Trends and Determinants of China's Industrial Agglomeration

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First submission: September 2006
First resubmission: November 2007
Second resubmission: October 2008

Abstract: This paper investigates trends and determinants of the geographic concentration of China's manufacturing industries using large firm-level data for the period of 1998 to 2005. It is found that the extent of industrial agglomeration in China, measured by the Ellison-Glaeser index, has increased steadily throughout the sample period, though it is still much lower than those of selected developed countries such as France, United Kingdom, and the United States. It is also found that local protectionism among China's various regions obstructs the process of geographic concentration of manufacturing industries, and this result is robust to the use of instrumental variable estimation for dealing with possible reverse causality and omitted variable problems and to the control for traditional determinants of industrial agglomeration such as Marshallian externalities, resource endowments and scale economies.

Keywords: Local protectionism, industrial agglomeration, China's manufacturing industries, Marshallian externalities, resource endowments, and scale economies
JEL classification codes: L11, R12, R30.

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* We thank Editor Jan Brueckner and two anonymous referees for insightful comments and suggestions. Jiangyong Lu acknowledges financial support from National Natural Science Foundation of China (70703017). Zhigang Tao acknowledges financial support from the University of Hong Kong and Hong Kong Research Grants Council.

1. Introduction

Since China initiated its economic reform in 1978, it has undergone dramatic transformations from a centrally planned economy to a market economy. Along with this process, there have been significant changes in the geography of China's economic activities. Before 1978, almost every major economic activity, including its location choice, was centrally planned, and those plans were not necessarily drawn according to market forces but rather influenced by political considerations. For example, in the late 1960s, there was a drive to relocate production of key industrial products from coastal areas to interior provinces in preparation for possible wars with neighboring countries and regions. With the economic reform, it is expected that the market forces for industrial agglomeration should have redressed some of the poor location choices of economic activities caused by the central planning and played an important role in determining China's new economic geography.

However, both anecdotal evidence and statistical analysis suggest that the same economic reform in China has led to the rise of local protectionism among China's various regions, which in turn slows down the process of market-driven industrial agglomeration.[1] Before 1980, all revenues collected by the local governments were handed over to the central government, and local expenditures were then budgeted by the central government. There was weak correlation between revenues collected and expenditures budgeted (Jin, Qian and Weingast [29]). Hence there was little incentive for local governments to pursue economic development. From 1980 to 1993 the central government experimented with a series of fiscal decentralization policies as a key component of its economic reform, and since 1994 it has adopted a uniform policy of fiscal decentralization across China's various regions (see, for example, Bahl [6]; World Bank [45]; Jin, Qian and Weingast [29]). Under the 1994 fiscal decentralization policy, local governments can keep all the business taxes and income taxes of local enterprises (all enterprises located in its regions except those state-owned enterprises affiliated at the central government level), and 25% of the value added taxes of all enterprises located in its regions. Clearly, the fiscal decentralization policy provides the local governments with strong incentive for

[1] Based on aggregated sectoral data and inter-regional input-output tables, Young [46] and Poncet [36] argue that local protectionism in China grew more and more serious over the 1990s. Meanwhile, Fan and Wei [19] find that both the pattern and the speed of price convergence in China are highly comparable to those measurements in well-developed market economies, providing support for the view of market integration in China. Using industry-level data, Bai, Du, Tao, and Tong [7] show that the degree of industrial agglomeration in China first went down and then climbed up during the period of 1985-1997. Contrasting China's coastal area with its interior for the period of 1985-1994, Fujita and Hu [21] find that China's industrial production showed strong agglomeration toward the coastal area, and that income disparity between the two areas had been increasing.

developing the local economy. But it also leads to local protectionist policies for shielding local firms and industries from regional competition.

The market forces for industrial agglomeration, against the local governments' incentive for protecting local firms and industries, make the study of China's economic geography exciting and challenging. In this paper, using a large data set of China's manufacturing firms for the period of 1998 to 2005 we investigate the trends and determinants of China's industrial agglomeration, with a focus on the impacts of local protectionism on industrial agglomeration.

The data set we use in this paper comes from the Annual Survey of Industrial Firms conducted by China's National Bureau of Statistics for the period of 1998 to 2005. One possible reason for the mixed results in the literature about the trends of China's industrial agglomeration is the use of different data sets. In particular, without firm-level data sets, it is difficult to control for the impacts of industrial structures and provide an accurate measure of China's industrial agglomeration (Ellison and Glaeser [17]). Our firm-level data set allows us to construct the Ellison and Glaeser index of China's industrial agglomeration. We find a consistently increasing time trend of industrial agglomeration in China from 1998 to 2005, in sharp contrast to some of the findings in the literature (Young [46] and Poncet [36]). However, comparisons with the Ellison and Glaeser indices of manufacturing industries in selected developed countries such as France, United Kingdom and United States reveal that the extent of industrial agglomeration in China remains considerably low despite its increasing time trend.

We next investigate the determinants of China's industrial agglomeration, with a focus on the possible impacts of local protectionism in explaining China's low albeit increasing industrial agglomeration. Indeed, a critical condition for industrial agglomeration is the free flow of goods and services across regions without any government interference, but this precondition often breaks down in reality. Local protectionism slows down the process of industrial agglomeration within a country, similar to the adverse impacts of national protectionist policies on international trade and specialization.[2] Despite their importance, studies on the impacts of protectionist policies are quite limited mainly due to the difficulty of measuring protectionism. In

[2] In recent years, research focus has been shifted towards political factors that may facilitate or obstruct the process of geographic concentration of economic activities. For example, Ades and Glaeser [1] show that political instability is associated with urban concentration. Holmes [25] classifies states in the United States as either pro-business or anti-business, and finds that the manufacturing share of total employment increases by about one-third when one crosses the border from an anti-business state into a pro-business state, which suggests that state policies matter in attracting businesses.

this paper, we focus on the incentive of local government officials to protect local firms and industries, and develop an indirect measure of local protectionism – the share of state-owned enterprises in employment (measured at the 3-digit industry level – with a higher share indicating a greater incentive for local protectionism. Ordinary least squares estimation shows that the share of state-owned enterprises in employment has negative and statistically significant impacts on industrial agglomeration.

Our result could be biased due to some reverse causality and omitted variable problems. To address the potential endogeneity problems, we use the share of state-owned enterprises in the number of enterprises in 1985 (also measured at the 3-digit industry level) as an instrument for the share of state-owned enterprises in employment for the period of 1998-2005, and find that our result regarding the negative impacts of local protectionism on industrial agglomeration is robust to instrumental variable estimation. While our focus is on the impacts of local protectionism, we also control for the traditional determinants of industrial agglomeration, including Marshallian externalities (Smith [41] and Marshall [32]), resource endowments (Ohlin [34]), and scale economies (Krugman [31]). Again, our result regarding the negative impacts of local protectionism on industrial agglomeration remains robust to these controls.

There is a large literature on the determinants of industrial agglomeration. Kim [30] and Ellison and Glaeser [18] examine the explanatory power of the resource endowment theory, Audretsh and Feldman [5] look into the importance of knowledge spillovers, Holmes [25] studies the role of input sharing, and Rosenthal and Strange [37] provide a comprehensive test of multiple determinants of agglomeration. See Rosenthal and Strange [39], and Duranton and Puga [16] for excellent surveys of recent empirical and theoretical studies on agglomeration economies. This paper contributes to the literature by focusing on the impacts of local protectionism on industrial agglomeration, and also providing evidence for Marshallian externalities in the setting of a developing economy.

The rest of the paper is organized as follows. In Section 2, we describe our data set, construct the Ellison-Glaeser index of China's industrial agglomeration, examine its time trend, and make comparisons with the indices of industrial agglomeration in France, United Kingdom and United States. In Section 3, we present our econometric analysis on the determinants of China's industrial agglomeration, with a focus on the impacts of local protectionism. We use the instrumental variable estimations to deal with the possible reverse causality and omitted variable problems, and control for the traditional determinants of industrial agglomeration. The paper concludes in Section 4 with some discussion for future work.

2. Trends of China's industrial agglomeration

2.1. Data

The main data set for this study comes from the Annual Survey of Industrial Firms (ASIF) conducted by China's National Bureau of Statistics for the period of 1998 to 2005. The survey covered all state-owned enterprises and those non-state-owned enterprises[3] with annual sales of five million Renminbi[4] or more in the following three categories of industries: (1) mining, (2) manufacturing, and (3) production and distribution of electricity, gas and water. Table 1a shows the number of enterprises covered in the survey throughout the sample period: it ranges from 161,000 to 270,000. The location choice of enterprises in the first and third categories is heavily influenced by the regional disparities in resource endowments. We thus focus on the sub-sample of manufacturing firms with the goal of investigating the trends and determinants of industrial agglomeration. As shown in Table 1a, the number of manufacturing firms covered in the sample ranges from 146,000 to 251,000. There is a clear upward time trend, mainly because manufacturing firms in China have been growing rapidly over the sample period with more and more firms having annual sales of five million Renminbi or more. It is also because the year 2004 was an industry census year, meaning there was more comprehensive survey coverage in that year, which may explain the jump from 2003 to 2004 in the number of enterprises and the slight decrease from 2004 to 2005. Following the literature (Ellison and Glaeser [17]; Rosenthal and Strange [37]), employment figures will be used to measure geographic concentration of manufacturing activities. As a result, those observations with missing or zero employment figures are deleted, resulting in a loss of less than 5% of the data (see Table 1a for details).

There are two drawbacks with the Annual Survey of Industrial Firms dataset. First, it does not cover small non-state-owned enterprises with annual sales less than five million Renminbi. The estimation of industrial agglomeration could be biased, if the

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[3] According to the classifications of China's National Bureau of Statistics, non-state-owned enterprises include three types of enterprises: collectively-owned enterprises (such as township and village enterprises), China's indigenous privately-owned enterprises, and foreign multinationals operating in China.

