An Empirical Analysis of the Bidirectional Dynamic Effect between Financial Competition and Industrial Agglomeration

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Abstract: This paper uses the data of 30 provincial-level panel in China to establish a dynamic panel simultaneous equations model. The system generalized moment estimation (sysgmm) and three-stage least squares (3SLS) are used to estimate and test the robustness of the model, respectively, to study the relationship between financial competition and industrial agglomeration. The results show that: (1) there is a bidirectional causal relationship between financial competition and industrial agglomeration. Financial competition through preferential policies to encourage technology research and development, resulting in technological innovation spillover effect to attract industrial agglomeration, but the effect is not good, and industrial agglomeration will also encourage finance to increase the competitiveness; (2) the bidirectional effect has time lag, the early financial competition and industrial agglomeration In order to have an effect in this period. All of conclusions above have important implications for changing the mode of financial competition and improving the quality of industrial agglomeration.

1. Introduction
One of the main forms of the performance appraisal mechanism is to encourage local governments to take positive policy measures to promote economic development, encourage technological innovation through fiscal policy, and then attract industrial agglomeration. According to the theory of fiscal decentralization, local governments carry out fiscal competition through the supply of public goods to attract residents and promote local economic growth. According to the new economic geography, with the reduction of transaction costs and the improvement of manufacturing agglomeration, the industry itself can form the effect of increasing scale and technology spillover, and then promote economic growth. At present, the relationship between financial competition and industrial agglomeration at home and abroad is limited to one-way research, that is, the impact of financial competition on industrial agglomeration, or the impact of industrial agglomeration on financial competition.

But what is the relationship between financial competition and industrial agglomeration in a "world factory" like China? Is it one-way interaction or mutual influence? Around the above problems, this paper makes a brief study on the relationship between financial competition and industrial agglomeration. The possible innovation is to build a dynamic panel simultaneous equations model to analyze the possible two-way dynamic effect and time lag between financial competition and industrial agglomeration.

2. Model
Because fiscal competition and industrial agglomeration are taken as explanatory variables to analyze,
and at the same time, they are taken as explanatory variables to study the two-way influence, so we can not simply establish two single equation models to ignore their interaction, but should establish a simultaneous equation model to estimate and analyze:

\[
\begin{align*}
\text{ma}_{it} &= \alpha_0 + \alpha_1 \text{fc}_{it} + \sum \alpha X_{it} + \mu_{1i} + \varepsilon_{1it} \\
\text{fc}_{it} &= \beta_0 + \beta_1 \text{ma}_{it} + \sum \beta X_{it} + \mu_{2i} + \varepsilon_{2it}
\end{align*}
\]  

\( (1) \)

\( \text{ma}_{it} \) is the degree of industrial agglomeration of I Province in year t, \( \text{fc}_{it} \) is the degree of financial competition of I Province in year t, \( \alpha \) and \( \beta \) represent the coefficients to be estimated, and \( X_{it} \) represents a series of control variables, \( \mu_{1i} \) and \( \mu_{2i} \) means individual effect, \( \varepsilon \) and \( \varepsilon \) Represents the random error term.

In the simultaneous equations model constructed in this paper, there are two endogenous variables ma and fc, which should be estimated by instrumental variable method (IV). When the number of instrumental variables is more than the number of endogenous explanatory variables, it belongs to over identification, and GMM is more efficient. Considering the time lag between financial competition and industrial agglomeration, the dynamic panel data model is more accurate. Variable and data

**Industrial Agglomeration Degree (ma).** Because the selected provincial panel data does not include the enterprise size, location and the number of workers and other individual conditions, it is impossible to use the heifendahl Hirschman index, EG index and DO index. This paper adopts the agglomeration index based on the gross industrial output value of different industries

In view of the statistical caliber, data availability and sample representativeness, this paper takes coal mining and washing industry, automobile manufacturing industry, instrument manufacturing industry and other 25 sub industries as the object, using the gross industrial output value data of Industrial Enterprises above designated size. Because the gross industrial output value is not disclosed in the statistical yearbook of some years, the same representative gross industrial sales value with similar value is selected.

**Financial competition (fc).** In the existing research, from the two aspects of expenditure competition and tax competition, the proportion of various types of fiscal expenditure in total expenditure is used as the index to measure the level of expenditure competition \([8]\), and the tax revenue divided by GDP is used as the index to measure the level of tax competition. From the perspective of the government to encourage technological innovation, this paper measures the willingness of local financial competition and constructs the following financial competition indicators

\[
\text{fc}_{i} = \frac{\text{financial support}_{i}/\text{Internal R & D expenditure of enterprises}}{\beta_{it}}
\]

Our government generally gives financial subsidies according to a certain proportion of the budget amount of scientific and technological R & D projects, and gives tax relief according to the R & D expenditure of enterprises. This paper uses the ratio of "financial support" and internal R & D expenditure as an index.

