

# Innovative Capacity of Italian Manufacturing Firms

Alberto Ferraris

Department of Management, University of Turin, 10134, Italy

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**Abstract** In the current scenario of high technological competitiveness and environmental complexity, the innovation capacity of manufacturing firms is one of the principal key driver for competing on the global markets. The context is increasingly dominated by strong and growing competition between companies from all over the world so, manufacturing firms are forced to move the focus of competitive advantage on innovation. This paper focuses on innovative capacity of Italian manufacturing firms over the period 2007-2009 from three different points of view. First, the investments in technological equipment, plant, machinery and ICT; second, the R&D expenditures; third, the way that firms finance their innovation activity and investments. Analyzing a sample of 524 European manufacturing firms from these three different points of view, several findings emerge from the comparison of firms in different countries. Most Italian companies have a good basic ICT supply, but they invest relatively less than the average in new infrastructure, machinery and equipment. Investments in innovation and R&D are stronger, although funding strategies are unbalanced towards traditional debt instruments and they are more undifferentiated considering the final objectives of the investment. The research concludes with interesting managerial implications which provide a conceptual interpretation of the phenomena and prescribe actions to policy makers.

**Keywords** Manufacturing Firms, Innovative Capacity, Sources of Financing

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## 1. Introduction

The global economic situation seems to have different speeds. The IMF (International Monetary Fund) describes the current situation as a two-speed recovery phase, with a part of the world running and the other one gradually starting to walk again. The developed countries GDP grew by 2.5% in 2010 and 2.7% in 2011 while the GDP of emerging countries grew at a faster rate of 6.5% in 2010 and 7.1% in 2011. In the current recovery and growth framework there are mainly two obvious risks: on the one hand, those related to the fears about fiscal balance of some countries; on the other hand, those related to the dynamics of commodity prices, which seem to evolve faster in developing countries than in the developed ones because of the higher growth rate of GDP.

In this context, the Italian economy seems to recover more slowly than the European countries. The GDP, in fact, increased by 1.3% in real terms in 2011 (after a decline by 5.2% in 2009), with a private consumption increase of just 0.6%. The difficulties in the labor market, which still did not convincingly turnaround after the crisis, cause a weak consumer demand.

So, with reference to the situation of enterprises, the

starting point is given by the dynamics of manufacturing; after the sharp decline in 2009 and the gradual recovery observed in most of 2010, the dynamics of manufacturing seems to have lost impulse in the latest period (2011).

It is possible to better understand the dynamics of manufacturing firms after the crisis, investigating two different aspects: the production index and the confidence indicator[1].

The international comparison with the other EU countries (especially compared to Germany) does not provide comforting indication; it is clear the different “rhythm” of Italy. In fact, it is evident not only in the historical period before the crisis, but also in the expansion phase that followed. If Germany, for example, registered an increase by 23.9% in the production index from the lowest point of March 2009 to January 2011, Italy shows in the same period a growth by just 9.8%.

Another relevant way to examine the economic current framework is to take the confidence indicator into consideration. EU Commission data[2] suggest that all the EU countries touched the lowest point during the crisis in April, 2009. Considering the pre-crisis levels, German companies are more confident today than during the peak of the previous economic cycle (end of 2006 - first half of 2007); French companies have more or less the same confidence, while Italy and even more Spain are still far apart. The distance in March 2011 between the lowest level (Spain according to the data in this case) and the highest one (Germany) is 25 percentages points, the biggest difference

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\* Corresponding author:

alberto.ferraris@unito.it (Alberto Ferraris)

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since 1991.

In Italy, the manufacturing output, the confidence indicator and the profit trend, show a less brilliant dynamic compared to the other countries. The recovery from the shock of 2009 seems slower. It looks like the Italian manufacturing firms lack a “sprint”; the innovative activities are probably the key factor to affect a faster recovery.

Then, in this particular scenario, the innovative capacity of manufacturing firms became very important[3]. Innovative capacity relates to the firm’s capacity to engage in innovation, for example having the right tools and/or basic conditions for being innovators and successfully compete in the current scenario. The best performing manufacturing firms are increasing their investments in technology modernization to face the challenges coming from the crisis[4]; as a consequence they are introducing new product and process technologies[5].

This paper focuses on innovative capacity of Italian manufacturing firms from three different points of view. First, the amount of investments in technological equipment, in plant, machinery and ICT; second, the R&D expenditures, third, the way that firms finance their innovation activity and investments. So, this paper has the purpose to investigate these different aspects and to compare them with other European Regions in order to obtain some policy implications.

The paper is organized as following: Section 2 will examine the literature, then, the paper will describe the research methodology (Section 3). Section 4 (Findings) will show a qualitative analysis of the main topic under investigation, showing different aspects of innovation activity of Italian manufacturing firms. Finally, Section 5 offers a conclusion.

## 2. Literature Review

The literature on this theme is very wide and show many aspects related to competition, strategy, innovation, control, governance and management.

Manufacturing was considered as the main source of technological innovation and hence as the key driver for productivity growth, and not surprisingly innovation theory has been basically derived from the analysis of technological innovation in manufacturing[6]. However, since the 1980s a large number of scholars have studied innovation in services ([7-11]).

According to the aim of this paper, the analysis of the literature will focus on two different aspects: a) the characteristics of innovation in manufacturing sectors; and b) the way that firms finance this kind of activities.

