



Related and unrelated variety as regional drivers of enterprise productivity and innovation: A multilevel study

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ABSTRACT

We conduct multilevel analyses of Norwegian data and find that related industrial variety is a positive regional driver of enterprise innovation. Unrelated variety is a negative regional driver of enterprise productivity. This implies that regions with high levels of related variety and low levels of unrelated variety optimize enterprise performance. We argue that regional specialization is a two-dimensional construct inversely associated with related and unrelated variety. Thus, a specialized region (low in unrelated variety) is in fact a driver of enterprise productivity. In addition, we find that population density is another regional driver of enterprise productivity.

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1. Introduction

Do regional characteristics influence enterprise performance? In a review, [Howells and Bessant \(2012, p. 931\)](#) argue that “the geographical environment in which the firm is located can have an important effect on its growth, profit and overall development, including survival and innovative performance.” Yet despite a growing number of studies on economic-geographical regions, the linkages between regional characteristics and enterprises are poorly understood or underappreciated ([Christiansen and Jakobsen, 2012](#); [Gertler, 2010](#)). Firms or enterprises are frequently mentioned in this line of research, but they remain a vague entity ([Maskell, 2001](#); [Taylor and Oinas, 2006](#)). Scholars acknowledge that regional characteristics matter for value creation (e.g. [Krugman, 1991](#); [Porter, 2000](#)) and that critical resources reside beyond enterprise boundaries ([Das and Teng, 2000](#); [Dyer and Singh, 1998](#); [Ghosh and John, 2012](#)), but an enterprise can also be labeled a bundle of distinct resources residing within its boundaries ([Barney, 1991](#); [Barney et al., 2011](#)). In this paper, we intend to contribute to a more nuanced understanding of the region–enterprise nexus by analyzing how geographical localization characteristics are genuinely associated with the enterprise performance measures of *productivity* and *innovation* (while controlling for enterprise and industry

characteristics). Productivity is defined as output per worker ([Hall and Jones, 1999](#)), and innovation is defined as the creation of novel and useful products for enterprises “to gain a competitive edge in order to survive and grow” ([Grønhaug and Kaufmann, 1988, p. 3](#)).

Our study is grounded in the paradigm of evolutionary economic geography, which is concerned “about why regions differ in their ability to generate, imitate or apply new variety, and . . . the economic and institutional structures through which a region can retain or even expand its competitive position” ([Boschma and Lambooy, 1999, p. 412](#)). Furthermore, the paradigm emphasizes how regions evolve ([Martin, 2010](#); [Martin and Sunley, 2006](#)), the spatial dimension of innovation ([Boschma and Martin, 2007](#); [Kogler, 2015](#)), and the cognitive, organizational, social, institutional, and geographical dimensions of proximity ([Boschma, 2005](#)). Historically, there has been a wide-ranging debate over the regional characteristics that may spur value creation, covering factors from specialization to diversity or variety ([Arrow, 1962](#); [Glaeser et al., 1992](#); [Jacobs, 1969](#); [Marshall, 1890](#); [Romer, 1986](#)), but evolutionary economic geography “has gone beyond this dichotomy to argue that the crucial point . . . is encapsulated in the concept of related variety” ([Hassink et al., 2014, p. 1298](#)).

In this study, we examine the concept of related variety – in addition to unrelated variety – at a regional level. Yet in so doing, we emphasize that regional specialization is a two-dimensional construct; a low level of specialization can indicate a region with a high level of related or unrelated industrial variety. In a region with a high level of related variety, enterprises operate in different industries that share several similarities, whereas in a region

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		Related variety	
		Low	High
Unrelated variety	High	1) Regions with a low level of related variety but a high level of unrelated variety	2) Regions with high levels of both related and unrelated variety
	Low	3) Specialized regions (with low levels of both related and unrelated variety)	4) Regions with a high level of related variety but a low level of unrelated variety

Fig. 1. The dimensions of related and unrelated industrial variety.

with a high level of unrelated variety, enterprises operate in different industries that share few or limited similarities (Frenken et al., 2007). If we theorize that all the enterprises in a region operate in exactly the same industry, then it is a highly specialized region, with a low level of related and unrelated variety. With reference to related and unrelated variety, we can broadly classify regions into four categories in a 2 × 2 matrix (Fig. 1): (1) regions with a low level of related variety but a high level of unrelated variety, (2) regions with high levels of both related and unrelated variety, (3) specialized regions (with low levels of both related and unrelated variety), and (4) regions with a high level of related variety but a low level of unrelated variety.

