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EDITORIAL

Modelling knowledge and innovation spillovers in China

Min Qiang Zhao [a] and Jouke van Dijk [b]

ABSTRACT

The papers in this special issue focus on modelling knowledge and innovation spillovers with an emphasis on the context of China. The first paper decomposes the relative importance of economic growth into knowledge spillovers and technical diffusion, using cross-country data on a worldwide scale, as well as provincial data at the regional scale of China. The second paper investigates whether the economic and financial performances of reformed state-owned enterprises are affected by the presence of non-state-owned enterprises from related industries. The final paper examines how the spatial spillovers from inward and outward foreign direct investment affect the innovation activities of domestic firms in China's Shandong province. This special issue contributes to a better understanding of the channels for transferring knowledge and innovation spillovers in China.

KEYWORDS

knowledge spillovers, innovation spillovers, China

JEL C21, F21, O31, O33, O53

The determinants of productivity growth are the key component to understand economic growth. Prescott (1998) had called for a need to develop a theory of total factor productivity (TFP) that goes beyond the differences in physical and intangible capital and publicly available stock of technical knowledge to explain cross-country income differences. How knowledge or ideas flow across firms or regions can have a profound impact on economic growth. The theme of this special issue is to focus on modelling knowledge and innovation spillovers with an emphasis on the context of China. Recent contributions on this subject in this journal, not focusing on China, are by Bond-Smith, McCann, and Oxley (2018), Autant-Bernard and LeSage (2019), and Kazakis (2019).

In order to stimulate the international visibility of regional science research in China and to develop a stronger international research network for top-level Chinese scholars, the international workshop on 'Regional, Urban, and Spatial Economics in China' (RUSE) has been organized annually since 2012 through close cooperation between Chinese scholars and the editors of major international regional science journals. The sixth workshop (RUSE-6) was hosted by The Wang Yanan Institute for Studies in Economics, the Gregory and Paula Chow Center for Economic Research, and the School of Economics at Xiamen University in 2017. After

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submission and the standard double-blind peer-review process, two papers presented at RUSE-6 plus one additional paper submitted separately to *Spatial Economic Analysis* (Zhang, Wan, Li, & He, 2019, in this issue) have been selected for this special issue.

The first paper in this special issue, by Zhang et al. (2019, in this issue), decomposes the relative importance of economic growth into knowledge spillovers and technical diffusion, first at the global scale using cross-country data and then for regions in China using provincial data. Based on the World Bank's income classification, the authors divide the countries into four income groups and aggregate capital stock for each group of country economies, which they use to capture the heterogeneous effects of knowledge spillovers in a production function. Their specification of knowledge spillovers is in line with the learning-by-doing literature, which suggests that new knowledge could be generated as a by-product of conventional economic activities. By assuming that new knowledge is discovered through each firm's investment and that the flow of knowledge cannot be perfectly contained within firms as in Sheshinski (1967) and Romer (1986), an increase in the capital stock of a firm also leads to an increase in the stock of knowledge at the country and/or regional level. In terms of technical diffusion, the authors focus on the external effects of the spread of technology via research and development (R&D) activities from one location to another. More specifically, they aggregate patent applications and patent grants by different groups of economies to capture the heterogeneous impacts of technical diffusion. The spatial contiguity matrices are used to model the effectiveness of knowledge spillovers and technical diffusion. The authors first use cross-country data from the Penn World Table and the World Intellectual Property Organization to estimate a production function with both knowledge spillovers and technical diffusion. The regression results show that the source of global spatial economic interaction comes from knowledge spillovers rather than technical diffusion, and that knowledge spillovers of high-income countries and upper middle-income countries appear stronger than those of lower income countries. Next, the authors use Chinese provincial data to re-estimate the regression model. The economies are divided into eight groups based on geographical locations. Again, the knowledge spillover channel dominates the technical diffusion channel. Moreover, the effect of knowledge spillovers within China is only slightly larger than its global counterpart. The authors suggest that the removal of China's household registration system (commonly known as the *hukou* system) and local protectionism could help increase those spillover effects. For the robustness checks, they use the surface-distance matrices to model the spillover intensity, and also include human capital in their production function. Their conclusion remains unchanged.

The remaining two papers use firm-level data to examine knowledge and innovation spillovers in China. As summarized by Jones (2016), the misallocation at the micro-level is well connected to a decline in TFP at a more aggregated level. An important source of misallocation is related to the allocation of ideas or knowledge. Those spillovers at the micro-level can help one to understand better the differences in TFP.

