Clusters, Co-agglomeration, and Urbanization: based on Chinese city data analysis

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Abstract

There is much controversy on the effects of spillovers of specialized industry agglomeration and diversified industry agglomeration on the promotion of urban development. However, the degree of industry agglomeration in Chinese cities is generally between complete diversification and specialization. In the case of multi-industry co-agglomeration, the local government provides subsidies for advantageous industrial clusters in order to increase the rate of urbanization. Compared to the rest of industries, the same type of industry responds stronger to the increase in the number of migrated labor force with respect to the degree of spillovers. This phenomenon leads to the further intensification of industries with fast growth of productivity. Finally, there may emerges “dual conflict” between the Nash Equilibrium states in the city and the optimal-utility-oriented employment structure of the whole society. Even if the balanced city size formed by the free population mobility is worthy in-depth discussion. For the first time, this paper attempted to conduct a discussion and empirical analysis on the matching between migrated labor forces and the urban industries. The research findings verify that the expansion rate of Chinese city size rests on co-agglomeration to a large degree.

Keywords: Match, Co-agglomeration, Spillovers effects City scale.

1. INTRODUCTION

Several cities which are renowned for the agglomeration of specialized industries do not necessarily form the “one – industry” structure, such as the Hollywood in United States, Sheffield in UK and Toyota in Japan. Some highly-diversified cities do not necessarily include the workforce in all industrial type (Helsley and Strange, 2014). Currently, it is universal that the industrial agglomeration mode of Chinese cities is between complete diversification and complete specialization, and such rules of co-agglomeration are easily overlooked by Chinese urban researchers. During the period of 1980s and 1990s, the industrial agglomeration mode with comparative high specialization and marketization, such as “One County, One Type” and “Economic of Clusters”, has appeared in local economies. Nevertheless, the local government has planned a large number of high-tech zones, industrial parks and new districts in recent years. These industrial zones with strong governmental characteristics include the enterprises of connected industrial chains as well as connection-disabled enterprises. Generally speaking, this type of agglomeration policies has two apparent features: the megacities aim to optimize the urban structure and set up certain freedom of access for industrial (population) according to agglomeration costs; the priority of development in small cities will be those
of large demands for the amount of employment, in order to extend an utmost effort to enlarge city size.

One-industry specialized city can hardly appear in China’s urbanization, and meanwhile it is impossible for China to bring forth multi-industry cities. In this collaborative agglomeration condition, if newly migrated skilled labor force is better matched with a corresponding industry of a city, the rising number of migrated labor force will give rise to asymmetric change to the city’s labor productivity in this industry. Industries with fast productivity will attract more labor force with similar skills or expertise by better payment, and give rise to population expansion in this industry, thus in return improving the policies governing the industry. Local government’s preferential policies on land and concession to certain industries will intensify the plurality chasing of economic entities. And eventually, the Nash equilibrium state in the city will be anything but the best employment structure. Such being the case, this paper attempted to discuss how the government’s clustering policy influences city size and urbanization structure in China in the perspective of industry clustering, and launched the explorative research by matching between labor force and industry.

We arranged the structure of our paper as follows: Part 1: introduction; Part 2: literature reviews of industry agglomeration differences and urban development; Part 3: the theoretical model of matching between labor forces and industries; Part 4: the empirical analysis of urban panel data; Part 5: research conclusions and suggestions on policies.

