



Agglomeration and productivity in China: Firm level evidence [☆]



Cui HU ^{a,*}, Zhaoyuan XU ^b, Naomitsu YASHIRO ^c

^a School of International Trade and Economics, Central University of Finance and Economics (CUFE), 39 South College Road, Haidian District, Beijing 100081, PR China

^b Industrial Economy Research Department, Development Research Center of the State Council, R.216, No. 225, Chaoyangmen Nei Dajie, Beijing 100010, PR China

^c Organization for Economic Cooperation and Development (OECD), Economics Department, 2 Rue André Pascal, Paris 75016, France

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ABSTRACT

This paper conducts an in-depth evaluation on the role of industrial agglomeration in productivity growth of China's industrial sector by exploiting large dataset of manufacturing firms active in 176 three-digit industries and in 2860 counties. We also complement our analysis with the 2004 Census data to capture the agglomeration of small firms. Unlike previous studies that often focused on specific industries, we assess the impact of agglomeration in a comprehensive range of industries and extend the scope of analysis to upstream industries as well. Moreover, we explore how the ownership of Chinese firms shapes their ability to benefit from agglomeration effect as well as to act as the source of externality. We find that congestion and fiercer competition offset the benefits of agglomeration for firms operating within agglomerated regions. On the other hand, a co-location of large firms contributes significantly to productivity. We also find a more important contribution from the agglomeration of upstream industries than from that of the same industry. Private enterprises are the primary source of agglomeration effects especially in upstream industries, whereas their productivity is boosted most by the agglomeration of other private enterprises. We reckon that industrial agglomeration contributed up to 14% of the productivity growth in China's industrial sector between 2000 and 2007.

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1. Introduction

Sustainability of China's competitiveness as manufacturing base is recently questioned as enterprises in China are facing rise in labor and resource costs, currency appreciation and tighter constraints associated with environmental protection. However, if the competitiveness of Chinese industry is mainly founded on the productivity improvement as opposed to cheaper labor cost, China is likely to retain its position as the world's major exporter of manufacturing goods. A likely source of such productivity growth is the industrial agglomeration which increased consistently since the mid-1990s, driven by the globalization of the Chinese economy (Lu & Tao, 2006). The geographic concentration of industrial activities was associated with a dramatic increase in number of firms, namely of the clustering of interconnected small firms (Long & Zhang, 2012). Case studies reported that such clustering of small and medium enterprises (SMEs) reduced the technological barrier to entry and promoted quality upgrading of Chinese firms (Fleisher, Hu, McGuire, & Zhang, 2010; Huang, Zhang, & Zhu, 2008). However, it is less clear whether the contribution of agglomeration can be generalized beyond the findings on specific industries or regions.

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* Corresponding author. Tel.: +86 13501193242 (mobile).

E-mail address: pkucuihu@gmail.com (C. Hu).

Industrial agglomeration is often considered to generate positive externalities such as knowledge spillover, more efficient input sharing and richer labor pooling (Marshall, 1890). On the other hand, it can be associated with negative effects on productivity due to congestion and fiercer competition. Comprehensive assessments of the net effects of agglomeration in China are still limited and their findings remain inconclusive. For instance, Batisse (2002) reported a negative relationship between the industrial specialization of a province and its growth in value-added, whereas Fan and Scott (2003) reported a positive relationship between an industrial concentration and the province-level productivity. Empirical evidences at firm-level are even more limited and are often confined to specific industries. An example is Lin, Li, and Yang (2011) which studied the impact of agglomeration on productivity of textile industry firms and reported that initial positive externalities are overwhelmed by diseconomies as the agglomeration intensifies.

This paper provides a comprehensive assessment of agglomeration effects on productivity of Chinese firms by exploiting a large survey data of manufacturing firms across 176 three-digit industries spanning between 2000 and 2007. Because the annual survey data covers only the firms with sales of 5 million RMB or above, observing agglomeration effects solely based on those data ignores the clustering of smaller firms which are found to play an important role in upgrading of Chinese industries. Therefore, we complement our base analysis by incorporating the agglomeration of smaller firms using the 2004 Census data that covers all the manufacturing firms.