[4] It is equivalent to US$735,300 at the exchange rate of 1 US$ to 6.8 Renmimbi in October 2008.

distribution of small non-state-owned enterprises varies across regions.[5] Second, the Annual Survey of Industrial Firms data are firm-level data, not plant-level data typically used in the literature. Multi-plant firms have become more and more common since China initiated its economic reform in 1978, and it may affect the analysis of industrial agglomeration if this phenomenon varies from region to region.[6]

Industry census data sets would be ideal in terms of comprehensiveness in coverage of enterprises, even though they are still firm-level data sets. Nonetheless the industrial census data of 1995, the latest year of which the data is made available, suffers from poor data quality. The number of enterprises shrinks from 750,000 to 119,790 after the deletion of firms with missing values in total sales, number of employees, or fixed capital (Pan and Zhang [35]).[7] Thus in this study we use the data set of Annual Survey of Industrial Firms. One possible direction for our future research is to use plant-level datasets and test the robustness of our results obtained with the firm-level datasets.

Information on firm location is essential for studies of economic geography. For each firm in the ASIF data set, there is information on its address and the name of county, city and province where it is located. The existing studies show that the choice of geographic scope may affect the measure of industrial agglomeration – the so-called border effects. More recently, there are several studies using ZIP code as the basic geographic unit or even using precise location data to minimize the border effects (Rosenthal and Strange [38]; Duranton and Overman [15]). However, the focus of this study is to examine the impacts of local protectionist policies on industrial agglomeration. Hence, the ideal geographic scopes for this study are the ones corresponding to the administrative areas where local government officials can have policies influencing inter-regional trade and industrial agglomeration. For this reason, county will be treated as the most disaggregated geographic scope, followed by city and province.

Along with China's spectacular economic growth, its administrative boundaries and consequently codes of counties, cities or even provinces have experienced significant

[5] It is generally agreed that, in choosing production locations, non-state-owned enterprises are more likely to be led by market forces than state-owned enterprises. The absence of small non-state-owned firms in the ASIF data implies that our analysis may under-estimate the extent of China's industrial agglomeration.
[6] For manufacturing firms, firm location is generally the location for production, though there could be multiple locations for production.
[7] Since 1998, however, a direct reporting system has been adopted by China's National Bureau of Statistics, which has ensured the quality of statistical data (Holz [27]; Holz and Lin [28]). The 1998-2005 ASIF data is thus of much better quality than the 1995 census data.

changes in the last thirty years. For example, new counties could be established, while existing counties could be combined into larger ones or even elevated to cities. From 1998 to 2005, the number of counties in China increased from 2,496 to 2,862 (a total of 366), while the number of changes in county codes was 648. As firms may not be aware of the changes in the county codes, they may misreport in the annual surveys of industrial firms. Furthermore, even if the county codes reported are accurate, they may not be comparable across years. To address these problems, we first check the accuracy of the county codes based on firms' reported addresses. Next, using the 1999 National Standard (promulgated at the end of 1998 and named GB/T 2260-1999) as the benchmark classification system of county codes, we convert the county codes of all firms of 1999-2005 to that benchmark system.

Aside from firm location, we also need information on firms' primary industry codes in order to conduct a study of China's industry agglomeration. For each firm in the ASIF data set, there is information on its primary 2-digit, 3-digit, and 4-digit industry codes. However, in 2003, a new classification system for industry codes (named GB/T 4754-2002) was adopted to replace the old classification system (named GB/T 4754-1994) that had been used from 1995 to 2002. To make the industry codes in the whole sample period (1998-2005) consistent, we convert the industry codes in the 2003-2005 data to the old classification system by using a concordance table (in the case of a new 4-digit code corresponding to an old 4-digit code, or several new 4-digit codes corresponding to an old 4-digit code) or by assigning a new code with an old code based on product information (in the case of several old 4-digit codes corresponding to a new 4-digit code). Industrial agglomeration will then be measured at the 4-digit industry level, followed by 3-digit and 2-digit industry levels with increasing industrial scope.

Tables 1b and 1c give the number of firms by industry and year and the size of employment by industry and year, respectively. The first column of both tables is the list of two-digit manufacturing industries covered in the survey, which are comparable to those of the Standard Industrial Classification codes. There is a general trend of relative decline in the first half of the sample period (1998-2001), especially in terms of the number of firms, presumably due to the negative impacts of the 1998 Asian Financial Crisis, and then a trend of robust growth in the remaining sample period. All but three industries have seen an increase in the number of firms, but about half of the industries have witnessed an increase in the size of employment. These results suggest increasing competition (more and smaller firms) in China's manufacturing industries during the sample period.

2.2. Measuring China's industrial agglomeration

Most existing studies of China's industrial agglomeration rely on highly aggregated data in terms of both industrial and geographic scopes. However, measures based on the aggregated data may fail to give an accurate picture of China's industrial agglomeration. For example, the car manufacturing industry and the bicycle manufacturing industry are two 4-digit industries of the same 2-digit transport industry, but they have different characteristics and exhibit different spatial patterns. Industrial agglomeration measured at the 2-digit industry level could then be misleading. Similarly, industrial agglomeration could be high when measured at the aggregated regional levels, but low at the disaggregated regional levels, causing the so-called modifiable area unit problem (Arbia [3]). We deal with these problems by measuring industrial agglomeration at various industrial scopes (from 4-digit level to 3-digit level and then to 2-digit level) and geographic scopes (county, city and province) (Rosenthal and Strange [37]; Devereux, Griffith and Simpson [11]).

All existing studies of China's industrial agglomeration use the measurement of either the Gini or the Hoover index. However, as Ellison and Glaeser [17] point out, those coefficients do not take into account the impacts of industrial structure and may fail to give an accurate measure of industrial agglomeration. To address the problem, Ellison and Glaeser [17] construct a model-based index of geographic concentration (called the EG index or γ index) which takes a value of zero if employment (or output) is only as concentrated as it would be had the plants in the industry chosen locations randomly by throwing darts at a map. The γ index takes the following form:

$$\gamma_i \equiv \frac{G_i - \left(1 - \sum_r x_r^2\right) H_i}{\left(1 - \sum_r x_r^2\right)(1 - H_i)}.$$

$G_i \equiv \sum_r (x_r - s_r)^2$ is the spatial Gini coefficient, where x_r is the share of total employment or output of all industries in region r and s_r is the share of employment or output for region r in industry i. $H_i \equiv \sum_i z_i^2$ is the Herfindahl index of industry i, with z_i standing for the output share of a particular firm in industry i. The Gini coefficient is expected to be larger in industries consisting of fewer and larger firms, even if locations were chosen completely at random (Dumais, Ellison and Glaeser

[14]). The Ellison-Glaeser index is essentially the difference between the Gini coefficient and the Herfindahl index, measuring the degree of industrial agglomeration that is beyond the level implied by the industrial structures.

The compilation of the Ellison-Glaeser index requires the use of firm-level data of employment or output. With the ASIF firm-level data set, this paper represents the first attempt to measure China's industrial agglomeration using the Ellison-Glaeser index.[8] In principle, both employment data and output data can be used to calculate EG index. Employment data is preferred to output data in the existing studies, as measurement using the output data may compound the impact of employment with that of capital.

2.3. Agglomeration of China's Manufacturing Industries

The Ellison-Glaeser indices of China's manufacturing industries are calculated at various geographic scopes (province, city and county) and industrial scopes (2-, 3-, and 4-digit industries). Weighted means (by employment) of γ_i indices across industries for each year of the sample period are given in Table 2a. Several interesting patterns can be found. First, similar to the findings of Rosenthal and Strange [38], the average level of agglomeration increases as one goes from 2 to 3-digit industries and from 3 to 4-digit industries, and it is also true as the geographic scope goes from county to city and from city to province.[9] Second, the γ_i indices for all possible combinations of industrial and geographic scopes have increased during the sample period of 1998-2005, which suggests increasing geographic concentration in China's manufacturing industries. These results are in contrast to the findings obtained using aggregate data by Young [46] that industrial agglomeration has decreased throughout China's economic reform.

Table 2b reports the EG index (γ_i), the corresponding Gini index (G_i), and the Herfindahl index (H_i) calculated at the county level for all the 2-digit industries throughout the sample period.[10] Between 1998 and 2005, all but one industry (garments & other fiber products) had increasing γ indices.[11] Electronic &

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[8] Using the EG index, Alecke, Alsleben, Scharr, and Untiedt [2], Devereux, Griffith and Simpson [11], Maurel and Sedillot [33], and Rosenthal and Strange [37] study spatial agglomeration of manufacturing industries in Germany, the U.K., France, and the U.S., respectively.

[9] See Rosenthal and Strange [37] for discussion of possible reasons behind the patterns.

[10] We choose the combination (2-digit industry level and county level) that gives the lowest EG index.

[11] Among 171 3-digit industries, 145 industries have increasing γ_i from 1998 to 2005; among 540

telecommunications had the biggest absolute increase in the γ index, followed by furniture manufacturing, and leather, furs, down & related products. Based on the γ indices of 2005, the three most geographically aggregated industries are stationery, educational & sports goods, electronic & telecommunications, and leather, furs, down & related products, while the three least geographically aggregated industries are metal products, papermaking & paper products, and printing & record pressing.

