify how we are going to measure it. In section 2 we attempted to define competitiveness; however, when trying to go beyond the task of definition, measuring the competitiveness of firms or industries may prove to be rather difficult. In fact, aggregating the various notions discussed earlier into one quantitative variable which could provide a measurement to a firm's performance is not so easy. Such task becomes even harder when constrained by a set of variables which are already defined, as in our case. In order to deal with a similar challenge, various studies on competitiveness have used one or more proxies, some of which look at outcomes and others at inputs. A typical 'outcome proxy' for competitiveness is the extent to which a firm manages to increase its market share.

A possible way of measuring it would be comparing the sales turnover over the whole sector turnover for two consecutive years. Unfortunately, we do not have data on turnover sales for two years; however, as already mentioned, we have a specific question asking if the sales turnover for year 2003 has increased, diminished or remained stable with respect to the turnover of the period 2001-2002. We shall use this variable to measure changes in competitiveness. We are aware that such proxy might capture other factors rather than a shift in competitiveness, such as an increase in the overall market dimension caused, for instance, by a change in trade agreements. However, the period considered was not characterised by any major change in trade relations, and this increases our confidence in using such proxy as the dependent variable. We shall also use the actual turnover as an alternative dependent variable. Table 5 reports a simple definition of our dependent variables.

Dependent variables	
Turnover change	Whether or not a firm marked an increased, an unaltered or a decline in turnover change over the period 2001-2002
Turnover level	Five interval categories of turnover to which a firm declares to belong to

Table 5: Dependent variables description

Comparing the factors affecting changes in turnover with those affecting actual levels of turnover will allow us to capture a dynamic aspect of possible convergences (divergences) towards (from) high levels of competitiveness. An example might help in understanding this point: let's say that firms operating in sector *X* have, *ceteris paribus*, a higher probability of having a high turnover, but firms operating in sector *Y* have, *ceteris paribus*, a higher probability of being among those firms experiencing an increase in sales turnover; then we could conclude that, on average, sector *Y* is closing the gap with sector *X*.[2]

We shall regress these dependent variables over a set of explanatory variables which will be defined according to the theoretical framework introduced in section two, as well as on a group of variables which will shed light on the main characteristics of the firms included in our sample. We refer to the latter set of variables (i.e. size, age, sector) as *control variables* because they capture the diversity of firms. Specifically, the use of these variables is desirable because it allows us to study the impact of the explanatory variables on turnover and turnover change by controlling for firms' different characteristics.

Control Variables	
Age	Firm's year of constituency
Size	Firm's number of employees
Sector	Industry dummies for
	Food & beverage
	Clothing (*base category*)
	Footwear, leather
	Wood and furniture
	Chemical & plastic products
	Non Metallic mineral products
	Metal products
	Mechanical products
	Electrical equipment, motor vehicle
	Other sectors

Table 6: Control variables description

[2] We shall be able to capture these probabilities by using ordered probit and interval regression models and calculating marginal effects as will be discussed in the following section.

Firm's size is proxied by the number of employees, while nine dummy variables denote the industries[3]. We also control for firms' age distinguishing among firms constituted before 1960, between 1961 and 1970, between 1971 and 1980, between 1981 and 1990, between 1991 and 2000, and after 2000.

The explanatory independent variables are selected along the theoretical lines discussed in the previous section and should provide measures of the four possible strategies followed by competitive SMEs. We shall calculate and compare the impact of these strategies - innovation strategy, ICT strategy, network strategy and internationalisation strategy - over our dependent variables.

As already mentioned, the structure of the survey does not allow us to use all possible variables when referring to the whole sample, as some questions were posed solely to innovating firms. This obliges us to run our regression in a reduced form for the whole sample and in a more comprehensive one for innovating firms. In tables 7 and 8 we report the two sets of explanatory variables for the two samples.

Independent variables	Description
Innovation Variables	
Product innovation	1 if a firm introduced product innovation in the period 2001-2002
Process innovation	1 if a firm introduced process innovation in the period 2001-2002
Organisational Change	1 if a firm introduced organisational change in the period 2001-2002
Marketing Innovation	1 if a firm introduced marketing innovation in the period 2001-2002
Network strategy	
National network	1 if a firm entered into partnership arrangement with Italian firms
Foreign network	1 if a firm entered into partnership arrangement with foreign firms
Internationalisation strategy	
Local trade	1 if the firm's trade serves the local market
Regional trade	1 if the firm's trade serves the regional market
National trade	1 if the firm's trade serves the national market
Export	1 if the firm is an exporter

Table 7: Independent variables for all SMEs

[3] In the survey firms are classified into ten sectors. We restrict our analysis to nine sectors dummies plus one latent sector (clothing) which serves as base.

Independent variables	Description
Innovation Strategy Variables	
Product innovation	1 if a firm introduced product innovation in the period 2001-2002
Process innovation	1 if a firm introduced process innovation in the period 2001-2002
Organisation Change	1 if a firm introduced organisational change in the period 2001-2002
Marketing Innovation	1 if a firm introduced marketing innovation in the period 2001-2002
Workforce training	1 if a firm invested in the formation of their labourers between 2001-2002
New Workforce training	1 if a firm invested in training of new labourers between 2001 and 2002
Manager Training	1 if a firm invested in training of managers between 2001 and 2002
Unaltered innovation exp.	1 if a firm reported unaltered innovation expenditure in the period 2001-02
Increase innovation exp.	1 if a firm reported increased innovation expenditure in the period 2001-02
ICT strategy variables	
Informative ICT firm	1 if web catalogue of a firm's product is available to other firms
Interactive ICT firm	1 if web site provides an interactive form for other firms
E-commerce ICT firm	1 if an on-line ordering facility is available for firms
Informative ICT consumer	1 if web catalogue of a firm's product is available to consumers
Interactive ICT consumer	1 if web sites provides an interactive form available to consumers
E-commerce ICT consumer	1 if an on-line ordering facility is available for consumers
Network strategy	
National network	1 if a firm entered into partnership arrangement with Italian firms
Foreign network	1 if a firm entered into partnership arrangement with foreign firms
University support to innov.	1 if a firm receives support from university
Public support to innov.	1 if a firm receives support form public institution
Science support to innov.	1 if a firm receives support form scientific research centre
Bic support to innov.	1 if a firm receives support from a Business Innovation Centre
Chamber support to innov.	1 if a firm receives support from Chamber of Industry & Trade
Industry support to innov.	1 if a firm receives support from industrial association
Private support to innov.	1 if a firm receives support from private institution
Sector support to innov.	1 if a firm receives support from same sectors
Supplier support to innov.	1 if a firm receives support form suppliers
User support to innov.	1 if a firm receives support from users
Internationalisation strategy	
Local trade	1 if the firm's trade serves the local market
Regional trade	1 if the firm's trade serves the regional market
National trade	1 if the firm's trade serves the national market
Export	1 if the firm is an exporter

