INNOVATION DRIVERS AT FIRM LEVEL:
THE ROLE OF UNIVERSITY COLLABORATION IN R&D
(PRELIMINARY REMARKS)

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Abstract. Numerous studies agree that innovation has a key role in economic development. A common conclusion among these studies is the central importance of innovation in fostering economic development, with R&D investments seen as essential to enhancing national competitiveness.

Within this framework, collaborative networks between firms and universities play a strategic role, as they facilitate knowledge transfer.

Building on the work of Ciccarelli *et al*. (2025), which analyzed the macroeconomic spillovers of universities and firms R&D regional expenditure on value added, this study shifts the focus to the micro-level in order to provide a more comprehensive understanding of these effects. Using data from Permanent Business Census carried out by ISTAT since 2019, this paper shows the importance of R&D, and particularly the effect on firm performance of collaboration with universities.

1. Introduction

This research takes its cue from the work of Ciccarelli and De Dominicis (2025), which investigated the impact of regional spending on research and development on productivity in Italy[1]. Recent ISTAT research, on the other hand, have studied the emerging issues related to productivity and use of from Business Census micro data (ISTAT, 2025; De Panizza *et al*., 2024).

Starting from this context, a collaboration stems from the need to explore, through microdata, dynamics previously analysed using a macro approach (Ciccarelli *et al*., 2025). The goal is to integrate academic and statistical expertise for a more detailed and robust understanding of socio-economic phenomena.

In a constantly evolving economic context, the ability of companies to establish effective relationships with other economic actors — other companies, public or

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[1] , The research activity of the working group at the University of Teramo was carried out as part of a larger project called "Vitality project", an initiative funded by the NRRP (National Recovery and Resilience Plan) aimed at promoting the development and transfer of innovation to strengthen the competitiveness of regional production systems, improving their sustainability and quality of life in urban and rural areas.

scientific institutions — represents an important factor of competitiveness (Arvanitis *et al* 2020).

This paper analyses data relating to collaborations established by approximately 280,000 Italian companies with more than 3 employees in 2022, offering an overview of the main contractual forms adopted, the structural characteristics of the companies involved and the associated economic performance. Particular attention is paid to collaborations with universities and research centres, which are still limited but associated with higher levels of productivity.

At this stage of the project, the present study aims to provide a preliminary analysis of the relationships between interaction networks, organizational structures, and economic performance. In particular, this investigation seeks to identify patterns, potential correlations, and interpretative frameworks that may guide subsequent, more structured empirical analyses. The main finding that emerges from this paper is that collaboration between businesses and institutions – especially universities – represents not only a crucial tool for increasing innovation and competitiveness, but also a key mechanism for knowledge transfer, developing qualified human capital, and strengthening productivity in the long run.

This paper has been organized as follows: in Section 2 we briefly discuss the main literature about the topic; in section 3 methodology and data are presented; in section 4 we discuss the results; in section 5 concludes the paper.

2. Literature review

Since the earliest contributions to the literature on the relevance of external knowledge for firms, Allen and Cohen (1969) and Arrow (1974) argue that companies cannot rely solely on their internal resources for their development. Instead, they must leverage external knowledge to gain advantages that would then be transformed into innovation (Grimaldi *et al*., 2021).

Such external knowledge is a key factor for firm performance (Coehn, 2010), with the main sources being suppliers, customers and finally research partners. Among these, collaborations between universities and firms are the fundamental pillar for transferring scientific and technological knowledge (Metcalfe, 1995; Hagedoorn *et al*., 2000; Hall *et al*., 2003). A wide range of interactions between universities and firms are oriented towards the transfer of scientific knowledge (Rosenberg *et al*., 1994; Marques *et al*., 2024).

