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The Spatial Distribution and Influencing Factors of Employment Multipliers in China's Expanding Cities

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Abstract: In the process of urbanization in developing countries, creating enough jobs to realize the transition from an agricultural population to a non-agricultural population is a major goal of development. The differences and localities of cities need to be considered in the policymaking process. This study estimated the local employment multipliers of expanding cities in China and calculated the employment multiplier of each city. First, there are obvious differences in the size of employment multipliers across cities; therefore, it is necessary to adopt different policies in employment promotion. Second, an inverted-U-shape relationship is detected between employment multiplier and city size, namely the larger the city, the greater the employment multiplier, but when the city size exceeds a certain value, the employment multiplier begins to decline. Third, different degrees of influence are generated by factors for cities at different levels of economic development. Based on the research results, we suggest that expansion of the trade sector be promoted in small- and medium-sized cities, to give full play to its employment multiplier effect; meanwhile, in large cities, the degree of specialization of the trade sector and diversification of the non-trade sector should be improved.

Keywords: expanding cities; employment multiplier; spatial distribution; influencing factors; China

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1. Introduction

Problems associated with urban employment have received increasing attention; in particular, fluctuations in the international trade environment and regional competition among cities have led to an alarming degree of job flux between cities [1,2]. While some cities have excellent employment vitality, others have sustained job losses and rising unemployment. William Julius Wilson considered the issue of unemployment as the core and origin of sundry American urban pathologies [3]. This problem is not exclusive to the United States; developing countries face the same issues, thus aiming for much higher employment and the resolution of unemployment [1,4–6]. Scholars have analyzed the problem of employment in developing countries and the significance of employment promotion [7]. First, job creation is key to realizing the shift of labor from the low-income and low-outcome sectors to the high-income and high-outcome sectors in developing countries. It is also directly related to the reduction in the size of unemployment. Second, increasing opportunities for the poor to obtain jobs and better their lives would address income redistribution. Even though there is some dispute over the reasons for job creation—for example, division among economists on whether productivity and marginal product growth are consistent with job creation—and on issues of efficiency and equity [7], efforts to create jobs have always been a relevant topic among academics and governments. The importance of employment varies from country to country, at different levels of development. Even in developing countries, there are significant differences between different institutional systems.

China has made remarkable achievements in urbanization in the 21st century. In the future, China will continue to promote urbanization, which means that a large proportion of the agricultural labor force will be converted into a non-agricultural labor force [8]. Lewis's classic paper on the labor market [9] concluded that one of the core functions of Chinese cities is to affect the spatial transfer of a large proportion of the agricultural population from low-income and low-output sectors to high-income and high-yield sectors in the process of urbanization; this means that how to respond to the increase in urban employment demand is a practical problem that Chinese cities have needed to face and solve for a long time.

When it comes to how to create more jobs, economists have validly offered a series of classic suggestions, including using the basic multiplier [10,11]. Economists argue that the basic activities of a local economy are premised on the existence and development of non-basic activities and that a city's service sector will decline if jobs are lost in the trade sector. This is true, regardless of how well developed a city's service sector currently is [12], such as in the case of Detroit. Therefore, the local government is committed to attracting enterprises and productive activities through a series of incentive measures [13]. It is believed that such immigration will not only bring a direct increase in employment and income but also have a driving effect on other local industries through a multiplier effect [14]. Specifically, this facilitation effect, known as the "local multiplier effect", is mainly achieved through the demand of labor forces in the tradable sector for production and life services of the local non-tradable sector [15].

The concept of the multiplier originates from Keynesian economics [15]. In the 1960s and 1970s, some scholars tried to advance the idea of an employment multiplier [16] and used it to study the economic base multiplier [10]. However, the idea did not receive much attention at the time. Until the early 2000s, Moretti modeled and estimated the size of America's overall employment multiplier [11]. Subsequently, this model has been used to estimate the employment multiplier in several countries and regions, including Japan [17], Sweden [14,18], Italy, and the United States [11,19–21]. As a result, a wealth of conclusions was obtained in a short time. Scholarship on the employment multiplier has confirmed its practical significance and discovered significant differences between different regions. These differences are also reflected in the choices of spatial scale and research time [22,23].