Table 8: Independent variables for innovating SMEs

4. Econometric approach and its implementation

The methods provided by econometrics are designed to extract information from data generated by an economic process. The features of the economic process in which we are interested are the factors underling the decision-making process of enterprises. Specifically, this paper tries to answer the following question: why do some small and medium size enterprises are more competitive than others? As discussed, we aim at

answering this question assessing the contribution of several explanatory variables on firm's competitiveness measured true turnover and turnover change of firms.

Specifically, we will regress two different models, both for all firms and for innovating firms. Models (1a) and (2a) hold for all firms whereas models (1b) and (2b) hold for innovating firms:

$$y_{tc}^{*} = \boldsymbol{\beta}_1'\mathbf{x}_1 + \boldsymbol{\beta}_2'\mathbf{x}_2 + \boldsymbol{\beta}_3'\mathbf{x}_3 + \boldsymbol{\beta}_4'\mathbf{x}_4 + \varepsilon \quad (1a)$$

where y_{tc}^{*} indicates whether a firm reported an increased, an unchanged or a decline turnover change in the period 2001-2002, $\mathbf{x}_1$ represents a vector of firm characteristics, $\mathbf{x}_2$ is a vector of variables which capture innovating strategy, $\mathbf{x}_3$ is a vector of networking variables and $\mathbf{x}_4$ is a vector of variables which captures firms' internationalisation strategy.

This model, when estimated for the restricted sample of innovating firms incorporates a fifth vector, $\mathbf{x}_5$, which contains a set of ICT variables. Moreover, the number of explanatory variables included in vectors $\mathbf{x}_2$, $\mathbf{x}_3$ and $\mathbf{x}_4$ increases when we consider solely innovative firms[4]:

$$y_{tc}^{*} = \boldsymbol{\beta}_1'\mathbf{x}_1 + \boldsymbol{\beta}_2'\mathbf{x}_2 + \boldsymbol{\beta}_3'\mathbf{x}_3 + \boldsymbol{\beta}_4'\mathbf{x}_4 + \boldsymbol{\beta}_5'\mathbf{x}_5 + \varepsilon \quad (1b)$$

The second model is identical to the one just described with the exception of the dependent variable (y_{tl}^{*}) which now represents the level of turnover.

$$y_{tl}^{*} = \beta_0 + \boldsymbol{\beta}_1'\mathbf{x}_1 + \boldsymbol{\beta}_2'\mathbf{x}_2 + \boldsymbol{\beta}_3'\mathbf{x}_3 + \boldsymbol{\beta}_4'\mathbf{x}_4 + \varepsilon \quad (2a)$$

$$y_{tl}^{*} = \beta_0 + \boldsymbol{\beta}_1'\mathbf{x}_1 + \boldsymbol{\beta}_2'\mathbf{x}_2 + \boldsymbol{\beta}_3'\mathbf{x}_3 + \boldsymbol{\beta}_4'\mathbf{x}_4 + \boldsymbol{\beta}_5'\mathbf{x}_5 + \varepsilon \quad (2b)$$

[4] A full list of the variable included in each model is reported in tables 6 and 7.

The data of both dependent variables are ordinal in nature and the data on turnover levels are also interval coded (see table 5). There are two possible procedures that could be exploited here. A standard ordered probit model could be used for both models as this captures the ordinal nature of the dependent variable assuming that the threshold values delineating the different categories are unknown. However, when considering turnover levels it would be more appropriate to use a second procedure (referred to as an interval regression) which explicitly takes into account the value of the known thresholds governing the intervals.

Hence, ordered probit and the interval regression share the same framework with the only difference that, in the first model, the boundaries are parameters that we are going to estimate and, in the second one, the boundaries are given. The ordered probit and the interval regression models, in fact, take the same form:

$$Y^* = \boldsymbol{\beta}'\boldsymbol{x} + \varepsilon$$

where $\boldsymbol{x}$ is the vector of the observed factors (i.e. firm specific characteristics) and ε is the error term. The dependent variable will be respectively:

model 1: ordered probit

$$Y = \begin{cases} 1 & \text{decline} \\ 2 & \text{unaltered} \\ 3 & \text{increase} \end{cases}$$

model 2: interval regression

$$Y = \begin{cases} 1 & \text{less than 300,000 €} \\ 2 & \text{between 300,001 to 1 milion €} \\ 3 & \text{between 1 to 5 milion €} \\ 4 & \text{between 5 to 10 milion€} \\ 5 & \text{more than 10 milion €} \end{cases}$$

For the ordered probit the relationship between the unobserved variables Y^* and the observed variable Y is as follows:

$$Y = \begin{cases} 1 \quad if \quad Y^* \le c_1 \\ 2 \quad if \quad c_1 \prec Y^* \le c_2 \\ 3 \quad if \quad c_2 \prec Y^* \end{cases}$$

where c_i are arbitrary cut-off points or so-called threshold parameters.