The positive link resulting from collaboration between firms and universities has been identified in several European countries. Consider, for instance, the work of Laursen and Salter (2004), which analyzes the United Kingdom, and Segarra-Blasco and Arauzo-Carod (2008) for Spain. A broader comparison can be found in the work of Fontana, Geuna, and Matt (2006), who examine various European countries such

as Denmark, France, Germany, Greece, Italy, the Netherlands, and the United Kingdom.

In Italy, over the past 15 years, universities have given a boost to what is referred to as the *third mission* - the generation and transmission of knowledge outside the academic boundaries to support socioeconomic development (Hall *et al*. 2003; Cohen *et al*., 2025), including territorial development.

Universities primarily engage in collaborative relationships with firms in the field of R&D, which can be of either commercial or non-commercial nature (Arranz *et al*., 2008). Such relationships take general formal forms such as research contracts, consultancy agreements, joint R&D projects, collaborative research initiatives. Such collaborations have also been widely adopted as policy tools to foster innovation within firms (Perkmann e Walsh, 2007).

According to Leydesdorff (2012), collaborations are crucial in innovation-driven model of growth, and their effects have been analyzed at different levels: firms, sector and territory (Grimaldi *et al*., 2021).

Following Aschhoff and Schmidt (2008) and Malerba and Orsenigo (1996), Cohen (2010), our analysis incorporates respectively both sector and firm size. It is within this framework that our research is situated, capturing some typical characteristics of the Italian entrepreneurial landscape, highlighting its limitations in building effective university–firm networks.

3. Methodology and data sources

To fully explore the role of business relations with universities and R&D, we make use of the integration of two relevant official statistics data sources:

(i) Permanent Business Census: a sample survey carried out every 3 years since 2019, which provides information on emerging issues such as business organization, business relationships and production filières, competitiveness and environmental sustainability, finance (i.e. credit rationing). The unit of observation and analysis is the legal unit and the reference year of the analysis is 2022. The use of this statistical source is very relevant as the field of observation of the survey are enterprises with 3 or more employees, active in industry and services and resident in the Country. Survey design is complex: on a census basis for enterprises with more than 20 employees while it is a sample for enterprises with less than 20 employees.

(ii) Business Register on Structural Business Statistics (Frame SBS), annually produced by Istat by extending the basic Register Statistical Archives of Active Enterprises (ASIA) through the integration of administrative, tax and survey sources. Frame SBS register provides the information available on the main economic variables: revenues, turnover, costs of goods and

services, labour costs, wages and salaries, value added. It covers the classes of the Nace Rev.2 classification for sections B to S, except for financial and insurance activities (section K), Public Administration, defence and compulsory social insurance (section O) and division 94 (activities of membership organization).

Overall, our integrated data source is sample of about 280,000 enterprises with 3 or more employees representing about 1 million enterprises and represent 22.5% of Italian firms, 85% of value added, 75% of employees. Relevant variables selection for the purpose of our analysis and descriptive statistics: nominal labour productivity (measured by value added per employee) and key metrics as: width of business networks, type of network, type of stakeholder sourced from direct survey. We also make an in-depth exploration on the subsample of firms with more than 10 employees which were asked to answer a specific question on the type of business functions involved in university collaborations.

4. Results

The available data allow for very detailed reflections on innovation dynamics and on the system of relationships between universities and firms; however, some preliminary considerations are necessary in order to properly understand the results.

First, potential information distortions should be acknowledged, mainly due to the fact that the measures reported are based on firms' self-declarations and may, in some cases, overestimate (or underestimate) the intensity of the relationships between firms and universities. Moreover, it should be emphasized that the present study must be assessed within a purely descriptive, rather than causal, framework: we have investigated the existence of possible network relationships, but at this stage we do not make any claims regarding potential causal links between the presence of such relationships and firms' performance.

Companies often benefit from collaborating with other businesses or institutions to carry out activities or functions effectively. Working in partnership can be more advantageous than operating independently. In 2022 around 430,000 businesses — 42% of companies with three or more employees — have made this choice, having at least one business relationship with other companies or institutions. Analysing these companies' profiles, particularly with regard to the breadth of their business networks, the types of contracts with their stakeholders, the stakeholders involved, and their economic performance, provides valuable insights into their organisational structures and strategic approaches.