In addition to the selection of the time and spatial scales, the multiplier effects of different positions in the trade industry also differ. It is generally believed that highly technical positions bring more multipliers [14,24]. As for the formation of differences in employment multipliers within the industry, neo-Keynesian economists believe that highly skilled individuals and households will have higher consumer spending because they have higher wage incomes [11,25], resulting in more demand for non-tradable products and services. From the perspective of upstream and downstream industrial structure and production, higher technical levels will increase the likelihood [26] that not only will each additional job in the upstream end of the production system result in immediate employment demand, but the trade department will also bring jobs to the middle and lower reaches of production activities. However, the employment multipliers for skilled jobs of the same levels in different cities also differ [24], which shows the importance of considering differences among cities when discussing the multiplier.

In addition to the estimation of the employment multiplier, scholars have explained the reasons for differences in multipliers from different perspectives. The present study attempts to explain the reason for these differences but offers mostly descriptive explanations of single factors, such as urban scale [27], development level and location [22], and mobility [17]. Some research model analyses have also examined the relationship between individual factors and employment multipliers. All the above provide many theoretical and empirical foundations for understanding the multiplier. Given the background of new economic geography, production trade and labor mobility between urban areas are important for understanding a city's employment. With this approach, the multiplier theory of overflow and model is used to explore the preliminary results [28]. Recent em-

pirical studies incorporate the spatial spillover of the employment effect into the study of employment multipliers [19].

There are deficiencies in the literature. First, both the existence and differences of employment multipliers have been confirmed [11,22,23], but the research scale has been concentrated at the macro regional and national levels. In terms of policy suggestions for urban development, a differentiation policy is necessary. Different cities have shown huge differences in city size, population structure, function, and locational conditions; these difference are particularly evident in developing countries, including China, which is undergoing rapid urbanization. Hence, this necessitates different development policies [29]; for example, development policies that work well in big cities may not have the same effect in smaller ones [30]. The small-city employment multiplier has been studied with this in mind [27]. However, the differences between cities are not just about size. On this basis, first, we need to estimate the employment multiplier of each city and the reasons for the difference in order to formulate effective employment promotion policies. Second, a mechanism analysis of the differences among employment multipliers is lacking. Most research addresses applications and tests of the model proposed by Moretti [11]. Almost all scholars have affirmed the differences in employment multipliers between industries, along different spatial scales, and in different cities [19,20,22,23], but they have not conducted further studies on the theoretical framework of the formation of differences. Third, Pred and Krugman argue that cities have different employment multipliers at different stages of development [31], especially during expansion and recession. While all prefectural cities are included in the study of China [22], including shrinking cities, the actual multiplier of urban sprawl is understated. Although the regionalization approach gave greater depth to the multiplier, the error generated by including shrinking cities could not be completely eliminated.

This study identified Chinese prefecture-level cities in the expansion process. The employment multiplier for these cities was estimated by using the City Statistical Yearbook data and OLS (Ordinary Least Square) regression. In addition to calculating the urban employment multiplier, this paper establishes a basic understanding of the framework and analyzes the formation mechanism of such differences within this framework to understand the causes of the differences, based on which development suggestions are provided. Section 2 establishes an analytical framework that combines relevant research. The methods of the study and resulting data are discussed in Section 3. Section 4 introduces the urban employment multiplier calculation results and the space–time evolution law. The paper concludes with a discussion and suggestions.

2. Analytical Framework

The expression "employment multiplier" refers to the speed and effect of change in the non-tradable sector brought about by the change in the trade sector. Therefore, it includes both positive and negative aspects. However, most of the multipliers mentioned in the current literature show the positive promotion effect brought about by the growth of the trade or manufacturing sector [23,28,32]. Krugman argues that the employment multiplier goes beyond a single positive effect to take a more interesting and complex form. This effect is mainly reflected in the process of urban contraction and recession [33]. When jobs in the trade sector are lost, the change rate of total urban employment is different from that of non-tradable sector employment. Economists believe that the rate of change caused by employment increases and decreases in the non-tradable sector is different from that of the trade sector [31]. There are different degrees of effects in creating and reducing trade sector jobs of the same scale within the same city, which means that incorporating all cities into one model would skew the results of the employment multiplier in the presence of shrinking cities.