In order to construct the likelihood function, we first define the probability that the respondent's response is 1, 2 or 3 (i.e. $P(Y=1)$, $P(Y=2)$ and $P(Y=3)$), which is true whatever the distribution F is.

$$\begin{aligned} P(Y=1) &= P(Y^* \le c_1) \\ &= P(\boldsymbol{\beta}'\boldsymbol{x} + \varepsilon \le c_1) \\ &= P(\varepsilon \le c_1 - \boldsymbol{\beta}'\boldsymbol{x}) \\ &= F(c_1 - \boldsymbol{\beta}'\boldsymbol{x}) \end{aligned}$$

$$\begin{aligned} P(Y=2) &= P(c_1 \prec \boldsymbol{\beta}'\boldsymbol{x} + \varepsilon \le c_1) \\ &= P(c_1 - \boldsymbol{\beta}'\boldsymbol{x} \prec \varepsilon \prec c_2 - \boldsymbol{\beta}'\boldsymbol{x}) \\ &= F(c_2 - \boldsymbol{\beta}'\boldsymbol{x}) - F(c_1 - \boldsymbol{\beta}'\boldsymbol{x}) \end{aligned}$$

$$\begin{aligned} P(Y=3) &= P(c_2 \prec Y^*) \\ &= P(c_2 \prec \boldsymbol{\beta}'\boldsymbol{x} + \varepsilon) \\ &= 1 - F(c_2 - \boldsymbol{\beta}'\boldsymbol{x}) \end{aligned}$$

The second step is to define the number of observations associated with each probability. Specifically, let's denote with $i = 1....I$ the enterprises with $Y=1$, i.e. the firms which reported a decline in turnover, with $j = 1...J$ the firms with $Y=2$, i.e. the firms which reported a turnover unaltered compared to the previous years and finally with $k = 1...K$ the firms with $Y=3$, i.e. the firms which reported increased turnover.

Hence, the likelihood function can be formulated as:

$$L = \prod_{i=1}^{I} F(c_1 - \boldsymbol{\beta}'\boldsymbol{x}_i) \prod_{j=1}^{J} \left[F(c_2 - \boldsymbol{\beta}'\boldsymbol{x}_j) - F(c_1 - \boldsymbol{\beta}'\boldsymbol{x}_j) \right] \prod_{k=1}^{K} \left[1 - F(c_2 - \boldsymbol{\beta}'\boldsymbol{x}_k) \right]$$

Now, assuming that the disturbance term, ε, is independent of x and normally independently distributed across the survey respondents (with zero mean and unit variance), we will have an ordinal probit. We subsequently get rid of the constant term (assuming $\boldsymbol{\beta}'\boldsymbol{x} = \beta_0 + \boldsymbol{\beta}'\boldsymbol{x}$) and maximise the log likelihood function with respect to $c_1 - \beta_0/\sigma$, $c_2 - \beta_0/\sigma$ and $\boldsymbol{\beta}/\sigma$.

In the interval regression model, the threshold parameters are known; therefore the relationship between the unobserved variables Y^* and the observed variable Y is as follows:

$$Y = \begin{cases} 1 & if \quad Y^* \leq 300 \\ 2 & if \quad 301 \prec Y^* \leq 1 \\ 3 & if \quad 1 \prec Y^* \leq 5 \\ 4 & if \quad 5 \prec Y^* \leq 10 \\ 5 & if \quad 10 \prec Y^* \end{cases}$$

These values enter into likelihood function, which we are now able to maximise with respect to $\boldsymbol{\beta}$ and σ. This procedure, as opposed to ordered probit, provides a more efficient estimator as it exploits the given threshold information and involves estimation of fewer parameters (Reilly et al., 2004). Furthermore, given that the introduction of the known thresholds fixes the scale of the dependent variable, the estimated coefficients are also open to a more direct and intuitive OLS-type of interpretation. The estimates contained in β parameters' vector are interpretable on the assumption that we have actually observed the y_i^* outcome for each of the individuals in the sample.

5. Results and interpretation

We shall present the results of the two models described above separately. We estimated the ordered probit model and the interval regression model for all the firms

(both innovative and non innovative[5]) first, and then solely for innovative firms. All estimates were obtained using STATA 7.0.

Most of the estimated coefficients of both models were significant and correctly signed, implying that the explanatory variables selected are a good predictor of firms' performance. Concerning the diagnostic test results, the McFadden R^2 (which compares the likelihood for the intercept only model to the likelihood for the model with the predictors), its adjusted version and the McKelvey and Zavoina R^2 (which measures model fit as the proportion of variance accounted for) suggest a poor fit for the ordered probit model.[6] The goodness of fit, however, increases substantially when we consider interval regression. It should be emphasized that the poor goodness-of-fit does not imply model mis-specification as the underlying model contains large random components. We shall now present both sets of results separately.

5.1 Estimated coefficients for ordered probit model

As already discussed, the ordered probit model was estimated using turnover change as dependent variable. In table 9 we report estimation results for the whole sample (i.e. model 1a). We first look at control variables to see which structural characteristics affect changes in turnover. As we can note, micro firms and small firms have a negative relationship with turnover change compared to medium-sized firms (base category); implying that micro and small firms are decreasing, over time, their share of turnover when compared to larger firms.

Our empirical result is not consistent with previous empirical literature suggesting that the reverse is true, i.e. micro-firms have a positive relationship with turnover change compared to larger firms. This literature highlights how the position of small firms is relatively weak; they are closer to a critical threshold which indicates that an eventual decline in their profitability would lead the firms out the market. Conditional on exiting market, 'survivors' micro-firms are forced to be more profitable than larger firms (Dune et al., 1989).

[5] Firms were classified as innovators or non-innovators on the basis of their answer to the following question: "Has your firm introduced any innovation in product, in processes, in organisation and in marketing during the last two years?"

[6] For a clear description of these indexes see: http://www.gseis.ucla.edu/courses/ed231c/notes3/fit.html

However, a possible explanation to our finding is that there are actually severe constrain to micro and small firms' growth. In order to test this hypothesis we need to identify and measure these possible constrains. Recent literature has focused on the role of financial markets on growth. Our survey shows that 10 percent of medium-sized firms report that private banks credit supply is inadequate to their demand, whereas this percentage goes up to 21 and 25 percent when small and micro firms are considered, respectively.[7] These finding are certainly informative but, as pointed out by Wagenvootr, (2003), "simply asking for the views of SME managers cannot provide hard evidence for finance constraints". Nonetheless, at first approximation, these responses provide interesting insights.

More rigorous investigation has been carried out by Wagenvootr, (2003) using data on balance sheets and income statements of more than 200,000 European manufacturing and construction firms. One core result of this study is that European SMEs suffer from a structural financing problem that hinders their growth. In particular, it was observed that finance constraints tend to hinder the growth of small and very small firms and to be less binding for medium-sized enterprises (Wagenvootr, 2003).

- Insert Table 9 about here -

Table 9: Ordered probit model (whole sample)

Firms' age is positively related to turnover change. In particular, young firms (those constituted after 2000) are correlated with turnover change more than older firms. More precisely, it looks as though (with just one exception for firms constituted between 1981 and 1990) the younger the firm is the higher its chance to experience increase in turnover change are. This may be related to the fact that younger firms employ younger managers, who are better trained to operate in the knowledge economy. However, this could also simply mean that younger firms start from lower turnover and therefore have higher probability to improve their performance, hence closing the gap with older firms. As discussed in section 3.2, we will be able to check this hypothesis comparing these finding with those obtained from model 2a.