Concerning the first aspect, many studies investigated the innovative capacity of manufacturing firms through econometric models ([4],[12],[13]) at a single national / regional level ([14-16]), while others are focused on different kind of relationship between innovative capacity and other determinants such as R&D cooperation ([17-19])

family control ([20],[21]) and exportation ([22],[23]).

Concerning the second aspect, several scholar have deeply analyzed the financing point of view ([24-29]).

So, this study tries to fit the existent lack of studies through a qualitative analysis of this two aspects comparing different countries/regions.

### 2.1. The Characteristics of Innovation in Manufacturing Sectors

Wakelin[30] analyzed the relationship between productivity growth and R&D expenditure for 170 UK firms finding a positive and significant correlation.

Reichstein and Salter[31] using a large scale survey of UK manufacturing firms found that firm size, the presence of formal research and development, and the use of suppliers as a source of knowledge all increase the chances that a firm will be a process innovator.

Chudnovsky et al.[4] using panel data from innovation surveys in Argentina with information for 1992–2001 showed that in-house R&D and technology acquisition expenditures have positive payoffs in terms of enhanced probability of introducing new products and/or processes to the market. In turn, innovators attain higher productivity levels than non-innovators. The results also showed that large firms have a higher probability of engaging in innovation activities and of becoming innovators.

Triguero and Córcoles[16] analyzed the persistence of innovation in a panel of Spanish manufacturing firms for the period 1990–2008. They found that R&D (input) and innovation (output) are highly persistent at the firm level. Also, regarding firm specific characteristics, they found that size and outsourcing have a positive impact on both processes and past innovative behavior was clearly more decisive in explaining the current state of R&D and innovation activities than external factors or firm-level heterogeneity.

Hall et al.[12] using data on a large unbalanced panel data sample of Italian manufacturing firms found that R&D and ICT are both strongly associated with innovation and productivity, with R&D being more important for innovation, and ICT investment being more important for productivity. Examining the contribution of IT to innovation production across multiple contexts and analyzing annual information from 1987 to 1997 for a panel of large U.S. manufacturing firms Kleis et al.[13] found that a 10% increase in IT input is associated with a 1.7% increase in innovation output for a given level of innovation-related spending. This relationship between IT, research and development (R&D), and innovation production was robust across multiple econometric methodologies and is found to be particularly strong in the mid to late 1990s, a period of rapid technological innovation. This results has also demonstrated the importance of IT in creating value at an intermediate stage of production through improved innovation productivity. However, R&D and its related intangible factors (skill, knowledge, etc.) appear to play a more crucial

role in the creation of breakthrough innovations.

Instead, Becker[18] investigated the role of R&D cooperation in the innovation process—in context with other factors—and stated that the intensity of in-house R&D stimulates the probability and the number of joint R&D activities with other firms and institutions significantly.

The importance of R&D cooperation has risen steadily as a consequence of the growing complexity, risks and costs of innovation[17]. Firms engaged in the innovation process are aware of the necessity of establishing R&D cooperation to obtain expertise which cannot be generated in-house. Collaboration with other firms and institutions in R&D is a crucial way to make external resources usable.

Concerning the relationship with family control, Lichtenthaler and Muethel[21] using data from a sample of 119 German manufacturing firms showed that family involvement is positively related to dynamic innovation capabilities. Specifically, the degree of family involvement, which describes the owner family's ability to influence firm behavior, is positively related to sensing innovation opportunities and to transforming a firm's innovation processes, while it is insignificantly related to seizing innovation opportunities. The findings suggest that dynamic innovation capabilities are an important characteristic that differs between firms with varying levels of family involvement. Also, particular characteristics, such as a long-term orientation, illustrate that the activities of firms with family involvement differ from those of other firms[20].

With referred to export attitude, Nassimbeni[22] proposed a predictive model on the basis of an empirical investigation carried out on a sample of small units, exporters and non-exporters. They are compared in terms of technology and ability to innovate, besides a number of other structural factors. This study showed that the propensity of small units to export is strictly linked to their ability to innovate the product and develop valid inter-organizational relations.

Regarding this topic Basile[23] analyzing the relationship between innovation and export behavior of Italian manufacturing firms in different exchange rate regimes stated that innovation capabilities are very important competitive factors and help explain heterogeneity in export behavior among Italian firms.

However, the exchange rate evaluation reduces the importance of technological competitiveness in affecting exports because it allows also non-innovating firms to enter foreign markets. Moreover, he found that once new firms have entered the market, they continue to be exporters also when the exchange rate returns to its previous level (hysteresis) and concluded that the export intensity of innovating firms is systematically higher than that of non-innovating firms.

## 2.2. Sources of Financing

Freel[24] investigated the funding environment facing product innovating small manufacturing firms and both

supports and contradicts a number of “stylized facts” which have emerged over the last decade. Amongst the key findings it appears that, whilst innovators were no more nor less likely to have sought external funds, they were significantly less likely to have successfully accessed bank finance. This finding is of particular gravity since bank debt remains the primary source of external finance employed. Further, the author noted that the low use of genuine risk capital to fund product innovation and raised the question as to what extent this reflects supply or demand side deficiencies. The role of public subsidies, in the form of grant funding, is also investigated with some tentative evidence pointing to the role grants play in validating technology or as leverage to access further funds. Dahlstrand and Cetindamar[25] analyzed the dynamics of innovation financing by using the case of Sweden and showed the importance of government and venture capital in financing innovation.