2. LITERATURE REVIEWS

Most of urban theories are the in-depth exploration of the Henderson’s assumption of specialization or diversification (Henderson, 1974). In general cases, the increasing marginal returns of intermediate inputs are an important factor of specification agglomeration (Abdel-Rahman and Fujita, 1993), and the cost-saving property of product transportation is the major dominance of complete diversification agglomeration. However, under the circumstance of economic agglomeration, the degrees of technology spillovers in the same industry or between industries are significantly different from each other. Taking the Silicon Valley IT industry as an example, according to the Marshall-Arrow-Romer externalities (MAR), intra-industry specialization agglomeration promotes knowledge spillovers. Opposite to the MAR theory, Jacobs holds it that as the leading industry’s knowledge spillovers to the rest of the industry, the geologically centered diversification agglomeration is more conducive to creation and growth (Jacobs, 1969). The knowledge spillovers of spatially-benefited business clusters (Michael, 1990) promote the growth of urban output, in terms of both the minor part of specialization agglomeration and the major part of industry co-agglomeration. Afterwards, researchers on urban economics are devoted to the interactive effect of industry co-agglomeration on urban growth (Delgado et al., 2010; Glaeser and Ponzetto, 2010; Klepper, 2010). In view of the development experience of Chinese cities, specialization is in negative relation to the growth of urban economy (Li and Song, 2016). Moreover, the western China is proved to respond stronger to specialization agglomeration, and it is more cities of small-to-medium size than megacities that improve their productivity with specialization agglomeration (Sun and Guo, 2013; Hu et al., 2015). believe that the effect of diversification agglomeration decreases gradually from east to west. In terms of the current stage of urbanization, diversification agglomeration is more conducive to the development of Chinese economy. In contrast to the urban-scale inefficiencies expounded from the perspective of new economic geography (Krugman, 1991), this paper discusses how the effect of technology spillovers on the asymmetric productivity of the same/cross industry leads to urban-scale variations under the circumstances of China’s urban industrial agglomerations. What is important is that this paper takes into account the special environment in China where the government influences population freedom and industrial cluster policies (Hu et al., 2016); therefore, the final result of
urbanization may limit or accelerate the expansion of urban size. We strongly agree with “plurality chasing” phenomenon put forward in the research of industry co-agglomeration (Helsley and Strange, 2014). Such phenomenon refers to that the economic individuals prefer to choose the city dominated by the same industry, and China is no exception of this law. In terms of the laws for site selection of domestic-funded enterprises, the city with large proportion of state-owned enterprises is not conducive to the agglomeration of new enterprises, and the same business or industrial cluster still tends to agglomerate in the specific space (Fichera et al., 2016; Balocco et al., 2015; Cannistraro et al., 2016). Due to the mismatch of power and right of property between the superior and the subordinate administrative levels, the fiscal transfer leads to the phenomenon of industrial agglomeration to the cities at the upper level, intensifying “plurality chasing” behavior of the enterprises; i.e., the active function of the government brings about the choice behavior of economic individuals at a deeper level (Gyourko et al., 2013). The existing land policies in China have several disadvantages such as restricting rural labor forces from complete mobilization, and releasing some space for industries that fail to benefit each other (Hu et al., 2015). With the three factors of population mobility constraint, industrial agglomeration policies and state-owned land system, the Chinese urbanization may result in the oversize of equilibrium size in some countries, and the structural mismatch between cities with the optimal employment utility.

3. THE THEORETICAL MODEL OF MATCHING BETWEEN LABOR FORCES AND INDUSTRIES

3.1 Matching model hypothesis

In the case of co-agglomeration, the urbanization structure and urban growth rest on the matching degree of the following two aspects:

(i) There are differences of the matching efficiency between an industry and labor forces of intra-industry types of skills.

When \( n_{ij} = n_{kj} \), we have \( \frac{\partial g_i}{\partial n_{ij}} > \frac{\partial g_k}{\partial n_{ij}} \), in which \( n_{ij} \) means the total number of employments of the type \( I \) labor force in city \( j \), and \( g_i(\cdot) \) is the urban productivity of the industry \( i \). This means that when the type \( I \) labor force and the type \( k \) labor force are of the same number, compared to the measure to increase the number of type \( k \) labor force, the efforts to promote the urban productivity per capita are more rewarding by increasing the number of type \( I \) labor force.

(ii) There are differences of the matching efficiency between different industries and labor forces of the same type of skills.

We have \( \frac{\partial g_i}{\partial n_{ij}} > \frac{\partial g_k}{\partial n_{ij}} \). For the industry \( k \), the spillover effect of the industry \( I \)'s productivity per capita will be stronger if the number of the type \( I \) labor force increases. Briefly speaking, in contrast to multi-industry matching, the matching efficiency (i.e. technological spillover effect) is higher (stronger) between the migrated labor force and the industry they are in.