The EG index (γ_i) is in essence the difference between the Gini index (G_i) and the Herfindahl index (H_i), measuring the extent of geographic concentration that is beyond the level implied by the industrial structures. It is thus possible that industries with high Gini indices may have low EG indices, whereas industries with low Gini indices may have high EG indices. As shown in Table 2b, in 2005, tobacco processing ranked 20th among all industries in the EG index despite the fact its Gini index was the 3rd highest. It turns out that much of the industry's high Gini coefficient was due to its highly concentrated industrial structure (the highest Herfindahl index among all industries). A counter-example is nonmetal mineral products, which ranked 16th in the EG index despite the fact its Gini coefficient ranked 22nd of all industries in 2005. This is because much of the industry's low Gini coefficient was caused by its fragmented industrial structure (the lowest Herfindahl index among all 2-digit industries). Compared with the existing studies about China's industrial agglomeration, ours is the only one that takes into account the impacts of industrial structures and arguably provides the most accurate measure of China's industrial agglomeration.

The EG index is designed to facilitate comparison across industries, across countries, and over time. The EG indices for manufacturing industries in the United Kingdom, the United States, and France have been studied by Devereux, Griffith and Simpson [11], Ellison and Glaeser [17], and Maurel and Sedillot [33], respectively, and their main findings are summarized in Table 2c together with ours. Note that these studies are carried out using data of various industrial and geographic scopes, and therefore the results are not directly comparable. The study of the U.S. manufacturing industries by Ellison and Glaeser [17] is the most comparable one to ours, given that similar geographic and industrial scopes are used.[12] Following the definitions of *not very concentrated industries*, *somewhat concentrated industries*, and *very concentrated industries* in Ellison and Glaeser [17], we find that 75.98%, 16.2%, and 7.82% of all

4-digit industries, 404 industries see γ_i increase from 1998 to 2005.

[12] It should be pointed out, however, that our study is conducted at the firm level whereas theirs is at the plant level.

4-digit industries in China can be classified as not very concentrated industries, somewhat concentrated industries, and very concentrated industries, respectively. The corresponding ratios for the United States are 10.00%, 65.00%, and 25.00%. These numbers reveal that the 4-digit manufacturing industries in China are much less concentrated across counties than those of the United States. Similar conclusions can be drawn by comparing the findings of China with those of the United Kingdom and France.

In summary, using firm-level data to compile the Ellison-Glaeser indices, we find an increasing trend of industrial agglomeration in China for the period of 1998-2005. This is in line with and further supports the upward trend found by Bai, Du, Tao and Tong [7] in the latter half of 1985-1997 period. However, China's industrial agglomeration remains lower when compared with those in developed countries such as France, United Kingdom and United States. It is possible that some institutional factors such as local protectionism may interfere with the process of industrial agglomeration in China. In the next section, we shall investigate the determinants of industrial agglomeration in China, with a focus on the impacts of local protectionism.

3. Determinants of China's Industrial Agglomeration

3.1. Local protectionism

Existing studies focus on the market forces for facilitating the process of geographic concentration of economic activities, and identify three determinants of industrial agglomeration: Marshallian externalities, resource endowments, and scale economies. For the effective working of the market forces, however, it is essential to have the free flow of goods or services across regions. This fundamental condition is not readily satisfied though, as witnessed by the protests against global competition and lobbies for protectionist policies accompanying the World Bank and IMF annual meetings. In the case of China, in particular, the fiscal decentralization policy initiated in China's economic reform has given local government officials incentives for protecting local firms and industries as well as for pursuing economic development.

Despite its importance, studies on local protectionism and its adverse impacts on industrial agglomeration are rather limited. This is mainly because it is difficult to quantify protectionist policies of different forms and nature. A protectionist policy could be prohibited sales of locally made materials such as silkworms and tobacco leaves to other provinces, or restrictions on rural-urban labor migration, or preferred lending by local banks to local firms (Young [46]; Au and Henderson [4]; Wong, Lu, Tao, Jiang, Siu, and Sun [44]). It could be blatant blockage of provincial borders prohibiting the entry of goods made elsewhere, or government regulations on the specifications of goods or services that implicitly favor local firms and industries. In less perfect business environments such as those in China, there could be more expropriations of firms from other regions in the form of informal levies and extralegal payments, and there could be court rulings and legal enforcements in favor of local firms (Clarke [10]).

Given the difficulty of constructing direct measures of local protectionism, we instead take an indirect approach by examining what motivates the local governments to protect their local firms and how it may vary across industries. In particular, we need to discuss how China's central-local government relations have evolved after the economic reform initiated in 1978.

Over thousands of years, the Chinese political system has been predominantly characterized by the centralization of political power. The People's Republic of China founded in 1949 has continued this tradition, with the central government having the authority of appointing the leaders of the local governments and exerting absolute administrative control over the local governments. Economically, from 1949 to 1978, China adopted the central-planning economic system, with plans made by the central government and implemented by the local governments. The main actors of the economy -industrial enterprises- were mostly state-owned, and they were controlled by the central and local governments to carry out the detailed work toward fulfilling central plans. All the profits of the industrial enterprises were collected by the local governments and then handed over to the central government, which then allocated budgets back to the local governments as part of the economic plans. Under this system of central planning, there was no obvious correlation between the profits collected and handed over by the local governments to the central government and the budgets they were allocated (Jin, Qian, and Weingast [29]). Consequently, there was little material incentive for the local governments to pursue economic development. Similarly, the industrial enterprises were deprived of any material incentives, and were extremely inefficient. By 1978, the Chinese economy was in a precarious state, desperate for the introduction of market incentives and economic reforms.

Since 1978, state-owned enterprises have been able to retain some of their profits after paying various types of taxes. Non-state-owned enterprises including foreign-invested firms and China's indigenous private firms have been allowed to emerge and develop. Along with the enterprise reform, there have been changes in the relations between China's central government and local governments. While the central government still keeps the authority of appointing the leaders of local governments, it has introduced fiscal decentralization policies under which local governments can share taxes of firms located in their regions with the central government, and also consulted more with the local people for the appointment and promotion of local government officials. This change in the central-local government relation is referred to as Chinese-style federalism, specifically, political centralization with economic decentralization.

From 1980 to 1993, the central government experimented with several fiscal decentralization policies in various regions of China. The key component of the fiscal decentralization policies was the marginal rate for the sharing of various taxes between the central and local governments. In an effort to jumpstart the incentive of local governments for pursuing local economic development, the central government initially offered very generous sharing rules to the local governments, with the marginal rates being 100% for fifteen economically backward provinces and lower than 100% for the remaining fourteen economically more developed provinces (Wang [43]). After experimenting for almost fourteen years (from 1980 to 1993), the central government rolled out a uniform fiscal decentralization policy across all regions in China, which has been used since then. Under the 1994 fiscal decentralization policy, there are taxes collected and kept entirely by the central government (central taxes), taxes collected and kept entirely by the local governments (local taxes), and taxes shared between the central and local governments (shared taxes). Specifically, local governments have the income taxes and business taxes of local enterprises (i.e., all enterprises located in its regions except those state-owned enterprises affiliated at the central government level), and 25% of the value-added taxes of all enterprises located in its regions. Compared with the policies of 1980-1993, some provinces have benefited from having higher marginal rates than before, while other provinces have had lower marginal rates than before (Wang [43]). The central government has managed to increase the ratio of central budgetary revenue in total revenue (World Bank [45]). Nonetheless, compared with the pre-1980 fiscal arrangement between the central and local governments, local governments have definitely enjoyed higher shares of the taxes of firms located in its regions, and hence have greater incentives for developing the local economy.[13]

[13] The correlation between provincial budgetary expenditure and provincial budgetary revenue increased from 17.2% for the period of 1970-1979 to 99.8% for the period of 1995-1999 (Jin, Qian and Weingast [29]).

The fiscal decentralization policy is, however, a double-edged sword, as it also leads to protectionist policies by the local governments favoring their local firms and shielding them from regional competition, thereby offsetting market forces for industrial agglomeration and hindering the process of geographic concentration of economic activities.

In protecting inefficient local firms from regional competition, local governments are particularly favorable to those state-owned enterprises. This is because government officials can get more private benefits from state-owned enterprises than from other types of enterprises. As shown by Shleifer and Vishny [40], it is easier for local government officials to have state-owned enterprises create job opportunities and hire more local people than bribing private firms to do the same things. With more job opportunities for local people, it is easier for local government officials to have reappointment or even promotion, as the central government is increasingly reliant on the opinion of local people for these decisions. Compared with other formerly socialist economies, there is an even more compelling reason for protecting inefficient state-owned enterprises in China. This is because China has adopted a regulatory state for its transition from to a market economy, with a high degree of government versus the market in the economy (Du, Lu and Tao [12]). In particular, due to the inefficient social security system, China's state-owned enterprises have been used for absorbing surplus labor and maintaining social stability (Bai, Li, Tao, and Wang [8]; Bai, Lu and Tao [8]).

For the same reasons stated above, local governments give favors to state-owned enterprises when nurturing local firms to engage in new industries or to compete against firms from other provinces in some highly profitable industries. Indeed much of China's overcapacity in industrial production is due to the mushrooming of state-owned enterprises into any promising and highly profitable industries. Favors could be in the forms of faster business registration, better infrastructural support, more policy loans by local and often state-owned financial institutions, and guaranteed government purchases of goods or services. Taken together, local governments are expected to have more protectionist policies in those local industries with higher shares of state-owned enterprises. We thus construct a variable – *Share of State-Owned Enterprises in Employment* – defined as the employment offered by state-owned enterprises and weighted by the percentage of state-ownership in those enterprises in the industrial total – for each three-digit industry. Definition and summary statistics of this variable is shown in Table 3, and its correlation with other variables (to be introduced below) is shown in Table 4. We expect that this variable –a proxy for the incentive of local governments for practicing local protectionist policies – have negative impacts on industrial agglomeration.

We start by pooling all observations (firms and years), and run ordinary least square regressions examining the correlation between the Ellison-Glaeser index of industrial agglomeration and the share of state-owned enterprises in employment, both of which are measured at the three-digit industry level. The results of the pooled cross-sectional regressions at the county level, city level, and province level are reported in columns 1 to 3 of Table 5 respectively. *Share of State-Owned Enterprises in Employment* is found to have negative and statistically significant coefficients at all three geographic scopes (county, city and province).