Our analysis also comprises three notable features. First, we use the number and the average output size of firms in a spatial unit to capture the size and the *quality* of an agglomeration. The number of firms is highly relevant to many aspects of Marshallian externality. For instance, knowledge spillover within an agglomeration is proportional to the number of firms, when each firm engages in some types of knowledge creation and the nearby firms all benefit from its outcome (Henderson, 2003). Also, larger number of firms in a region increases the scale and depth of inputs demand, allowing a more efficient input sharing. Finally, it enhances the efficiency of matching between firms and workers via deeper labor pooling. On the other hand, the average size of firms in an agglomeration not only captures the size of input demand and labor pooling for a given number of firms, but also the co-location of productive enterprises. Firm size has often been seen as a proxy of productivity and several studies have indeed reported significant externalities arising from the co-location of large firms (Greenstone, Hornbeck & Moretti, 2010; Li, Lu, & Wu, 2012).

Second, we incorporate explicitly the agglomeration of upstream industries. The presence of rich supporting industries that provide high quality intermediate goods is essential for a country's industrial competitiveness. The agglomeration of upstream industries increases the varieties of inputs supplied, and by allowing firms to specialize in their core activities while outsourcing some of in-house production (Broda & Weinstein, 2006; Holmes, 1999). Given that sharing of specialized inputs has always been considered as an essential element of Marshallian externality, it is somewhat surprising that previous studies did not take into account the agglomeration of upstream industries.

Finally, we explore how a firm's ownership structure shapes its ability to benefit from agglomeration effects as well as its ability to act as the source of agglomeration effects. The difference in corporate behavior and culture can define the extent to which a firm benefits from an agglomeration (Saxenian, 1994). Chinese firms differ substantially in their performances and corporate behaviors across their ownership (Jefferson, Rawski, Wang, & Zheng, 2000). State-owned enterprises (henceforth, SOEs) enjoy privileges in administrative treatment, good access to finance and sometimes monopolistic power, but can be driven by policy rather than profit. Private enterprises (henceforth, PEs) are managed by vibrant entrepreneurs and are highly profit-oriented, but often face barriers to market entry and difficulty in accessing credit. Foreign-invested enterprises (henceforth, FIEs) possess advanced technologies but often engage in low value-added activities such as the assembly and re-export of imported intermediate inputs, referred as the processing trade. Such stark differences across ownerships may not only shape the ability of Chinese firms to absorb knowledge spillovers but also shape their ability to act as the source of spillovers.

We find positive and sizable contributions by the agglomeration of upstream industries to the total factor productivity (TFP) of Chinese firms. Our estimates imply that doubling the number of firms in upstream industries raises the TFP by 3.2%. On the other hand, agglomeration effects within the same industry are more complex: increase in number of firms within the same county is seen to suppress TFP. This somewhat surprising finding suggests that severe congestion and intense competition associated with agglomeration are offsetting the Marshallian externality. The increase in number of firms in a moderate distance is associated with smaller negative impact or even positive impact to productivity. We also find that increase in average firm size contributes importantly to higher TFP. This suggests that the qualitative aspect of an agglomeration, namely the co-location of large firms possessing rich knowledge stock defines the benefits of agglomeration. When looking across different ownerships, PEs seem to be the main recipient of both positive and negative agglomeration effects but this becomes less clear when the agglomeration of smaller firms is incorporated. However, we find that the agglomeration of PEs impacts the productivity of Chinese firms more than that of SOEs or FIEs. Especially, PEs are the main sources of the sizable agglomeration effects from upstream industries. The agglomeration effects from PEs are self-reinforcing in a sense that the productivity of a PE is most enhanced by the agglomeration of PEs. Based on our estimated results, we reckon that industrial agglomeration contributed up to 14% of TFP growth in China's industrial sector during 2000–2007.

The next section provides a non-exhaustive review of works on industrial agglomeration, especially in context of China. Section 3 describes the dataset used in our analysis, the method to construct indicators of agglomeration and to estimate TFP and our empirical model. Section 4 lays out our estimation results and discusses the prominent feature of agglomeration effects in China. Based on the results from Section 4, Section 5 computes the role of agglomeration in the productivity growth of China's industrial sector during the sample period. Section 6 concludes with policy implications.

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