The second paper, by Zhu, He, and Hu (2019, in this issue), studies how the economic and financial performances of reformed state-owned enterprises (SOEs) are affected by the presence of non-SOEs and SOEs from related industries. During the central planning era (1952–78), SOEs were the core element of China's economy. Since the market reform in 1978, non-SOEs have been gradually allowed to grow and compete with SOEs. As reported by Zhu (2012), the average annual growth rate of TFP in the non-state sector was 4.02%, whereas the comparable growth for the state sector was −0.05% during the period 1978–98. Beginning in the late 1990s, the restructuring of state enterprises led to the privatization of many small-scale low-efficiency state firms through management buyouts, and some of these were even allowed to go bankrupt. The authors use the data from China's Annual Survey of Industrial Firms to classify those firms into three groups: SOEs, reformed SOEs and non-SOEs. They then apply the method proposed by Hidalgo, Klinger, Barabási, and Hausmann (2007) to construct density indicators to measure the strength of spillovers from SOEs and non-SOEs in each location, respectively. In their

regression model, unreformed SOEs serve as the control group, while reformed SOEs belong to the treatment group. To reduce the impact of self-selection, the authors use propensity score matching to construct a sample of unreformed SOEs with similar pre-reformed features of the treatment group. Their regression results show that reformed SOEs benefit more from knowledge spillovers derived from non-SOEs than their unreformed counterparts in terms of both economic (i.e., labour productivity, TFP and output) and financial (i.e., leverage ratio) performance. Such conclusions remain robust even four years after the reform took place. To gauge the impact of the institutional landscape, the authors divide cities into two groups based on the level of marketization and economic liberalization (measured by the share of non-SOEs' output). The additional regression results show that non-SOEs' knowledge spillovers have a greater impact on reformed SOEs (in comparison with unreformed SOEs) in cities with a higher level of marketization and economic liberalization. However, the difference between the impacts of SOEs' knowledge spillovers on reformed and unreformed SOEs is smaller or insignificant in general.

The third paper, by Huang and Zhang (2019, in this issue), studies how the spatial spillovers from inward and outward foreign direct investment (FDI) affect the innovation activities of domestic firms in China's Shandong province. Inward FDI flows started in China in the form of joint ventures in 1979. As explained by Branstetter and Nicholas (2008), China's increasing openness to inward FDI not only helps stimulate the competition in domestic markets but also allows domestic workers to be trained in foreign technology and management practices, which facilitates knowledge spillovers between domestic markets and advanced economies. Chinese outward FDI also began to develop in the late 1970s. Initially, these outward FDI activities were mainly conducted by centrally controlled SOEs and largely motivated by the government's political interest. However, after the 1980s, the primary focus of outward FDI switched from political to economic (Cai, 1999). The Going Global Strategy initiated by the Chinese government in 1999 further promoted outbound investment by domestic firms. The connection between FDI and knowledge spillovers has already been established in the FDI literature, but this paper provides firm-level evidence from a large-scale panel data set and examines the spillover impacts of both inward and outward FDI using a spatial dynamic panel model. The firm-level data come from China's Annual Survey of Industrial Firms, and the outward FDI data come from the Chinese Ministry of Commerce. The authors use organization codes and firm names to merge these two data sets. The spillover variable of inward FDI is constructed as the weighted average (using an inverse distance matrix) of the employment shares of inward FDI firms. The authors also use sales and total assets to construct alternative spillover variables. The construction of the spillover variable of outward FDI follows the same method based on outward FDI firms. Their regression results show that both inward and outward FDI can significantly stimulate the R&D activities of domestic firms, and the spillover effect from outward FDI is stronger than that from inward FDI. Furthermore, outward FDI can help stimulate domestic firms to produce new products, but the spillover effect of inward FDI on output innovation activities is either small or cannot be precisely measured.

In summary, this special issue contributes to a better understanding of the channels for transferring knowledge and innovation spillovers in China and how this compares with other countries and differs by type of firm and type of investment. It is clear that knowledge spillovers dominate technical diffusion as a transfer channel both at the global level between countries and between regions in China. Besides insight into the relative importance of the transmission channel, the type of firm is also of importance. The results show that the impact of non-SOEs is greater than of SOEs. An interesting finding is that the spillover effects of Chinese investments abroad (outward FDI) are stronger on innovation and the production of new products than foreign investments in China. Institutions are also relevant: the removal of China's *hukou* system, less local protectionism and higher levels of marketization and economic liberalization go together with greater impact of knowledge spillovers.

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