UNIVERSITÀ CATTOLICA del Sacro Cuore

DIPARTIMENTO DI SCIENZE ECONOMICHE E SOCIALI

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Quaderno n. 129/marzo 2018

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Abstract

This paper provides an empirical investigation of the impact of market orientation on firms' economic performance during the period 1998-2012 using a panel of Italian manufacturing firms. We introduce a dynamic concept of market orientation, in that we define a market-oriented firm as one that persistently undertakes product and marketing innovation, while at the same time introducing organisational changes and training efforts to manage and improve its knowledge asset over the long term. The conceptual framework within which we have developed the analysis considers both the management approach, from which we take the notion of a firm's market orientation to innovation, and the economics of innovation approach. The results show that being a market-oriented firm significantly affects profitability, in a framework in which this latter is simultaneously estimated with productivity, thus allowing for more precise estimates of the relationship being tested for.

JEL Classifications: L25, O30, O32, O33
Keywords: Product Innovation, Market Orientation, European Community Innovation Survey, Profitability, Productivity, Innovation Persistence.

1 Introduction

The relationship between innovation and economic performance at the firm level has been much analysed within the tradition of the industrial organisation studies. However, few studies have concentrated on the joint role of market orientation and product innovation in firms' performance. Typically these two aspects have been analysed in quite diverse research fields as the first falls within the sphere of the traditional management view to analysing firm performance, whereas the second enters the scope of the economics of innovation approach. However, these two aspects of a firm's culture represent the two faces of the same coin, i.e. a firm's attitude to adopting both technological and non-technological innovation.

In the generation of new technologies, product innovation occupies a central role, firstly, because amongst different forms of technological change it is the most easily recognizable by customers, and secondly because the primary goal of innovation is to enhance firms' profitability, and successful innovation depends, ultimately, on consumers' choices. This view, which has crucially affected economic studies at the industry level since the early '70s, is clearly stated in the Schumpeterian view of competition (Schumpeter, 1934), according to which firms engage in risky innovative efforts when they foresee prospects for gaining competitive advantages by creating products or services which are preferred by the market. Additionally, in recent years, characterized by high competition in global marketplaces, firms have faced increasing complexities when developing new products to fit with customers' requirements; the ability to cope with customers' needs represents a core strategic issue within a firm's organizational context.

An increasing number of studies have focused on the notion of "market orientation", since it was introduced in the 1990s, with the aim of understanding its link with a firm's performance. According to this line of reasoning, organisations that are market-oriented, i.e., those that are able to intercept and respond to customer needs, can adopt the most appropriate marketing strategies and, hence, perform at higher levels (Deshpande and Webster Jr, 1989; Narver and Slater, 1990; Day, 1994). Furthermore, a positive relationship is predicted between (successfully) product innovation and market orientation when the latter is combined with organizational capabilities and learning orientation, as new products are generated for customer satisfaction and, thus, market-oriented firms can gain higher market performance (Hurley and Hult,

1998; Gatignon and Xuereb, 1997). In the context of a firm's innovative behaviour, this approach also reconciles with the process view of innovation proposed by Geroski et al. (1993), who argued that the bulk of superior competencies acquired over the years by innovative firms allows a company's profitability to persist over time. Previous research suggests the existence of a causal link running from firm-efficiency characteristics, and any persistent innovation pattern, to profitability (Geroski et al., 1993; Roberts, 1999; Cefis and Ciccarelli, 2005). Finally, the prevailing literature suggests that a market oriented firm should adopt a long-term perspective in its investment decisions, thus implying that, in order to continuously "create superior value to customers" (Narver and Slater, 1990), a business must persistently innovate.

The aim of this study is on the one hand to provide a more precise definition of market orientation, which can be tested for, avoiding the use of ad hoc surveys as described in the prevailing literature. On the other hand, we provide new evidence on the impact of innovation on firms' economic performance, pinpointing complementarities between product innovation, organisational enhancements and marketing innovation in a simultaneous equation framework. The definition of market orientation that we introduce is also related to the concept of persistent innovation, and this enables us to also consider the impact of such an attitude on firms' performance. We thus define a market-oriented firm as one that persistently undertakes product and marketing innovation, and at the same time adapts its organisation to such changes, thus providing a definition that is not static but includes a dynamic perspective. This definition refers to a firm which has continuously and successfully innovated in both product and marketing during the observed time span, and has introduced organisational changes, facilitating adaptation to new market conditions.

We consider productivity and profitability as the two measures of a firm's performance and we set up a model in which these variables are simultaneously determined. Thus, this approach aims to jointly analyse these two aspects of a firm's innovative behaviour that have been typically analysed separately. As a firm's innovative behaviour requires time to generate effects on its performance, we consider whether this persistent attitude provides a significant impact on performance also enabling firms to gain a significant premium with respect to those firms that do not act accordingly.

The proposed empirical investigation is based on a panel of manufacturing firms linking four waves of the Italian Community Innovation

Survey (CIS) with an administrative data source providing economic and financial information at the firm level during the period 1998-2012. The empirical model is built on an interpretative framework which is suitable for investigating the extent to which the innovation-performance relationship is also related to firm, industry or geographical characteristics. In addition, the panel nature of the database enables us to incorporate information on a firm's innovating behaviour over an adequate time span. The paper is structured as follows. Section 2 provides an overview of the literature by focusing on the role of market orientation, persistent innovation and the determinants of firms' performance. Section 3 presents the data set, while Section 4 describes the empirical model which is based on a simultaneous equation specification. We discuss the estimates in Section 5 and conclude the paper in Section 6.

2 Analysing firms' performance: type of innovation, market orientation, and persistent patterns

Firms often tend to undertake groups of innovation activities which include both technological and non technological aspect of the production process simultaneously. Recent theoretical and empirical research has increasingly recognised that looking at the adoption of single innovations or types of innovations may be misleading. Other activities, such as marketing, organisational and workforce management strategies may produce, together with technological innovation, significant impact on firms' performance. Following this stream of investigation, the existence of multiple interactions between technological and non-technological factors of production may boost a firm's performance in that doing more of any one subset of a group of innovation activities may increase the returns from doing more of other subsets of the remaining activities. The hypothesis is that the simultaneous undertaking of several innovative practices is not an accident, but rather the result of the coordinated action between traditionally separate activities and work practices. Given this view, Milgrom and Roberts (1990) analyse the case of a multiproduct profit maximising firm by formalising a theoretical model in which the firm chooses a set of decision variables which are supposed to form clusters of complementarities. Following

this approach, a growing number of scholars have emphasised the complementarity between different aspects of innovation, e.g. technological and non-technological innovations, yielding a series of studies that use micro-data derived from innovation surveys.