Hall and Lerner[26] found that, while small and new innovative firms experience high costs of capital that are only partly mitigated by the presence of venture capital, the evidence for high costs of R&D capital for large firms is mixed. Nevertheless, large established firms do appear to prefer internal funds for financing such investments and they manage their cash flow to ensure this. Evidence showed that there are limits to venture capital as a solution to the funding gap, especially in countries where public equity markets for venture capital exit are not highly developed. Magri[27] investigated small manufacturing firms in collecting external finance and highlighted special features in financial structures of small innovative firms, compared with firms of similar size that do not innovate. The evidence showed that small innovators rely less on financial debts and more on internal financial resources; no important differences appear for large firms. Another finding was that small innovative firms showed a lower investment sensitivity to cash flow than small non-innovative firms: it was more likely that the high incidence of internal financial resources allows them more flexibility in deciding their investments. No difference in investment sensitivity to cash flow, by innovative attitude, was found for large firms.

Finally, Carboni[28] using a comprehensive firm level data set for the manufacturing sector in Italy, examined whether public funding affects the financial sources available for R&D and found that grants encourage the use of internal sources. The results also show some evidence of positive effects on credit financing for R&D.

## 3. Methodology

It has been used data collected by GFK Eurisko systems through CATI (Computer Assisted Telephone Interview) and CAWI (Computer Assisted Web Interview) interviews to executive managers during the period 2007-2009. The sample consist of 525 manufacturing companies and their different home countries are indicated in Table 1.

To better understand the characteristics of enterprises the

sample is been divided by sector and company size, taking the main geographical areas of each country into account, Table 2 shows a descriptive statistics of the sample.

It has been used a large firm-level data set which enabled to consider the level of innovative capacity of Italian manufacturing firms compared with the European ones.

Innovative capacity is one of the most important factor that help manufacturing firms to face the challenges coming from this crisis and to compete in an international frame work, so best performing manufacturing firms would increase their investments in technology modernization and innovation expenditures to introduce several new product and process technologies ([4],[5]).

**Table 1.** Firm's home countries (%)

Home country	Nr.	%
Italy	105	20.00
Austria	25	4.76
France	97	18.48
Germany	82	15.62
Hungary	33	6.29
Spain	94	17.90
UK	89	16.95
Total	525	100.00

**Table 2.** Sample descriptive statistics

Sector/ Employees	10-19	20-49	50-249	> 249	Total
Food & Beverage	20	25	7	3	55
Textile and Publishing	48	54	21	9	132
Metallurgic	40	43	19	7	109
Chemicals and Plastic	28	33	8	4	73
Tools and Machinery	33	40	28	15	116
Other	10	14	11	5	40
<b>Total</b>	179	209	94	43	525

In particular the focus is on the level of technological equipment and investments in plant, machinery and ICT, on the amount of research and development (R&D) activity and, finally, on the way that firms finance their innovation activity and specific investments.

To define the level of technological equipment and investments in plants, machinery and ICT questions like “what is the level of ICT used in enterprises”, “how much is the cost of the broadband Internet connection”, “how relevant is the digital divide” and “what is the company perception of the importance of the broadband” were proposed to the

To analyze the amount of research and development (R&D) activity questions like “what is the level of product and process innovation introduced”, “what is the combination of product and process”, “how much protection instruments of intellectual property are used”, “what is the R&D intensity” and “which is the share of companies

conducting R&D outsourcing or in-house R&D” were proposed.

Finally, to analyze the way that firms finance their innovation activity and their specific investments in plants, machinery and ICT questions concerning the weight of self financing, leasing, factoring, bank loans and intercompany funding were proposed.

## 4. Findings

The importance of the manufacturing sector is widely recognized, so that innovation theory has been basically derived from the analysis of technological innovation in manufacturing[6]. Indeed the manufacturing was considered the key drive for productivity growth because of its strong influence of technological innovation.

Within the manufacturing sector, this research revealed different results with referred to: (a) technological equipment and investments in plant, machinery and ICT, (b) the amount of research and development activity (R&D), (c) the financing of intangible assets and R&D investments

More specifically:

(a) technological equipment and investments in plant, machinery and ICT.

This analysis shows that the use of ICT in enterprises is now widespread in the Italian industrial structure: more than 82.4% of Italian companies, in fact, has a broadband Internet connection. The use is higher among the big companies (93.1% of firms with more than 250 employees have it) but also among SMEs more than 80% have it. The international comparison, however, shows a slight gap between Italy and the average of the countries included in the survey, which concerns both large companies and SMEs (the average spread in seven countries is equal to 89.2%).

The cost of connection is not the major impediment in the spread of broadband (only 7.3% of companies indicate it as a problem). Rather, the main obstacles are the perception that broadband is not necessary to the companies activity (as indicated by 34.4% of companies without broadband) and the lack of connectivity of the territory (as indicated by 23.1% of companies). This confirms that the “digital gap” is still an issue to be addressed in our country.

However, the more complex ICT technologies are less widespread compared to the other European countries. For example, the e-commerce information systems are adopted only by 13.9% of Italian firms, compared to 33.1% of Austrian firms, 28.5% of German firms and 50% of United Kingdom firms.

