

Labour Tasks and Innovation in US Commuting Zones

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Introduction

Innovation as engine of economic growth has received widespread attention by the academic literature. Especially, studies in economic geography have stressed the relevant role of innovation for a sustained development of regions. Among the sources of local innovation, a wide array of empirical works have researched on the role of the local industry composition. In this respect, the extensive literature on Marshallian and Jacobian externalities as well as the one on the local availability of related and unrelated varieties has demonstrated that the technological structure of places is a fundamental determinant of local path dependence and of its possible relaxation. In particular, what seems to trigger local development through innovation is a region's endowment of knowledge intensive industries. Hence, a parallel field of study has emerged that uses local occupations, rather than industries, as basic units of analysis in applied studies of urban and regional development. The intuition is that knowledge creation is fostered by the effective local endowment of human capital rather than by the overall size of the local knowledge intensive industries. In this direction is the stream of works that investigate the role of skilled and STEM workers and the role of knowledge clusters in local development (Feser, 2003; Carlino et al., 2007; Atkinson and Mayo, 2010).

Objectives

Within this framework, we move a step further and investigate whether and how the local task composition affects innovation activity. In line with recent literature on the labour market (Acemoglu and Autor, 2011), we treat occupation as the outcome of the execution of several tasks by workers and inspect whether the heterogeneous incidence of a particular task - rather than the whole occupation - across locations affects the latter's innovation performance. As moving from industries to occupations allows for the isolation of the effect of human capital on local firms' innovation efforts, so moving from occupations to their task composition further helps shedding light on which particular feature of local occupations especially drives innovation. We, therefore, focus on the US Commuting Zones (CZs) and test the impact of the local task composition on the patenting activity over the period 2000-2010.

Methodology

To measure labour tasks we match, by occupation, IPUMS-USA information on US workers to the O*NET survey items. The latter include a wide set of indicators that describe several aspects of a job among which we select those ones that help identifying manual, abstract and routine tasks usually adopted by the literature. We further compute the ratio of abstract to the conjunct of abstract, routine and manual tasks in an occupation to define a simple measure of task complexity. To uncover how and if tasks by workers on their job affect innovation propensities of firms, we consider the Commuting Zones (CZs) as the most natural territorial aggregation level for our research as they effectively represent the spatial span within which labour is used and produces its outcomes. Then all the task and labour market indicators are aggregated at the level of CZ by means of the procedure made available by Autor and Dorn (2013).

With respect to our outcome variable, we measure local innovation performance by means of the number of patents granted to resident inventors. Although as indicators of innovative efforts and outcomes, patents are affected by inherent limitations (Griliches, 1990), they represent the more reliable proxy of innovative activity at regional level. Indeed, several prominent studies in the economic geography literature adopt patents as a measure of innovation and/or knowledge creation (Acs et al., 2002; Porter, 2003; Crescenzi et al., 2007; Hunt and Gauthier-Loiselle, 2010; Balland et al., 2015; Carolina Castaldi and Los, 2015; Balland and Rigby, 2017; Rodríguez-Pose and Wilkie, 2019).

As far as the occupational composition of the US CZs, in this work we source data from the 2000 and 2005-2010 samples of the IPUMS US database. These samples include homogeneous information on the 2000 Puma territorial unit that allows us to aggregate individual level information on occupation typology, working hours and another bunch of individual characteristics - age, income, etc. - at the CZ on the basis of the work by Autor and Dorn (2013). We match by occupation, working individuals from IPUMS US with information on the items of the O*NET to define the task composition of a Commuting Zone. Thus, after defining the abstract task intensity of a given occupation as the ratio of abstract to the total of abstract, manual, and routine task scores, we retrieve from IMPUS the importance of each occupation in each US Commuting Zone by using as weights the shares of workers performing different occupations.

Then, we perform a set of Negative Binomial regressions in which the dependent variables are the number of granted patents in each US CZ, while, among the explanatory variables, we include the intensity of abstract tasks of the CZ workers.

Results

The results show that the coefficient of our main variable of interest is significant and positive therefore implying a relevant role for the abstract intensity of local labour tasks in

the process of innovation. To be stressed is that this finding holds by controlling for a set of relevant factors that, in most previous works, have been found to affect patenting activities at regional level (cf. the above references). Aside from population, which accounts for the different size of the Commuting Zones, the percentage of employees in high-tech industries, the share of highly educated workers and the R&D intensity of business companies at the level of US States, affects positively the number of granted patents. Several robustness checks confirm the positive impact of abstract tasks.

Main implication

The fact that also the effects of education, high-tech orientation, and intensity of business R&D are statistically significant supports the need of including in future studies on regional innovation other characteristics of the firms' employees, such as their skills, abilities, and even personality traits.

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