3.2 The employment structure of industry-optimization city in the clustering policy

In the case of industry co-agglomeration, an industry-optimization city is a city whose employment structure has the maximum labor force utility. The type \( I \) industry-optimization city structure \( \vec{n}^* = (n_{11}^*, n_{21}^*, ..., n_{I1}^*) \) is the maximum \( U_i(\vec{n}_j) \). We calculate the first-order derivative of the industry \( I \)'s labor force utility \( U(\vec{n}_j) \), and thus for an
arbitrary $k \in \{1, 2, \ldots, I\}$, we have:

$$
\frac{\partial U_i}{\partial n_{ij}} = \frac{\partial g_i}{\partial n_{ij}} - c'(N^i) = 0.
$$

The labor force productivity of urban industries $g_i(.)$ varies with the local industry clustering governmental policies, leading to the change of the employment structure of the industry-optimization city. The urban optimized employment structure (urban Pareto Optimality efficiency) is the maximum value of the weighted sum of the labor force in all the urban industries

$$
W = \sum_{i=1}^{I} \lambda_i U_i(n_{ij}, n_{kj}, \ldots, n_{lj}),
$$

where the weight of profits $\lambda_i > 0$, and we have

$$
\sum_{i=1}^{I} \lambda_i = 1, \quad \lambda_i = N_i / \sum_{i=1}^{I} N_i.
$$

For a city with the Pareto Optimality structure, the weighed utility sum function’s first-order derivative satisfies the condition of

$$
\sum_{i=1}^{I} \lambda_i \frac{\partial U_i}{\partial n_{ij}} = \sum_{i=1}^{I} \lambda_i (\frac{\partial g_i}{\partial n_{ij}} - c'(N^i)) = 0
$$

(1)

On the basis of the above formula, we derive the contract curve which consists of the optimal structure of Pareto efficiency with different weights $\lambda_i$. For example, the productivity change caused by the matching between labor force in the textile industry and the (cross-) industry is different from the one caused by the matching between labor force in the IT industry and the (cross-) industry, which means that the optimal urban employment structure in the textile industry is different from that in the IT industry. The curves in Figure 1 is obtained when the city $j$ only contains the textile industry cluster’s (type 2) and IT (type 1) cluster’s co-agglomerated employment structure.

![Figure 1. The employment structure of two industries](image)

### 3.3 The balanced urban size in the case of incomplete population mobilization

The transfer of labor force depends on the utility of different cities. However, the government of large cities in China sets the degree of freedom of population mobility, and the small cities expand the city size as far as possible. This shows the urban preference of labor force population type directly. We let $P_w$ be the disjoint subset of the employment structure portfolios of $W$ types of labor force ($W < I$), and there should be

$$
\cup_{w} P_w = \{1, 2, \ldots, I\}.
$$

The industry $m$ and industry $n$ is co-agglomerated when and only when $m$ and $n$ are the elements of $P_w$. For example, the urban industry portfolio $P_i = \{1, 2, \ldots, i-1\}$ is the result of the co-agglomeration of industries $1, 2, \ldots, i-1$, and thus the city’s employment structure is $j = (N_1, N_2, \ldots, N_{i-1}, 0, 0, \ldots, 0)$, where $N_i$ is the number of employments in the industry $i$.

Similarly, the industrial organization form $P_z = \{i, i+1,\ldots, I\}$ is the co-agglomeration of industries, $i+1,\ldots, I$. Assuming that there are four types of labor force $i = A, B, C, D$ and
that each city \( j \) has a pair of industries. Therefore, there are six city types according to employment structures:

\[
\begin{align*}
\hat{j}_1 &= (N_1, N_2, 0, 0) \\
\hat{j}_2 &= (N_1, N_1, 0, 0) \\
\hat{j}_3 &= (N_1, N_3, 0, 0) \\
\hat{j}_4 &= (N_2, N_1, 0, 0) \\
\hat{j}_5 &= (N_2, N_4, 0, 0) \\
\hat{j}_6 &= (N_3, N_4, 0, 0)
\end{align*}
\]

The \( j \)-related utility level of labor force \( I \) is \( U(j) = w_i - c(N_j) \). We determine the orders of the utility obtained by labor force \( I \) in the corresponding city ("\( \geq \)" denotes the equal size of utility):

\[
\begin{align*}
i &= A, U_A(j_2) > U_A(j_1) = U_A(j_4) > U_A(j_3) \\
i &= B, U_B(j_1) > U_B(j_4) > U_B(j_3) = U_B(j_6) \\
i &= C, U_C(j_2) > U_C(j_4) > U_C(j_6) = U_C(j_3) \\
i &= D, U_D(j_3) > U_D(j_6) > U_D(j_4)
\end{align*}
\]