During the period 2007-2009 the percentage of Italian companies investing in plant, machinery and ICT was 80.5%, ranking far below the average of the seven countries considered (equal to 87.8%). In the international ranking, Germany, Austria and Spain are at the first places; share of companies engaged in investment are respectively 97.1%, 94.7% and 91.4%. (Figure 1).

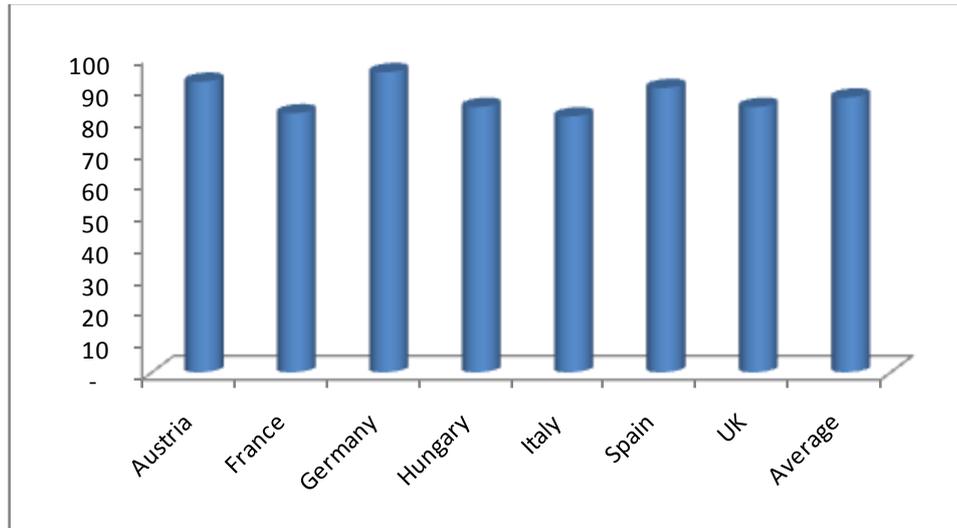


Figure 1. Percentage of companies which have invested in technological equipment, plants, machinery and ICT in the 2007-2009

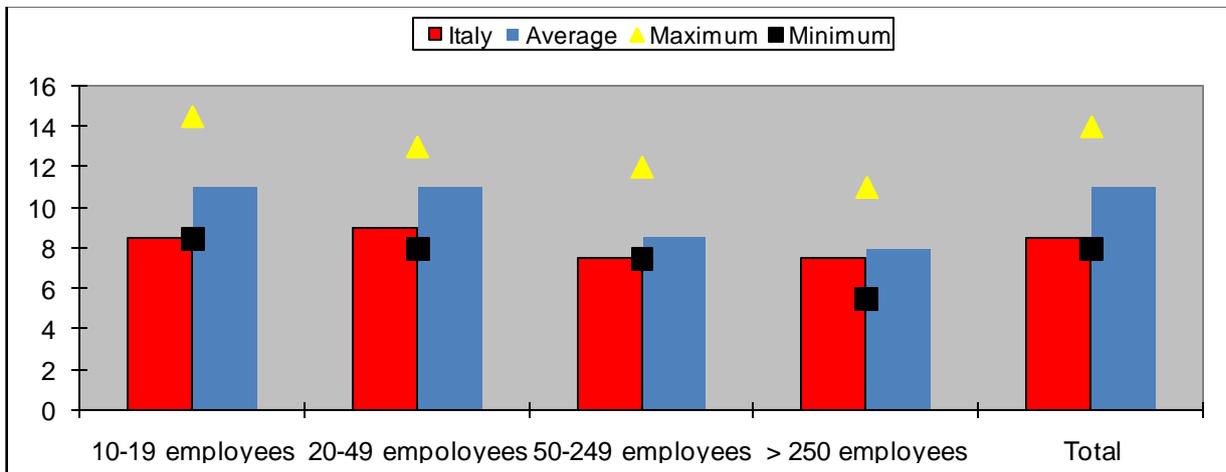


Figure 2. Percentage on turnover of investments expenditures on plants, machinery and ICT in the 2007-2009

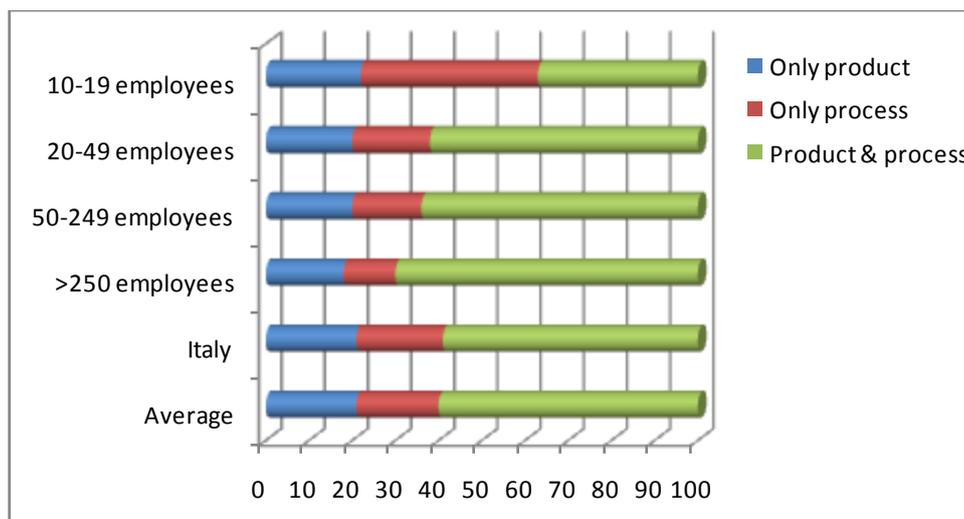


Figure 3. Percentage of Italian firms that have introduced innovations in 2007-2009 by type