Next we carry out fixed-effect estimations as a way of controlling for time-invariant unobservable variables, with the results summarized in columns 4-6 corresponding to the three geographic scopes (county, city and province). The estimated coefficients of *Share of State-Owned Enterprises in Employment* become statistically insignificant though still negative as predicted. It is possible, given our dataset of China's manufacturing firms is only for a period of eight years (1998-2005), that the lack of changes may cause the insignificant results.

In columns 7-9, we report the estimation results where the dependent variable is the change in the EG index of industrial agglomeration between 1998 and 2005 and the independent variable is the change in the *Share of State-Owned Enterprises in Employment* between 1998 and 2005. The change in the *Share of State-Owned Enterprises in Employment* has negative and statistically significant coefficients at all three geographic scopes.

The above results imply that local governments have stronger incentives to protect those industries with higher shares of state-owned enterprises. The negative and statistically significant impacts of local protectionism on industrial agglomeration may offer a partial explanation as to why China's industrial agglomeration remains low compared with those of developed countries such as France, United Kingdom and United States.

3.2. Robustness checks

Instrumental variable estimations

The ordinary least squares estimation results reported in Table 5 regarding the impacts of local protectionism on industrial agglomeration could be biased due to some reverse causality and omitted variable problems. For example, it is possible that in industries with lower degrees of agglomeration, firms are more evenly distributed across China's regions and they have lobbying activities in more regions of China, which could result in more serious local protectionism in the industries. Meanwhile, industrial agglomeration and local protectionism could be endogenously affected by some common factors which have not been controlled for.

To deal with these potential endogeneity issues, we take the instrumental variable approach as a robustness check. Following the literature (for example, Au and Henderson [4]), we use a variable measuring the legacies of China's early-reform period – the share of state-owned enterprises in the total number of enterprises in 1985 (also calculated at the 3-digit industry level) – as the instrumental variable for the share of state-owned enterprises in employment for the period of 1998-2005.[14] The data used for constructing the instrumental variable comes from the Industrial Census of 1985 available from China's National Bureau of Statistics. The scope of manufacturing activities in 1985 is quite different from that of 1998-2005, because China has had fast economic growth on the one hand and dramatic changes in the technological landscape on the other. To ensure consistency, we restrict our instrumental variable estimation to the subsample of 3-digit industries of 1998 to 2005 that have identical industry names as those in 1985 (eighty-eight out of 160 3-digit industries), which results in some reduction in the sample size and may affect the statistical significance of the estimation results.

Table 6 summarizes the results of the instrumental variable estimations. In columns 1-3, we pool all observations (eighty-eight industries over eight years) at three different geographic scopes. In columns 4-6, we restrict our analysis to the observations of 2005 – the last year of the sample – with eighty-eight industries at the three geographic scopes. In columns 7-9, we look at the change on the EG index between 1998 and 2005 also at the three geographic scopes. Panel A of Table 6 reports the results of the second-stage estimations. As in Table 5, the share of state-owned enterprises in employment has negative and mostly statistically significant impacts on

[14] As we use only one instrumental variable for one potentially endogenous variable, there is no concern of over identification.

industrial agglomeration in the pooled sample. For the subsample of observations in 2005, the estimated coefficients are negative but not statistically significant, presumably because of the reduction in sample size on the one hand and the lack of variations in the one-year observations on the other hand. Similar to our ordinary least squares estimation results, the change in the share of state-owned enterprises in employment between 1998 and 2005 also has negative and mostly statistically significant impacts on the change in the industrial agglomeration between 1998 and 2005.

The validity of our instrumental variable estimations hinges upon the satisfaction of the relevance condition and the exclusion restriction. The relevance condition is confirmed by the highly significant correlation between the instrumental variable and the share of state-owned enterprises in employment (the results of the first-stage estimations as reported in Panel B of Table 6),[15] and the significant results of the Anderson canonical correlation LR statistic (Panel C of Table 6). Meanwhile, the concern for weak instrument is ruled out by the result of the Cragg-Donald F-statistic (also reported in Panel C of Table 6).[16]

With regard to the exclusion restriction (i.e., the instrumental variable does not affect industrial agglomeration through channels other than the share of state-owned enterprises in employment), it can be argued that the instrumental variable is measured by data in the early-reform period of China, and it is not expected to affect industrial agglomeration through (observable or unobservable) variables of 1998-2005 other than the share of state-owned enterprises in employment. Nonetheless, we carry out two tests related to the exclusion restriction. First, if the instrumental variable affects the industrial agglomeration through channels other than the share of state-owned enterprises in employment, then the residues from the second-stage estimations should be correlated with the instrumental variable. Panel D of Table 6 reports the regression results of the residues of the second-stage estimations on the instrumental variable. Clearly the correlation between the two is close to zero in magnitude and statistically insignificant. Second, if the instrumental variable affects industrial agglomeration only through the share of state-owned enterprises in employment, then it should not have significant impacts on industrial agglomeration

[15] The lowest Shea partial R-square of the first stage regression (the one for the EG index of 2005) is 0.21, implying that the share of state-owned enterprises in the total number of enterprises decided by planners in 1985 still has a good explanatory power of the share of state-owned enterprises in employment twenty years later. Compared with the Shea partial R-square for the whole period of 1998-2005 (0.29), however, it is clear that the instrumental variable was losing relevance over time.

[16] The Cragg-Donald F-statistic values for our regressions are significantly above the value of 10, which is considered as the critical value by Staiger and Stock [42].

conditional on the share of state-owned enterprises in employment. Indeed Panel E of Table 6 shows that the coefficients of the instrumental variables do become insignificant in all estimations when it is used together with the share of state-owned enterprises in employment as an independent variable.

In summary, our ordinary least squares results are robust to the use of the instrumental variable estimations, suggesting that local protectionism has causal and negative impacts on the extent of industrial agglomeration.

Control for omitted variables

While the focus of our analysis is about the impacts of local protectionism on industrial agglomeration, it is also important to control for the traditional determinants of industrial agglomeration discussed in the literature. As a robustness check for our ordinary least squares estimation results, we develop proxies for the traditional determinants of Marshallian externalities, resource endowments, and scale economies, and include them in the regression analysis.

Marshall [32] identifies three specific channels of externalities (i.e., knowledge spillovers, labor market pooling, and input sharing) that may contribute to the process of industrial agglomeration. A commonly used proxy for the importance of knowledge spillovers is the proportion of R&D expenditure in total sales. However, as Feldman, Feller, Bercovitz and Burton [20] argue, formal R&D expenditure data ignore the complex process of technological accumulation and do not take into account R&D output performance. As a result, more comprehensive and outcome-based proxies of knowledge spillovers, such as innovation (Audretsch and Feldman [5]; Rosenthal and Strange [38]) are used. We use another comprehensive and outcome-based proxy of knowledge spillovers – *new products to output ratio*. In the ASIF database, output of new products is reported, and the variable *new products to output ratio* can be readily constructed.[17] We expect *new products to output ratio* to have a positive effect on industrial agglomeration.

It is argued that abundant supply of specialized inputs could lead to geographic concentration of downstream firms (Marshall [32]). Indeed Holmes [26] finds a

[17] A product is identified as a new product by China's National Bureau of Statistics only if it is produced for the first time at least within a province. It is possible that some of these new products may reflect local catch-up effort in copying new products from other regions or countries. To a large extent, a significant percentage of innovation in the developing countries such as China is in essence imitation. However, this still represents a step forward in product development.

positive correlation between localization of industries and their degrees of vertical disintegration (i.e., input sharing). In this paper, following Holmes [26], we construct a variable called *purchased-inputs intensity* – defined as the ratio of purchased-inputs including raw materials to total output – to proxy for the degree of vertical disintegration or input sharing and expect it to have a positive effect on industrial agglomeration.

In searching for proxies for the importance of labor market pooling in an industry, the third channel of Marshallian externalities, we need to identify industry characteristics that are related to the specialization of the industry's labor force. Rosenthal and Strange [37] employ three proxies: labor productivity, the percentage of management staff in the total employment, and the percentage of workers with doctorate, master, and bachelor's degrees. Unfortunately, the ASIF data does not contain any information on the education level of employees, and it does not separate employees into management staff and production workers either. To construct a proxy for the importance of labor market pooling, it is assumed that the wage level is commensurate with the skill level required in competitive industries. We define *wage premium* of an industry as the regional wage premium of an industry over the average wage in that region, averaged over all regions and weighted by the industry's employment shares in those regions.[18] The higher the wage premium of an industry, the higher the skill level required in the concerned industry, which then implies a greater need for labor market pooling and more inclination for geographic concentration. Thus, we expect *wage premium* to have a positive effect on industrial agglomeration.

It has been argued that geographic concentration is more significant in industries exhibiting greater scale economies (Krugman [31]). In principle, however, there is no need for us to consider the effects of scale economies, as the Ellison and Glaeser index measures industrial agglomeration beyond what is implied by industrial structures including the extent of scale economies. Indeed, for this reason, Dumais, Ellison and Glaeser [13] and Rosenthal and Strange [37] do not include any proxy of scale economies in their empirical studies of industrial agglomeration. Recently, Alecke, Alsleben, Scharr, and Untiedt [2] argue that the EG index is still affected by the size of an industry indirectly and in a non-linear fashion through the Herfindahl index, and they find significant effects of scale economies on industrial agglomeration even with the use of the EG index. In this paper, we construct *average firm size* –

[18] In calculating the wage premium, the wage levels at non-state-owned enterprises are used. It is because, unlike state-owned enterprises (Gordon, Bai and Li [23]), non-state-owned enterprises are not shielded from market competition and they set wage levels according to market forces.

defined as the total output of an industry divided by the number of firms in the industry – as a proxy of scale economies and check if scale economies still matter with the EG index used as a measure of industrial agglomeration.