According to the methodological guidelines for the Community Innovation Survey (CIS) provided by the OSLO manual (OECD, 2005) non-technological innovation includes marketing and organisational innovations, where marketing innovation is defined as "the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing" and an organisational innovation refers to "the implementation of a new organisational method in the firm's practices, workplace organisation or external relations".

Our investigation is based on the definition of a market oriented firm implying a persistent effort devoted to product and marketing innovation, together with the introduction of organisational changes and efforts to improve a firm's internal knowledge on new or improved products. This definition is more restrictive than that typically used in previous studies, which have mainly focused on analyzing the impact of marketing and organizational innovation on firms' performance typically on a cross section basis. Also, it differs from the managerial approach to market orientation, in that these latter use ad hoc surveys and measures particularly focused on business units. Alongside the first group of studies, Schmidt and Rammer (2007) and Schubert (2010) used the German CIS to test whether marketing and organisational innovation are complements to or substitutes for product or process innovation. Both analyses were performed on a cross-sectional basis with Schubert (2010) using data from the 2007 wave of the German CIS and Schmidt and Rammer (2007) using the 2005 data. In both cases the authors find that when focusing on a large set of manufacturing and service firms participating in these surveys, marketing and organisational innovation does complement technological innovation, implying a positive impact on firms' performance. However, this impact crucially depends on the performance measure which is adopted. Indeed, Schubert finds that the percentage of sales due to new products - a measure of innovation success - increases and costs are reduced when marketing innovation is simultaneously introduced with product or process innovation. These findings confirm the results of Schmidt and Rammer (2007) who also find a significant effect of both marketing and organisational innovation on innovative sales and cost reductions

for those firms which also introduced product and process innovation.

The relationships between marketing innovation and innovation performance are explored in a dynamic context by Lhuillery (2014), who used an unbalanced panel of manufacturing firms which has been obtained by matching four consecutive waves of the French CIS. Sales of new or improved products are used as an indicator of innovation success. He finds that marketing innovation has a short-term direct (contemporaneous) effect on innovation success, whereas the long-term (lagged) effect is not significant. In high-tech sectors the short-term effect is not significant for incremental products. In order to test for the role of marketing in enhancing the persistence of innovation success, an interactive term between the lagged share of innovative sales and a lagged dummy for marketing innovation was also introduced. Results support the view that marketing innovation does not raise the persistence of product innovation in low-tech industries. In high-tech industries results are more controversial as the interactive coefficient is positive and significant for incremental innovation, whereas it is negative and significant for radical innovation.

Battisti and Stoneman (2010) used the Fourth UK CIS to explore the impact of the adoption of a range of innovative activities, including product, machinery, marketing, organisation, management and strategic innovations. By using a clustering approach, they show that there is a significant degree of complementarity between these innovation practices. They identify two major sets of innovations: on the one hand, marketing, organisation, management and strategic innovations (labelled wide innovation) and, on the other, more traditional activities: machinery, process and product innovations (labelled technological innovation). Wide organisational innovation is found to play a crucial role in the innovative activity of UK firms. They find a positive impact of both such activities on firms' performance; however, they did so by using a qualitative and subjective measure of performance derived from respondents' judgments upon the impact on future value added, a data imposed limitation.

In a more recent contribution, Junge et al. (2016) find that product and marketing innovation positively affect the growth rate of firms' value added, also taking into account skill intensity, using administrative data and the CIS innovation survey for the Danish economy.

Management studies have mainly analysed the relationship between market orientation and businesses' performance, focusing on the need to; i) consider customer satisfaction as a core strategic issue, before

products are developed, and; ii) adapt a firm's organizational structure to ensure interfunctional coordination between different departments within the organization. Within this literature, market orientation has been defined as a form of organisational culture (Deshpande and Webster Jr, 1989; Narver and Slater, 1990; Day, 1994). In the definition of Narver and Slater (1990), a market-oriented firm is one that manifests a customer and a competitor orientation together with inter functional coordination. It has been argued that market orientation when combined with organisational capabilities and learning orientation, may increase a firm's ability to interpret customers' needs and, thus, to successfully innovate (Hurley and Hult, 1998; Gatignon and Xuereb, 1997).

Studies appearing in the organization-oriented tradition have tried to conceptualise and, then, test the role of market orientation in creating improved organisational performance. These studies are based on appropriate surveys and the use of ad hoc variables indicating organisational culture (Hurley and Hult, 1998) or, more specifically, market orientation (Narver and Slater, 1990; Slater and Narver, 1994; Atuahene-Gima, 1996; Han et al., 1998). Potential limitations of this stream of empirical research may be found in the extensive use of subjective measures (mainly on a cross-sectional basis), which concerns are clearly recognised by the scholars in the field of organisation studies. Slater and Narver (1994) recommend using different sources of data and the introduction of objective measures of firm performance. These findings opened the way to other studies that have refined the original conceptual framework. Olson et al. (1995) found a positive impact on a firm's performance of the availability of coordinated functional departments, by using data from 45 product development projects in 12 firms and multivariate tests of significance. This evidence implies that marketing and R&D integration impacts positively on firm performance.

Gatignon and Xuereb (1997) include technological and organisational issues within the Narver and Slater approach. They emphasise how firms must be consumer- and technology-oriented in those markets characterised by high demand uncertainty to be able to market innovations (new products). Conversely, when markets are less turbulent and, thus, demand is relatively stable, a competitive orientation is more relevant for promoting a product innovation. Hult et al. (2005) and Morgan et al. (2009) explicitly consider organizational responsiveness in their empirical investigation on a large data sets of US businesses, also controlling for market information-processing and marketing capa-

bilities elements. Their results, although representing a step forward in the empirical investigation on market orientation and performance, still maintain the limitations of previous research, in that longitudinal designs are still absent.