The urban preference of labor force types is:

\[
\begin{align*}
P(\hat{j}_1) &: A > B > C \\
P(\hat{j}_2) &: C > A > D \\
P(\hat{j}_3) &: C > D > B \\
P(\hat{j}_4) &: B > D = A \\
P(\hat{j}_5) &: D > A = C \\
P(\hat{j}_6) &: A > C = D
\end{align*}
\]

According to the aforementioned features of urban preferences and labor preferences, the process of labor force migration is:
Step 1: Type A/B/C/D labor forces selectively migrate to the respective cities $j_1/j_2/j_4/j_5$ where they obtain the maximum utility.

Step 2: labor forces (enterprises) may succeed or fail in the fierce competition of labor force market. Considering that both type A labor force and type C labor force hunt jobs in city $j_2$ (according to step 1), type C labor force will be more likely to match with $j_2$ if it has higher productivity or if the strategies of $j_2$ better promotes the development of type C industry clustering. In this case, most of the type A losers will choose to migrate to the rest of the cities, and $j_1$ becomes the judicious choice.

Step 3: (stable Nash equilibrium): the final stable matching between cities and labor force must be:

$$
(A, j_1), (B, j_4), (C, j_2), (D, j_5) \quad (17)
$$

Finally, when labor force migration is in a stable Nash equilibrium, the industrial cluster and employment structure can be determined naturally, and the final labor force utility level is equivalent to the utility level of self-sufficiency:

$$
U_A(j_1) = w_{ij_1} - c(N^{h_A}) = U_A(0) \quad (18)
$$

$$
U_B(j_4) = w_{ij_4} - c(N^{h_B}) = U_B(0) \quad (19)
$$

$$
U_C(j_2) = w_{ij_2} - c(N^{h_C}) = U_C(0) \quad (20)
$$

$$
U_D(j_5) = w_{ij_5} - c(N^{h_D}) = U_D(0) \quad (21)
$$

Allowing for another possibility of city-labor (industry) matching $(A, j_4), (B, j_1), (C, j_2), (D, j_5)$, we obtain the utility result as:

$$
U_A(j_4) = w_{ij_4} - c(N^{h_A}) = U_A(j_1) = U_A(0) \quad (22)
$$

$$
U_B(j_1) = w_{ij_1} - c(N^{h_B}) > U_B(j_4) = U_B(0) \quad (23)
$$

$$
U_C(j_2) = w_{ij_2} - c(N^{h_C}) = U_C(0) \quad (24)
$$

$$
U_D(j_5) = w_{ij_5} - c(N^{h_D}) = U_D(0) \quad (25)
$$

This explains the reason why the utility of A, C and D remains unchanged while the utility of B is lifted significantly, when A and B migrate to the other’s city in the state of stable Nash Equilibrium $(U_A(j_4)=U_A(j_1)=U_A(0), U_B(j_4)=U_B(0), U_C(j_2)=U_C(0), U_D(j_5)=U_D(0))$. This phenomenon implies that the city cannot have Pareto Optimization employment utility structure at the equivalent state.

**4. ECONOMETRIC MODELS AND EMPIRICAL ANALYSIS**

**4.1 Model hypothesis and variants**
According to theoretical analysis, urbanization is the function of salary, human capital, infrastructure, market potential, specialization and co-agglomeration. The form of its econometric equation can be determined as:

In the econometric analysis, except for some exceptional cases of severe data loss, we have the reliable version of 2004-2013 data from 252 national cities at the prefecture level or above. The data sources include the China Urban Statistical Yearbook and the China Regional Economic Statistics Yearbook (See table 1). Below is a description of the related variables and measures.

(1) Urban industry specialization and agglomeration $MI_j$ are mostly the analysis of the share of local employment in a given industry, $MI_j = \max_i (z_{ij})$, where $Z_{ij}$ is the employment share of the industry $i$ in the city $j$. The positive parameter estimation of the index indicates that there exists the condition of MAR externalities.

(2) $WI_j$ is the urban diversification cluster index, $WI_j = \frac{1}{\sum_j z_{ij}^2}$. The larger the index is, the higher the degree of diversity is. The positive parameter of the index indicates that there exists the condition of Jacob externalities.