[7] The different response rates have been tested using Pearsone χ^2 to be statistically significantly different.

As far as sectors are concerned, it is quite interesting to observe how firms operating in the typical *made in Italy* industries (i.e. clothing; footwear and leather; wood and furniture) are those less likely to experience an increase in turnover change. As broadly discussed in section 2, this finding indicates a structural weakness of traditional sectors which are subject to the competing pressure of low income (and low wages) countries.

We shall now turn our attention towards independent explanatory variables. In the first specification of model 1, we have a smaller number of explanatory variables due to the aforementioned survey problems. More precisely, we have a set of variables which refer to innovation strategies, a set of variables referring to trade penetration (i.e. local, regional, national and international reach) and internationalisation strategy, and two variables referring to networking strategies achieved through collaborative agreements.

First, we can observe that innovation has always a positive impact upon turnover change. However, the introductions of new methods based on production, delivery and distribution (i.e. process innovation) are, by far, more effective. These are followed by product innovation and organisation change. Finally, marketing innovations do affect positively turnover change but to a lesser extent.

As far as internationalisation is concerned, it is interesting to observe how exporting firms are less likely to experience increase in turnover. This result is in line with several recent studies (see, among others, Beranrd and Jensen, 1999; Clerides, 1996) that document how the status of exporter is not a determinant factor of firm's success in obtaining higher turnover change vis-à-vis non-exporters. Vice versa, the relationship between past increases in turnover change and future exporters is positive. Moreover, it is worth noting how in the Italian case this result might be affected by the recent introduction of the euro currency and its subsequent appreciation which has negatively affected Italian (and European) volume of exports (ICE, 2004).

Further, presence in national and/or local market is positively correlated with turnover change, while presence in regional market is negatively related to it.

With regard to networking strategies we can observe how collaborative agreements do affect positively turnover change. Such inter-firms agreements are particularly relevant when they take place at international level, suggesting that both networking and internationalisation of firms play a positive role in turnover increase.

These parameter estimates do not indicate the marginal effect[8] of each regressor on the dependent variable; hence, we additionally calculate these effects of the above mentioned variables on the probability for turnover increase (columns 4-9 of table 8).

Unsurprisingly, our analysis of the probability of achieving positive turnover change confirms the results so far discussed. Specifically, we can now quantify the effect of innovating upon turnover change: firms introducing product innovation or organisational changes are over 4 percentage points more likely to register positive turnover change; whereas, *ceteris paribus*, firms introducing process innovation are over 7 percentage points more likely to experience turnover increase.

Also collaborative agreements have a significant impact over the probability of experiencing positive turnover change: firms which collaborate with foreign enterprises are, *ceteris paribus*, almost 4.5 percentage points more likely to experience positive turnover change, whereas national collaborative networking increases the probability of experiencing increase in turnover of 1.2 percentage points.

5.2 Estimated coefficients for ordered probit model (innovating firms)

We shall now restrict the focus of our analysis to innovating firms. This will allow us to estimate a better specification of model 1 which encompasses a broader set of explanatory variables. Along the line of the analysis conducted in the previous section we start by looking at firms' characteristics and subsequently investigate the effects of explanatory variables. We will report the marginal effects calculated separately from the regression results (table 10).

- Insert Table 10 about here -

Table 10: Ordered probit model (innovating firms)

When restricting the analysis to innovating firms, industry dummies indicate that a higher probability of experiencing turnover increase is associated with firms operating neither in the *made in Italy* sectors nor in the most science based sectors (i.e. Chemical

[8] Marginal effects indicate the percent point change of probability if the exogenous variable goes up with 100 per cent or the value of the indicator variable changes from zero to one. The effects are calculated at the mean of the exogenous variables.

& plastic products; Electrical equipment)[9]. With respect to the base sector (Clothing), 'Non Metallic mineral products' and 'Food & beverage' are, *ceteris paribus*, respectively 9 and 4.5 percentage points more likely to experience positive turnover change.

Also for this restricted sample the micro size is a disadvantage. Firms with less than 10 employees, compared to the medium-sized firms (the base category), are almost 8 percentage points less likely to increase their turnover.

Again the age of the firm is positively correlated with a positive turnover change, young firms being, *ceteris paribus*, on average 16 percentage points more likely to report turnover increase. Also the marginal effect for those firms constituted between 1991 and 2000 indicates, *ceteris paribus*, a higher probability of experiencing positive turnover change of over 15 percentage points than those constituted before 1960.

Innovation has, indeed, a positive impact upon innovating firms' probability of experiencing positive turnover change. However, not all innovation strategies weigh the same: our results indicate a statistically significant correlation between two forms of innovation (process innovation and organisation change) and firm's performance; whereas we discover a negative (but not significant) coefficient for product innovation and marketing innovation variables.

By looking at the marginal effects with respect to process innovation and organisation change we observe how such innovating strategies increase the probability of firms to expand their turnover by 1.8 and 2.7 percentage points, respectively. The importance of process innovation and organisational changes does not come as a surprise if we consider the low propensity of Italian firms to invest in R&D. This result is in line with the analysis developed by Piva and Vivarelli (2004), according to which technologically-intermediate countries (like Italy) are more committed to embodied technical change (especially process innovation) linked with organisational changes due to the lack of domestic investment in R&D.

The fact that small and medium enterprises investments in innovation are not adequate is corroborated by the finding that firms which do invest in innovation experience a remarkable increase in competitiveness. In fact, those firms that increase

[9] This definition is grounded on Pavitt taxonomy (Pavitt, 1984).

expenditure for innovation are, *ceteris paribus*, over 30 percentage points more likely to report an increase in turnover change compared to those firms which keep low their expenditure (the base category).

As discussed in section 2.1, innovation in SMEs is often obtained through skilled workers spin-off or even through investment in labour force re-qualification. This is a source of knowledge flows into small firms which, in turn, enhances their innovating capability. Our data show that the probability of having higher turnover increases with workers and manager training. Such finding is consistent with economic theory which states that human capital investment foster firms' productivity (Loewenstein and Spletzer, 1994 and 1999; Katz and Ziderman, 1990; Acemoglu and Pischke, 1999).