Even in terms of share of sales, investments of Italian companies are lower than the overall sample (9% against 10.5%). This trend concerns especially the smaller firms: the

gap between the Italian companies and the average of the total sample is approximately two percentage points in firms with less than 20 employees; and it decreases with increasing

size (Figure 2).

However, the lower Italian propensity to invest is not combined with a stronger response to the crisis. Less than a third of Italian companies (the 27.8%) report a decrease in tangible assets investments in 2009, compared to the 33 % in the total sample. The countries suffering most for the crisis are Spain (where the companies forced to reschedule their investments have been 47.3%), France (42.8%), and Hungary (35.4%).

(b) the degree of research and development (R&D) activity.

In terms of innovation, Italian companies are more active than the average of the total sample: 66.4% of Italian firms introduced product or process innovation in 2007-2009, compared with an average of 64.3 % (the higher rates are recorded in Austria and Spain).

The integration of product and process is the most common type of innovation introduced by 66.4% of Italian companies (slightly above the average of the sample, 64.4%). Figure 3 shows that 22.6% of the Italian innovators focused exclusively on products while 18.6% introduced only process innovations (compared to an average over the whole sample, respectively, 21.7% and 15.9%). The combined development of product and process innovation is more common in large enterprises: increasing the size, the share of innovators that adopt exclusively product or process innovations decrease.

A reason could be the larger number of family business in our country. This would confirm the studies of Lichtenthaler and Muethel[21] which states that an increase of family control increases the tendency to innovate.

Among the innovators, 28.7% introduced also organizational changes: a percentage below the average of

the sample (31.7%). Austrian and German companies have a greater complementarity between product or process innovation choices and organizational choices; the share of firms combining these different kinds of change rises, respectively, to 50.2% and 41.1 %.

Italian companies over the three years achieved a share of turnover from innovative products on average higher than the overall sample (24% versus 21.3%). The data shows that small firms (with less than 50 employees) as well as large ones (with more than 250) tend to have high percentage coming from innovative products (Figure 4). Moreover, in about one third of cases (33.4 %) the innovative product introduced by Italian firms appears to be new also to the market (the average of the seven countries considered is 30.7%) .

The results demonstrate that the use of protection instrument of intellectual property in Italian companies is in line with the average of the total enterprises analysed. 22.2% of Italian companies declare that they protect their innovations with patents, industrial designs, trademarks or copyrights (the sample mean is 22.5%). The most widely protection form is the patent; 12.6% of Italian companies used it in 2007-2009, followed by the brand (used by 12.5% of companies). Instead, the use of industrial design and copyright seems to be poor. The copyright is fairly rarely used by manufacturing firms since its nature is designed to protect intangible intellectual property. Instead, the gap in the use of the registered industrial design among Italian companies (3%) and the total sample (7%) is remarkable. The distance is even more evident comparing Italy with Germany, where 11.5% of the companies forwarded request for industrial design in three years.

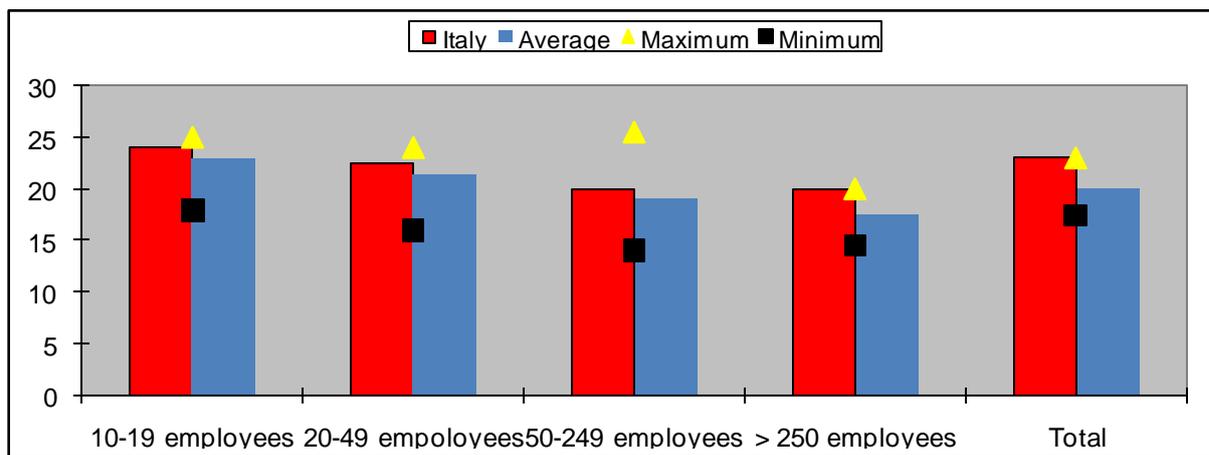


Figure 4. Percentage of turnover achieved from innovative products sale in 2007-2009

