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Specialization, institutions and innovation within China's regional innovation systems

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ABSTRACT

Drawing upon the insights from economic geography and regional innovation systems, this paper examines whether and how the agglomeration of industries influences their innovative outputs, with a focus on the importance of regional institutions in the Chinese context. Based on a dataset that covers 29 two-digit SIC manufacturing industries in 30 provincial-level Chinese regions in 2009, it found that specialization externalities within industries do exist in Chinese regions. These impacts are further moderated by regional institutional factors, suggesting that the benefits of localization economies are predicated on the development of institutions in regions.

1. Introduction

It has been well documented that knowledge spillovers or externalities generated from R&D or other innovative activities are often geographically bound within the region where the new knowledge originated (Jaffe, 1989; Jaffe et al., 1993; Audretsch and Feldman, 1996). Prompted by the dynamic view of technological externalities proposed in Glaeser et al. (1992), a stream of studies has examined the extent to which innovation performance within a particular region is influenced by the composition of economic activities within that region (Feldman and Audretsch, 1999; Paci and Usai, 1999; Greunz, 2004). With regard to the mechanisms that generate important technological externalities or knowledge spillovers, one prominent view emphasizes the importance of specialization externalities which Glaeser et al. also termed as Marshall–Arrow–Romer (MAR) externalities, and claims that the concentration of an industry within a geographic region is conducive to knowledge spillovers. A different view suggested by Jacobs (1969), however, contends that the most important knowledge spillovers occur between industries, not within an industry, and therefore external diversity is more important than specialization externalities for promoting innovation and growth.

The debate on this research issue has clear implications for policy decisions concerning regional innovation and economic growth, especially in catch-up economies. For instance, if the MAR theory is correct, then local governments should develop a narrow group of core industries to take advantage of MAR externalities and obtain greater innovation output. By contrast, if the Jacobs thesis is valid, local policy should focus on fostering a diversity of economic activities and developing connections between industries. Unfortunately, empirical evidence for each view has been documented (see Beaudry and Schiffauerova, 2009, for a recent review) and the debate surrounding the validity of the MAR and Jacob theses continues. Nowadays, a consensus seems to have formed that validation of either thesis is context and/or model dependent (de Groot et al., 2009). The MAR externalities exist in some economies, but not in others. Despite this consensus, the reason why MAR externalities only work sometimes, however, is not well studied in the literature. Moreover, although the context-dependent view suggests that certain contextual elements should be factored in before any meaningful implications can be uncovered, few insights on which elements are critical for MAR externalities to work can be drawn from the current literature. One additional drawback associated with this line of research is that it stresses the role of only technological spillovers and ignored the impact of other types of externalities generated from agglomeration. MAR thesis proposes that, besides technological spillovers, labor market pooling and input sharing are also important sources of localized economies (Marshall, 1920). They may have a bearing on the innovation outcomes too.

Drawing upon the literature of regional innovation systems (Carlsson et al., 2002; Edquist, 2005), I argue in this study that institutional elements of innovation systems, such as laws, rules, established practices and routines, can moderate the role of different externalities. To what extent these MAR externalities are able to reveal themselves are conditioned by whether institutions related to labor market practices, intermediate organizations and innovation behaviors are well established. In a context where labor forces are not allowed to move freely, for example, the benefit from labor market pooling will certainly be very limited. In a transitional economy like China, this was often the case

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in the early stage of its transition. In the literature of localization economies, however, this issue has not been extensively studies (Rosenthal and Strange, 2001).

Besides these theoretical motivations, another practical motivation for this research is derived from an important observation in the development of Chinese economy. In the eastern regions of China manufacturing sectors are becoming increasingly concentrated (Fan, 2004; Wen, 2004). Mody and Wang (1997), Batisse (2002) and Gao (2004) have explored the impact of local industrial structure on the growth rate of each region-industry unit in the tradition of Glaeser et al. (1992). But the effect of local industrial structure on firms' innovation has not been studied in the Chinese context. Despite the increasing world-wide importance of the Chinese economy, it is still unclear whether the agglomeration is able to foster the innovation and catch-up process in Chinese manufacturing industries, especially considering the fact that many institutions are not well deployed. In a broader context, many latecomers are facing similar situations. They are looking to develop complementary activities among basic industries that drive industrial scope and efficiency while facing pressure to catch up with western economies. In this sense, an analysis of the relationship between specialization and innovation in China is in order, which will hopefully enhance the understanding of industry dynamics and catch-up strategy in latecomer countries.