Firstly, in terms of economic sector, business relationships are more prevalent among construction and industrial companies, involving around 71% and 59% of units, respectively. In the trade and other service sectors, business relationships are

less common, affecting around 33% of companies in both cases (Figure 1). Relationships grow significantly as business size increases. This phenomenon involves 38% of micro-enterprises (3-9 employees), 58% of small enterprises (10-49 employees), 70% of medium-sized enterprises (50-249 employees) and 77% of large enterprises (250 or more employees). Collaborations are more prevalent in northern Italy, where around 45% of companies are involved, than in southern Italy (38%).

Figure 1 − *Business relationships by sector, size and macro area. Year 2022. Percentage values.*
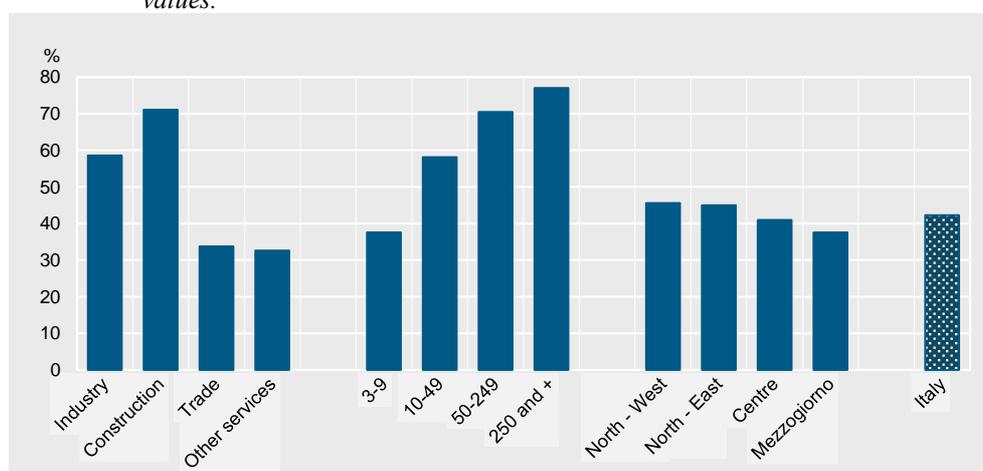
Sources: our elaborations on Permanent Business Census 2023.

Business relationships are established through various types of contracts (Figure 2). Among firms that have at least one relationship with other entities, subcontracting[2] is the most prevalent (66%), followed by order contracts[3] (57%). Informal and formal agreements[4] are less common, involving around 33% and 17% of units, respectively. The size of a company affects which type of contract it adopts. Subcontracting and orders are common across businesses of all sizes.

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[2] The company is a supplier that sells goods and/or services based on technical specifications and designs provided by the buyer, rather than from a catalog.

[3] The company is the client. It orders and/or purchases goods and/or services and provides technical specifications and designs.

[4] Formal agreements include consortia, joint ventures, franchises, and temporary business associations.