Wixe (2015) has shown that enterprise productivity increases in regions with industrial specialization, but with reference to the concepts of cognitive, organizational, social, and institutional proximity (Boschma, 2005), we will hypothesize that productivity is an inverse function of unrelated variety. Furthermore, with reference to the concepts of technological externalities (Jacobs, 1969) and cognitive proximity, we will hypothesize that related variety has a positive effect on enterprise innovation. In our view, this implies that regions with high levels of related variety and low levels of unrelated variety (Fig. 1, Box 4) optimize enterprise performance by fostering both innovation and productivity. With reference to the concepts of pecuniary externalities (Krugman, 1991) and geographical proximity (Boschma, 2005), we will also hypothesize that regional population density increases enterprise productivity.

Economic-geographical regions can accordingly be studied along a number of dimensions, and here we examine whether related and unrelated variety and population density can foster pecuniary and technology externalities or spillovers at an enterprise level. Density implies that a firm is localized in geographical proximity to numerous other firms realizing economies of scale and pecuniary externalities by serving a large market (Krugman, 1991) and benefiting from relatively abundant access to factor conditions (Feser, 2002; Henderson, 2003; Porter, 2000). Industrial variety can induce technological (Jacobs) externalities or spillovers from resource sharing across branches and foster innovation as knowledge diffuses across industrial boundaries and firms recombine and apply ideas from different perspectives (Carlino, 2001; Jacobs, 1969; Schumpeter, 1934). It can be argued that related industrial variety in particular fosters positive externalities from resource sharing, or knowledge and technology spillovers, because of the relatively narrow cognitive distance between enterprises (Boschma, 2005; Hassink et al., 2014; Nooteboom et al., 2007). Following this line of reasoning, regions with unrelated industrial variety will conversely experience less resource sharing because the cognitive distance between the enterprises is too great. Below, we also argue how unrelated variety is likely to constrain enterprise productivity.

The major aim of this study is to identify regional characteristics that may foster or constrain enterprise productivity and innovation. However, we argue that such knowledge may also

have practical implications for policymakers, managers, investors, and other stakeholders in their pursuit of optimized value creation.

The present work is a multilevel study, and the data are generally derived from the Norwegian part of the Community Innovation Survey (CIS) “Innovation in the business enterprise sector, 2010” by Statistics Norway in collaboration with Eurostat. Participation in the Norwegian part of the CIS study is mandatory for selected firms; thus, we avoid potential nonresponse bias in the data. We analyze more than 6500 enterprises nested within a wide range of industries located in 89 distinct economic-geographical regions throughout the country.

To model related and unrelated industrial variety, we apply Shannon’s (1948a,b) measure of entropy with reference to enterprises’ Standard Industrial Classification (SIC) codes, which correspond to the European Community’s Nomenclature of Economic Activities (NACE) codes. The concept of population density is modeled by dividing the number of inhabitants by the geographical sizes of regions (Frenken et al., 2007). The concepts of related and unrelated industrial variety and population density are thus constants for enterprises residing within a particular region, and vary between regions. Other independent variables and the dependent variables for this study, productivity and innovation, are measured at the enterprise level of analysis.

2. Theoretical positioning and hypotheses

Back in 1890, Marshall introduced the concept of agglomeration economies, a term with a connotative association with regional industrial specialization. In 1969, Jacobs introduced the term “urbanization economies,” which may be associated with industrial diversity or variety. It has been debated whether specialization or diversity foster local externalities in terms of knowledge or technology spillovers (Beaudry and Schiffauerova, 2009), but we emphasize that industrial specialization is a two-dimensional construct in which a low level of specialization can indicate a region with a high level of related or unrelated industrial variety. We believe that such a distinction can provide a more nuanced picture of how regional industrial characteristics foster enterprise productivity and innovation.

Furthermore, it should be noted that later extensions of Marshall’s work on agglomeration and industrial specialization emphasize the role of local rivalry as a catalyst for regional development (for a review and synthesis of Marshall’s scholarly work, see Glaeser et al., 1992). The concepts of related and unrelated variety also take account of this issue, in that low variety in terms of these dimensions in fact describes industrial specialization within a region (Fig. 1).

It may also be argued that agglomeration economies can induce pecuniary externalities (Martin and Sunley, 1998) as a function of regional size or population density (Krugman, 1991). In his seminal paper, Krugman (1991, p. 485) asks rhetorically: “how far does a technological spillover spill?” He continues, “if one firm’s actions

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