The purpose of this paper is to fill both the theoretical and the practical gap and investigate the importance and micro-foundations of specialization on innovation in China. More specifically, I first investigate whether MAR externalities exists, and then go one step further to explore which type of externalities is at work or not. In terms of the role of institution-dependent externalities, China is an especially suitable context to examine for at least two reasons. Firstly, China has undergone a dramatic transition from central-planned to market regimes during the past three decades. Given the importance of state-owned enterprises in Chinese economy and the strong role of visible hands of governments, the agglomeration of many industries was not only driven by the location decisions of firms, but also dictated by central or local development initiatives. The formation of geographical agglomeration in many industries is thus not in parallel with the development of institutionalization. Moreover, the process of transition and the pace of institutionalization vary greatly across regions. It is possible to investigate the impact of institutionalization process at the regional level.

In this study, I use a region-industry combination as the unit of analysis and try to relate the innovative outcomes of enterprises to the composition of economic activities within a particular region-industry combination. The empirical analysis is based on a dataset of 29 two-digit SIC manufacturing industries in 30 Chinese provincial-level regions in 2009. The results confirm the existence of localization economies in China and also demonstrate that the benefits of MAR externalities are moderated by institutional elements. These findings validated the importance of regional institutions in innovation systems.

This research extends previous empirical studies in at least two aspects. First, it not only provides new evidence for the importance of localization economics in facilitating industrial innovations in the case of China, but also explores the micro-foundations of MAR externalities. Secondly, it bridges two separate lines of research. Although previous studies have repeatedly argued for a systematic view of regional innovations (Li, 2009; Malerba, 2002), few empirical works on region-industry level specialization have taken into account the institutional elements deemed important in innovation system literature (Feldman and Audretsch, 1999; Paci and Usai, 1999; Greunz, 2004). Similarly, studies on innovation systems have paid little attention to the economic composition of systems. By exploring the moderating effect of institutions on localization economies, this study regards both MAR externalities and institutions as important features of regional innovation systems, and thus deepens our understanding of innovation systems.

This paper is organized as follows. Section 2 briefly reviews the literature concerning the effect of specialization externalities and institutions on innovation. Regional variation of institutions in China is briefly discussed in Section 3. Section 4 describes data source and variable construction. Following the presentation of main results in Section 5, discussions and limitations are reported in Section 6. Finally, Section 7 concludes.

2. Specialization, institutions and innovation

2.1. Specialization and innovation

Although it is generally accepted that the economic composition of a region has a bearing on its innovation performance, little consensus exists as to how the underlying mechanisms work. In examining the impact of dynamic externalities on city growth, Glaeser et al. (1992) discussed two types of externalities. One type is specialization (or MAR) externalities attributed to Marshall (1920), which generate localization economies. They exist between firms within the same industry and the knowledge spillovers mainly occur within the industry. In this sense, they are external to firms, but internal to an industry within a specific region. This view of knowledge spillovers suggests that the concentration of a specific industry within a particular region is conducive to knowledge flows across firms and thus promotes innovation. The other type of externalities is associated with urbanization economies and noted as diversity externalities. They are external to industries but internal to geographical regions. Since originally suggested by Jacobs (1969), they are sometimes termed Jacobs externalities. This view emphasizes the inter-industry spillovers and contends that the variety and diversity of geographically proximate industries promote knowledge spillovers and ultimately innovation and growth. In Jacobs' view, the variety of local economic activities leads to a greater return to new knowledge by bringing together complementary knowledge across diverse firms and economic agents.

Closely related to the distinction between the two types of technological externalities, a second interesting controversy is about the impact of local competition on innovation output. Is a region with more small firms more innovative? Or does greater competition across local firms foster the pursuit of innovation? According to the MAR theory, local monopoly allows externalities to be internalized by innovators and thus is more conducive to innovation than local competition. Jacobs (1969), however, argues that local competition speeds up the diffusion and adoption of innovation, and therefore is superior to local monopoly. Porter (1990), although taking a view of MAR externalities, stands behind Jacobs on this point in favor of local competition.

Empirical studies have tried to find evidence that the composition of economic activities within a particular region has an influential impact on innovative output through such externalities or knowledge spillovers, but the results have been contrasting and inconsistent so far. For instance, Baptista and Swann (1998) demonstrated that a firm is more likely to innovate if it is in a region where own-sector employment is strong and diversification does not contribute to innovation in the UK. van der Panne (2004) demonstrated that in the Dutch context MAR externalities hold and local competition negatively impacts innovation. Boschma and Weterings (2005) found that Dutch software firms are more productive in innovation when they are located in a region with a specialized ICT sector. All these studies validate the MAR argument to some extent.

By contrast, Feldman and Audretsch (1999) showed that the specialization of a particular industry within US metropolitan areas does not promote innovative output, indicating important technological knowledge spillovers are likely to occur between industries rather than within industries. Andersson et al. (2005) analyzed the case of Sweden and argued that diversity is conducive to innovation in manufacturing industries, providing support for Jacobs' urban externality hypothesis. As a matter of fact, specialization and urban externalities do not need to be exclusive. In an empirical analysis of 784 Italian local labor systems and 85 industrial sectors, Paci and Usai (1999) found that both

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