China Economic Review 35 (2015) 105–120

Contents lists available at ScienceDirect

China Economic Review

How does agglomeration promote the product innovation of Chinese firms?

Hongyong ZHANG [1]

Hongyong ZHANG is a fellow at Research Institute of Economy, Trade and Industry (RIETI), 1-3-1 Kasumigaseki, Chiyoda-ku, Tokyo 100-0013, Japan

ARTICLE INFO

Article history:
Received 18 November 2014
Received in revised form 19 June 2015
Accepted 21 June 2015
Available online 7 July 2015

JEL classification:
L60
O14
R11

Keywords:
Agglomeration economies
Localization economies
Urbanization economies
Product innovation
New product

ABSTRACT

This study empirically analyzes the effect of agglomeration economies on firm-level product innovation (new products), using Chinese firm-level data from 1998 to 2007. In terms of new product introduction and new product output, I find that Chinese firms benefit from urbanization economies (as measured by the number of workers in other industries in the same city and by the diversity of industries in the same city). Conversely, I find no positive effects of localization economies (as measured by the number of other workers working for neighboring firms in the same industry and in the same city). These results suggest that in China, urbanization economies play an important role in fostering product innovation by urban size and diversity.

1. Introduction

China has had impressive industrialization, urbanization, and economic growth over the last three decades. During this process, industrial agglomeration has increased steadily and consistently (Ge, 2009; Wen, 2004). Recently, using large firm-level data for the period of 1998 to 2005, Lu and Tao (2009) calculate Ellison–Glaeser index (Ellison & Glaeser, 1997) to measure the degree of China's industrial agglomeration. They find that though the extent of industrial agglomeration is still much lower than developed countries, it has increased steadily throughout that period. Moreover, Chinese firms enjoy an increase in innovative output in terms of total factor productivity (TFP), new product sales, and patent applications (Brandt et al., 2012; Hu & Jefferson, 2009; Jefferson et al., 2004). Table 1 summarizes several indicators on the trends of urban agglomeration and innovation in China from 1998 to 2012. According to the indicators in Panel A, there is a very clear trend of increasing geographic concentration of population and economic activities in China. In Panel B, research and development (R&D) spending and invention patents granted increased significantly, and the number of firms with new product introduction also increased rapidly over this period.

Is there a positive relationship between these two phenomena, increasing industrial agglomeration and innovation in China? And, do Chinese firms benefit from agglomeration? In standard economics of agglomeration, agglomeration

E-mail address: zhang-hong-yong@rieti.go.jp.
[1] Tel.: +81 3 3501 8231; fax: +81 3 5510 3927.

http://dx.doi.org/10.1016/j.chieco.2015.06.003
1043-951X/

Table 1
Trends of agglomeration and innovation in China.

Indicators	1998	2002	2007	2012
Panel A:				
(1) Population in urban agglomerations of more than 1 million (% of total population)	13.8	16.5	19.0	22.0
(2) Ellison-Glaeser index (two digit industry, city level)	0.0042	0.0066	0.0113	
Panel B:				
(3) Research and development expenditure (% of GDP)	0.65	1.07	1.40	1.98
(4) Number of invention patents granted	4733	21,473	67,948	217,105
(5) Number of industrial firms with new product introduction	10,845	10,938	27,485	

Source: Indicators (1) and (3) are taken from World Development Indicators, the World Bank; (4) is from web site of China's National Bureau of Statistics (NBS); (2) and (5) are calculated by the author from Annual Surveys of Industrial Firms (ASIF), National Bureau of Statistics (NBS).

economies are generally assumed to improve productivity and spur innovation of firms through localization economies and urbanization economies.[2] In particular, localization of economies, as proposed by Marshall (1890), indicates that concentration of an industry in a given area generates positive externalities on input markets, labor markets, or knowledge exchange.[3] By contrast, urbanization economies, as emphasized by Jacobs (1969), imply that industrial diversity in a city facilitates the transmission of technology and knowledge of different industries, and thus creating new knowledge and technology. Jacobs focuses on inter-industry knowledge spillovers and argues that diversity rather than specialization promote innovative activity and economic growth. This gives rise to the following research questions. Does agglomeration account for innovative output (termed as new product in this paper) in developing countries such as China? If it does, how do innovation activities of Chinese firms benefit from agglomeration economies, from localization economies, and/or from urbanization economies?