More recent studies try to tackle this limitation by using a longitudinal framework. Kumar et al. (2011) use information on more than 260 US top managerial responses over the period 1997-2005 to test whether market orientation is a source of sustainable competitive advantage. However, their analysis is not strictly longitudinal, as it only combines information gathered at three different points in time. Their results do support the hypothesis of a positive impact of market orientation on sales and profits, which, however, is greater for early adopters. Also, they underline that such benefits require time before they can be fully realised. Given this framework, one can think of the market orientation approach as an extension of the strategic analysis of managerial competencies proposed by the the resource-based view of the firm (Penrose, 1959; Wernerfelt, 1984) and, more specifically, by the dynamic capabilities approach (Teece, 2007). According to this latter view, the firm achieves competitive advantages by organisational improvements and learning processes, resulting in adaptation to a continuously changing business environment.

Indeed, key elements of the market orientation approach are a focus on customer needs together with information acquisition and use by an organisation which aims at pursuing such a goal. For this reason, market orientation may be thought of as a key market based asset. We can therefore rationalise the causal mechanisms linking market oriented behaviour and firm performance by thinking of market intelligence generation and dissemination as the first step of the process, which is then followed by the firm response. This entails the development of marketing capabilities to be implemented by means of organisational competencies designed to fulfill this requirement and aimed at improving knowledge management within the firm. This issue is emphasised by Morgan et al. (2009), who underline how capacities relating to market orientation are crucially associated with the marketing function, in particular with respect to product development and management, pricing, selling, communications and the development and execution of appropriate strategies.

The choice of our proxy for market orientation explicitly relates to such considerations, as we consider, together with product innovation, both marketing and organizational innovation, and learning efforts

made to manage and improve a firm's innovative knowledge asset.

Given this framework we aim to test i) whether this attitude affects a firms' performance, and ii) to what extent this attitude impacts its performance, using a simultaneous equation model in which productivity and profitability are jointly estimated.

It is worth recalling that the definition adopted to describe a market-oriented firm brings about the concept of persistent innovation. The debate on this issue has emphasized the factors that enable persistently innovating firms to gain a premium with respect to competitors. Three main rationales have been considered: i) the existence of sunk costs in innovating activities (Mañez et al., 2009), ii) the positive correlation with a past successful pattern of innovations (success-breeds-success) that has a positive impact on firms' profitability and may also positively affect their future ability to finance future innovation (Le Bas and Latham, 2006), iii) the dynamic process of innovation that allows a firm to learn and adapt its innovation strategy (Geroski et al., 1993, 1997). Such a technological view is used to describe not only the profit premium that a persistent innovator earns in a static framework, but also the effects that may be produced in an intertemporal context. In other words, a persistent innovating behaviour may affect a firm's profitability in the long-run, thus allowing for a persistent gain over competitors.

Mueller (1990) considers the persistence of profits in a Schumpeterian framework, which is driven by creative destruction, in that persistence is determined by entry conditions, that may represent a threat to the incumbent firm. Cefis and Orsenigo (2001) consider the role of technology more explicitly, by using an input measure (patents) of a persistent innovative behaviour. Their interpretative framework is Schumpeterian, in that persistence is the result of either creative destruction or monopolistic competition. Moreover, Cefis (2003) underlines how profit persistence is closely related to innovation persistence, as the probability of earning profits above the long term average is higher for those firms that innovate steadily compared with occasional innovators. The role of non-technological innovation and, in particular, of market orientation, has not been considered in this debate, as the emphasis has mainly been on either the traditional structure-conduct-performance (SCP) mechanism, or on a firm's efficiency conditions and technological opportunities.

The studies by Delorme Jr. et al. (2002), and Slade (2004), although using different methodological approaches, do find support for

the SCP paradigm, thus claiming for the role of market structure in determining a firm's profitability. In a different perspective, the management view of firms' profitability, the studies by Roberts (1999, 2001) and Hawawini et al. (2003), have specifically recognise the role of managerial abilities - e.g., product innovation - in determining profitability and its persistence.

Technology adoption and technological spillover are additional crucial factors to be considered when attempting identification and weighing of the determinants of firms' performance. The former refers to the fact that innovation may provide a competitive advantage to innovating firms, thus allowing for an increase in their profitability, which may even be persistent (Mueller and Cubbin, 2005). Technological spillover has been emphasized in a number of different studies, which have underlined the importance of R&D spillover in affecting firm productivity (Griliches, 1984, 1992; Mairesse and Sassenou, 1995; Los and Verspagen, 2000), but only a few have examined its impact on firm profitability. Previous studies suggest the presence of a clearly negative effect due to technological spillovers as measured by research inputs (Jaffe, 1986; Hanel and St-Pierre, 2002), and more controversial results are obtained when they are measured by research output (Geroski et al., 1993).

The effect of innovation on firm's profitability may also be rationalized on the grounds that the innovation process affects the internal allocation and use of resource, thus enabling innovating firms to react and adapt quickly to exogenous demand or supply shocks (Geroski et al., 1993).

As concerns productivity, the impact of innovation can be analyzed with respect to both the input and output of the innovation process. R&D expenditure has typically been considered as a proxy for knowledge capital, which, in combination with other production inputs, contributes to a firm's growth in terms of production. Innovation input can be considered by focusing on the use of new and more efficient capital goods. This approach follows the line of investigation derived from studies on endogenous growth (Romer, 1990), which implies a close interaction between the R&D sector, investment in machinery and equipment and final output growth rate. Innovation output is considered the key variable in affecting productivity in the seminal study by Crépon et al. (1998), where patents per-employee or the share of innovative sales are used as to proxy such an innovative measure. This model focuses on the empirical tools required to tackle the estimation bias related to information available only for innovative firms, when using

innovation surveys. This methodology has inspired an increasing number of empirical investigations based on national innovation surveys. In our investigation, however, we do not adopt this methodology because we explicitly consider both innovating and non-innovating firms, as the aim is to underline the profit premium that market-oriented firms receive with respect to non-innovating and occasionally-innovating firms, taking productivity as endogenous.

