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Introduction

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Affiliations and acknowledgements

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1 Introduction

This issue of Economia Marche, *Journal of Applied Economics* opens with the "Economia Marche Lecture" delivered by David Audretsch in Ancona on May 2013. The lecture was about the role of universities in an entrepreneurial society (Audretsch, 2007). After an historical review of the role of universities in industrial economies, prof. Audretsch underlined the key role achieved by universities in the knowledge economy as one of the main producers of new knowledge and of the educated people able to make use of it. Policy makers around the world are more and more aware that public investment in research and education is the fundamental driver of long term economic growth.

Moreover, the increased public spending on research is raising concerns about the economic and social impact of such investment. Studies of this issue highlight the presence of a 'knowledge filter', i.e. barriers or gaps that reduce the economic valorization of research results and, as a consequence, potential applications of the new knowledge (Braunerhjelm *et al.*, 2010). For the most part, these barriers are the result of the rules and regulations governing research institutions.

As Audretsch points out in his lecture, one of the first actions to overcome the knowledge filter was the Bayh-Dole Act (1980) which gave to US universities the incentive to directly exploit the results of publicly funded research. The Bayh-Dole act changed the attitudes of universities to the exploitation of research results, and paved the way to what has been called the 'entrepreneurial university', i.e. a university which is actively involved in the transfer of new knowledge into valuable products and services. This is done through the valorization of intellectual property (patenting and licensing), collaboration with firms, and the direct involvement of researchers in entrepreneurial ventures aimed at exploiting research results (academic spin-offs).

In the last few decades, universities around the world have dedicated increasing resources to supporting technology transfer activities, especially by creating specific organizational units aimed at sustaining these activities: technology transfer offices (TTO).

The willingness of academics to be involved in new entrepreneurial ventures, and the ability of universities to support these new ventures have attracted considerable attention over the last 10 years. This is because academic spin-offs are a more direct mechanism for transferring research results into products and services and have the highest impact at local level. In some cases, academic spin-offs have played a fundamental role in the formation of new high-tech clusters (Lawton Smith *et al.*, 2008). Academic entrepreneurship is also a more effective way to overcome the 'knowledge filter' since the direct involvement of researchers in the commercial exploitation of research results, reduces the problem that can arise when exchanging knowledge between different institutions.

In the 'entrepreneurial society', i.e. a society that relies more and more on its capabilities for change and innovation, entrepreneurship has become a critical force driving economic growth. It provides a link between the creation of new knowledge and its timely and effective application in valuable innovations. Universities are playing a pivotal role not only in the creation of new knowledge (its traditional mission) but also in promoting entrepreneurship (Acs *et al.*, 2009). Prof. Audretsch demonstrates that the contribution of universities to promoting new ventures goes far beyond the activity of TTOs. This is not only because many new ventures that involve academics are not 'formally' acknowledged by TTOs but also because the university plays a fundamental role in promoting an entrepreneurial culture among researchers and students, and as a result, in society as a whole (Audretsch, 2012).

In Italy, the systematic involvement of universities in technology transfer activity is a recent phenomenon. According to the last NetVal report, in 2003, only four universities had TTOs. The number has grown rapidly to reach 61 universities in 2012, approximately two-thirds of the total university population (Bax *et al.*, 2013). Given the organizational 'rigidities' that characterize Italian institutions, technology transfer activities carried out by universities have sometimes developed faster than the resources allocated to TTOs. On the whole, much remains to be done on both sides.

In terms of university-industry relations the Italian situation is characterized by low level of investment in R&D by the private sector, which results in an even lower level of private funds aimed at sustaining research activity in universities. According to the annual survey of R&D (Eurostat), Italian universities receive only about 1% of their overall R&D investment from the business sector, against the EU average of about 6% and a corresponding value for Germany of about 15%. Considering that average R&D expenditure in the Italian university system exceeds 5 billion euros, this means an absolute contribution of about 70 million euros per year (ISTAT, 2013). This amount underestimates the relations between universities and firms sine it does not account for other forms of university industry relations, such as collaborative research (mostly funded by EU), and contract research, i.e. those privately funded activities that are carried out by universities on behalf of firms and institutions. According to the data provided by ANVUR for the 2004-2010 research assessment exercise, the 93 private and public Italian universities received an average of 467 million euros per year from contract research (only a part from private firms).