Particularly, the marginal effects indicate that firms which invest in managers' re-qualification are, *ceteris paribus*, over 6 percentage points more likely to report an increase in turnover.

We can now turn to consider the impact of ICT strategy upon competitiveness. The findings show that website technologies do improve firms' performances. The most effective use of internet facilities is business-to-business (B2B) e-commerce. However, those firms equipped with a website dedicate to customers use (excluding e-commerce) do experience a positive impact upon turnover change. In other words, ICT strategy is particularly successful when used for B2B e-commerce, and to provide detailed information on firms' products to final consumers. In fact, firms promoting business-to-consumer (B2C) e-commerce are, *ceteris paribus*, less likely to report an increase in turnover change by almost 5 percentage points.

As far as network strategy is concerned we investigate both the impact of inter-firms networks as well as more complex networking strategies which include external actors such as universities, research centres and other local and national institutions. Innovating firms' turnover growth has a positive and statistically significant relationship with university, supplier and user support.[10] On average, firms which make use of one of these three 'external' sources of support in their innovating process are between 4 and 8 percentage points more likely to report an increase in turnover.

[10] In this context we refer to support to innovate.

However, also collaboration with other firms (operating in the same sector) is statistically relevant. Innovating firms which make use of networking with other firms in their innovating process are, *ceteris paribus*, 8 percentage points more likely to report increase in turnover change.

This result is corroborated by the fact that collaborative agreements affect substantially the probability of increasing innovating firms' turnover. More precisely, firms which collaborate with foreign enterprises are, *ceteris paribus*, more than 8 percentage points more likely to experience positive turnover change, whereas firms which collaborate solely with national firms are less than 1 percentage points more likely to register positive turnover change

This last result confirms our expectation from internationalisation strategy. However, as already observed in section 5.1, exporting firms are less likely to experience increase in turnover. In fact, *ceteris paribus*, firms operating in regional and national markets are respectively 1.6 and 2.6 percentage points more likely to experience an increase in turnover, as opposed to exporting firms which are, *ceteris paribus*, 4.9 percentage points less likely to increase their turnover.

All in all, this analysis suggests that process innovation and organisational change are important factors in the development of Italian manufacturing small and medium firms. Also a certain use of modern information and communication technologies is associated with increase in competitiveness. However, B2C e-commerce has no positive impact over turnover change, suggesting that final customers might be not ready yet to embrace such technologies. An alternative explanation of this finding is that firms using B2C e-commerce are also those more internationalised and that e-commerce is used mainly for international sales. If so, B2C e-commerce might have suffered from the strong appreciation of the euro as discussed earlier.

Furthermore, we noticed how enterprises engaged in collaborative relationships (both at national but mainly international level) are likely to be more competitive. This result is not very surprising if we think of the many reasons for collaboration (i.e. sharing cost and risk, accessing and serving international markets, etc.).

In the following section we further investigate the determinants of competitiveness of small and medium-sized manufacturing enterprises. We will analyse the result obtained from the estimation of model 2a and 2b (as reported in section 4). As already

discussed, these two additional models were estimated using an interval regression model with known threshold values as the dependent variable (turnover) was ordinal in nature and interval coded.

5.3 Estimated coefficients for interval regression

We shall now address, with a different econometric model, the same question investigated so far: which are the determinants of small and medium firms competitiveness. In doing so we will employ an interval regression model regressing the same independent variables over turnover. Table 11 summarises the main results of this analysis.

- Insert Table 11 about here -

Table 11: Interval regression model (whole sample and restricted sample)

In explaining the main findings, it is worth noting that most of the results are qualitatively similar to the previous analysis. Moreover, our dependent variable is expressed in levels (and not in logs), therefore we will concentrate only on the sign of each regressor and its relative magnitudes and confront these results with those earlier obtained.

At a first glance we can observe that there is a statistically significant negative relation between age of the firm and turnover. This finding would suggest that the younger is the firm the lower the turnover is. However, the results obtained from the ordered probit model suggested that younger firms were more likely to experience turnover growth. We can infer that there is a dynamic element pushing, on average, younger firms to close the gap with older (and probably better established) enterprises.

The impact of firm size over turnover is pretty much the same as observed earlier: with micro and small firms being disadvantaged when compared to the base category of medium firms. In this case, combining this finding with the results obtained in sectio 5.2 we can conclude that the poor performance of micro and small enterprises gets worse over time. It is worth mentioning that the results concerning firms' age and size do not change if we consider either the whole sample or the restricted sample (i.e. innovating firms).

Looking at sector' dummies, we notice that when we consider the whole sample, the *made in Italy* industries (i.e. Clothing; Footwear and leather; Wood and furniture) are again the less advantaged in terms of turnover levels. Combining this finding with those earlier obtained for turnover changes, we can conclude that firms operating in these traditional sectors have got an initial disadvantage in terms of turnover levels, and that this disadvantage is growing over time.

When considering solely innovative firms, the picture does change. Now, the only sectors which show a positive correlation with turnover are the chemical sector and the food sector. As the base category is clothing, this result might suggest that innovating firms in the clothing sector are rather productive if compared with other firms operating in the same sector, as well as if compared with other innovative firms operating in other sectors.

We turn now our attention towards explanatory variables. Estimations reported in table 11 show that there is always a positive and significant relationship between turnover and various innovation forms. This is consistent with what we observed earlier. Innovating firms' turnover is also positively correlated with investment in innovating activities, as well as in labour force re-qualification.

With respect to market reach and internationalisation we can notice how now there is a statistically significant positive correlation between turnover and national reach of trade as well as with exports. On the contrary, firms which operate mainly for the local and regional market are negatively correlated with turnover. This finding corroborates our hypothesis that the negative correlation between exports and turnover change was due to the short term effect of sharp appreciation of the Italian currency.

The result regarding ICT impact upon turnover comes as a surprise as it shows a positive correlation with those typology of uses which were negatively correlated with turnover change, and vice versa. A partial explanation for such contrasting results could be found in the idea, discussed earlier, according to which firms use e-commerce mainly to reach international customers and therefore might have suffered from currency appreciation.

Collaborative arrangements are important for turnover: keeping all other things equal, firms engaging in collaborative networking reach higher turnover levels. However, it is worth noting that when restricting the sample to innovating firms,

collaborative agreements do have a positive impact upon turnover only if take place with foreign entrepreneurs.