(3) The urban industry co-agglomeration index is $XI_j = \frac{1}{\sum \bar{z}_{ij}}$, where $\bar{z}_{ij}$ is the total urban employment share of all the labor forces except for those in the most populated industry $m$ and those in the lease populated industry $n$.

(4) $DL_j$ is a proxy variable of urban infrastructure, denoting the proportion of the actual urban road area to the mean urban area.

(5) The proxy variable of human capital advantage is measured by the number of college students (person) per 10,000 people in the city.

(6) $WG_j$ is the proportion of the average wage of workers in urban average.

(7) $MP_j$ is the quotient obtained when the city internal distance is divided by the total retail sales of consumer goods, i.e. $MP_j = I_j / d_j$. $I_j$ denotes the actual total retail sales of consumer goods in the downtown area (unit: ten thousand yuan). $d_j = 2/3 \sqrt{A_j / \pi}$ represents the urban internal distance, and $A_j$ is the building-up downtown area.

(8) The government’s acting force on urban development $FS_j$ is represented by the proportion of fiscal expenditure on the city’s GDP.

(9) The urbanization rate $Urban_j$ is calculated by multiplying the urban area population by the proportion of the population at the prefecture level and above by 100.

(10) $Size_j$ is the size of the city. In order to ensure the consistency of data sources, we use the number of residents in municipal district to determine the city size, which is obtained by dividing the municipal productivity per capita by the total municipal productivity.
Table 1 The sample statistics of all variables in Chinese cities at the prefecture level or above

<table>
<thead>
<tr>
<th>variables</th>
<th>Mean</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>159.2801</td>
<td>2331.7677</td>
<td>7.9142</td>
<td>229.3934</td>
</tr>
<tr>
<td>Urban</td>
<td>33.3110</td>
<td>100</td>
<td>3.8246</td>
<td>23.3426</td>
</tr>
<tr>
<td>MI</td>
<td>0.3099</td>
<td>0.9789</td>
<td>0.0483</td>
<td>0.1122</td>
</tr>
<tr>
<td>WI</td>
<td>6.5521</td>
<td>50.2532</td>
<td>0.0482</td>
<td>2.4029</td>
</tr>
<tr>
<td>XI</td>
<td>1.8386</td>
<td>38.4481</td>
<td>0.0098</td>
<td>0.8242</td>
</tr>
<tr>
<td>DI</td>
<td>0.5928</td>
<td>17.1740</td>
<td>0.0182</td>
<td>0.9715</td>
</tr>
<tr>
<td>EDU</td>
<td>163.0862</td>
<td>1270.5263</td>
<td>3.7470</td>
<td>200.8178</td>
</tr>
<tr>
<td>FS</td>
<td>0.1439</td>
<td>1.4851</td>
<td>0.0404</td>
<td>0.1762</td>
</tr>
<tr>
<td>WG</td>
<td>0.9076</td>
<td>7.3715</td>
<td>0.0484</td>
<td>0.4018</td>
</tr>
<tr>
<td>MP</td>
<td>1293112.4670</td>
<td>20706428.3201</td>
<td>4262316.1465</td>
<td>1131561.4860</td>
</tr>
</tbody>
</table>

4.2 Econometric verification and result analysis

It is not impossible that there is simultaneous endogenous relationship between industry agglomeration and urbanization. In order to guarantee no omission of variables, this model includes an extra estimation result from system GMM, in addition to those from the mixed effect, random effect and fixed effect. Table 2 lists the estimation results of the effect on urbanization according to nationwide urban data.