It is possible that variations of *average firm size* across industries may reflect differences in capital intensity. To the extent that high capital intensity is caused by the presence of high fixed costs, which imply scale economies, then *average firm size* is a good proxy for the extent of scale economies. It is also possible that variations of *average firm size* across industries are due to the differences in the degree of state control. Indeed, despite thirty years of economic reform, some of China's manufacturing industries are still monopolized by a few state-owned enterprises, in which case the average firm size is not really a proxy for the scale economies.[19]

Finally, variations in resource endowments across regions are traditionally considered to be an important determinant of agglomeration (Ellison and Glaeser [17]; Kim [30]). To control for the impacts of resource endowments, we construct two proxies regarding the intensity of resource usage from the 1997 Input-Output table,[20] namely, *agricultural products usage ratio* and *mining products usage ratio*. Agricultural products usage ratio is the total share of inputs from agricultural sectors, which include crop cultivation, forestry, livestock and livestock products, and other agricultural products. Mining products usage ratio is the total share of inputs from mining sectors, which include coal mining and processing, crude petroleum products, natural gas products, ferrous ore mining, non-ferrous ore mining, salt mining, non-metal minerals and other mining, and logging and transport of timber and bamboo. It should be pointed out, however, that the underlying assumption of relatively immobile resources for the resource-endowment theory may become less valid today than it used to be because transportation costs have declined dramatically in recent decades.[21]

We summarize definitions and summary statistics of the above variables in Table 3. Correlations between the dependent variable and independent variables are provided in Table 4.

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[19] We find that average firm size of state-owned enterprises was indeed larger than that of non-state-owned enterprises, though the difference was only statistically significant in 2003 and 2005.
[20] China's 1997 input-output table was constructed based on flows among 124 sectors, the classification of which lies between the 2-digit and 3-digit industrial classifications. A concordance table of the 124 sectors with the 3-digit industries is used, which explains why the regression analysis is carried out at the 3-digit industry level.
[21] For example, Glaeser and Kohlhase [22] show that costs of moving goods declined by over 90% in real terms during the twentieth century.

We include the above proxies for the traditional determinants of industrial agglomeration (new product to output ratio, purchased-inputs intensity, wage premium, average firm size, agricultural products usage ratio and mining products usage ratio) in the ordinary least squares estimation along with the proxy for local protectionism.[22] As shown in Table 7, the share of state-owned enterprises in employment still has negative and statistically significant impacts on industrial agglomeration in both the pooled regressions and the 1998-2005 difference regressions, suggesting that our ordinary least squares estimation results of Table 5 are robust to the inclusion of the control variables for the traditional determinants of industrial agglomeration.

Estimation results for the traditional determinants of industrial agglomeration are largely consistent with the findings in the existing literature. In the pooled regressions, the coefficients of *new products to output ratio* are positive and statistically significant at all three geographic scopes, supporting the important role of knowledge spillovers in industrial agglomeration. Similarly the coefficients of *purchased-inputs intensity* are positive and statistically significant at all three geographic scopes, confirming the possibility that input sharing could be a contributing factor to localization (Holmes [26]). The coefficients of *wage premium* corresponding to the three different geographic scopes are all positive, but only one of them (the one at the city level) is statistically significant, lending some support to the role of labor pooling in industrial agglomeration.[23] The coefficients of *average firm size* are positive and statistically significant at all three geographic scopes, suggesting that it is still necessary to control for the scale economies even when the EG index is used as an indicator of agglomeration. Meanwhile, both *agricultural products usage ratio* and *mining products usage ratio* have positive and mostly statistically significant coefficients, implying that regional variations in resource endowments do matter in determining the patterns of industrial agglomeration in China's manufacturing industries.[24]

In the fixed effect estimations (columns 4-6 of Table 7), wage premium and purchased

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[22] It is highly likely that these proxies for the traditional determinants of industrial agglomeration are endogenously determined (Hanson [24], and Rosenthal and Strange [37]). Due to the difficulty of finding separable and distinct instrumental variables for all these proxies in addition to that of local protectionism, we simply include them in the ordinary least squares estimation. This estimation strategy is, however, reasonable given our focus on the impacts of local protectionism.

[23] One possibility is that the proxy for labor market pooling used in this paper – wage premium – is not the most ideal as compared with those used in the literature (Rosenthal and Strange [37]).

[24] This result could be interpreted as showing that transportation costs remain significant in China and as a result resources are relatively immobile. It could also be interpreted as demonstrating that local governments have protectionist policies on the sales of locally endowed resources and nurture industries with intensive usage of these resources.

inputs intensity continue to have positive and statistically significant impacts on industrial agglomeration, while the results for the third channel of Marshallian externalities (new product to output ratio) become much weaker than before. Both agricultural products usage ratio and mining products usage ratio drop out of the regressions as they are measured using the data from the 1997 input and output table and experience no change in the sample period. The impacts of average firm size become much weaker, in line with the predictions of Ellison and Glaeser [17]. In regressions of the changes in industrial agglomeration between 1998 and 2005 on those of the independent variables, only the change in purchased inputs intensity and new product to output ratio manage to have statistically significant impacts.

In summary, our results on the impacts of local protectionism are robust to the controls for traditional determinants of industrial agglomeration. Furthermore we find strong evidence supporting the role of Marshallian externalities in facilitating industrial agglomeration in China.

4. Conclusions

This paper examines the trends and determinants of China's industrial agglomeration using a large firm-level data set for the period of 1998-2005. We first compute the measure of industrial agglomeration developed by Ellison and Glaeser [17]. Our results show that industrial agglomeration in China increased consistently between 1998 and 2005. The increasing trend is robust in all combinations of industrial and geographic scopes, in contrast to the results of earlier studies such as Young [46] and Poncet [36]. Comparing with developed countries such as France, United Kingdom and United States, however, we find that China's industrial agglomeration remains considerably lower.

Next we investigate the determinants of China's industrial agglomeration with a focus on local protectionism. It is found that industrial agglomeration is lower in industries with higher shares of state-owned enterprises in employment, suggesting a role of local protectionism among China's various regions in obstructing the process of geographic concentration of manufacturing industries. This result is robust to the use of instrumental variable estimation for controlling for possible reverse causality and omitted variable problems. It is also robust to the inclusion of proxies for the traditional determinants of industrial agglomeration such as Marshallian externalities, resource endowments, and scale economies. Meanwhile, there is strong evidence supporting the positive role of Marshallian externalities in contributing to China's industrial agglomeration.

Industrial agglomeration has been considered a source of sustainable competitive advantages for a national or regional economy. It has been studied extensively by economists dating back to Adam Smith. In recent years, attention has been shifted towards the political factors that may contribute or obstruct the process of industrial agglomeration. In this paper, we focus on the relation between China's central and local governments, a relationship that has undergone dramatic changes during China's economic reform, and investigate the role of local protectionism, unleashed by China's key economic reform of fiscal decentralization, on the extent of China's industrial agglomeration. Our study contributes to the literature by incorporating some of the unique features in the developing and transition economy of China. It also provides evidence on the Marshallian externalities in the setting of China, lending support to those governments of developing countries seeking to enact policies that nurture externality economies and facilitating the process of industrial agglomeration. Future work on China's industrial agglomeration should be directed at collecting plant-level data sets and having a closer look at the interactions between market forces for industrial agglomeration and the political factors against it. Future work should also be directed at finding data sets of longer duration so as to examine the relative impacts of local protectionism versus traditional determinants of industrial agglomeration over time.[25]

[25] The central government has realized the detrimental impacts of local protectionism and therefore outlawed tariffs on interregional trade. In addition, with the reform of China's banks, it is increasingly difficult for the local governments to ask for policy loans from their local banks in support of inefficient local firms. These factors may explain the relative decline of local protectionism versus market forces for agglomeration over time. We thank an anonymous referee for pointing out these possibilities.

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Table 1a: Sample size of the data set (number of firms by year)

Number of firm \ Year	1998	1999	2000	2001	2002	2003	2004	2005
(1) The original data including mining, manufacturing, and production and distribution of electricity, gas, and water	164,981	161,888	162,741	171,117	181,428	196,206	270,425	265,739
(2) The data set of manufacturing firms only	149,556	146,985	148,243	156,862	167,046	181,508	251,628	246,379
(3) The data set of manufacturing firms only after deleting those observations with missing or zero employment	143,968	140,659	142,407	152,311	162,573	178,275	246,625	244,315
(4) Percentage of manufacturing firms with missing or zero employment	3.7%	4.3%	3.9%	2.9%	2.7%	1.8%	2.0%	0.8%

