

Regional knowledge spillovers: Fact or artifact?

Gottfried Tappeiner^a, Christoph Hauser^{a,*}, Janette Walde^b

^a *Department of Economic Theory, Economic Policy and Economic History, University of Innsbruck, Universitaetsstrasse 15, 6020 Innsbruck, Austria*

^b *Department of Statistics, University of Innsbruck, Universitaetsstrasse 15, 6020 Innsbruck, Austria*

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Abstract

The explanation of different levels of innovation and their spatial distribution represents the central focus of the analysis. The empirical literature documents the incidence of spatial autocorrelation in patenting activities and interprets them as evidence for knowledge spillovers. Alternatively, the authors propose the spatial pattern of input variables in innovation processes as driving forces of patenting autocorrelation. They analyze 51 Nuts 1 regions in Europe and find that the high degree of spatial autocorrelation exhibited by patent applications can be explained comprehensively by the spatial location of the input factors in the knowledge production function. These are traditional indicators on R&D investments and human capital from Eurostat and proxy variables on social capital from the European Values Study. This finding has important implications for the scope of an autonomous regional innovation policy.

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1. Introduction

It is a well accepted consensus in the literature that technological change and knowledge are fundamental for the competitiveness and long term growth of economies. These issues have been explored first and foremost by the proponents of the New Growth Theory (Romer, 1986, 1990; Lucas, 1988; Krugman, 1991). However, with the advent of the knowledge-based economy the focus of the analysis has shifted from technological change to innovation – the creation

and diffusion of new knowledge in the form of novel products and processes. Rather than on static models of equilibrium the interest has turned to dynamic models of change where “knowledge is the most important strategic resource and learning the most important process” (Lundvall in Morgan, 1997, p. 493). In such a setting it is of prime importance to identify and document resources and activities that enhance the creation and diffusion of knowledge in order to safeguard sustained competitiveness. Such an analysis is complicated by what is termed by Rosenberg (1982) the “black box” of innovation: the multi-faceted and complex nature of innovation processes characterised by loops and feedback flows between a multitude of agents and institutions. The systemic conceptualisation of innovative activity has shifted the focus of analysis from individual firms to a more aggregated dimension: nations (Lundvall, 1992),

* Corresponding author. Tel.: +43 512 507 7354; fax: +43 512 507 2980.

E-mail addresses: gottfried.tappeiner@uibk.ac.at (G. Tappeiner), christoph.hauser@uibk.ac.at (C. Hauser), janette.walde@uibk.ac.at (J. Walde).

sectors (Malerba, 2002) and regions (Cooke et al., 1997). The latter territorial unit is regarded a suitable level of investigation for the considerable variance of regional innovation in many states. Porter (2003) analyzes the regional economic performance in territorial sub-units of the US and finds that variation in patenting by far exceeds the variation of average wages and employment growth. In addition, there is considerable empirical evidence that local economic conditions and regional idiosyncrasies influence the innovation performance of resident firms (see for example Baptista and Swann, 1998).

The heterogeneity of the innovation landscape points to an important feature of knowledge dissemination: Notwithstanding its public good properties and the advances in information technology, knowledge does not diffuse instantly but is subject to frictions similar to transaction costs. A vast amount of empirical literature has produced evidence that knowledge is bounded in space.¹ In a comprehensive survey Döring and Schnellenbach (2006) classify the empirical research of knowledge spillovers in two main groups: The first group places the emphasis on micro-level data with an analysis of patent citations and their spatial distribution. The second group adopts a macro-level approach with aggregate data and the estimation of knowledge production functions. The latter approach usually employs a function formalized by Griliches (1979) which relates knowledge output to knowledge inputs in order to test if local investments in R&D by neighboring firms and public institutions have an impact on the innovation outputs of resident firms. The impact of the interaction in confined locations requires techniques that are able to demonstrate the spatial interdependence of close actors. Pioneering work in this area has been conducted by Anselin et al. (1997, 2000) who analyze the impact of academic knowledge spillovers on private innovation.

Spatial autocorrelation of innovation indicators is interpreted as evidence of knowledge spillovers that spread from the place of origin to the adjacent locations and decay with distance. Spatial dependence is modeled either with the aid of an additional regressor in the form of a spatially lagged dependent variable (Spatial Lag Model) or through spatial autocorrelation in the error term (Spatial Error Model). In this fashion the method illustrates the incidence of spatial dependence; however, it is a mere technical approach and there is no indication on the transmission mechanisms that cause knowledge

to diffuse and decay. In other words, there is no direct evidence that knowledge really spills over.

Alternatively, we hypothesize that rather than knowledge spillovers it is the spatial concentration of one or more of the input factors in the innovation process that lies at the heart of spatial dependence of regional patent applications. In order to adequately model the driving factors of innovation we use indicators on private and public R&D, human capital and notably social capital developed by Hauser et al. (2007). The indicators on social capital are integrated as proxies for the existence and impact of transmission channels of an important type of knowledge for innovation processes – tacit knowledge. This procedure permits us to investigate the stated hypothesis with an analysis of the spatial autocorrelation of patent applications, each of the independent variables and the autocorrelation of the error term. If the spatial autocorrelation of innovation is caused by the spatial distribution of the independent variables we expect the spatial autocorrelation in the error term to disappear.

The paper proceeds as follows: In Section 2 we provide a review of the literature. Section 3 illustrates the data set used in the study. Section 4 documents the methods applied for the analysis. Section 5 follows up with the presentation of the results, Section 6 provides the major theoretical and political conclusions.

2. Literature review: importance of networks and knowledge spillovers for innovation

With the advent of the New Growth Theory the analysis of wealth creation and economic disparities has risen to prominence. This strand of literature identifies knowledge creation in the form of human capital formation or learning by doing as the engine for economic growth. The emphasis on knowledge and information has arguably been fuelled by the formation of the new economy and the advances in information and communication technologies. Subsequently, the bursting of the high tech bubble led to a shift of the focus of analysis from the productivity enhancing impact of technology to knowledge diffusion among people. A more holistic conception of the knowledge-based economy was defined as comprising all sectors (to varying degrees) instead of only a handful of high tech industries. David and Foray (2002) identify communities (rather than specific industries) as the driving forces of technological change: “Knowledge-based economies emerge when people, with the help of information and communication technologies, group together in an intense effort to co-produce (i.e., produce and exchange) new knowledge.” (p. 14). They conclude that in order to safeguard

¹ For surveys and critical assessments of the literature on empirical evidence of knowledge spillovers see Breschi and Lissoni (2001b), Audretsch and Feldman (2004) and Döring and Schnellenbach (2006).

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