Table 2 Estimated results of the effect on urbanization in the industry agglomeration mode

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pool OLS</th>
<th>Fixed Effects</th>
<th>Random Effects</th>
<th>System GMM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Urban Size</td>
<td>Urban Size</td>
<td>Urban Size</td>
<td>Urban Size</td>
</tr>
<tr>
<td>Constant</td>
<td>3.783125**</td>
<td>1.374733**</td>
<td>2.847323**</td>
<td>1.654665**</td>
</tr>
<tr>
<td>MI</td>
<td>1.095527**</td>
<td>-1.430795**</td>
<td>0.385132**</td>
<td>0.558697**</td>
</tr>
<tr>
<td>WI</td>
<td>0.009061**</td>
<td>-0.070687**</td>
<td>0.008469**</td>
<td>0.010953**</td>
</tr>
<tr>
<td>XT</td>
<td>-0.005711**</td>
<td>0.100506**</td>
<td>-0.235181**</td>
<td>-0.026869**</td>
</tr>
<tr>
<td>WG</td>
<td>0.109458**</td>
<td>0.037962**</td>
<td>0.019322**</td>
<td>0.026866**</td>
</tr>
<tr>
<td>DL</td>
<td>0.005229**</td>
<td>0.127131**</td>
<td>0.007737**</td>
<td>0.016001**</td>
</tr>
<tr>
<td>In MP</td>
<td>1.437335**</td>
<td>3.744741**</td>
<td>0.128799**</td>
<td>0.846522**</td>
</tr>
<tr>
<td>FS</td>
<td>-0.016901**</td>
<td>-0.170577**</td>
<td>-0.287643**</td>
<td>-0.271832**</td>
</tr>
<tr>
<td>In EDU</td>
<td>0.143621**</td>
<td>0.001436**</td>
<td>0.182183**</td>
<td>0.178003**</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.384203</td>
<td>0.954255</td>
<td>0.817999</td>
<td>0.817999</td>
</tr>
<tr>
<td>Wald Test</td>
<td>480.69436</td>
<td>194.187169</td>
<td>0.000000</td>
<td>0.000000</td>
</tr>
<tr>
<td>Sample</td>
<td>2515</td>
<td>2515</td>
<td>2515</td>
<td>2515</td>
</tr>
</tbody>
</table>

(The System GMM estimation in the round brackets is z statistics, and the rest is t statistics; what is in the square brackets is the concomitant probability of statistics; ** indicates the significance at the level of 1%, * indicates the significance at the level of 5%, * indicates the significance at the level of 10%).

First, we discuss the degree of industrial agglomeration on the urbanization rate or the city size. The results show that the specialization agglomeration parameter has passed the significance test in all the equations, that the specialization agglomeration has a positive effect on the increase in urbanization rate, and that the specialization agglomeration is not conducive to the enlargement of the city scale. This result basically complies with the theoretical expectation mentioned before. According to the empirical result of the influence of diversification agglomeration on the city scale, all the equations’ parameter estimation has passed the significance test. According to the effect of
diversification agglomeration on urbanization rate, the parameter estimations of
diversification agglomeration are positive in all equations, but merely significant in
the system GMM equation. This phenomenon shows that the parameter estimation of
the effect of diversification agglomeration on urbanization rate is improved significantly after
endogeneity is controlled. The parameter estimation of the effect of co-agglomeration on
urbanization rate varies greatly in all the equations. After the problem of
heteroscedasticity, autocorrelation and endogeneity is controlled, the parameter
estimation of the effect of co-agglomeration on urbanization rate is significantly positive, but is negative on urban size. Inversely, the effect of co-
agglomeration on the urbanization rate is significantly negative, but is positive on urban size. These empirical results indicate that, according to the 2004-2013 data analysis
results of industries, their complete specialization agglomeration and diversification
agglomeration have respectively significant and less significant promotion effects on
China’s urbanization rate through technology spillover effect. Despite the lack of the
technological spillover effect’s significant promotion of the rise in urbanization rate in the
case of industry co-agglomeration, its effect on urban size has been enlarged.

Secondly, the parameter estimation of each control variable is considered. In the system
GMM estimation, the effect on urbanization by the proportion of the local wage to the
national average wage has passed the positive significance test. This indicates that after
the inherent problem of auto-correlation and endogeneity has been controlled,
parameter estimation becomes more reasonable, and the rise in income levels promotes
the urban agglomeration of migrated labor forces. In the system GMM estimation, the
effect on city size by the proportion of the local wage to the national average wage has
failed to pass the significance test. The parameter estimations of the urban market
potential in each equation are significantly positive, implying that the impact of market
potential on urban size or urbanization rate is positive. This phenomenon also indicates
that the development of the urban market potential will be conducive to the further
promotion of urbanization. In the system GMM estimation, the proportion of fiscal
expenditure to urban GDP is negative to the regressive parameter of urbanization rate,
passing the significance test. It indicates that in the current urbanization stage, the cities
with high proportion of fiscal expenditure to urban GDP are often backward middle-to-
western Chinese cities, and that the limited urban revenue is mainly used by local
governments to serve for the construction of urbanization.