There is a large empirical literature investigating the effects of localization and urbanization on *process innovation*, i.e., productivity. For example, Henderson (2003) and Martin et al. (2011) investigate the relative effects of localization economies and urbanization on plant or firm-level TFP in the United States and France, respectively. Despite its economic importance, there are few empirical studies focusing on agglomeration and firms' *product innovation*. Feldman and Audretsch (1999) and De Beule and Van Beveren (2010) are two of the few exceptions.[4] Feldman and Audretsch find a tendency for innovative activity in complementary industries sharing a common science-base to cluster together in a city. The diversity has a strong positive effect and specialization a negative one, on new product introductions reported by trade journals in the United States. Using cross-sectional data for Belgium firms, De Beule and Van Beveren (2010) find a positive impact of own-industry employment concentration on the product innovation. However, they consider localization only. Recent theoretical work by Duranton and Puga (2001) provides micro-foundations for the link between diversity and innovation. They argue that diversified cities can play a role in the development of new products and show that firms can benefit from innovations by locating in diversified cities.[5]

The purpose of this study is to investigate whether and how localization or urbanization promotes product innovation in China. I rely upon a direct measure of innovative output (new product) rather than on a measure of intermediate output, such as patented inventions,[6] and I consider that the indicator of new product reflects the direct contribution of R&D output to economic growth of China. I utilize Chinese firm panel data for manufacturing industries, with yearly observations from 1998 to 2007. I focus on this period for two reasons. First, as reported in Brandt et al. (2012), Chinese manufacturing sector enjoyed a significant productivity growth (process innovation) and high turnovers during this period. Compared with process innovation, it would be very interesting to investigate whether Chinese firms have made progress in product innovation in the same period. Second, the growth of industries has been uneven across China's cities for the period of 1998–2005 (Lu et al., 2013). They focus on growth of output and employment. Whether this spatial disparity also relates to product innovation needs to be examined.

In empirical analysis, I first regress the new product firm dummy on firm characteristics and agglomeration variables (both localization economies and urbanization economies) controlling for firm fixed effects. I find that both the size and diversity of neighboring industries promote the introduction of new products. Then I employ the random effects Tobit model and regress new product intensity on the agglomeration variables. The estimation results show that the new product output of firms also benefits from urbanization economies rather than localization economies. As there are no previous studies investigating the effects of agglomeration on the product innovation of Chinese firms, this paper presents the first evidence of the manner in which urbanization economies affect product innovation (new products). The results remain robust to using subsamples, alternative variables, and panel estimation methods.

This study is related to the emerging literature on agglomeration and firm performance in China. For example, Lin et al. (2011) and Yang et al. (2013) find that localization has positive effects on firm-level productivity of the textile industry and the electronics industry. Long and Zhang (2011) argue that industrial proximity contributes to the performance (credit constraint, productivity, and

[2] In some related literature (for example, Lu et al., 2013), localization is also referred as specialization and urbanization is referred as diversity. This paper uses these terms interchangeably.

[3] Glaeser et al. (1992) suggest that the concentration of an industry in a city promotes knowledge spillovers between firms and that such concentration would therefore facilitate innovation in that city-industry. An important assumption is that knowledge externalities to firms exist only for firms within the same industry.

[4] Kuchiki and Tsuji (2010) is a collection of comprehensive studies on cluster and innovation in emerging economies. These studies focus on very specific sectors, regions, and policy issues without using large firm-level data and estimating the effects of agglomeration on product innovation.

[5] Duranton and Puga (2001) also argue that when the product become mature, firms switch to mass production and relocate to specialized cities where production costs are lower. The issue of product cycles and relocations across cities goes beyond the scope of this study.

[6] Griliches (1990) warns that the number of patented inventions is not the equivalent of a direct measure of innovative output since not all innovations are patented.