The causes of the low levels of private investment in research lie in the sectoral composition of Italian industry which is based mostly on low and medium tech industries, and the predominance of small firms. As a result, the DUI (learning by doing, using and interacting) innovation model largely predominates; this model relies on interactions with customers and suppliers and requires little investment in R&D and no relations with research structures (Jensen *et al.*, 2007).

Even when considering the 'autonomous' flows of knowledge that universities produce through the valorization of intellectual property (patents), the Italian system shows large room for improvement. According to ANVUR data for the period 2004-2010, Italian universities were granted (either at national or international level) an average of less than 200 new patents per year. This figure has increased in recent years (231 in 2011 according to the last Netval report), but remains far above the potential for the exploitation of the intellectual property generated within the Italian university system.[1]

The Italian situation seems more dynamic in relation to generation of academic spin-offs. The phenomenon is rather recent in Italy. A specific law passed in 1999 allows universities, as an exception to current legislation, to authorize their staff to be involved in entrepreneurial ventures aimed at commercializing the results of university research. The response of universities and their staff to this new opportunity was generally favorable. Since the beginning of 2000, universities have been encouraging the start-up of university spin-offs and supporting their initial development, and providing incubation services within their structures. Up to 2013, Italian universities had promoted some 1000 spin-offs, most of which are still active (Iacobucci *et al.*, 2013). As expected, there are significant territorial differences for this phenomenon,

[1] It does not help that Italy, unlike most EU countries and the USA, in 2001 adopted the so-called 'professor privilege' under which the researcher can choose to own the patent personally, rather than leaving ownership rights to the university.

both in terms of location of spin-offs and their performance. The phenomenon is probably too recent to allow a complete assessment of its impact on the local economies (Iacobucci and Micozzi, 2014).

As already mentioned, the entrepreneurial activity of academics is one of the most important ways to overcome the knowledge filter between university research and its exploitation in innovation. This is especially true in for Italy, where other technology transfer mechanisms are still weak. Moreover, Italy is characterized by low and medium tech industries and there is a need to foster start-up firms in knowledge intensive sectors. University spin off firms may be important for the formation of new clusters in high-tech sectors.

The experience of the Bayh-Dole act in USA and, to a lesser extent the Italian legislation on spin-offs, demonstrate that normative changes may have a significant impact when they are able to change the incentives for organizations and people. However, culture and behaviors are fundamental for the diffusion of novelty. Although the attitudes of Italian universities and academics towards technology transfer have changed during the last decade, much remains to be done.

The article by Barbieri, Rubini and Micozzi analyzes the technology transfer activities of academicians involved in the formation of spin-offs. It tries to explain whether engaging in academic entrepreneurship could change the attitudes of researchers to other forms of technology transfer such as patenting and collaborating with firms. Barbieri, Rubini and Micozzi identify different behaviors among scholars engaging in entrepreneurial activity; some show an increased propensity to collaborate with other firms after the establishment of the spin-off, but this pattern is not uniform. A better understanding of the motives and incentives of academicians for engaging in technology transfer activity is essential for universities and policy makers to design effective measures to promote this engagement.

In relation to the specific impact of academic entrepreneurship in the formation of new high-tech clusters, the role of the local context is fundamental. Although universities can promote the formation of spin-offs, their individual success and ability to influence the local economy depend on the presence of several actors operating in the different phases that characterize the start-up and subsequent development of innovative firms. This is the focus of Dubbini, Micozzi and Micozzi's paper which focuses on the role of entrepreneurship education before and after start-up, and within different contexts: high-school, undergraduate, and graduate curricula. Entrepreneurship education is under-developed in Italy if compared with the situation of other developed countries (Iacobucci and Micozzi, 2012); for this reason there is much scope for improvement both in quantitative and qualitative terms. The Dubbini et al. paper contextualizes the potential role of entrepreneurship education to the Marche region. The Marche region is characterized by the presence of a strong manufacturing sector, mainly based on small firms. Until the recent crisis, the region was also characterized by high rates of entrepreneurialism. However, there is a growing need to foster entrepreneurship especially among young people and in more innovative sectors. The paper by Dubbini et al. examines the activities and the roles of different actors within the local system that may contribute to fostering innovative entrepreneurship.

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