3 Data description

Our main source of information is the *Micro-Manu dataset*[1], a panel of Italian manufacturing firms linking consecutive waves of the Italian Community Innovation Survey - which is conducted every two years in coordination with the EU Science and Technology Statistical Programme. This information is linked with the ASIA archive (Statistical Register of Active Businesses)[2] and an administrative data source providing balance sheets and income statements for those firms included in the CIS samples of respondents. In accordance with international standards (OECD-Eurostat 2005), firms are classified by their type of innovation activity (technological and non-technological). Information on non-technological aspects of innovation, particularly new marketing methods and new organizational practices, allows one to consider comprehensive innovative activities by focusing on the reciprocal interactions between product, marketing and organizational innovation. The data set provides information for those firms which responded in at least one wave starting from the period 1998-2000.

To analyse firms' innovative pattern in a longitudinal context, we select an unbalanced panel of firms from the original dataset responding to at least three consecutive non-overlapped[3] CIS waves (CIS1, years 1998-2000; CIS2, years 2002-2004; CIS4 years 2006-2008; and CIS6, years 2010-2012). We have more than 700 firms, corresponding

[1]The Micro-Manu dataset is a result of collaboration between the Italian National Institute of Statistics (ISTAT, Regional office for Lombardy) and the Catholic University of the Sacred Hearth. We would like to thank Valerio Fiorespino, Roberto Monducci, Giovanni Barbieri e Rosalia Coniglio of the Italian National Institute of Statistics (ISTAT) for providing access to the data.

[2]This archive is the most relevant administrative register used by ISTAT as the basis for many sample surveys and even census investigations.

[3]A characteristic that merits attention is that the measurement of the degree of innovation persistence may be over-estimated when two consecutive waves are partially overlapped.

to nearly 3,000 observations over the whole period 1998-2012[4] (Table 1). It is worth noting that the mean size of firms from the selected sample is 264 employees, but the size increase to 365 employees when the balanced sample of firms present in all the four waves is considered. This non-negligible change is due to the specific nature of the CIS's sampling design, given that large firms with more than 250 employees are selected on a census basis, while small firms are randomly selected, and this sampling mechanism may negatively affect the probability of a small firm being selected in consecutive surveys.

Firm balance sheets and profit and loss accounts, available from administrative sources, provide financial and economic information for the period 1998-2012. Linking the CIS data with accounting information allows for the use of a wider set of economic indicators typically not considered in the innovation survey micro-data and therefore this link enables us to better explore the relationships between innovation and

Table 1: Unbalanced panel of Italian manufacturing firms responding to at least three consecutive waves (Cis1, 1998-2000; Cis2, 2002-2004; Cis3, 2006-2008; Cis5, 2010-2012)

patterns of presence	*obs.*	*n. of firms (average)*	*size (n. of employees, median)*	*firms by innovative behaviour (sample proportion)*		
				persistent product innovation	*persistent marketing innovation*	*market orientation*
0111	796	191	281	0.08	0.09	0.05
1110	1,032	258	116	0.02	0.15	0.04
1111	1,084	271	365	0.10	0.12	0.09
total	*2,912*	*728*	*264*	*0.07*	*0.12*	*0.06*

Notes. The patterns of presence indicate absence (0) or presence (1), during the four consecutive innovation surveys. Persistent innovative behaviour (over at least three consecutive CIS waves): *persistent product innovation* - the firm has innovated persistently only in the product domain; *persistent marketing innovation* - the firm has innovated persistently in the marketing domain; *market orientation* - the firm has innovated persistently in both the product and marketing domains and, at the same time, has introduced organizational improvements (including training activities linked to technological innovation).

[4]We acknowledge an anonymous referee for suggesting this alternative solution. In a previous version of this work we used a balanced panel of the first three CIS waves and, thus, a reduced number of observations. With the availability of an additional CIS wave for the period 2010-2012 we could add the "0111" pattern that were not available at time of the previous version of this work.

economic performance, which otherwise would have not been possible. One should note that the full samples of firms from the CIS surveys also include small individual firms for which balance sheet information is not available from the Italian public register, thus our analysis excludes these firms. We have compared the final sample of firms for which there is complete accounting information to the starting samples in the CIS surveys, and then concluded that the loss of sampling units due to the use of out-of-sample information is acceptable concerning a possible problem of size-bias.[5]

Economic performance. Operating profitability, return on sales (ros), is used for investigating profits generated by the core business of a manufacturing firm. Labour productivity (y), which is given by the real value added per employee ratio (log value), is the other performance index that may be considered an intermediate measure of a firm's innovation success[6].

Financial efficiency. A measure of a firm's exposure to external financing sources (lev) is used to consider financial efficiency and reflects the extent to which a firm uses internal resources instead of borrowing to finance its activity. It is given by the ratio of shareholders' funding to total debts.

Capital intensity. The role of physical capital is taken into account by considering the kl ratio (tangible fixed assets per employee, log value). It measures the extent of capital deepening in fostering productivity. We test its impact by using an econometric approach which enables us to consider also other possible determinants related in particular to a firm's innovative effort. One should also note that capital deepening may incorporate process innovation, as this latter typically implies the acquisition on new machinery.[7].

[5]If one compares the CIS sample distribution by size-class relative to the period 2006-2008 with the distribution obtained when firm-level accounting information is added, the results show a reduction from 64% to 56% of firms in the first class (firms less than 50 employees) and accordingly an increase in both the 2nd class (firms between 50 and 250 employees; + 5 percentage points) and the 3rd class of medium-large firms with more than 250 employees (+3 percentage points).

[6]We use 2 digit industry deflators to take into account the effect of price changes. We consider only variations in productivity that depends on labour efficiency and not on price changes that may therefore reflect customers' willingness to pay

[7]It is worth noting that one can observe a strong correlation (0.81 on average)

Innovative effort As previously mentioned, together with physical capital, a firm's innovative effort should be considered, to describe the core determinants of labour productivity. The proxy we use, i.e. R&D investments (*r&d*) and marketing investments (*mkt*) expenditure may be also thought of as proxies of knowledge capital which can contribute directly to labour productivity growth but also it can exert such a positive influence through Total Factor Productivity (TFP) growth. As we refer to the entire sample of innovative and non innovative firms, the aforementioned expenditures are not available for this latter group of firms. Therefore, we use two dummy variables indicating whether a firm has undertaken respectively R&D investment and marketing investment[8]. Another innovative effort that may improve a firm's efficiency - and therefore enters the productivity equation - is represented by the attitude to introduce organizational innovation (*innorg*).