The article combines the multiplier theory with the theory of the urban development stage, and offers the phased view that increases in the trade sector during urban expansion will bring about a significant employment multiplier effect. This is consistent with the

results of most studies [20,21,27]. When the expansion of a city has gradually slowed to a steady state, the growth rate of the trade sector also slowed. In this state of development, the non-tradable sector will no longer grow in multiplier form, and the two sectors may show a negative relationship in terms of growth rate. When a city enters a recession, the tradable and non-tradable sectors are simultaneously reduced. The decline of the tradable sector then leads to the contraction of the non-tradable sector at a different rate than when cities are expanding. As a result, this study found it necessary to distinguish between expanding and shrinking cities in order to calculate a more precise multiplier effect of employment.

Joan Robinson proposed a theoretical framework to inform our understanding of the urban employment multiplier effect in China. Robinson constructed the formation process and influencing factors of the multiplier from the perspective of economics [34]. She argued that the employment multiplier is affected in two ways. The first is the number of times income passes through different cycles, which is the geometric progression. The second is the degree of residents' consumption, which is reflected by the wage–profit ratio, relief–wage ratio, and savings–profit ratio. Robinson's contribution was to construct a complete dynamic analytical framework of employment multipliers from individuals to cities to countries, rather than simply finding the influencing factors. This is of great help for us to analyze the employment multiplier in China, but Robinson's framework is based on the capitalist market economy, and there are differences in how influencing factors express themselves in Chinese cities.

A basic theory of the formation of the multiplier is established based on the theory proposed by Robinson [34]. The realization of the employment multiplier effect from the trade sector to the local non-trade sector is based on the consumption demand of the production and life of the practitioners in the tradable sector [11,15]. Manufacturing sector workers earn wage income, which is used for production and consumption, creating effective demand as a result. New Keynesian economics takes the perspective that in a capitalist market, one part of a household's wages is spent while the rest is saved. The consumption aspect influences the urban labor market in two ways. The first part consists of the demands of the entire trade department for related products and services, including innovation, design, advertisement, and law. The second aspect consists of influencing the urban services industry through individuals, such as catering and entertainment. These two types of consumer demand lead to the first step in multiplier realization. The jobs generated by the first approach pay higher wages, which Alan Scott and others call "cultural cognition". The second method produces low-income jobs, which belong to the category of physical practice. The increase in these jobs will bring income to the corresponding job recipients; these recipients will also consume in the city, thus further generating the second-step employment multiplier, which is generally smaller than the first-step multiplier. The second-step multiplier is also affected by individual income: The higher the income, the larger the scale of consumption and the higher the employment multiplier. In the same way, a multi-step employment multiplier is generated, and the total employment multiplier is finally obtained through addition. This means that a higher-wage income sector will generally correlate with a higher employment multiplier [20]. The cyclical coherence of employment and public spending has also been demonstrated in several countries [35].

The relationship between cities is the key to the size of the urban employment multiplier [19]. The previous idea was based on the assumption that the region has no connection to the outside world. In other words, the employment effect produced by the trade sector is realized in the city. In reality, cities are related to other regions as components of urban systems. Some of the local consumption spending spills over to other cities through this relationship, so part of the employment multiplier from the increase in the trade sector spills over to the linked cities [36], as scholars believe that export-oriented strategies are less effective in promoting employment than import substitution [37]. However, the spillover effects between cities are not equal. According to the theory of centrality, it is not difficult to deduce that in urban networks, the employment overflow in big cities is much higher than

that in small cities [38,39]. The close relationships between cities makes the transformation of spatial scale very important in the process of understanding and analyzing the urban employment multiplier. Keynes also discusses the differences in employment multipliers across different scales in his work [15].

Scholars have also proposed factors influencing the employment multiplier from the perspective of geography. Moretti identified three factors affecting the urban employment multiplier [11,14]. First, the employment multiplier is directly related to consumers' consumption preferences for non-traded goods. As mentioned above, the realization of the employment multiplier is based on residents' consumption activities. If residents save more of their income, the employment demand for non-tradable sectors in the city will decrease, thus keeping the employment multiplier at a low level. Second, the type of employment in the trade sector also has important implications because higher income leads to greater growth in demand for local services [24]. Third, the labor-and-housing-supply elasticity, which affects the space overflow of economic activities. If the supply is completely elastic, the multiplier is the largest.