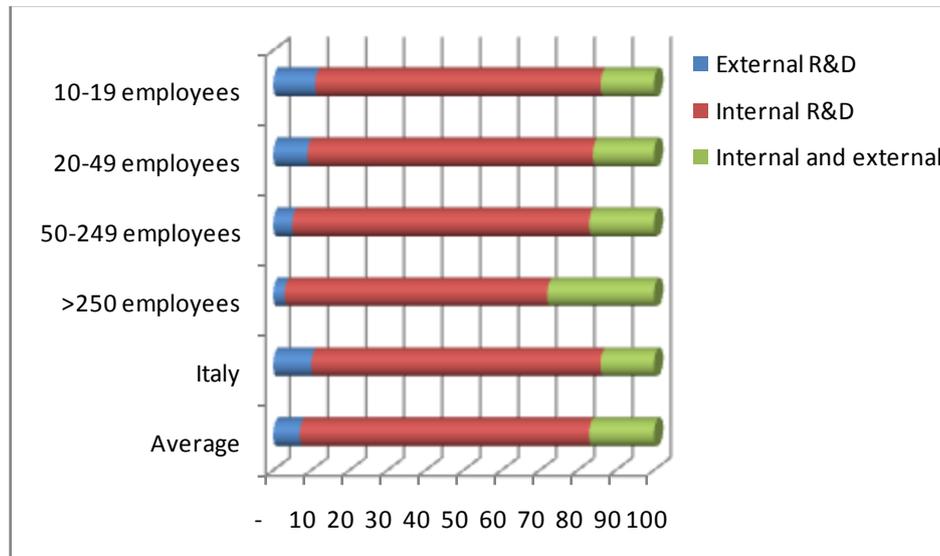


Figure 5. Percentage of companies that perform R&D activities (by type) in 2007-2009

Few are the companies, in Italy and abroad, that license patents in the period of reference: 1.8% in Italy, compared to 2% in the total sample. Austria is the country where companies sold more patents, 3.6% of the companies are affected by the phenomenon.

During the period 2007-2009 52.8% of Italian companies conducted research and development activity (R&D), a percentage above the average of the seven countries considered, equal to 46.2% (Figure 5).

The Austrian companies are the only ones showing a higher participation in R&D, with 49.2%. In Italy as in other countries the share of firms involved in R&D increases with firm size. In terms of R&D intensity, Italian companies are located above the sample mean, with a share of R&D expenditure of 7.5% of turnover. The German companies' share is the only one higher than the Italian, R&D expenditure amount is 7.9% of turnover (7.3% in the total sample). The main difference between Italy and Germany is the R&D intensity of larger firms: regarding firms with more than 250 employees, Germany invested about 8% of revenues in R&D, compared with 5.1% in Italy.

Regarding the kind of research carried out, in Italy 75.2% of companies conducting R&D uses only in-house structures, 9.1% entirely purchase it by external structures, while 15.7% combines in-house and external research. Compared to the average of the total sample, in Italy the share of firms doing complete R&D outsourcing is higher (9.1% against 7.6%). Large enterprises (with more than 250 employees) are more inclined to integrate in-house activity with research and development services purchased externally. Among the firms belonging to industrial groups, which in Italy represent almost 15% of the sample, 11.4% acquire R&D from other companies within their group.

High level of in-house R&D may have positive payoffs in terms of enhanced probability of introducing new products and/or processes to the market[3] and the intensity of in-house R&D stimulates the probability and the number of

joint R&D activities with other firms and institutions significantly[15].

In terms of share of spending, research conducted within the company is predominant (it absorbs 62.7% of the research expenditure in Italy). The German companies are the most focused on in-house activities, their internal research accounts for almost 72% of total expenditure, the largest absolute value in the sample.

Among the external service providers related to research, Italian companies prefer those located in their home country: 30.1% of external R&D expenditure goes there (23.8% in the total sample). The university is not one of the preferred suppliers of Italian companies. Indeed, in Italy, the industrial use of the research conducted within the university system is the lowest among the countries considered: only 22.3% of external R&D comes from universities, compared with an average of 29.4% in the seven countries considered. Hungary and Austria are at the other end of Italy: respectively 57.6% and 51.4% of the research that doesn't take place internally is purchased from the university system.

The main barrier to innovation, according to Italian companies, is the lack of adequate financial tools (as pointed out by 47.6% of companies surveyed). Another significant barrier to innovation is the perception of an excessive economic risk, indicated by 39.4% of Italian companies, and the lack of trained staff (indicated by 16.6%). In general, studying the barriers to innovation, there are no substantial differences between the responses provided by Italian companies and those of the other countries considered.

Finally, considering the response to the crisis, 35.6% of Italian firms postponed investments in product and process innovation during 2009, compared with an average of 34.5% of the total sample. As already noted for investments in machinery, equipment and ICT, Spanish companies are the ones that postponed the most (50.2% delayed their innovative activities).

(c) the financing of technological equipment and R&D

investments.

