

Direct and indirect effects of universities on European regional productivity

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Extended abstract

Universities are fundamental actors in the current knowledge-based economy, not only for the generation of high-level human capital, the creation and diffusion of new knowledge and technological enhancements, but also for actively contributing to regional social and economic development. The awareness that universities play an essential role explains why higher education institutions (HEI) worldwide have significantly increased since the first university was founded in Bologna in 1088. The World Higher Education Database in 2021 records 20,000 HEI in 196 countries worldwide, almost 3,000 in Europe. These numbers have been growing steadily, especially in the post-World War II period, when the total of world HEI has quadrupled, and Europe almost tripled.

The literature has remarked that the functions carried out by universities are complex and highly differentiated as their roles have been changing over time to respond both to academic and societal needs in a multifaceted interplay with local and international stakeholders and institutions. The list of universities' functions is long, and it has been institutionalised in three missions: teaching, research and "third mission". While the first two are traditional functions, the latter has mainly developed in the last three decades, and it is still an evolving concept characterised by a high degree of heterogeneity and vagueness. The third mission includes a wide range of activities, like know-how and technological transfer, regional leadership, a hub of knowledge networks, entrepreneurship development, public engagement (Goldstein et al. 1995; Drucker and Goldstein, 2007).

As it is well known, the first two functions generate an expansion of human capital and technological capital. According to several scholars (refer, among others, to Romer, 1990b; Mankiw et al., 1992; Griliches, 1979), these two intangible factors are the key drivers of economic growth, although the literature has not focused on the role played by HEI as their main "supplier". This is especially the case in lagging regions, where R&D activities are almost entirely carried out by public universities due to the scarcity of large innovative firms. While an extensive theoretical and empirical literature has documented the effects of both human and technological capital, studies on the impacts of the third mission functions are still in their infancy because of the difficulties in providing clear definitions that allow for a rigorous empirical assessment (Uyarra, 2010; Varga, 2009; Brekke, 2021 for a recent ample review). Thus, universities accomplish a complex, diversified and growing set of societal functions combining the outcomes of their first two missions – teaching and research – with the provision of development-promoting services to the society. (R1.2) Hence, the need to assess the overall comprehensive impact exerted on the local economy by universities' presence, over and above the one already accounted for by human capital and technological capital. This is the main aim of our study, which is posited at the intersection of two main streams of literature with the specific purpose of bridging them and thus providing a novel contribution that enhances the understanding of the role played by universities at the local level.

The empirical literature on the impact of HEI has mostly developed along two main research avenues: the first focusing on the effects on GDP, and the second emphasising the supply-side impact by using a Knowledge Production Function (KPF). Among the former, a few articles have explicitly investigated the universities' influence on local economic performance, measured mainly by GDP and employment, with a specific attention to regions within one country. Goldstein and Drucker (2006), Lendel (2010), Hausman (2012), Drucker (2016) focus on the US counties and states; Schubert and Kroll (2016) on German NUTS3 regions; Agasisti et al. (2019) on Italian labour market areas. To the best of our knowledge, only two empirical studies employ extensive cross-country comparisons to thoroughly investigate the contribution of HEI to regional development. The seminal contribution by Valero and Van Reenen (2019), who consider 1500 regions globally, and Agasisti and Bertolotti (2020) on 284 regions in Europe. Both studies assess the impact of the universities' presence on regional GDP per capita growth, thus focussing on the contribution to local demand arising from students and staff expenditures and universities' purchases and investments.

The second stream of the literature concentrates on the universities' effects on firms' and local systems productivity growth within the KPF framework. At the beginning, the main research purpose was to explicitly identify the extent to which university R&D spills over firms within the regional system of innovation (Acs et al., 1994; Varga, 2001). More recently, Buesa et al. (2010) have

generalised the analysis by considering, not only R&D, but a broader set of indicators. Finally, Ponds et al. (2010) and Wanzenböck and Piribauer (2018) have extended the KPF model by including networks of different nature: university-industry collaborations and EU funded R&D partnerships, respectively.

So far, the two approaches on the role of HEI have mainly developed independently of each other. In this paper, we propose to bridge them by taking advantage of the merits of both and analysing how universities can act as a key driver of Total Factor Productivity (TFP) growth at the regional level. As TFP is a comprehensive measure of economic performance that encompasses the efficiency enhancing effects of knowledge-related processes, it allows us to focus on the long-run supply-side productivity effects that universities exert on the local economy. TFP is widely recognised as the main driver of economic growth, especially in mature economies (Easterly and Levine, 2001). We follow a recent research line of research, started with Marrocu et al. (2013), which investigate TFP differentials in European regions by introducing the potential productivity-enhancing role of universities.

We contribute to the literature in several ways as depicted in the conceptual framework in Figure 1. First, for the first time we assess the role of HEI on TFP dynamics for a very ample sample of European regions (270) at the NUTS2 level over the period 2000-2016. This allows us to provide a thorough picture of regional productivity disparities in Europe, which, notwithstanding some convergence in the last two decades (EU Commission, 2017), are still a central issue (Rodríguez-Pose and Crescenzi, 2008; Iammarino et al., 2019). We then empirically assess the effect of HEI on TFP dynamics, once we account for human and technological capital, as well as a wide array of local characteristics that may affect the regional performance, such as the quality of the institutions, the territorial features, and the production structure.

Second, we provide novel evidence on disentangling the three effects that universities exert on the regional system in which they are located. The first two indirect effects are related to the creation of human capital and innovations by providing higher education and basic research. It is worth highlighting that local universities, especially in advanced territories, contribute to the enhancement of human capital jointly with external HEI thanks to graduate mobility (Corcoran and Faggian, 2017) and to the development of technological capital through universities-firms' collaborations. The third effect is entirely due to the existence of the university itself, we can deem this as a "direct" university effect, which has no substitutes and does not exist in territories with no universities. It is intrinsically related to the core institutional features of the universities. As they carry out the ever-evolving third-mission functions, universities are able to leverage multidimensional

skills and capabilities, create synergies, promote value co-creation and, ultimately, act as a proper economic and cultural engine.

Third, in assessing the three possible university effects described above, we also investigate the role played by external factors that can influence regional productivity growth due to university knowledge spillovers from "proximate" regions. The existence of such externalities has relevant implications for both academic and public policies as far as university funding and the creation of new HEI are concerned.

Finally, we also contribute to the extant literature by investigating the two transmission channels through which universities contribute to human and technological capital enhancement and, consequently, to productivity growth at the regional level.

Main results indicate that the impact of universities on regional productivity growth is positive and sizeable. It proves robust to the inclusion of other factors, such as institutional capital, agglomeration forces and production structure. This direct effect goes along with the more traditional "indirect" effects exerted by human and technological capital. Moreover, we have found robust evidence that the universities positively affect the regional growth rate of human and technological capital. These intangible assets represent, in turn, the key determinants of local productivity growth. Thus, universities play an essential role in enhancing, directly and indirectly, the productivity of regions in Europe. Finally, we show that the positive impact of universities may spread across regional boundaries, and it is thus reinforced by spatial positive externalities from neighbouring territories.