Economists and geographers have achieved much in employment multiplier theory and empirical research, but not enough to explain the differences in employment multipliers, especially to explain the horizontal differences between cities within the same economic system. Based on scholarly research, and considering the particularity of China as a large developing country, this paper determines the following factors of concern. The first is the economy and industrial structure. Both the specialization degree of the trade sector and the diversification degree of the non-trade sector have important internal relationships with urban employment. The former determines the income levels of the trading sector and the city as a whole [12,40,41], which is consistent with the theory of competitive advantage. The latter affects the geometric size of the non-tradable sector consumption resulting from job growth in the tradable sector; the more diversified the non-tradable sector, the richer and larger the local consumer goods market, leading to more consumer spending by households [31]. The second consists of urban geographical factors. Spatial location, or more precisely the spatial connection among cities, on the one hand, affect labor flow and product trade; on the other hand, the importance of the spatial spillover effect in the multiplier calculation has been confirmed in American cities [19,28]. In the process of rapid urbanization in China, urban production and trade networks are more closely linked, so the spillover caused by this locational relationship is expected to be more significant in China's urban system. In addition to spatial connections, there is also urban size. The influencing mechanism of city size is similar to that of industrial diversity; big cities have a richer variety of consumption and a larger market size. However, because there are already enough living service agencies in big cities, the threshold scale of the multiplier effect will be relatively high.

The first two kinds of factors affect the theoretical expected value of a city's multiplier, and the adjustments of the employment multiplier and job crowding out are the factors that cause the actual multiplier to deviate from the theoretical multiplier. As shown in the previous analysis, the important condition for the emergence of the multiplier is assumed to be the elasticity of labor supply. If the labor supply is inelastic, there will be no multiplier, or the multiplier will be small. Research in Japan has confirmed this view [17]. Housing costs also affect employees' decisions; if the expansion of production in the trading sector leads to a rise in wages and the increase in housing prices is thus greater, there will be a crowd effect on basic employees in the non-tradable sector, reducing the multiplier effect.

3. Materials and Methods

3.1. Research Area

This study selected prefecture-level cities in China as the study area. The choice of spatial scale on the employment problem is very important in the study; prefecture-level cities are the main economic and social units in China. Prefecture-level cities are marked

by certain independence and significant levels of difference. Therefore, prefecture-level cities were selected as research subjects.

Choosing Chinese cities as the study area of the employment multiplier reflects unique advantages. First, there are vast differences among many cities in China. The literature focuses on developed countries with high urbanization levels and low labor-supply elasticity. The formation process of China's urban system in the stage of rapid urbanization has unique advantages for studying the formation and evolution of employment problems. Second, in developed countries, particularly the United States, the manufacturing sector is not the main sector of the economy, but that economy is dominated by financial innovation and other activities. Therefore, the impact of changes in the trading sector on non-tradable sectors is not as significant as imagined. China is a manufacturing power, and the migration of manufacturing to developing countries, which is common in developed countries, is rare in China [22]. The driving role of the manufacturing industry in the urban economy is stronger in developing countries than in the case of China, a developed country in a period of transition. Third, both government and market forces affect urban and regional development [42], which is not covered by the current research. Further study of Chinese cities is of great significance for improving the employment multiplier theory and providing reference for developing countries.

China is divided into three regions in the following analysis. The eastern region is mainly coastal provinces with the highest density of population and the most advanced urban economy. It is the most attractive region for internal migrants. The central region is also populous, but urban economy and attractiveness of cities in this region are moderate. The western region is sparsely populated and economically backward. Employment multipliers in cities located in different regions are very likely to be different and their influencing factors are expected to have both similarities and differences as well.