Self-financing is the favorite funding source, among Italian companies, for the activities of investments in machinery, equipment and ICT (see Figure 6). The share of self-financed investments among Italian companies is 49.5%, a value lower than the average of the seven countries considered (equal to 53.6%). Spain is the only country with a share lower than Italy (the self-financing covers the 39.6% of investments).

The lower use of self-financing in Italy is associated with a use of debt instruments higher than average, especially bank loans, leasing and factoring and, in particular for SME, is a critical issue[27]. Bank lending in Italy covers 23% of the investment (compared to an average of 24% of the total sample), less than that recorded in Spain (31.3%) and France (32.5%), and not much more than Germany (22.7%). Leasing and factoring weigh considerably in financing

investments of Italian industrial system: these forms cover 24.3% of Italian capital investment, the highest among the countries considered, where the average is 15%.

The intercompany funding is basically absent in Italy: it covers 0.5% of the investments over the three years. On the other hand, 5.5% of the investments are related to intercompany transfers in Austria, and 4.6% in Germany (2.8% is the average in the seven countries considered). Public funding covers 1.6% of the investments of Italian companies; the contribution is lower than the one of other European countries, with the exception of the United Kingdom and France (1.5%). Furthermore the contribution of venture capital is poor in the countries considered ([25],[26]). In fact, in the total sample, the average share of investments financed through this source is about 0.5%. In Italian companies that share reaches the minimum level of 0.1%.

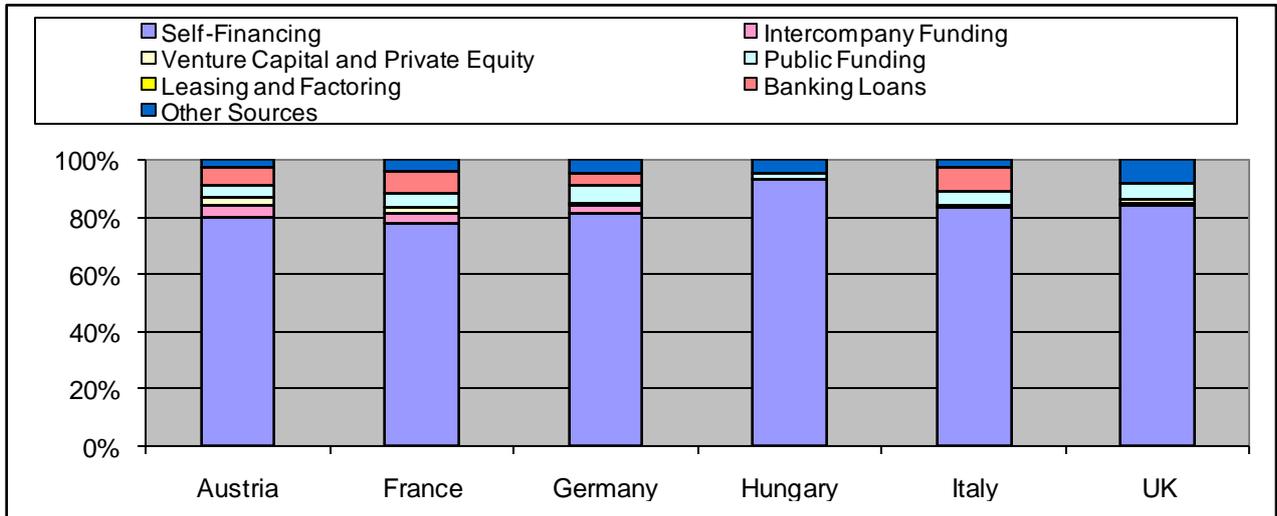


Figure 6. Sources of financing of investments in plant, machinery and ICT in 2007-2009 (%)

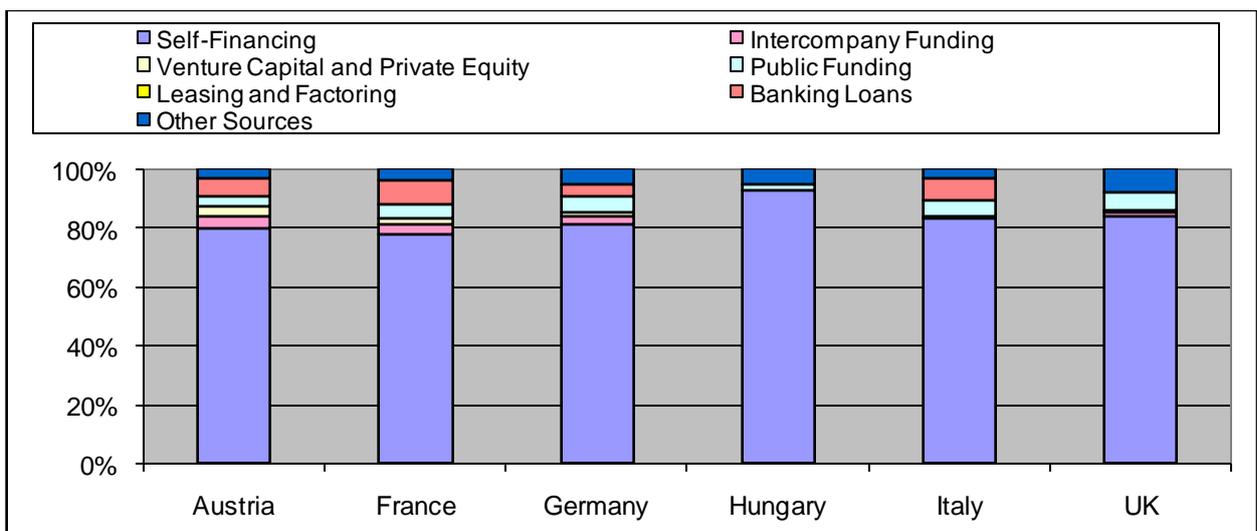


Figure 7. Sources of financing of R&D in 2007-2009<sup>1</sup> (%)

<sup>1</sup> Data for Spain are not available because of too much missing data.