Table 1b: Number of firms by industry and year

	Number of firms							
Industry	**1998**	**1998**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Food Processing	11,238	10,494	9,921	9,778	9,907	10,412	13,299	13,885
Food Production	4,960	4,533	4,311	4,268	4,358	4,565	4,886	4,912
Beverage Production	3,561	3,324	3,174	3,110	3,125	3,152	3,392	3,483
Tobacco Processing	342	333	330	306	276	244	207	184
Textile Industry	10,846	10,512	10,552	11,805	12,975	14,272	22,315	21,113
Garments & Other Fiber Products	6,612	6,462	6,929	7,974	8,935	10,111	11,775	11,755
Leather, Furs, Down & Related Products	3,211	3,064	3,057	3,449	3,861	4,460	6,083	5,983
Timber Processing, Bamboo, Cane, Palm Fiber & Straw Products	2,357	2,300	2,445	2,711	2,952	3,472	4,654	5,015
Furniture Manufacturing	1,411	1,419	1,453	1,594	1,731	1,933	3,005	3,084
Papermaking & Paper Products	4,581	4,466	4,479	4,868	5,142	5,536	7,300	7,309
Printing & Record Pressing	3,754	3,646	3,551	3,562	3,687	3,780	4,564	4,400
Stationery, Educational & Sports Goods	1,751	1,762	1,837	2,003	2,290	2,584	3,676	3,603
Petroleum Processing, Coking Products, & Gas Production & Supply	1,003	955	958	994	1,113	1,279	1,932	1,930
Raw Chemical Materials & Chemical Products	10,850	10,846	10,934	11,620	12,252	13,530	18,589	18,861
Medical & Pharmaceutical Products	3,144	3,116	3,165	3,364	3,569	3,721	4,238	4,523
Chemical Fibers	782	784	807	870	897	1,001	1,733	1,543
Rubber Products	1,724	1,746	1,728	1,733	1,775	1,981	3,017	2,945
Plastic Products	5,874	5,874	6,073	6,768	7,534	8,397	12,124	12,093
Nonmetal Mineral Products	14,011	13,874	14,049	14,285	14,923	16,061	19,431	19,684
Smelting & Pressing of Ferrous Metals	3,094	2,911	2,864	3,058	3,215	3,702	6,225	5,922
Smelting & Pressing of Nonferrous Metals	2,316	2,312	2,442	2,730	2,856	3,173	4,649	4,611
Metal Products	7,919	7,870	8,119	9,097	9,832	10,946	15,885	15,734
Machinery & Equipment Manufacturing	9,076	8,884	9,092	9,841	10,579	11,899	17,981	17,737
Special Equipment Manufacturing	6,421	6,161	6,155	6,214	6,367	6,880	10,717	10,231
Transportation Equipment Manufacturing	6,519	6,378	6,565	6,948	7,322	8,045	11,532	11,200
Electric Equipment & Machinery	7,367	7,384	7,659	8,528	9,243	10,222	15,699	15,143
Electronic & Telecommunications	4,024	4,073	4,298	4,735	5,237	5,845	8,928	8,723
Instruments, Meters, Cultural & Official Machinery	1,754	1,709	1,790	1,972	2,090	2,230	3,390	3,302
Other Manufacturing	3,466	3,467	3,670	4,126	4,530	4,842	5,399	5,407
Total	**143,968**	**140,659**	**142,407**	**152,311**	**162,573**	**178,275**	**246,625**	**244,315**

Note: Industries in this table are ranked according the sequence of industries in Chinese Standard of Industrial Classification (GB/T 4754-2002).

Table 1c: Size of employment by year and industry

	Number of employment							
Industry	**1998**	**1998**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Food Processing	1,973	1,783	1,655	1,648	1,710	1,736	1,846	2,078
Food Production	1,002	955	905	891	972	1,040	1,063	1,142
Beverage Production	1,130	1,050	1,008	936	901	873	824	873
Tobacco Processing	290	278	257	246	231	211	194	195
Textile Industry	5,710	5,068	4,800	4,746	4,755	4,863	5,562	5,599
Garments & Other Fiber Products	2,112	2,024	2,153	2,366	2,648	3,005	3,271	3,458
Leather, Furs, Down & Related Products	1,103	1,093	1,125	1,265	1,408	1,647	2,043	2,221
Timber Processing, Bamboo, Cane, Palm Fiber & Straw Products	492	471	492	509	516	584	713	781
Furniture Manufacturing	249	253	270	297	338	419	652	719
Papermaking & Paper Products	1,270	1,180	1,119	1,130	1,140	1,144	1,279	1,277
Printing & Record Pressing	670	601	555	543	552	553	572	596
Stationery, Educational & Sports Goods	613	639	651	668	754	867	1,099	1,142
Petroleum Processing, Coking Products, & Gas Production & Supply	779	716	634	591	556	600	654	708
Raw Chemical Materials & Chemical Products	3,858	3,682	3,435	3,157	3,081	3,078	3,266	3,435
Medical & Pharmaceutical Products	1,025	994	990	1,020	1,045	1,073	1,062	1,154
Chemical Fibers	480	459	428	402	377	377	432	467
Rubber Products	761	707	664	612	611	626	788	779
Plastic Products	1,098	1,108	1,110	1,167	1,291	1,439	1,768	1,862
Nonmetal Mineral Products	4,502	4,310	4,083	3,889	3,860	3,916	4,081	4,151
Smelting & Pressing of Ferrous Metals	2,953	2,751	2,602	2,477	2,378	2,501	2,607	2,708
Smelting & Pressing of Nonferrous Metals	1,120	1,078	1,053	1,090	1,022	1,035	1,155	1,190
Metal Products	1,746	1,648	1,615	1,642	1,732	1,897	2,453	2,604
Machinery & Equipment Manufacturing	3,392	3,012	2,835	2,703	2,628	2,772	3,110	3,223
Special Equipment Manufacturing	2,516	2,172	2,056	1,843	1,771	1,787	2,042	2,007
Transportation Equipment Manufacturing	3,356	3,160	3,052	2,955	2,958	3,079	3,365	3,485
Electric Equipment & Machinery	2,377	2,277	2,285	2,249	2,383	2,643	3,361	3,572
Electronic & Telecommunications	1,840	1,854	1,960	2,047	2,290	2,746	3,680	4,351
Instruments, Meters, Cultural & Official Machinery	636	575	559	552	571	621	686	727
Other Manufacturing	907	916	963	1,005	1,080	1,183	1,283	1,329
Total	**49,961**	**46,813**	**45,316**	**44,646**	**45,559**	**48,315**	**54,909**	**57,833**

Note: Numbers in the table are in thousand. Industries in this table are ranked according the sequence of industries in Chinese Standard of Industrial Classification (GB/T 4754-2002).

Table 2a: Weighted means and summary statistics of industrial agglomeration in China's manufacturing industries (indices calculated based on employment data and weighted by employment)

Industry and Region	1998	1999	2000	2001	2002	2003	2004	2005	Change
2-digit industry									
County	0.0018	0.0018	0.0022	0.0023	0.0026	0.0033	0.0046	0.0048	0.0030
City	0.0042	0.0045	0.0052	0.0058	0.0066	0.0077	0.0100	0.0104	0.0062
Province	0.0173	0.0194	0.0216	0.0230	0.0267	0.0305	0.0363	0.0370	0.0197
3-digit industry									
County	0.0043	0.0040	0.0047	0.0051	0.0059	0.0069	0.0085	0.0089	0.0046
City	0.0092	0.0094	0.0108	0.0118	0.0133	0.0151	0.0184	0.0193	0.0101
Province	0.0316	0.0341	0.0377	0.0399	0.0451	0.0500	0.0578	0.0593	0.0277
4-digit industry									
County	0.0064	0.0063	0.0077	0.0083	0.0097	0.0111	0.0131	0.0133	0.0069
City	0.0128	0.0131	0.0156	0.0172	0.0197	0.0217	0.0257	0.0263	0.0135
Province	0.0402	0.0433	0.0484	0.0510	0.0580	0.0631	0.0723	0.0741	0.0339

Table 2b: Agglomeration of China's manufacturing industries at 2-digit industry level and county level (indices calculated based on employment data)

	γ index								
Industry	1998	1999	2000	2001	2002	2003	2004	2005	Change (1998-2005)
Food Processing	0.0010	0.0011	0.0014	0.0014	0.0019	0.0028	0.0038	0.0042	0.0032
Food Production	0.0006	0.0006	0.0008	0.0010	0.0012	0.0014	0.002	0.0022	0.0016
Beverage Production	0.0006	0.0005	0.0006	0.0008	0.0009	0.0013	0.0022	0.0022	0.0016
Tobacco Processing	0.0001	0.0001	0.0005	0.0009	0.0010	0.0012	0.0014	0.0026	0.0025
Textile Industry	0.001	0.001	0.001	0.0011	0.0014	0.0018	0.0027	0.0026	0.0016
Garments & Other Fiber Products	0.0054	0.0034	0.0029	0.0027	0.0026	0.0029	0.0029	0.0028	-0.0027
Leather, Furs, Down & Related Products	0.0035	0.0052	0.0058	0.0064	0.0080	0.0091	0.0105	0.0102	0.0067
Timber Processing, Bamboo, Cane, Palm Fiber & Straw Products	0.0014	0.0013	0.0017	0.0022	0.0024	0.0033	0.0053	0.0054	0.0040
Furniture Manufacturing	0.0013	0.0020	0.0019	0.0018	0.0024	0.0057	0.0076	0.0081	0.0068
Papermaking & Paper Products	0.0005	0.0006	0.0007	0.0011	0.0013	0.0013	0.0012	0.0013	0.0007
Printing & Record Pressing	0.0000	0.0007	0.0008	0.0011	0.0015	0.0016	0.0015	0.0014	0.0014
Stationery, Educational & Sports Goods	0.0194	0.0203	0.0213	0.0176	0.0175	0.0191	0.0205	0.0206	0.0012
Petroleum Processing, Coking Products, & Gas Production & Supply	0.0021	0.0022	0.0093	0.0045	0.0042	0.0054	0.0052	0.0051	0.0031
Raw Chemical Materials & Chemical Products	0.0006	0.0005	0.0009	0.0007	0.0008	0.0011	0.0020	0.0021	0.0016
Medical & Pharmaceutical Products	0.0005	0.0003	0.0005	0.0009	0.0012	0.0016	0.0026	0.0028	0.0024
Chemical Fibers	0.0008	0.0012	0.0014	0.0012	0.0023	0.0031	0.0062	0.0061	0.0053
Rubber Products	0.0010	0.0012	0.0015	0.0008	0.0012	0.0012	0.0019	0.0021	0.0011
Plastic Products	0.0021	0.0027	0.0024	0.0022	0.0022	0.0021	0.0034	0.0033	0.0012
Nonmetal Mineral Products	0.0009	0.0009	0.0011	0.0012	0.0014	0.0018	0.0027	0.0030	0.0021
Smelting & Pressing of Ferrous Metals	0.0011	0.0011	0.0008	0.0011	0.0016	0.0022	0.0034	0.0036	0.0025
Smelting & Pressing of Nonferrous Metals	0.0023	0.0024	0.0025	0.0025	0.0028	0.0030	0.0036	0.0037	0.0014
Metal Products	0.0007	0.0008	0.0009	0.0010	0.0012	0.0014	0.0011	0.0012	0.0005
Machinery & Equipment Manufacturing	0.0008	0.0008	0.0009	0.0010	0.0012	0.0015	0.0021	0.0022	0.0013
Special Equipment Manufacturing	0.0009	0.0009	0.001	0.0011	0.0013	0.0015	0.0014	0.0014	0.0006
Transportation Equipment Manufacturing	0.0019	0.0019	0.002	0.0024	0.0025	0.0026	0.0032	0.0034	0.0015
Electric Equipment & Machinery	0.0015	0.0014	0.0018	0.0022	0.0027	0.0039	0.0052	0.0056	0.0041
Electronic & Telecommunications	0.0069	0.0069	0.0083	0.0095	0.0103	0.0123	0.0178	0.0175	0.0105
Instruments, Meters, Cultural & Official Machinery	0.0019	0.0019	0.0022	0.0020	0.0024	0.0030	0.0037	0.0040	0.0021
Other Manufacturing	0.0030	0.0030	0.0032	0.0033	0.0036	0.0036	0.0032	0.0032	0.0002