Market orientation A firm's attitude towards market orientation is captured by a dummy variable indicating whether the firm has innovated persistently (i.e. over at least three consecutive CIS waves) in both the product and marketing domains and, at the same time, has introduced organizational improvements (including training activities linked to technological innovation). This variable, which also represents an innovation output, directly affects a firm's competitive advantage and, through this mechanism, its operating profits.

Other firm-specific characteristics. Firms'*age* (years, log value), available from the ASIA statistical archive, may have a positive impact on a firm's growth and thus it may exert an indirect impact on profitability. Also, we consider other variables - available from the CIS survey - which reflect a firm's propensity to internationalize. Thus, we use two dummy variables: the first indicates whether a firm belongs to an international group (*gp_int*) and the second indicates whether a firm sells its products in the international market (*intern*). The first variable may affect a firm's efficiency[9] whereas the latter is closely related

between investment in machinery and equipment and process innovation according to the evidence available from the CIS surveys.

[8]Otherwise a different modeling strategy should have been applied, i.e. focusing only on innovative firms or using a Tobit model with a selection equation. This approach, however, is beyond the scope of our investigation, which aims at pinpointing the different behavior and performance of innovative and non innovative firms.

[9]Indeed, after some experimentations the group dummy variable enters significantly only the productivity equation. It is also worthwhile to note that the weight

to the ability to expand internationally and thus increase turnover and profitability.

Sectoral structure and localization. Industry-specific characteristics are taken into account by considering two sectoral dummies which, in line with the Pavitt taxonomy, identify the high and medium-high technology sectors (*pavitt_mh*) and the low and medium-low technology sectors (*pavitt_ml*). Geographical characteristics are captured by four regional dummies (*nwest, neast, centre, south*) reflecting a firm's location in the north-west, north-east, central or southern regions of Italy. Also we consider the *cr5* ratio to capture the SCP mechanism described in Section 2 and the ratio of the sectoral number of product innovating firms to the total number of firms in that sector (*sect_inpd*). This latter variable captures two alternative mechanisms. The first may exert a positive effect on profitability as a significant number of sectoral innovating firms increases the overall industry's technological opportunities. The second effect may be negative as long as the increase in the sectoral number of innovating firms reduces the a firm's opportunity to exploit the gain from innovation.

It is worth stressing that balance sheet information is provided on a yearly base, while the qualitative variables derived from the CIS survey are defined on a three-year time span. In order to tackle the problem of different timing of information we averaged accounting information over a three-year period, thus the economic and financial indexes are provided as average values over the reference CIS time span. Descriptive statistics are reported in Table 2.

4 Model specification

We model the impact of innovation on firms' economic performance by using a simultaneous equation framework that incorporates a set of explanatory variables as proposed in the previously-described literature on the determinants of firms' performance.

Thus we specify a model in which productivity (y), as measured by real per capita (employee) value added, is treated as an endogenous variable which in turn is determined by physical capital, a proxy

of multinational enterprises (MNE) within our sample of firms is very low. Therefore, the impact of diversified fiscal rules on the profitability of firms belonging to international groups may be ruled out without any loss of generality.

Table 2: Descriptive statistics

		period	1998-2000	2002-2004	2006-2008	2010-2012	total period
variable name	*type*	*variable description*					
ros	c	Return on sales. The ratio between gross operating profits and sales. An index of operating profitability.	0.12	0.12	0.10	0.10	0.11
Y	c	Value added per employee (thousands euros)	70.5	72.0	72.5	78.8	72.4
market orientation	0/1	1 if the firm has persistently undertaken product and marketing innovation and, at the same time, has introduced organizational improvements (including training linked to tech. innovation)	0.09	0.11	0.11	0.08	0.10
KL	c	Tangible fixed assets per employee (thousands euros)	64.1	73.4	73.3	90.1	78.0
lev	c	The ratio of shareholders' funding to total debts	0.79	0.82	0.85	1.03	0.86
cr5	c	Concentration index (Pavitt sectors) %	31.8	29.9	26.4	29.3	29.4
sect_innpd	c	Share of sectoral technological innovators %	40.2	31.7	54.0	54.6	45.1
intern	0/1	1 if the firm sells its products in the international market	0.83	0.80	0.83	0.89	0.83
pavitt_mb	0/1	1 if in the low and medium-low technology sectors	0.64	0.62	0.62	0.59	0.62
pavitt_ma	0/1	1 if in the high and medium-high technology sectors	0.36	0.38	0.38	0.41	0.38
AGE	c	Firm's age (years)	26.8	28.7	32.7	35.8	30.7
innorg	0/1	1 if the firm has undertaken organizational innovation	0.71	0.52	0.51	0.59	0.57
r&d	0/1	1 if the firm has undertaken R&D investments	0.44	0.51	0.57	0.60	0.53
mkt	0/1	1 if the firm has undertaken marketing investments	0.83	0.80	0.83	0.89	0.83
gp_int	0/1	1 if the firm belongs to an international group	0.16	0.20	0.22	0.25	0.21
nwest	0/1	1 if the firm is localized in the North-West	0.40	0.40	0.40	0.39	0.40
neast	0/1	1 if the firm is localized in the North-East	0.36	0.36	0.36	0.38	0.36
centre	0/1	1 if the firm is localized in the Centre	0.10	0.10	0.10	0.11	0.10
south	0/1	1 if the firm is localized in the South	0.14	0.13	0.13	0.13	0.13

Notes. The variable Y and K have been deflated using sectoral deflators (base year 2010).

of knowledge capital, organizational innovation and a set of control variables that deal with regional and sectoral characteristics reflecting industrial technological levels, and other firm specific characteristics.

The other endogenous variable is operating profitability (ros)[10], as measured by the ratio of operating margins to sales, which depends on the mechanisms described in Section 2, according to the different factors that may affect a firm's profitability, i.e., SCP, firm efficiency or innovation process view. We also include in this case control variables that capture regional differences, sectoral technological opportunities and internationalization attitude. The impact of a market oriented behavior is included in the profitability equation, as it reflects a firm's customer driven attitude finalized to improving returns from product innovation. This variable also reveals a firm's persistent attitude towards product innovation.