Figure 2 − *Type of business relationship by size. Year 2022. Percentage values on enterprises having at least one business relationship.*
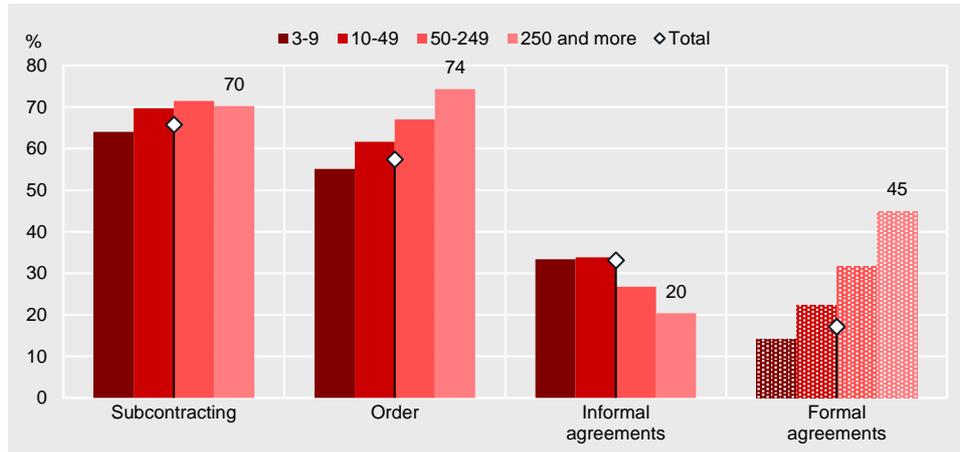
Sources: our elaborations on Permanent Business Census 2023.

Figure 3 − *Type of stakeholders by sector. Year 2022. Percentage values on enterprises with at least one business relationship.*
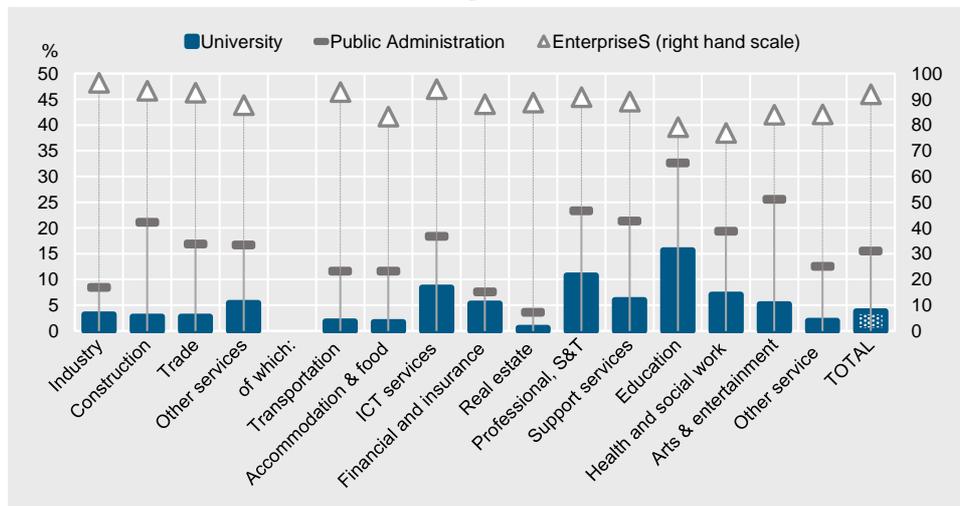
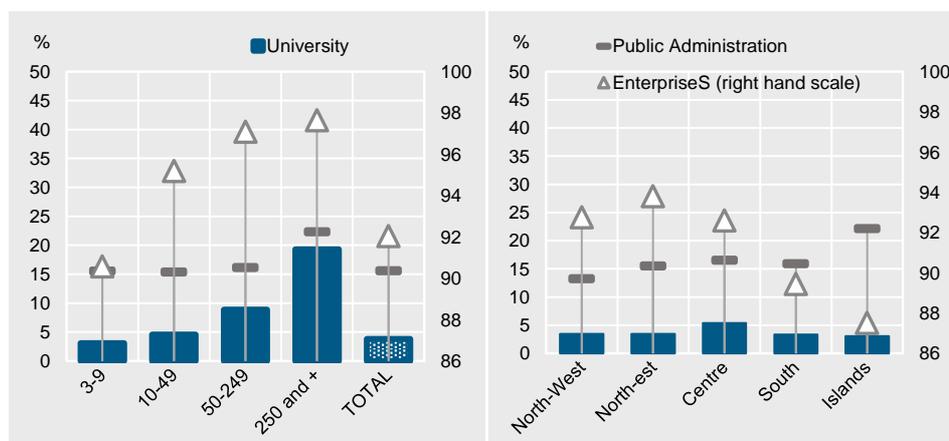*Sources: our elaborations on Permanent Business Census 2023.*