According to the previous analysis, expanding cities were selected as the research unit, so it is necessary to identify and exclude shrinking cities. There are many ways to identify shrinking cities; this study chose the more direct method, which is the reduction of population size, or rate of change. In order to classify the types of urban growth or contraction more carefully, both population growth in municipal districts and population change in municipal districts relative to those of non-municipal districts were investigated. The formula is as follows:

$$\Delta P_s\% = \frac{\left| P_{s(2018)} - P_{s(2008)} \right|}{P_{s(2008)}} - p_a \quad (1)$$

$$\Delta P_{ss}\% = \frac{\left| P_{ns(2018)} - P_{ns(2008)} \right|}{P_{ns(2008)}} - p_a \quad (2)$$

$$D = \Delta P_s\% - \Delta P_{ss}\% \quad (3)$$

where P_s is the municipal population, P_{ns} is the population of non-municipal districts, and D is the difference in the rate of population change between municipal and non-municipal districts. Here, the change in the rate of the population of both municipal and non-municipal districts is subtracted from the national average population growth rate for that period, p_a, to exclude the effects of overall population growth. If D is less than 0, the city is in the contraction stage and was not included in the research scope. As a result, 169 cities were selected for the study (Figure 1).

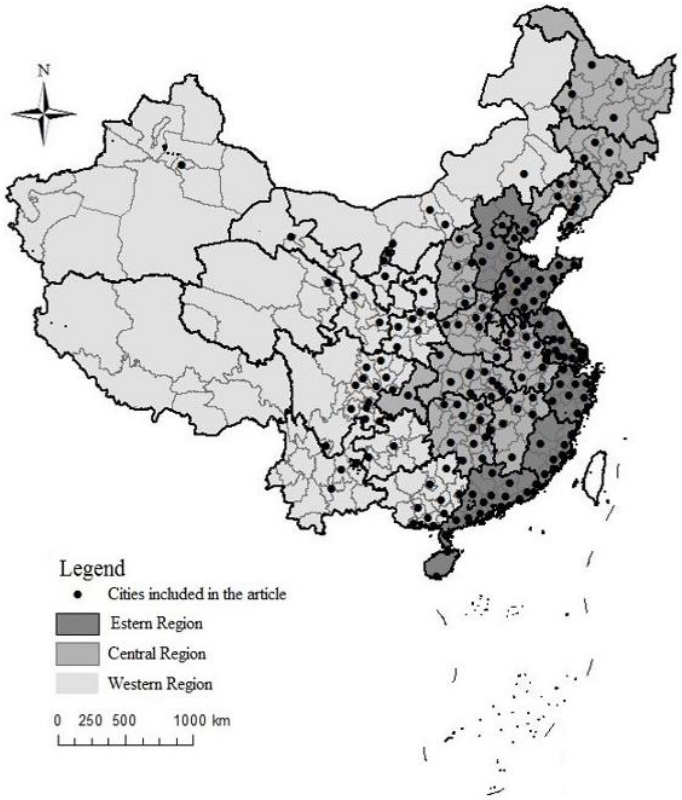

Figure 1. Map of 169 expanding cities included in the article.

3.2. Data

The study used industry statistical data from the China City Statistical Yearbook, from 1998 to 2018, for prefecture-level cities, including manufacturing- and service-sector sectors, which mainly include transportation, warehousing, storage, post, information transmission, computer services and software wholesale, retail accommodation, catering, financial, real estate, leasing and commercial services, scientific research, technical services, geological prospecting, water, environment and public facilities management, education, health, cultural and sports entertainment, resident services, and other services. Industrial structure data use China's economic census data, while location data use Chinese regional urban road network data.

Regarding the number of employees, data from the whole city, rather than those of municipal districts, were selected as the research data for this study because, in the case of China's urban development, the development of central cities is strongly connected with that of the surrounding areas. On the one hand, some manufacturing is concentrated in outlying municipal districts. On the other hand, people who work in municipal districts must live in municipal departments, and their consumption and employment effects will overflow to the municipal districts.