The structure of the model is recursive, in that productivity affects profitability, and not vice-versa. This model can be estimated consistently by using OLS, provided that the equations' disturbances are not cross-correlated, i.e. the system is diagonal recursive. We have tested for this property using the Breusch–Pagan test (Breusch and Pagan, 1980); however, it entails the rejection of the hypothesis of uncorrelated errors between equations.[11] For this reason, following (Lahiri and Schmidt, 1978) and (Hanssens et al., 2003), we decided to estimate the system of equations by 3SLS, thus providing consistent estimates of the parameters.[12]

Following the variable description of Section 3, the explanatory variables in the productivity equation are:

- a proxy of knowledge capital ($r\&d$ and mkt);

[10]The use of an operating measure of profitability may be rationalized on the grounds that we aim at pinpointing the relationship between innovative activity and a firm's core business. Other measures of firms' profitability (e.g., ROA, ROE) are strongly influenced by financial returns that, firstly, are not directly related to the core business and, secondly, may crucially depend on the economic valuation of total assets that in many cases may be biased.

[11]The corresponding LM test is as follows: $\tilde{\chi}^2$ =11.71 (1 d.f.).

[12]We use a 3SLS random effect estimators. This choice can be justified on the grounds that the RE specification enables one to control for the effect of time-invariant variables such as regional areas and industrial sectors, and also the market orientation variable. In addition, when the target population is large, and the selected sample may not be fully representative regarding all the characteristics under investigation, it may be preferable to adopt a random effect model as it allows for a generalisation of the inferences beyond the sample used in the model.

- organization innovation (*innorg*);

- physical capital deepening (*kl*);

- sectoral innovation characteristics (*pavitt_mh* and *pavitt_ml*);

- localization (*nwest*, *neast*, *centre* and *south*) and other firm specific characteristics (*age* and *gp_int*).

The profitability equation includes explanatory variables that capture the effect of market orientation, firms' efficiency coditions, market structure and technological spill-over:

- market orientation (*market orientation*);

- financial efficiency (*lev*);

- productivity (*y*);

- ability to sell products on international markets (*intern*);

- market structure (*cr5*);

- technological spill-over (*sect_inpd*).

The empirical specification includes, therefore, two equations, one for a firm's productivity and one for profitability , as follows:

$$\begin{aligned} y_{it} =& \beta_0 + \beta_1 pavitt\_mh_i + \beta_2 innorg_{it} + \beta_3 r\&d_{it} + \beta_4 mkt_{it} + \beta_5 gp\_int_{it} \\ &+ \beta_6 kl_{it} + \beta_7 age_{it} + \beta_8 nwest_i + \beta_9 neast_i + \beta_{10} centre_i + v_{it} \end{aligned} \tag{1}$$

$$\begin{aligned} ros_{it} =& \alpha_0 + \alpha_1 market\ orientation_{it} + \alpha_2 y_{it} + \alpha_3 cr5_{it} + \alpha_4 lev_{it} + \alpha_5 intern_{it} \\ &+ \alpha_6 sect\_inpd_{it} + u_{it} \end{aligned} \tag{2}$$

where v_{it} and u_{it} are one-way error components, and the subscripts i and t identify, respectively, firms and the time. We then estimate these equations, as previously discussed, by using a 3SLS random effect model. This implies that each error term includes a firm specific random component, which is assumed to be uncorrelated with the observed explanatory variables, and a white noise idiosyncratic disturbance.

5 Empirical investigation

5.1 Results - general

The panel of firms used in the present study covers fifteen-years (1998-2012). However, in the system of equations presented in the previous section, the time variable refers to a three-year time span, according to the CIS reference interval. It is worth noting that, by using this specification, we are not able to explore lagged effects, for example, in the innovation-profitability relationship given that this would determine a substantial drop in the number of observations available for the econometric investigation. Contemporaneous relationships are instead analysed taking into account, however, that; (i) the measures of innovation used here refer to adoption decisions which may have occurred during a three-year period without knowing the precise year of acquisition, (ii) in order to deal with this issue we use a three-year average of the economic information derived from balance sheets.

Following the argument presented in the previous section comments are based on the 3SLS estimates. Table 3 reports the overall results together with the impact of changes in the explanatory variables on profitability and productivity respectively.

As concerns profitability, the SCP mechanism is not significant, whereas those variables that reflect a firm's efficiency condition do exert a significant and stronger impact.

A ten per cent increase in a firm's productivity brings about a 0.09 p.p. increase in profitability. An equivalent increase in the leverage variable determines a higher impact on profits as their increase corresponds to 0.11 p.p. It is worth recalling that the leverage variable is defined as the ratio of shareholders funding to total debts. Thus, the estimate suggests that internal resources play a crucial role in affecting a firm's profitability, particularly when economy wide risks prevail and the cost of borrowing increases.[13] In addition, although our leverage index does not allow one to distinguish between different categories of debt (short- and long-run) or the typology of lenders (banks or other financial institutions), we believe this index may adequately describe the financial choices of our panel of firms that operate in a context where bank financing is the most significant source of firms'external financing, as is common - on average - in all European economies.

[13]See Myers and Majluf (1984) for a discussion on the role of internal resources in affecting firms' investment decision according to the pecking order theory.

Table 3: Determinants of firm economic performance: panel estimates over the period 1998-2012

	3SLS estimation (random effect)		marginal effects for selected changes in the independents (in parentheses)	
variables	*ros*	*y*	*ros*	*y*
y	0.00886***		+0.09 p.p. (+10%)	
	[0.000545]			
mkt_orientation	0.0124***		+1.2 p.p. (=1)	
	[0.00390]			
cr5	0.00011			
	[0.000102]			
sect_inpd	-0.000291***			
	[7.95e-05]			
lev	0.0107***		+0.11 p.p. (+10 p.p.)	
	[0.00109]			
intern	-0.00412			
	[0.00296]			
age		0.177***		+17.7% (+1)
		[0.0185]		
pavitt_mh		0.116***		+11.6% (=1)
		[0.0163]		
innorg		0.0339***		+3.4% (=1)
		[0.0122]		
r&d		0.0175		
		[0.0138]		
mkt		0.0435***		+4.3% (=1)
		[0.0139]		
gp_int		0.132***		+13.2% (=1)
		[0.0162]		
kl		0.239***		+2.4% (+10%)
		[0.0066]		
neast	0.0035	0.0101		
	[0.00323]	[0.0188]		
centre	-0.0050	-0.0278		
	[0.00591]	[0.0336]		
south	0.0349***	-0.142***		
	[0.00449]	[0.0282]		
Constant		7.7258***		
		[0.0997]		
Observations	2,912			

Notes. Time dummies included. Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Variable y, *age* and *kl* are in log values. Recall that profitability (ros) is a ratio, whereas productivity (y) is expressed in log values and thus impacts are calculated accordingly.