Note: Numbers in the table are in thousand. Industries in this table are ranked according the sequence of industries in Chinese Standard of Industrial Classification (GB/T 4754-2002).

Industry	Gini index								
	1998	1999	2000	2001	2002	2003	2004	2005	Change (2005-1998)
Food Processing	0.0018	0.0017	0.0021	0.0032	0.0062	0.0038	0.0045	0.0049	0.0031
Food Production	0.0017	0.0020	0.0022	0.0025	0.0030	0.0030	0.0036	0.0040	0.0023
Beverage Production	0.0020	0.0021	0.0024	0.0026	0.0031	0.0036	0.0043	0.0051	0.0031
Tobacco Processing	0.0067	0.0072	0.0073	0.0081	0.0090	0.0099	0.0130	0.0175	0.0108
Textile Industry	0.0014	0.0015	0.0015	0.0016	0.0019	0.0024	0.0032	0.0032	0.0018
Garments & Other Fiber Products	0.0065	0.0040	0.0035	0.0032	0.0031	0.0033	0.0032	0.0031	-0.0034
Leather, Furs, Down & Related Products	0.0050	0.0069	0.0077	0.0080	0.0094	0.0104	0.0115	0.0113	0.0063
Timber Processing, Bamboo, Cane, Palm Fiber & Straw Products	0.0037	0.0042	0.0041	0.0041	0.0039	0.0044	0.0065	0.0065	0.0028
Furniture Manufacturing	0.0037	0.0046	0.0043	0.0038	0.0042	0.0077	0.0091	0.0095	0.0059
Papermaking & Paper Products	0.0014	0.0016	0.0017	0.0021	0.0025	0.0023	0.0022	0.0021	0.0007
Printing & Record Pressing	0.0044	0.0016	0.0018	0.0022	0.0029	0.0030	0.0026	0.0026	-0.0018
Stationery, Educational & Sports Goods	0.0221	0.0230	0.0236	0.0196	0.0193	0.0208	0.0219	0.0222	0.0001
Petroleum Processing, Coking Products, & Gas Production & Supply	0.0218	0.0231	0.0246	0.0177	0.0135	0.0127	0.0104	0.0102	-0.0116
Raw Chemical Materials & Chemical Products	0.0018	0.0019	0.0019	0.0016	0.0017	0.0018	0.0025	0.0027	0.0009
Medical & Pharmaceutical Products	0.0022	0.0023	0.0024	0.0029	0.0032	0.0034	0.0041	0.0044	0.0022
Chemical Fibers	0.0107	0.0105	0.0118	0.0097	0.0099	0.0111	0.0120	0.0139	0.0032
Rubber Products	0.0039	0.0039	0.0046	0.0036	0.0042	0.0041	0.0041	0.0042	0.0003
Plastic Products	0.0028	0.0034	0.0031	0.0030	0.0028	0.0026	0.0037	0.0036	0.0008
Nonmetal Mineral Products	0.0012	0.0013	0.0014	0.0015	0.0017	0.0020	0.0029	0.0032	0.0019
Smelting & Pressing of Ferrous Metals	0.0117	0.0124	0.0138	0.0137	0.0133	0.0118	0.0107	0.0111	-0.0006
Smelting & Pressing of Nonferrous Metals	0.0092	0.0094	0.0099	0.0097	0.0091	0.0087	0.0083	0.0082	-0.0010
Metal Products	0.0013	0.0013	0.0015	0.0014	0.0016	0.0017	0.0013	0.0015	0.0002
Machinery & Equipment Manufacturing	0.0015	0.0015	0.0015	0.0017	0.0018	0.0021	0.0024	0.0025	0.0010
Special Equipment Manufacturing	0.0021	0.0022	0.0028	0.0023	0.0024	0.0027	0.0022	0.0023	0.0002
Transportation Equipment Manufacturing	0.0045	0.0044	0.0046	0.0048	0.0046	0.0045	0.0040	0.0049	0.0004
Electric Equipment & Machinery	0.0024	0.0023	0.0027	0.0030	0.0035	0.0047	0.0057	0.0062	0.0038
Electronic & Telecommunications	0.0084	0.0083	0.0096	0.0107	0.0114	0.0135	0.0189	0.0188	0.0104
Instruments, Meters, Cultural & Official Machinery	0.0044	0.0044	0.0047	0.0042	0.0044	0.0051	0.0054	0.0058	0.0014
Other Manufacturing	0.0043	0.0046	0.0046	0.0046	0.0044	0.0044	0.0041	0.0040	-0.0004

Note: Numbers in the table are in thousand. Industries in this table are ranked according the sequence of industries in Chinese Standard of Industrial Classification (GB/T 4754-2002).

Industry	Herfindahl index 1998	1999	2000	2001	2002	2003	2004	2005	Change (2005-1998)
Food Processing	0.0007	0.0006	0.0007	0.0018	0.0043	0.0011	0.0007	0.0007	0.0000
Food Production	0.0011	0.0014	0.0015	0.0016	0.0018	0.0016	0.0016	0.0018	0.0007
Beverage Production	0.0014	0.0016	0.0018	0.0019	0.0021	0.0024	0.0022	0.0030	0.0015
Tobacco Processing	0.0066	0.0071	0.0069	0.0073	0.0080	0.0087	0.0117	0.0151	0.0084
Textile Industry	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0004	0.0006	0.0001
Garments & Other Fiber Products	0.0011	0.0007	0.0006	0.0005	0.0005	0.0004	0.0004	0.0004	-0.0008
Leather, Furs, Down & Related Products	0.0015	0.0018	0.0019	0.0016	0.0014	0.0013	0.0011	0.0012	-0.0004
Timber Processing, Bamboo, Cane, Palm Fiber & Straw Products	0.0023	0.0029	0.0023	0.0019	0.0015	0.0011	0.0012	0.0011	-0.0012
Furniture Manufacturing	0.0024	0.0025	0.0024	0.0020	0.0019	0.0020	0.0015	0.0015	-0.0009
Papermaking & Paper Products	0.0009	0.0010	0.0010	0.0011	0.0012	0.0010	0.0010	0.0009	0.0000
Printing & Record Pressing	0.0044	0.0009	0.0010	0.0011	0.0014	0.0014	0.0011	0.0012	-0.0032
Stationery, Educational & Sports Goods	0.0027	0.0028	0.0024	0.0020	0.0018	0.0018	0.0014	0.0016	-0.0011
Petroleum Processing, Coking Products, & Gas Production & Supply	0.0198	0.0210	0.0155	0.0133	0.0094	0.0074	0.0053	0.0051	-0.0147
Raw Chemical Materials & Chemical Products	0.0012	0.0014	0.0010	0.0008	0.0009	0.0007	0.0005	0.0005	-0.0007
Medical & Pharmaceutical Products	0.0018	0.0020	0.0020	0.0020	0.0020	0.0019	0.0016	0.0016	-0.0001
Chemical Fibers	0.0099	0.0093	0.0104	0.0085	0.0076	0.0080	0.0059	0.0079	-0.0020
Rubber Products	0.0030	0.0027	0.0031	0.0028	0.0030	0.0029	0.0022	0.0022	-0.0008
Plastic Products	0.0007	0.0007	0.0007	0.0008	0.0006	0.0006	0.0004	0.0004	-0.0003
Nonmetal Mineral Products	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002	0.0002	-0.0001
Smelting & Pressing of Ferrous Metals	0.0106	0.0113	0.0130	0.0126	0.0118	0.0097	0.0074	0.0075	-0.0031
Smelting & Pressing of Nonferrous Metals	0.0069	0.0070	0.0074	0.0073	0.0063	0.0058	0.0047	0.0046	-0.0024
Metal Products	0.0006	0.0005	0.0005	0.0004	0.0004	0.0004	0.0003	0.0003	-0.0003
Machinery & Equipment Manufacturing	0.0007	0.0007	0.0007	0.0007	0.0006	0.0006	0.0004	0.0004	-0.0003
Special Equipment Manufacturing	0.0012	0.0013	0.0019	0.0012	0.0012	0.0012	0.0009	0.0009	-0.0003
Transportation Equipment Manufacturing	0.0026	0.0025	0.0026	0.0024	0.0022	0.0018	0.0008	0.0015	-0.0010
Electric Equipment & Machinery	0.0009	0.0008	0.0009	0.0008	0.0008	0.0007	0.0006	0.0006	-0.0002
Electronic & Telecommunications	0.0015	0.0014	0.0013	0.0012	0.0012	0.0012	0.0011	0.0014	-0.0001
Instruments, Meters, Cultural & Official Machinery	0.0025	0.0026	0.0025	0.0022	0.0020	0.0021	0.0017	0.0018	-0.0007
Other Manufacturing	0.0014	0.0016	0.0014	0.0013	0.0008	0.0008	0.0008	0.0008	-0.0006

Note: Numbers in the table are in thousand. Industries in this table are ranked according the sequence of industries in Chinese Standard of Industrial Classification (GB/T 4754-2002).