The control variables include technology R & D investment (tc), which is expressed by the proportion of R & D investment in the main business income of industrial enterprises; The technical personnel input (tl) of industrial enterprises is expressed by the proportion of R & D technical personnel in the average employees of industrial enterprises; Transportation infrastructure (tp) is expressed by the proportion of highway mileage in land area; The level of economic development (lnpgdp) is expressed as the logarithm of per capita GDP; The status of foreign investment (fdi) is expressed by the proportion of foreign direct investment in fixed assets investment of the whole society; Urbanization level (urb) is expressed by urbanization rate; The degree of nationalization (na) is expressed by the proportion of industrial sales output value of state-owned enterprises in GDP. The sample data were tailed at 1% and 99% quantile to eliminate the influence of extreme value.

This paper takes 30 provincial administrative regions of China as the research object (excluding Tibet, Hong Kong, Macao and Taiwan), and the data comes from the statistical yearbook of scientific
and technological activities of industrial enterprises, China Industrial statistical yearbook and statistical yearbooks of provinces and cities from 2000 to 2015. Due to the lack of data after 2016 in the statistical yearbook of science and technology activities of industrial enterprises, the core variable "financial competitiveness" cannot be constructed, so only the data of 2015 and before are used. The missing data were supplemented by interpolation.

3. An empirical analysis
As shown in Table 1, from the analysis results of the static panel fixed effect model Fe, (1) for the Ma equation and FC equation, the core explanatory variables are not significant, which indicates that it is inaccurate to estimate without considering the endogeneity, (2) The first-order lagged terms l.ma and l.fc are significant, which indicates that the lag of industrial agglomeration and financial competition exists.

From the results of sysgmm analysis, AR (1) statistics of ma equation and fc equation pass the significance test, while AR (2) statistics fail, indicating that there is first-order autocorrelation but no second-order autocorrelation in their random error terms; Hansen statistics did not pass the significance test, and accepted the original hypothesis that "all instrumental variables" are valid, indicating that sysgmm is more suitable.

For the ma equation, (1) the second-order lag term L2.fc has a positive effect on ma at the significance level of 1%, which indicates that with the increase of financial competition among provinces, it will promote technological progress and spillover, thus attracting more industrial agglomeration. However, its low regression coefficient also indicates that the effect is limited, which also proves that the effect of fiscal policy has time lag,(2) L2.tl has a positive effect on ma at the significance level of 1%, which indicates that R&D technicians of industrial enterprises before two periods can promote industrial agglomeration,(3) tp has a negative impact on ma at a significant level of 10%, which indicates that the improvement of local transport infrastructure may reduce transaction costs, but promote industrial decentralization,(4) L.lnpdgdp, fdi and urb had

|                   | FE ma | SYSGMM ma | FE fc | SYSGMM fc |
|-------------------|-------|-----------|-------|-----------|
| ma                | -0.0275 | 0.492*** | (0.0296) | (0.0912) |
| L.ma              | 0.814*** | 0.991*** | (0.0283) | (0.0149) |
| L.fc              | -0.00144 |          | (0.0476) |          |
| L2.fc             | 0.306*** | 0.293*** | (0.0444) | (0.0297) |
| tc                | 0.176 | 3.982*** | (1.143) | (0.899) |
| L.tc              | -0.141 | 3.432*** | (0.729) | (0.403) |
| tl                | -0.124 | 0.000126 | (0.683) | (0.604) |
| L2.tl             | 2.092*** | -3.071*** | (0.418) | (0.549) |
| tp                | 0.00443 | -0.0170* | (0.0218) | (0.00888) |
| lnpdgdp           | 0.0255** |          |          |          |
significant effects on ma.

For the fc equation, (1) ma and the first-order lag term L.ma have different effects on fc at the significance level of 1%. In this period, industrial agglomeration has a positive impact on financial competition, while in the previous period, industrial agglomeration has a negative impact on financial competition, but it still has a positive impact on the whole, which shows that in the long run, with the improvement of the degree of local industrial agglomeration, Local governments tend to increase financial competition,(2) L.fc has a positive effect on the current policy at the significance level of 1%, which indicates that the financial competition is accumulating and strengthening in the sample period,(3) tc has a positive effect on fc at the significant level of 1%, which indicates that the technology R&D expenditure of industrial enterprises in this period promotes the financial competition in this period, and proves that the subsidy preference is based on R&D expenditure,(4) tl has a negative effect at the significant level of 1%, which indicates that with the increase of the input of scientific research and technology personnel, the subsidy decreases, the willingness of financial competition decreases, and there may be a lack of incentive.

4. Conclusion
There is a two-way promoting effect between local financial competition and industrial agglomeration. Among them, financial competition produces technology spillover effect and promotes industrial agglomeration by promoting technological innovation, but the effect is relatively small; Industrial agglomeration will also encourage local governments to implement more subsidy policies, enhance financial competition, but also increase the burden of local finance. On the basis of considering local financial resources, local governments can change the way of government competition, flexibly use policy means, and promote industrial agglomeration.

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