6. Conclusions and open questions

A growing concern of Italian policy makers has been the ability of small and medium manufacturing firms to compete on global markets. One argument often put forward in this context is that not enough resources are devoted to innovative activities and that the typical micro structure of Italian firms represents a constrain to global development rather than a strength of the system.

Within this heated political debate, economists attempt to evaluate what are the real chances that the Italian SMEs' system would survive global competition and which are the best possible strategies (i.e. the *best practice*) to remain competitive. Two core topics in this regard are innovation and networks: the former represent, according to several authors, the only viable way for developed countries to be competitive under the growing pressure of developing countries which have a clear competitive advantage in the production of low skill and knowledge intensive goods. This argument leads to the idea that Northern countries have to turn into *knowledge societies* to be competitive and that Italian firms' long-term competitiveness crucially depends on their ability to innovate and learn continuously.

Innovation is indeed a crucial component in sustaining competitive advantage through value generating activities; however, it relies largely on the ability of individual firms to create and transfer knowledge. Upon this idea is grounded the second solution put forward: the importance of networks for competitiveness. In the Italian case, this strategy should be understood within the particular context of the so-called industrial districts. The Italian particular model of organisation of production, based on small dimension and often on informal relationships within and outside the firm, guarantees flexibility and a high degree of specialisation. These two features could be considerably useful in the creation of networks in general or of industrial districts in particular. However, also in this case, Italian firms' long-term competitiveness depends on their ability to exploit these advantages in a way that promotes the creation of knowledge networks, which, in turn, facilitate innovation mechanisms.

Strictly connected to innovation and networks there are two further strategies related to knowledge society: on the one hand the rapid diffusion of modern ICTs could increase the productivity as well as the reach of small and medium firms; on the other hand, the combination of communication technologies and political globalisation opens up international markets to small firms in a way which was unimaginable so far.

Our investigation is part of this broad debate and it attempts to provide some insights on the relative importance of each and every strategy so far mentioned. Using a unique database on SMEs we employed an ordered probit model and an interval regression model to test the key determinants for small and medium firms' competitiveness.

A preliminary result is that size matter: the smaller the firm is the lower is the turnover and the lower are the chances to experience turnover growth. This finding suggest, as broadly argued by the academia and policy makers, that micro firms (i.e. those with less then 10 employees) have a gap of competitiveness which grows over time.

When considering the strategic components of competitiveness, our analysis showed how innovation is a key factor; however, Italian firms still have a competitive advantage in process innovation and organisational changes. This finding is consistent with certain literature which emphasises how Italy is a technologically-intermediate country more inclined towards embodied technical change (especially process innovation) linked to organisational changes rather that to direct investment in product innovation.

Networking is indeed a source of competitiveness: inter firms networks of collaboration are always positively correlated with growing turnover; moreover, institutional collaboration emerges as a key source for innovation. In particular, Universities' support to innovation is always associate with a substantial increase in firms' turnover.

However, it emerged that super-national networks are, by far, the most effective ones. This finding undermines the importance attributed to the role played by geographical proximity (upon which the industrial district argument was grounded), emphasising instead the role of internationalisation as well as the importance of communication technologies able to shorten distances at low costs.

Consistently with this results we found that exporting firms are statistically significant correlated with higher levels of turnover. We also observed how exporters were not experiencing positive turnover growth. These findings are in line with a large body of literature on (lack of) learning by exporting firms, which suggest that there is no effect from exporting to future growth, but that there is a huge effect of past growth to future exporting by non-exporting firms.

All in all, this paper has shown that innovative activities, human capital investment and engagement in foreign collaborative projects are crucial factors in guaranteeing the good performance of Italian manufacturing firms. Moreover, in line with an *a priori* reasoning, it is undoubtedly true that firm size explains the main differences across firms in their innovative activities and in their revenues.

This investigation provides a first attempt to identify, through an econometric exercise, the determinants of small and medium firms' competitiveness, a topic which is particularly relevant in a country like Italy whose industrial structure still relies largely on small and medium firms. Identifying the winning strategies allows pinpointing the *best practice* and formulating policy prescriptions which could be of use to entrepreneurs aiming at attaining a competitive position at a global scale.

Finally, it is worth mentioning here that there are some other reasons (risks associated with capital market structure or the risk to be unsuccessful in developing new products, for instance), that limit the ability of Italian firms to be competitive. They might be the focus of our further investigation.