The *intern* dummy variable reflects a firm's ability to sell its product on international markets, and one would expect a positive and significant coefficient. However, this variable is not significant in the adopted specification, thus signalling that operating on international markets does not provide a premium in terms of higher profits. Indeed, one has to consider that operating on international markets brings about additional costs that may be not fully compensated by revenue increases. This effect seems to prevail in our panel of manufacturing firms and is also confirmed by simple descriptive statistics that show how return on sales for firms that operate on international markets are slightly less than the corresponding returns of firms which base their business mainly on domestic markets.[14] This result is plausible within the Italian manufacturing industry which is dominated by a relatively high number of small-sized businesses, which therefore face possible diseconomies when they approach international markets.

The *sect_inpd* variable reflects two contrasting mechanisms. On the one hand, it may reflect the information (epidemic) effect, in that - as the number of innovators increases a firm's probability of introducing an innovation increases accordingly - and, therefore, through this mechanism it may affect positively its profit margins. On the other hand, this variable may reflect the so-called stock effect (Karshenas and Stoneman, 1993), in that the increase in the number of adopters may reduce profit margins. The prevailing mechanism determines the sign of the coefficient, which in our case is negative, although very mild. Thus, the significant and negative coefficient (although mild) of this variable suggests that the positive effect of technological spillovers generated by the introduction of product innovations within the sectors tend to be offset by the competitive mechanism which reduces a firm's profitability, as the number of product innovators increases.

The variable reflecting a firm's market orientation, according to the discussion presented in Section 2, is positive and thus supports our research hypotheses. It implies that being a persistent product and marketing innovator, while at the same time introducing organizational changes and training efforts, determines a 1.2 p.p. increase in profitability.

As concerns the productivity equation, the capital-labour ratio reflects the role of physical capital and it shows an impact that implies

[14]The whole descriptive statistics dealing with the panel data set used for the present econometric estimation may be downloaded from: http:// www.istat.it/archivio/111638.

a 2.4 percentage increase corresponding to a 10% increase in capital deepening.

We have proxied the impact of knowledge capital by means of two dummy variables, i.e., the R&D and marketing expenditures dummies.

We have previously discussed the fact that we aim to analyse market-oriented behaviour by considering the whole set of firms, i.e. innovative and non innovative, and thus to determine the impact of such behaviour, taking as reference firms those which are both occasional innovators and non-innovators. In addition it is worth recalling that we estimate a recursive model in which productivity and profitability are jointly determined. We do not estimate an innovation equation using R&D intensity as in the model proposed by Crépon et al. (1998).

Taking this issue into account, variables reflecting product innovation inputs present the expected signs. The propensity to undertake marketing investments and to introduce organizational improvements may determine positive and significant improvement in a firm's productivity. The impact of the $r\&d$ dummy is positive although not significant at conventional significance levels.

This controversial result is coherent with the stylized facts of the Italian economy and, particularly, manufacturing, in that labour productivity has shown a significant decreasing trend since the mid '90s. During this period knowledge investment (in particular R&D) has also been decreasing, thus suggesting that Italian firms have been unable to grasp the technological opportunities prevailing at that time. Simple growth accounting exercises (ISTAT, 2008) show that the contribution of TFP to labour productivity growth has been significant and higher than the contribution of capital deepening until the mid '90s; afterwards, labour productivity has been sharply decreasing, mainly because of the decline in the TFP growth rate.

In addition, one should take into consideration that the regional dummies included in the model (reference area: North-West), also pick up the effect of the R&D propensity, given that it is highly geographically (North and Centre) concentrated thus implying significant regional gaps in the innovative effort.

The effect of technological opportunities is included by considering industries dummies related to technological levels. Results indicate that - on average - a positive and significant productivity gain (+ 11.6%) characterizes firms operating in the medium-high technology sectors compared to firms operating in the medium-low technology sectors.

We also control for age and group membership. Firms' *age* shows a

positive and significant coefficient, thus signaling that well-established firms may increase their productivity compared with younger or less established firms. International group membership (*gp_int*) also shows a positive impact, in that a firm which belongs to an international group may increase its productivity by 13.2%.

5.2 Market orientation and other persistent patterns

Results described in the previous section point out that market orientation is a key success element as it significantly increases a firm's profitability. A step forward in the analysis of the profit-innovation relationship is represented by an additional investigation in order to test whether being market oriented enables firms to earn higher profits compared with other relevant persistent patterns.

Thus, in order to explore thoroughly the innovative behavior of our panel of firms, we propose in Table 4 results from the 3SLS specification for a firm's profitability where the innovative effort has been alternatively defined in order to represent: i) product innovation which have been introduced persistently (i.e. in at least three consecutive survey occasions); ii) marketing innovation introduced on a persistent basis; iii) market orientation.

The attitude towards market orientation in our panel is captured by the dummy variable which indicates whether the firm has performed both product and marketing innovation persistently over a sufficiently long time path, i.e. during at least three consecutive sub-periods, and at the same time has adopted organisational innovation and learning activities related to technological innovation. The results in column 3 suggest that firms with a strong market orientation are able to increase profitability by 1.2 percent points compared to firms which do not show this characteristic. This result is confirmed and reinforced when we include in the same model the other two persistent patterns (column 4), thus taking as reference group only those firms that do not show a persistent pattern or are not innovative at all.