Adoption rates for subcontracting range from 64% among micro-enterprises to 71% among medium-sized businesses, while order rates range from 55% among micro-enterprises to 74% among large companies. Furthermore, formalised contractual relationships are more prevalent among larger firms (45%) compared to

14% of micro-enterprises. By contrast, informal agreements are more prevalent among smaller enterprises, with around a third of micro and small businesses using them, compared to 20% of large firms.

Business relationships are predominantly established with other enterprises, with 92% of companies reporting at least one such partnership (Figure 3). Collaborations with public administrations involve 16% of companies (approximately 67 thousand), while collaborations with universities or research centres are less frequent, involving 4% of companies (approximately 16 thousand). Linkages with universities or research centres are mainly established by enterprises operating in the other services sector, particularly in education, professional, scientific and technical activities, and information and communication technologies (ICT).

As businesses grow in size, their relationships with universities and research centres become significantly stronger (Figure 4). The respective percentages of businesses with at least one such relationship are 3% for micro-businesses, 5% for small enterprises, 9% for medium-sized enterprises and 19% for large enterprises.

Figure 4 - *Type of stakeholders by size and macro area. Year 2022. Percentage values on the total of enterprises with at least one relationship.*

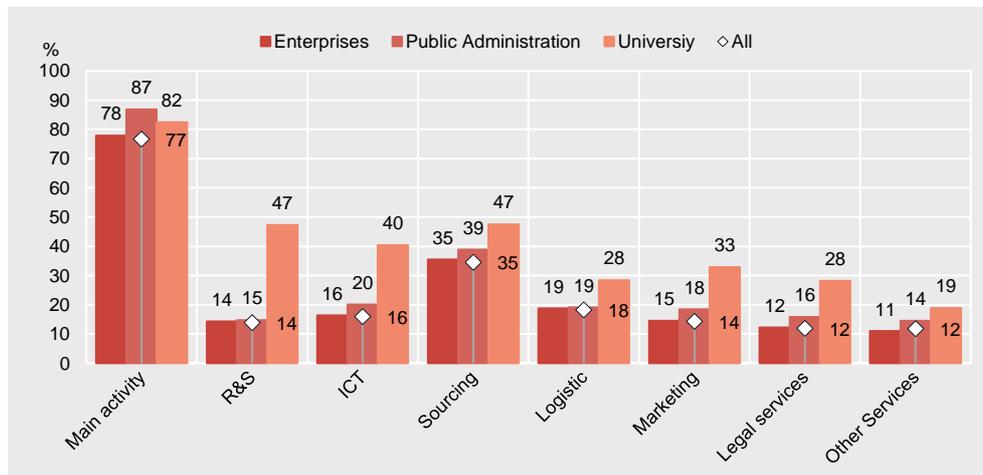*Sources: our elaborations on Permanent Business Census 2023.*

At territorial level, companies in central Italy, particularly those in the Lazio region, are the most likely to collaborate with universities and research centres.

We now focus on the subsample of firms with more than 10 employees to unveil the type of business functions involved in university collaborations, in R&D in particular. Therefore, we now focus only on small, medium and large firms.

This segment of enterprises accounts for over 216 thousands: 129 thousands (59.7%) has at least one business linkage with other subjects (stakeholders). The

majority (95%), in line with the surveyed population, declares to have business linkages with their firms, 13% has linkages with public administration, and 5.4% has linkages with universities. Several business functions may be involved in the relationship, ranging from firm's main activity to logistics, legal services as well as ICT and R&D. As expected, firms mainly activate business relations for their main activity (77%), especially with PA and university (Figure 5). Among other business functions, R&D functions ranks 7th together with sourcing among eight functions considered, but when involved the preferred stakeholder is university (47%).