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Model 1a - Dependent variable: Turnover Change								
	Ordered probit coefficients		Marginal effects					
			Decline		Unaltered		Growth	
	Coeff.	P >| Z |	Coeff.	P >| Z |	Coeff.	P >| Z |	Coeff.	P >| Z |
Control Variables								
Age								
Before 1960	*base*							
Between 1961-1970	0.1410029	0.000	-0.0419008	0.000	0.0011085	0.000	0.0407923	0.000
Between 1971-1980	0.3047977	0.000	-0.0885208	0.000	-0.0015074	0.000	0.0900283	0.000
Between 1981-1990	0.2556568	0.000	-0.0760539	0.000	0.0022865	0.000	0.0737674	0.000
Between 1991-2000	0.3826197	0.000	-0.1110784	0.000	-0.0017874	0.000	0.1128658	0.000
After 2000	0.6359555	0.000	-0.1547425	0.000	-0.0579824	0.000	0.2127249	0.000
Size								
0<employees<=9	-0.2956293	0.000	0.0849875	0.000	0.0032037	0.000	-0.0881912	0.000
10<employees<=49	-0.0104159	0.132	0.003237	0.389	-0.0003702	0.409	-0.0028668	0.386
50<employees<=249	*base*							
Sector								
Food & beverage	0.3199888	0.000	-0.0902831	0.000	-0.0067787	0.000	0.0970619	0.000
Clothing	*base*							
Footwear, leather	-0.326662	0.000	0.1110689	0.000	-0.0326857	0.000	-0.0783833	0.000
Wood and furniture	0.0811038	0.000	-0.0246255	0.000	0.0016925	0.000	0.0229329	0.000
Chemical & plastic products	0.107169	0.000	-0.0320173	0.000	0.0011789	0.000	0.0308385	0.000
Non Metallic mineral products	0.2790886	0.000	-0.0784156	0.000	-0.0066154	0.000	0.0850311	0.000
Metal products	0.1847511	0.000	-0.0548475	0.000	0.0013693	0.000	0.0534782	0.000
Mechanical products	0.1350696	0.000	-0.040128	0.000	0.0010403	0.000	0.0390877	0.000
Electrical equipment, motor vehicle	0.1573144	0.000	-0.0465765	0.000	0.0008986	0.000	0.0456779	0.000
Other sectors	0.138205	0.000	-0.0410746	0.000	0.0010961	0.000	0.0399785	0.000
Innovation Strategy Variables								
Product innovation (1/0)	0.1494631	0.000	-0.0452172	0.000	0.0028066	0.000	0.0424107	0.000
Process innovation (1/0)	0.2591385	0.000	-0.0771272	0.000	0.0023979	0.000	0.0747293	0.000
Organisation Change (1/0)	0.1476961	0.000	-0.0441166	0.000	0.0016222	0.000	0.0424944	0.000
Marketing Innovation (1/0)	0.0407811	0.000	-0.0124906	0.000	0.0010713	0.000	0.0114193	0.000
Internationalisation and Trade Variables								
Local Trade (1/0)	0.0342898	0.000	-0.0106364	0.000	0.0011776	0.000	0.0094588	0.000
Regional Trade (1/0)	-0.0311392	0.000	0.0096924	0.000	-0.0011385	0.000	-0.0085539	0.000
National Trade (1/0)	0.1394982	0.000	-0.0427364	0.000	0.0037099	0.000	0.0390264	0.000
Export (1/0)	-0.0068067	0.132	0.0021129	0.133	-0.0002369	0.143	-0.001876	0.132
Networking Strategy Variables								
No collaborative arrangement	*base*							
Foreign collaborative arrangements	0.1538207	0.000	-0.0453068	0.000	0.004044	0.086	0.0449025	0.000
National collaborative arrangements	0.0452643	0.000	-0.0138749	0.000	0.0012123	0.000	0.0126627	0.000
McFadden's R2:	**0.036**							
McFadden's Adj R2:	**0.035**							
McKelvey and Zavoina's R2:	**0.086**							

Table 9: Ordered probit model (whole sample)

Model 1b - Dependent variable: Turnover Change								
	Ordered probit coefficients		Marginal effects					
			Decline		Unaltered		Growth	
	Coeff.	P >| Z |	Coeff.	P >| Z |	Coeff.	P >| Z |	Coeff.	P >| Z |
Control Variables								
Age								
Before 1960	*base*							
Between 1961-1970	0.276435	0.000	-0.0701355	0.000	-0.02998	0.000	0.1001155	0.000
Between 1971-1980	0.110279	0.000	-0.0300884	0.000	-0.0084594	0.000	0.0385478	0.000
Between 1981-1990	0.1512958	0.000	-0.0411759	0.000	-0.0117663	0.000	0.0529422	0.000
Between 1991-2000	0.4219726	0.000	-0.1106751	0.000	-0.0117663	0.000	0.1498388	0.000
After 2000	0.4345381	0.000	-0.101359	0.000	-0.0606651	0.000	0.1620241	0.000
Size								
0<employees<=9	-0.2128308	0.000	0.05665	0.000	0.0186992	0.000	-0.0753492	0.000
10<employees<=49	0.0072707	0.642	-0.0020362	0.640	-0.0004657	0.647	0.0025019	0.643
50<employees<=249	*base*							
Sector								
Food & beverage	0.1303092	0.000	-0.0351177	0.000	-0.0107484	0.000	0.0458661	0.000
Clothing	*base*							
Footwear, leather	-0.6752873	0.000	0.2317281	0.000	-0.0468119	0.000	-0.1849162	0.000
Wood and furniture	-0.1479669	0.000	0.0433319	0.000	0.005972	0.000	-0.0493039	0.000
Chemical & plastic products	-0.0265566	0.037	0.0075267	0.040	0.0015397	0.022	-0.0090664	0.036
Non Metallic mineral products	0.2514795	0.000	-0.063377	0.000	-0.0280193	0.000	0.0913964	0.000
Metal products	0.0120333	0.173	-0.0033654	0.170	-0.0007791	0.184	0.0041445	0.174
Mechanical products	-0.0968312	0.000	0.0280497	0.000	0.0044945	0.000	-0.0325442	0.000
Electrical equipment, motor vehicle	-0.0678897	0.000	0.01944	0.000	0.003571	0.000	-0.023011	0.000
Other sectors	-0.0908172	0.000	0.0262581	0.000	0.0043081	0.000	-0.0305662	0.000
Innovation Strategy Variables								
Product innovation (1/0)	-0.0080098	0.093	0.0022465	0.094	0.0005072	0.094	-0.0027537	0.093
Process innovation (1/0)	0.0535457	0.000	-0.0150847	0.000	-0.0032681	0.000	0.0183528	0.000
Organisation Change (1/0)	0.0755077	0.000	-0.0209521	0.000	-0.0051786	0.000	0.0261307	0.000
Marketing Innovation (1/0)	-0.0057222	0.359	0.001608	0.360	0.0003568	0.353	-0.0019647	0.359
Decreased innovation expenditure	*base*							
Unaltered innovation expenditure	0.5998995	0.000	-0.1658774	0.000	-0.039477	0.000	0.2053545	0.000
Increase innovation expenditure	0.887165	0.000	-0.2436124	0.000	-0.0566147	0.000	0.3002272	0.000
Labourer training	0.0188525	0.003	-0.0052724	0.003	-0.0012208	0.004	0.0064932	0.003
New labourer training	0.0090143	0.225	-0.0025234	0.224	-0.0005794	0.234	0.0031028	0.226
Manager Training	0.2002983	0.000	-0.052464	0.000	-0.0190626	0.000	0.0715266	0.000
ICT variables								
Informative ICT firm	-0.0956236	0.000	0.0271738	0.000	0.0054031	0.000	-0.0325768	0.000
Interactive ICT firm	-0.1229892	0.000	0.0359638	0.000	0.0050743	0.000	-0.0410381	0.000
E-commerce ICT firm	0.3142017	0.000	-0.0770538	0.000	-0.038322	0.000	0.1153758	0.000
Informative ICT consumer	0.0792957	0.000	-0.0219183	0.000	-0.0055886	0.000	0.0275069	0.000
Interactive ICT consumer	0.1140023	0.000	-0.0306422	0.000	-0.0095494	0.000	0.0401916	0.000
E-commerce ICT consumer	-0.1487054	0.000	0.0441112	0.000	0.0049437	0.000	-0.0490549	0.000
Internationalisation and Trade Variables								
Local Trade (1/0)	-0.1190646	0.000	0.0336618	0.000	0.0070342	0.000	-0.040696	0.000
Regional Trade (1/0)	0.0491203	0.000	-0.013702	0.000	-0.0032425	0.000	0.0169445	0.000
National Trade (1/0)	0.0762825	0.000	-0.021398	0.000	-0.0048187	0.000	0.0262166	0.000
Export (1/0)	-0.1453892	0.000	0.0418505	0.000	0.0072154	0.000	-0.0490659	0.000
Network strategy								
University support to innovation	0.2134254	0.000	-0.0548845	0.000	-0.0220101	0.000	0.0768946	0.000
Public support to innovation	-0.1361264	0.000	0.040175	0.000	0.0049179	0.000	-0.045093	0.000
Science support to innovation	-0.0287079	0.139	0.008148	0.144	0.0016435	0.100	-0.0097915	0.136
Bic support to innovation	-0.0390285	0.087	0.0111249	0.093	0.0021473	0.045	-0.0132722	0.084
Chamber support to innovation	-0.0700992	0.000	0.020127	0.000	0.0035874	0.000	-0.0237145	0.000
Industry support to innovation	0.2234517	0.000	-0.0579809	0.000	-0.0221631	0.000	0.080144	0.000
Private support to innovation	-0.1166274	0.000	0.0336865	0.000	0.0055874	0.000	-0.0392739	0.000
Sector support to innovation	-0.1651648	0.000	0.0487578	0.000	0.0059244	0.000	-0.0546822	0.000
Supplier support to innovation	0.1100865	0.000	-0.0300815	0.000	-0.0083645	0.000	0.038446	0.000
User support to innovation	0.2333937	0.000	-0.0602062	0.000	-0.0237304	0.000	0.0839366	0.000
No collaborative arrangement	*base*							
Foreign collaborative arrangement	0.2407532	0.000	-0.0619402	0.000	-0.024743	0.000	0.0866832	0.000
National collaborative arrangement	0.0244407	0.000	-0.0068166	0.000	-0.0016158	0.000	0.0084324	0.000
McFadden's R2:	**0.034**							
McFadden's Adj R2:	**0.033**							
McKelvey and Zavoina's R2:	**0.084**							

