

Chapter 16

Knowledge-Based Externalities and Geographical Clusters: An Agent-Based Simulation Study

Nunzia Carbonara
Politecnico di Bari, Italy

ABSTRACT

Agglomeration economies are positive externalities associated with the co-location of firms within a bounded geographic area. Traditionally, these agglomerative advantages have been expressed in terms of pecuniary externalities and they have been identified as one of the key sources of geographical cluster (GC) competitive advantage. However, in the last years the basics of competition are changed and the ability of firms to create new knowledge is more crucial for success rather than the efficiency in production. This has shifted the attention of scholars on the role of knowledge and learning in GCs. In line with these studies, this chapter suggests that agglomeration economies are related to both pecuniary externalities and knowledge-based externalities. The latter are benefits that co-located firms can gain in terms of development of knowledge. To investigate whether knowledge-based externalities affect geographical clustering of firms, an agent-based model is developed. By using this model, a simulation analysis is carried out.

INTRODUCTION

Geographical clusters (GCs) are concentrations of interconnected companies and institutions in particular fields (Porter, 1998). These systems of firms (including also Marshallian and dynamic industrial districts) have been extensively investigated in the literature. Different aspects have been observed, and some notions and models have been developed aimed at identifying the sources of

competitive advantage, such as the agglomeration economies concept introduced by Marshall (1920) and further formalized by Krugman (1991); the flexible specialization production model conceptualized by Piore and Sabel (1984); the industrial atmosphere notion conceived by Marshall (1919); and the *innovative milieux notion* developed by the GREMI (Maillat et al., 1993).

Referring to agglomeration economies, these are positive externalities (benefits) resulting from

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the co-location of economic activities and motivating firms to geographically cluster. In fact, the spatial concentration of firms generates several benefits, such as: knowledge spillovers among competitors; industry demand that creates a pool of specialized labor; and industry demand that creates a pool of specialized input providers (Marshall, 1920). For Krugman (1991), the benefits of agglomeration in essence depend on three factors: i) substantial increasing returns to scale, both at the level of single firm (internal economies) and the industry (external economies); ii) sufficiently low transport costs; and iii) large local demand.

According to the geographical economics literature, firms tend to geographically cluster when agglomeration economies exist¹, which consist mainly of *pecuniary* externalities (Krugman, 1991), because they gain from the reduction of production cost and/or the increase of the production efficiency. Thus, GCs are cost efficient spatial configurations and their source of competitive advantage is based on cost reduction.

More recently strategic management literature has highlighted the limit associated with a competitive strategy based only on two sources of competitive advantage (cost reduction and differentiation) and has recognized the importance of knowledge as a fundamental factor in creating economic value and competitive advantage for firms (Grant, 1997; Leonard-Barton, 1995). What a firm knows, how it uses what it knows, and how fast it can develop new knowledge are key aspects for firm success (Prusak, 1997; Hamel and Prahalad, 1994). Therefore, knowledge is a key asset for competing firms and learning is a key process, because it increases the firm's cognitive capital, i.e. the firm's knowledge stock.

In the last years, some scholars have analyzed the role of knowledge in GCs and proposed a knowledge-based theory of GCs (Malmberg & Maskell, 2004; Maskell, 2001b; Tallman et al., 2004). Some works have investigated the nature of knowledge circulating in GCs, the knowledge transfer and creation processes embedded in GCs,

and the learning processes activated by firms in GCs (Albino and Schiuma, 2003; Albino et al., 2005). These are particularly effective in GCs, because proximity among firms largely enhances them (Baptista, 2000; Maskell, 2001a, Boshma, 2005).

These studies conceptualize GCs as venues of enhanced knowledge creation and they suggest that agglomeration economies are based on *knowledge-based* externalities (Lorenzen & Maskell, 2004; Maskell, 2001a). In this view, the very reason why a GC exists is to create a competitive advantage for the collective, as well as for individual firms, by enhancing individual firms' knowledge creation efforts (Arikan, 2009). In fact, the theory holds that geographic proximity increases not only the frequency of interactions between cluster firms but also the effectiveness of knowledge exchanges so as facilitating knowledge creation within GCs. Thus, firms can capture benefits from co-location not only in terms of lower costs or improved efficiency in production but also in terms of increased knowledge stocks.

The aim of this chapter is to contribute to the debate about the role of *knowledge-based* externalities in the process of geographical clustering of firms.

Could *knowledge-based* externalities explain the process of geographical clustering of firms? Do they are the very driving force of this process?

To address these questions, it is assumed that *knowledge-based* externalities are due to the existence within the GC of two processes of external learning (Malerba, 1988, 1992): learning by imitation and learning by interaction, and that the effectiveness of these learning processes is positively influenced by the geographical, cognitive, and organizational proximities among firms.

Such an assumption is built on recent studies that have highlighted the existence of relationship between the different dimensions of proximity, namely geographical, cognitive, and organizational, and the effectiveness of external learning

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