Figure 5 − *Type of stakeholders by business function. Year 2022. Percentage values on enterprises 10+ with at least 1 business relationship.*
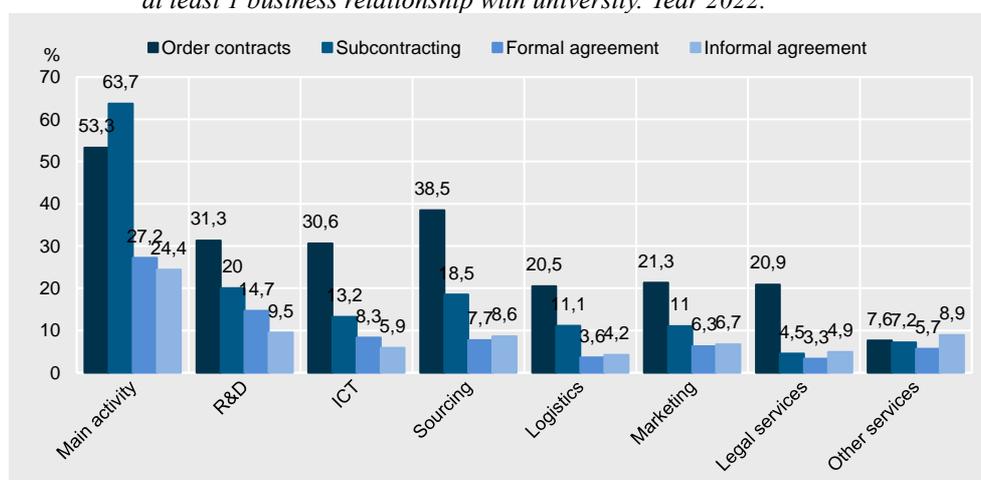

Sources: our elaborations on Permanent Business Census 2023.

Figure 6 further focuses on enterprises with 10 or more employees that activate business relations with university: they account for about 7,000 firms (5.4%) of total and are mainly subcontractors for universities in their main activities, meaning that firms usually sell to universities products and services related to their main business. By contrast, firms source from universities in the forms of order contract other functions. The most frequent are sourcing (38.5%), R&D (31.3%) and ICT (30.6%). These figures underline and quantify therefore the role of firms-university linkages in R&D.

Finally, we explore nominal productivity levels (measured by value added per employee) of firms by type of network (Figure 7). We find out that, compared to companies that operate in isolation, those that collaborate with others are more productive. Interestingly, labour productivity is higher in companies that collaborate with universities and research centres. This is true across all macro sectors, enterprise

sizes and macro area, except for the North-west of Italy. Such evidence is even more marked when considering statistical moments of the distribution of enterprises by type of business network. Labour productivity the upper 90th percentile of firms collaborating with universities is remarkably higher than other firms while lower productive firms are more evenly distributed among types of relations (Figure 8).