Table 10: Ordered probit model (innovating firms)

Dependent variable: Turnover

	Model 2a: all SMEs		Model 2b: Innovating Firms	
	Coeff.	P >| Z |	Coeff.	P >| Z |
Control Variables				
Age				
Before 1960	*base*		*base*	
Between 1961-1970	-41.46428	0.000	-55.95793	0.000
Between 1971-1980	-66.01136	0.000	-229.8183	0.000
Between 1981-1990	-204.0077	0.000	-375.9793	0.000
Between 1991-2000	-215.6584	0.000	-373.9576	0.000
After 2000	-299.4204	0.000	-538.9962	0.000
Size				
0<employees<=9	-5849.852	0.000	-6489.533	0.000
10<employees<=49	-4478.992	0.000	-4840.522	0.000
50<employees<=249	base		*base*	
Sector				
Food & beverage	148.1372	0.000	13.36313	0.000
Clothing	*base*		*base*	
Footwear, leather	-114.5893	0.000	-298.2201	0.000
Wood and furniture	-31.41442	0.000	-168.001	0.000
Chemical & plastic products	298.1378	0.000	148.2872	0.000
Non Metallic mineral products	60.50714	0.000	-1.398035	0.274
Metal products	32.82542	0.000	-81.91292	0.000
Mechanical products	202.4992	0.000	-22.77035	0.096
Electrical equipment, motor vehicle	61.05941	0.000	-68.87459	0.000
Other sectors	5.662923	0.436	-205.0689	0.000
Innovation Strategy Variables				
Product innovation (1/0)	161.4845	0.000	119.2335	0.000
Process innovation (1/0)	52.59198	0.000	20.50908	0.001
Organisation Change (1/0)	259.8611	0.000	160.2397	0.000
Marketing Innovation (1/0)	163.8579	0.000	136.601	0.000
Decreased innovation expenditure			*base*	
Unaltered innovation expenditure			186.7649	0.000
Increase innovation expenditure			85.32219	0.000
Labourer training			356.6564	0.003
New labourer training			8.243747	0.408
Manager Training			533.2627	0.000
ICT variables				
Informative ICT firm			374.6095	0.000
Interactive ICT firm			287.4598	0.000
E-commerce ICT firm			-141.6205	0.000
Informative ICT consumer			-176.5219	0.000
Interactive ICT consumer			-48.78295	0.007
E-commerce ICT consumer			69.85896	0.024
Internationalisation and Trade Variables				
Local Trade (1/0)	-197.6518	0.000	-279.797	0.000
Regional Trade (1/0)	-15.87301	0.000	-17.15337	0.008
National Trade (1/0)	129.3986	0.000	67.26768	0.000
Export (1/0)	329.6509	0.132	123.706	0.000
Networking Strategy Variables				
No collaborative arrangement	*base*		933.8791	0.000
Foreign collaborative arrangements	494.3429	0.000	-166.0257	0.000
National collaborative arrangements	6327.789	0.005	-301.1194	0.000
Public support to innovation			-318.7927	0.000
Science support to innovation			-259.4045	0.000
Bic support to innovation			47.32318	0.000
Chamber support to innovation			79.40973	0.000
Industry support to innovation			245.6316	0.000
Private support to innovation			-121.2748	0.000
Sector support to innovation			-166.3868	0.000
Supplier support to innovation			*base*	
User support to innovation			226.9495	0.000
No collaborative arrangement			-190.8817	0.000
Foreign collaborative arrangement				
National collaborative arrangement				
Constant	6327.789	0.000	7100.339	0.000
Sigma	1199.062		1433.489	
McFadden's R2:	**0.104**		**0.122**	
McFadden's Adj R2:	**0.104**		**0.122**	
McKelvey and Zavoina's R2:	**0.992**		**0.992**	

Table 11: Interval regression model (whole sample and restricted sample)