Considering the size, SMEs are the ones financing themselves through the use of bank loans [24], leasing and factoring; with increasing size of the company the share of investments related to these instruments decreases, while the share of self-financed investments and the one of intercompany funding increases.

Considering companies with more than 250 employees in Italy, the share of self-financing exceeds 64%, compared to 60.7%, the average of the total sample. The impact of intercompany finance is higher than the one in small enterprises, although in companies with more than 250 employees it remains well below the average of the seven countries considered (3.9% versus 13%). Finally, in 2009 few Italian companies benefited from investment tax breaks: 17.4%, against 19.8% in the total sample.

Analyzing financial choices about R&D investments, the majority of Italian companies (68.3%) declare not to adopt a specific funding strategy, but instead to use the same instrument used to finance tangible assets investments.

Within the countries considered, France (39%) has a much lower percentage than the average (66.4%), showing a greater tendency of companies to apply different investment strategies according to the objective of funding. Within companies adopting an *ad hoc* funding strategy for R&D, self-financing has a major role in all the countries considered (Figure 7).

In Italy, the self-financing covers the 86.4% of R&D expenditure, compared with 83.8% in the total sample. The importance of bank loans reduces to 5.3% on average in the seven countries considered, but in Italy is higher (6.6%).

The role of public finance, in contrast, is more relevant in the R&D funding than in tangible asset investments, covering on average 5% of expenditure. However, in Italy the share of research expenditure financed by public findings is the lowest of the sample (3.9%), except for Hungary. Finally, in Italy there is little use of intercompany funding and venture capital, which cover, respectively, 0.5% and 0.1% of the expenditure on R&D, well below the average of the total sample, 2.2% and 0.3%.

Finally, 17.3% of Italian companies take advantage from tax breaks for research and development, compared to an average in the seven countries considered equal to 14.2%. Austria is the country with the higher number of companies undertakings benefits from tax incentives, with 20.5% of firms.

## 5. Conclusions

In this paper I have investigated the level of technological equipment and investments in plant, machinery and ICT, the degree of research and development (R&D) activity and the way these kind of investments are founded across some European regions over the period 2007-2009.

The paper focused on the innovative capacity of manufacturing firms and tries to explain the reason for the existent gap (in terms of turnover, confidential indicator and

trend of profit) between the Italian companies and the European ones and tries to suggest some specific advices at policy makers level.

The findings of this paper suggest that the basic technological infrastructure reached a widespread diffusion in the Italian industrial structure, as well as in the other countries considered. However, advanced ICT use is less common in Italy. Regarding the investments in equipment, machinery and ICT over the period 2007-2009, Italian companies appear to be less active compared to the other firms in the sample (both in terms of number and sales). However, the lower Italian propensity to invest is not combined with a stronger response to the 2009 crisis: 28% of Italian companies, in fact, report a decrease in tangible assets investments in 2009, compared to 33.1% in the total sample.

On the contrary, regarding the technological innovation, the activity of Italy is above the average of the seven countries considered. A large part of the companies is involved in product and process innovations, although the simultaneously coexistence between the latter and the organizational changes is less evident. Moreover, Italian firms are largely engaged in R&D, confirming to prefer in-house R&D, but proving to be more prone to research and development outsourcing than the whole sample. University research, instead, is still poorly valued: even by international standards, there are very few Italian companies using universities as research providers.

On the financing side (concerning the level of this analysis), self-financing is confirmed to be the preferred tool for investments in machinery, equipment and ICT in all the countries considered. However, in Italy, it covers a share lower than the sample mean of investment spending. Instead, the considerable use of leasing and factoring is typical of Italy. Furthermore, few Italian companies set a specific funding strategy for R&D expenditure and use less financial instruments than other foreign firms, such as France, Germany and Austria.

Summarizing the main findings of this paper it is possible to state that Italian companies have a good basic ICT supply, but they invest relatively less than the average in new infrastructure, machinery and equipment. R&D investments are stronger, although their funding strategies are unbalanced towards traditional debt instruments and they are more undifferentiated considering the final objectives of the investment.

This research results suggest two main policy implications: first, the stimulation of investment in technological equipment and plant, machinery and ICT through tax breaks. This would be particularly relevant for SMEs that have investment levels significantly below the best manufacturing firms in Europe; this situation is not strictly linked to the crisis but is closely linked to the Italian structural framework. Second, the provision of subsidized loans for innovation research and/or tax breaks and incentives for university research to ensure a proper diversification of funding sources.

In future it may be interesting to find out and try to

measure others factors that could influence the innovative capacity of manufacturing firms, such as: the quality of human resources or some country specific advantages that could improve and make more clear conclusions.

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