Figure 6 - *Type of relation by business function. Percentage values on enterprises 10+ with at least 1 business relationship with university. Year 2022.*
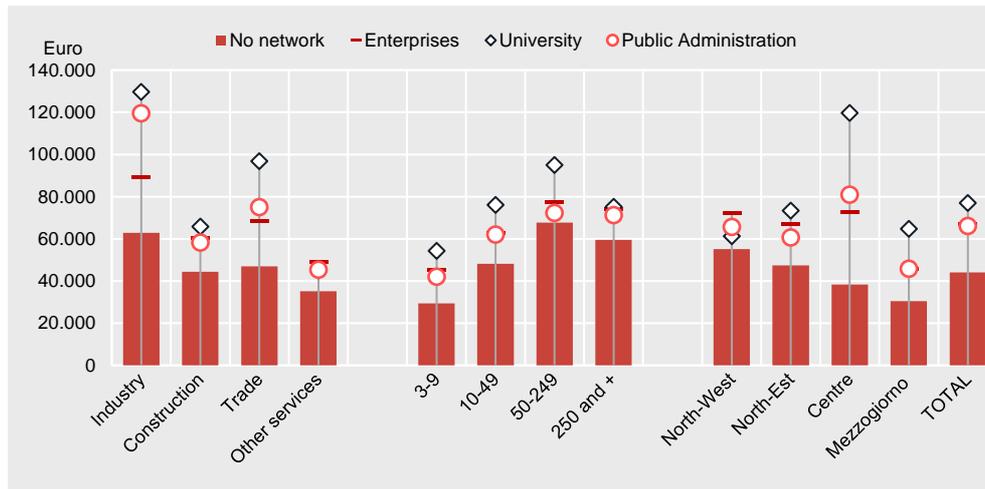

Sources: our elaborations on Permanent Business Census 2023.

5. Conclusions and future research

This study explores the relationships that the Italian regional industrial fabric has with other economic actors. The analysis conducted shows that collaboration between businesses and institutions – and in particular with universities – is a key driver for increasing innovation and productivity. Collaboration is more widespread in certain areas of the country (Central Italy) and among larger companies, and interaction takes place both within the scope of their core activities and in cross-cutting, high value-added areas such as Research and Development and ICT.Although the percentage of companies that have relationships with Universities or Research Centers remains low (which also depends on the type of company), companies that interact with universities show above-average productivity levels.

Figure 7 - *Business networks and labour productivity by sector, size and macro area. Year 2022 Values in euros.*

Sources: our elaborations on Permanent Business Census 2023.

Figure 8 – *Statistical moments of distribution of labour productivity by type of business network. Year 2022 Values in euros.*
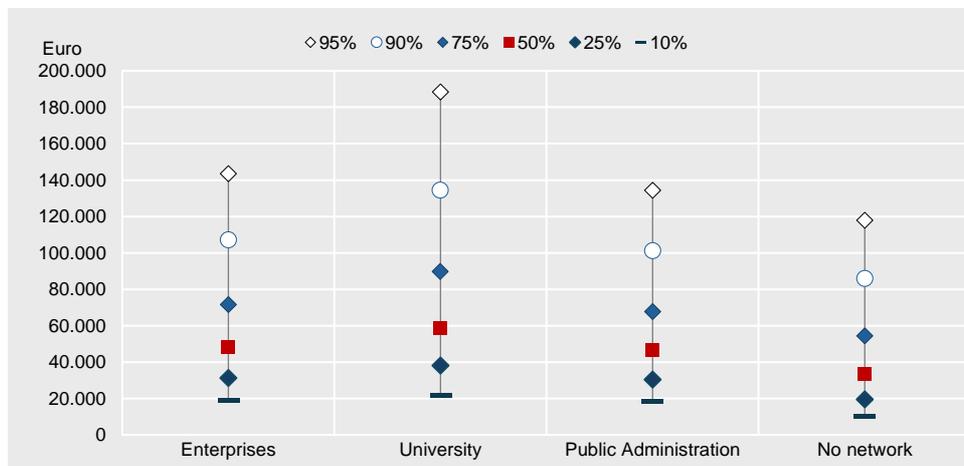
Sources: our elaborations on Permanent Business Census 2023.

These results confirm the importance of collaboration networks for business competitiveness and suggest the opportunity to promote policies that encourage links between academia and industry, especially for the benefit of smaller companies that

struggle to support R&D activities on their own, especially in a country where enterprises are small and can hardly internalize the R&D activities.

The future step is to identify the correct econometric models to estimate relationships between variables and impact, both in a macroeconomic and a microeconomic perspective: on the one hand the impact on productivity and value added and on the other hand the determinants that drive firms and universities to build networks with each other.

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