<table>
<thead>
<tr>
<th>Variable</th>
<th>East</th>
<th>South</th>
<th>Northeast</th>
<th>West</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2.145626</td>
<td>-2.568515</td>
<td>5.174392</td>
<td>-1.393753</td>
</tr>
<tr>
<td>M1</td>
<td>0.233926</td>
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Table 3 Estimation results of region-varying individual fixation effects
Since there are obvious differences between industrial structure, population policy and industrial cluster policy, it is necessary to estimate the urban samples in different regions separately. The estimation results of the urban samples in different regions are shown in Table 3.

The region-varying discussion of the parameter estimation of the urban agglomeration mode variables is as follows: First, the parameter estimation of the specialization agglomeration in eastern China is significantly positive. The parameter estimation of the specialization agglomeration in central China is significantly negative. In the rest of the regions, the parameter estimation of the specialization agglomeration is negative, albeit insignificant. In terms of the estimation of diversification parameters, only the eastern region is significantly positive. This shows that the specialization agglomeration and diversification agglomeration of the eastern region have great positive effects on the urbanization rate, but whether the industrial agglomeration is fully specialized or diversified in the underdeveloped areas is not necessarily related to the increase in the urbanization rate, which results from the low degree of regional economy opening to the outside world, the low degree of marketization, and the effect of government-led urbanization.

Secondly, the estimation of co-agglomeration parameters in the eastern region is significantly negative. None of the estimated parameters in other regions pass the significance test with great fluctuation. The results show that the impact of co-agglomeration on urban development changes with the rise in urbanization rate. The effect of diversification agglomeration on urban size is only effective in eastern regions. All the parameter estimations of the effect of co-agglomeration on urban size pass the significance test. This phenomenon indicates that no matter which stage of urban economic development is, co-agglomeration actively promotes the expansion of urban scale, especially for eastern region with higher degree of marketization. What is more, the similar parameter estimation results between the northwestern region and the central region means that when a large number of migrants migrate to the coastal cities, the technological spillovers of the intra-industry matching of labor forces is greater than that of the multi-industry matching of labor forces. Promoted by the industry clustering governmental policy, the expansion of urban size is accelerated.

5. CONCLUSION

At present, it is the underdeveloped central and western regions rather than the developed eastern coastal cities that have high degree of specialization. Most of the regional centers or capital cities presents the characteristics of industry co-agglomeration as what we have discussed herein. The partial phenomenon of the incomplete industry agglomeration and multi-industry clustering co-location activities changes with the change of population policies and its management at the government level as well as the games of industry clustering strategies. Through our analysis and urbanization verification of the matching theories of labor force and industry, we hold it that:

(1) The current specialization and diversification of urban agglomeration strongly promote the increase in Chinese urbanization rate. However, city size is largely determined by the level of industry co-agglomeration. Specialization agglomeration is not conducive to the expansion of urban scale, and there is no clear evidence that complete diversification agglomeration and urban scale expansion are positively correlated with each other.

(2) Under the guidance of the industry agglomeration led urbanization policies, there may emerges “dual conflict” between the Nash Equilibrium states in the city and the optimal-utility-oriented employment structure of the whole society. As multi-industry co-
agglomeration is a universal phenomenon emerging in the co-location of industries in urban China, it is inevitably for the local government to provide subsidies and support for advantageous industry agglomerations with higher productivity, and to attract more migrated labor forces as a way to promote urbanization. Nevertheless, the increment in migrated labor forces should guarantee that the spillover effect of the urban intra-industry productivity should exceed the urban productivity in other industries, or otherwise the local government will inevitably take measures to further strengthen the industry clustering policies. If so, the inherent “plurality chasing” behavior of the economic subject will finally overly enlarge the Nash Equilibrium urban size, without reaching the Pareto Optimality structure of employment utility in the whole society. If the utility-optimality employment structure in the whole society is maintained, the population mobilization will fail to remain at the Nash Equilibrium state.

6. ACKNOWLEDGMENTS

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7. REFERENCES