Conversely, those firms that have innovated in marketing alone, although persistently, do not exhibit a significant profitability premium (column 2). Product innovation, when performed persistently, has a positive and significant impact on a firm's profitability (column 1) and its impact is even higher than that observed for a market oriented

Table 4: Impact of innovation on firm profitability: panel estimates over the period 1998-2012 – 3SLS estimation - (random effect)

variables	(1)	(2)	(3)	(4)
persistent product innovation [(a)]	0.0266***			0.0286***
	[0.00465]			[0.00470]
persistent marketing innovation [(b)]		0.0103		0.0139
		[0.0144]		[0.0145]
market orientation			0.0124***	0.0148***
			[0.00390]	[0.00395]
y	0.00915***	0.00885***	0.00886***	0.00912***
	[0.000550]	[0.000547]	[0.000545]	[0.000552]
cr5	0.0000779	0.000108	0.000108	0.000081
	[0.000102]	[0.000102]	[0.000102]	[0.000102]
sect_inpd	-0.000373***	-0.000278***	-0.000291***	-0.000389***
	[8.17e-05]	[7.96e-05]	[7.95e-05]	[8.19e-05]
lev	0.0104***	0.0106***	0.0107***	0.0104***
	[0.00110]	[0.00109]	[0.00109]	[0.00110]
intern	-0.00387	-0.00367	-0.00412	-0.00456
	[0.00297]	[0.00295]	[0.00296]	[0.00298]
neast	0.00483	0.00447	0.00349	0.00412
	[0.00325]	[0.00324]	[0.00323]	[0.00327]
centre	-0.00472	-0.00489	-0.00504	-0.00428
	[0.00596]	[0.00593]	[0.00591]	[0.00596]
south	0.0351***	0.0352***	0.0349***	0.0350***
	[0.00452]	[0.00450]	[0.00449]	[0.00452]
Observations	2,370	2,370	2,370	2,370

Notes. Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. (a) the firm has innovated persistently in products but not in marketing (b) the firm has innovated persistently in marketing but not in products.

firm[15]. At first sight this result may appear controversial as market orientation is indeed relevant, in that the complementary role of product and marketing innovation when observed continuously over time emerges as one of the key determinants of a firm's economic performance.

The fact that persistent product innovation alone - which does not rule out occasional marketing activity - shows a stronger impact on profitability may be explained on the grounds that in some industries it could be the case that new products have lower selling expenses than older ones thus reducing the intensity of marketing and advertising. Bayus et al. (2003) show that this pattern can be seen in the personal computer industry and Pauwels et al. (2004) discuss the effect of marketing actions on firms' performance in the short and long-run in the automobile industry. Within the marketing literature a distinction between product- and market-oriented firms is also discussed, as the former focus more on product quality and functional features which *per-se* provide a competitive advantage to those firms that possess such an orientation. This debate is beyond the scope of the present study, although it is relevant to the management strategy and marketing literature. However, it is worthwhile noting that this consideration may help in interpreting the evidence we have presented.

6 Conclusions

We have presented an empirical model in which firms' profitability and productivity are estimated simultaneously, thus enabling us to provide consistent estimates of the relationship being tested for. The conceptual framework within which we have developed the analysis takes from the management approach to innovation the notion of a firm's market orientation, and from the economics of innovation the general view of the determinants of firms' performance. We have therefore set up an empirical model which incorporates these complementary views. Market orientation has been referred to a firm which continuously innovates in product and marketing, and in addition adapts its organizational structure to market conditions, also focusing on knowledge management. This notion entails the concept of a persistent innovative

[15] A simple test (z test; z= 2.44) on coefficient equality indicates that the difference in the two estimated coefficients in column (1) and (3) is statistically significant, see Paternoster et al. (1998) and Clogg et al. (1995).

attitude that enables us to discuss the results of the empirical model, taking into consideration the literature on persistence of innovation.

The estimates presented in this study show that the notion of market orientation adopted is relevant in affecting profitability. The effect on companies' returns on sales implies that a market oriented firm receives a profit premium of 1.2 p.p. This effect is even higher when compared with that derived from other mechanisms. We have considered variables reflecting the traditional structure conduct performance mechanism (SCP) on the one hand, and on the other, variables related to firms' efficiency conditions and technological opportunities. The impact of the former is not significant, contrary to that associated with the latter.

Productivity is then endogenised using a combination of different mechanisms which are related to knowledge capital, industry innovation characteristics,physical capital (capital deepening), and controls that pick up firms' age and location effects.

The effect of proxies for knowledge capital and innovation effort is not clear-cut, as the gain in productivity determined by investing in R&D is significant only at higher significance levels, in contrast with the organization and marketing expenditure variables, which show a positive and significant impact on productivity. This result is, however, coherent with the stylized facts prevailing in the Italian manufacturing industry as regards to investment in knowledge capital. Indeed, Italian manufacturing firms have substantially underinvested in R&D and, in general terms, in knowledge capital. Conversely, capital deepening - as measured by the capital-labor ratio - exerts a greater impact.

Being part of an international group has a significant and strong impact on productivity, together with age and industry technological opportunities. In addition, structural regional differences are still operational and significant, in that southern manufacturing firms do show a lower level of productivity, which then has an impact on the profitability equation. It is worth underlining that the estimates we have presented cover a relatively long time interval, enabling us to set up an empirical model that throws light on key variables affecting firms' performance in the long run.

We have also compared and discussed the impact on profitability of market orientation and persistent product innovation. We have found that the impact of the latter is higher compared with market orientation. This finding, which at first sight may seem a contradiction, is however consistent with the fact that one should take the possibly

declining pattern of marketing intensity into consideration. Indeed, in some industries new products have lower selling expenses than older ones, thereby reducing the intensity of marketing activities over time. Thus, given the adopted definition of market orientation, which also entails a persistent marketing activity, it could be the case that in some industries persistent product innovation (which does not rule out occasional marketing activities) may exert a higher impact on a company's profitability. However, it is worth underlining that in any case market orientation provides a significant and non negligible impact with respect to the whole set of firms that cannot be classified as market oriented. This fact underlines how companies, and therefore their management, do have an incentive to pursue market oriented behaviour, which ultimately entails a strong commitment to deploying technological and non technological capabilities.

All in all, our study has enabled us to provide a more precise definition of market orientation by using a large panel of manufacturing companies and avoiding the use of ad hoc or subjective measures, thus enabling a wider generalization of our findings.

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