Table 2c: Comparison of the Ellison-Glaeser index (or γ_i index) of China's manufacturing industries with those of selected developed countries

Literature	Country	Year	Industry	Region	Percentage of industries that are: not very concentrated	somewhat concentrated	very concentrated
Ellison and Glaeser （1997）	U.S.	1987	459, 4-digit	3000 counties	10.00%	65.00%	25.00%
Devereux, Griffith and Simpson（2004）	U.K.	1992	211, 4-digit	477 Zip codes	65.00%	19.00%	16.00%
Maurel and Sedillot （1999）	France	1993	273, 4-digit	95 counties	50.00%	23.00%	27.00%
This paper	China	2005	537, 4-digit	2862 counties	75.98%	16.2%	7.82%

Note: Industries with $\gamma_i > 0.05$, $0.02 \le \gamma_i \le 0.05$, and $\gamma_i < 0.02$ are defined as very concentrated, somewhat concentrated, and not very concentrated, respectively.

Table 3: Definitions and summary statistics of key variables

Variable Name	Definition	N	Mean	SD	Min	Max
EG index (3-digit, county)	EG index calculated at 3-digit industry level and county level	1277	0.0083	0.0162	-0.0232	0.2798
EG index (3-digit, city)	EG index calculated at 3-digit industry level and city level	1277	0.0160	0.0240	-0.0657	0.3928
EG index (3-digit, province)	EG index calculated at 3-digit industry level and province level	1277	0.0459	0.0630	-0.4371	0.4336
Share of state-owned enterprises in employment	(state ownership * employment / sum of all types of ownership) * total employment	1277	0.2741	0.2157	0	1
Wage premium	$\frac{\sum_r \frac{Wage_{ir}}{Wage_r} * Emp_{ir}}{\sum_r Emp_{ir}}$	1277	1.0083	0.2344	0.4497	3.4842
Purchased-inputs intensity	purchased-inputs / total output	1277	0.7894	0.1168	0.4186	3.3075
New products to output ratio	total new products of an industry / total output of the industry	1277	0.0729	0.0893	0	0.6429
Average firm size	total output of an industry / number of firms in the industry	1277	0.3040	0.3583	0.0438	4.6567
Agricultural products usage ratio	share of inputs from agricultural sectors	1277	0.0912	0.1752	0	0.8086
Mining products usage ratio	share of inputs from mining sectors	1277	0.0531	0.1185	0	0.7180

Note: Industry variables are calculated at the 3-digit industry level.

Table 4: Correlations between dependent and independent variables

		1	2	3	4	5	6	7	8
EG Index (3-digit, county)	1	1							
Share of SOEs in employment	2	**-0.206**	1						
Wage premium	3	-0.048	**0.348**	1					
Purchased-inputs intensity	4	**0.084**	**-0.134**	**-0.107**	1				
New products to output ratio	5	0.007	**0.276**	**0.392**	-0.044	1			
Average firm size	6	**0.313**	**-0.164**	**-0.164**	0.05	-0.032	1		
Agricultural products usage ratio	7	-0.048	-0.018	**-0.143**	-0.011	**-0.207**	**-0.162**	1	
Mining products usage ratio	8	**0.097**	**0.183**	**0.071**	**0.056**	**-0.154**	**-0.267**	**-0.182**	1

Note: Coefficients in bold are significant at 5% level (2-tailed)

Table 5: Impacts of share of state-owned enterprises in employment on industrial agglomeration

	Pooled OLS			Industry fixed effect			Change in EG index 1998-2005		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	County	City	Province	County	City	Province	County	City	Province
Share of SOEs in employment	-0.015***	-0.018***	-0.047***	-0.0023	-0.0069	-0.0043			
	(0.002)	(0.003)	(0.009)	(0.005)	(0.007)	(0.012)			
Change of Share of SOEs in employment 1998-2005							-0.020*	-0.028**	-0.082***
							(0.011)	(0.013)	(0.023)
Observations	1277	1277	1277	1277	1277	1277	160	160	160
R-squared	0.05	0.06	0.05	0.03	0.07	0.10	0.02	0.03	0.07

*, **, and *** stand for significant at 10%, 5%, and 1% respectively. Standard errors are in parentheses.

Table 6: Instrumental variable estimation of the impacts of local protectionism on industrial agglomeration[a]

	EG index of pooled sample			EG index of 2005			Change in EG index 1998-2005		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	County	City	Province	County	City	Province	County	City	Province
Panel A: Second stage of 2SLS									
Share of SOEs in employment	−0.018***	−0.012**	−0.0048	−0.019	−0.025	−0.12			
	(0.003)	(0.006)	(0.017)	(0.018)	(0.037)	(0.100)			
Change in Share of SOEs in employment 1998-2005							−0.034	−0.065***	−0.13***
							(0.022)	(0.019)	(0.039)
Observations	704	704	704	88	88	88	88	88	88
R-squared	0.06	0.05	0.03	0.04	0.03	0.02	0.18	0.22	0.18
Panel B: First stage of 2SLS	Share of SOE employment			Share of SOE employment			Change in Share of SOE employment 1998-2005		
Share of SOEs in 1985	0.57***			0.32***			−0.44***		
	(0.033)			(0.068)			(0.071)		
Shea partial R-squared	0.29			0.21			0.31		
Panel C: First stage tests									
Anderson Canonical LR Statistics	[207.35]***			[18.09]***			[27.60]***		
Cragg-Donald F-Statistics	293.09			22.26			39.11		
Panel D: Residual regression on instruments									
Share of SOEs in 1985	0.00097	−0.0028	0.0070	0.0014	−0.0024	−0.0063	0.00040	−0.0046	−0.0080
	(0.0017)	(0.0029)	(0.0081)	(0.0017)	(0.0032)	(0.0097)	(0.0084)	(0.0109)	(0.0201)
R-squared	0.0004	0.0012	0.001	0.001	0.007	0.002	0.0001	0.0019	0.0017
Panel E: Test of exclusion restriction									
Share of SOEs in employment	−0.012***	−0.023***	−0.073***	−0.011	−0.026	−0.0394			
	(0.002)	(0.004)	(0.010)	(0.009)	(0.018)	(0.050)			
Change in Share of SOEs in employment 1998-2005							−0.071***	−0.058***	−0.093***
							(0.015)	(0.016)	(0.029)
Share of SOEs in 1985	−0.0035	−0.0042	−0.0084	−0.0025	−0.016	−0.049	−0.016	0.004	0.019
	(0.002)	(0.004)	(0.011)	(0.007)	(0.013)	(0.035)	(0.012)	(0.015)	(0.028)
R-squared	0.07	0.06	0.07	0.03	0.03	0.02	0.23	0.22	0.19

*, **, and *** stand for significant at 10%, 5%, and 1% respectively. Standard errors are in parentheses.

[a] Shares of SOEs in 1985, from the Second National Industrial Censures of China, are used as instrument.

Table 7: Impacts of local protectionism on industrial agglomeration, with controls for traditional determinants of industrial agglomeration

	Pooled OLS			Industry fixed effect			Change in EG index 1998-2005		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	County	City	Province	County	City	Province	County	City	Province
Share of SOEs in employment	-0.024***	-0.036***	-0.10***	-0.0017	-0.011*	-0.0094			
	(0.003)	(0.004)	(0.010)	(0.005)	(0.007)	(0.012)			
Wage premium	0.0018	0.0063**	0.0022	0.0047*	0.0079**	0.0099*			
	(0.002)	(0.003)	(0.008)	(0.002)	(0.003)	(0.006)			
Purchased inputs intensity	0.012**	0.025***	0.061***	0.011***	0.025***	0.037***			
	(0.005)	(0.007)	(0.017)	(0.004)	(0.006)	(0.010)			
New product ratio	0.014**	0.025***	0.078***	0.0049	0.011	0.12***			
	(0.006)	(0.009)	(0.022)	(0.010)	(0.014)	(0.025)			
Average firm size	0.0050***	0.012***	0.044***	0.0070**	0.0038	-0.011			
	(0.001)	(0.002)	(0.005)	(0.003)	(0.005)	(0.008)			
Agricultural products usage ratio	0.00068	0.012***	0.042***						
	(0.003)	(0.004)	(0.010)						
Mining products usage ratio	0.021***	0.035***	0.11***						
	(0.004)	(0.006)	(0.015)						
Change in share of SOEs in employment 1998-2005							-0.019	-0.026*	-0.087***
							(0.012)	(0.014)	(0.025)
Change in wage premium 1998-2005							0.0088	0.011	0.0092
							(0.006)	(0.008)	(0.016)
Change in purchased inputs intensity 1998-2005							0.078*	0.14**	0.045
							(0.043)	(0.055)	(0.110)
Change in new product ratio 1998-2005							0.034	0.054	0.16**
							(0.029)	(0.037)	(0.071)
Change in average firm size 1998-2005							0.0096	0.011	0.012
							(0.007)	(0.009)	(0.018)
Observations	1277	1277	1277	1277	1277	1277	160	160	160
R-squared	0.10	0.13	0.15	0.05	0.09	0.14	0.08	0.11	0.11

*, **, and *** stand for significant at 10%, 5%, and 1% respectively. Standard errors are in parentheses.