3.3. Methods

3.3.1. Model and Variables

Based on the theoretical analysis and literature review, we developed an empirical model to examine the influencing factors of employment multiplier in Chinese cities. Independent variables include city size, degree of specialization of trade sector, degree of diversification of non-traded sector, locational condition, income, housing cost, and elasticity of labor supply.

$$Mult = \beta_1 CitySize + \beta_2 Div + \beta_3 Prof + \beta_4 Loc + \beta_5 Wage + \beta_6 Hou + \beta_7 Lab + \mu \quad (4)$$

In the model, the urban employment multiplier, represented by *Mult*, is the explained variable, indicating the degree of employment change in non-tradable sectors brought about by the growth of manufacturing jobs in a city. *City size* is the most important factor in the study of urban problems [43,44]. In this study, the permanent urban population was selected as a measure of urban scale. The degree of diversification in the non-tradable sector, represented by *Div*, measures the type and size of the local consumer goods market. The higher the diversification, the higher the local consumer expenditure, as measured by the diversification index. The degree of specialization of the trade sector, represented by *Prof*, affects urban development speed and income level [45], and the specialization index is calculated by using trade-sector employment data. The locational condition, represented by *Loc*, makes up for the industrial and economic relationships between cities, which are neglected in the model [28,46], and uses as a measurement the city's distance to the provincial capital city's expressway. For residents' income levels, we used *Wage*, which is representation in the model, largely to determine their consumption intentions and actual expenditure levels, and cities' average wage levels are used as the measurement index. The cost of living will have a crowding-out effect on employment, especially in low-skilled non-tradable sectors [47]. Housing prices, represented by *Hou*, are a closely watched employment factor in this study [48]. The elasticity of labor supply represented, by *Lab*, is the premise for the realization of the employment multiplier, and the scale of the urban floating population is used as a measure. B_i (i = 1,2,3 . . .) are coefficients, and μ is a constant term.

3.3.2. Employment Multiplier Calculation Method

On the basis of the model proposed by Moretti [11], we constructed the following model:

$$E^s_{ij,t} - E^s_{ij,t-1} = \beta_0 + \beta_1\left(E^m_{ij,t} - E^m_{ij,t-1}\right) + \alpha City_{i,t-1} + \varepsilon + \mu_\varepsilon \quad (5)$$

where the explained variable is the change in the quantity of employment in the service industry, measured by $E^s_{ij,t} - E^s_{ij,t-1}$, and the core explanatory variable is the change in the employment of the manufacturing industry in $City_i$. β_1 represents the size of the employment multiplier, and *City* refers to other macro variables that may affect both manufacturing and employment changes in a lagged phase. The selection of city-level variables is mainly based on whether they simultaneously influence the changes in the manufacturing and service industries, as well as the degree of influence. This study selects the proportion of government expenditure to GDP, the proportion of fixed-asset investment to GDP, and the ratio of foreign investment to GDP in the current year; μ_ε is the residual, and ε represents the fixed effect controlled in the study.

For the employment of multiplier calculation, the consistency of the OLS estimation error term was not associated with changes in manufacturing employment. This was difficult to meet within the current research context; as a result, instrumental variables were used. However, China's 2003–2015 study showed that the instrumental variable for this period of China's urban employment multiplier in instrumental variable regression results was not large, and the returned benchmark results by the model were robust.

The calculation of the instrumental variables was as follows:

$$\mathrm{IV} = \sum \frac{\mathrm{Emp}^{\mathrm{m}}_{-\mathrm{i,t}} - \mathrm{Emp}^{\mathrm{m}}_{-\mathrm{i,t-1}}}{\mathrm{Emp}^{\mathrm{m}}_{-\mathrm{i,t}}} \quad (6)$$

where $\sum \frac{\mathrm{Emp}^{\mathrm{m}}_{-\mathrm{i,t}} - \mathrm{Emp}^{\mathrm{m}}_{-\mathrm{i,t-1}}}{\mathrm{Emp}^{\mathrm{m}}_{-\mathrm{i,t}}}$ represents the change in manufacturing employment in regions other than city i. This is the impact of exogenous local economic conditions, which does not affect employment in the local service industry. This study first conducted a fixed-effects regression for the basic model in Equation (1), to obtain the benchmark results and then introduced an instrumental variable to conduct IV-2SLS (Instrumental Variable-Two Stage

Least Squares) regression to measure the multiplier effect of manufacturing on employment creation in the service industry.

3.3.3. Variable Calculation

Industry diversity was calculated by using the Herfindahl–Hirschman Index (HHI) [49], and the calculation formula is as follows:

$$\mathrm{hhi} = 1 - \sum_{n=1}^{N_i} S_{i,n}^2 \tag{7}$$

where N_i is industry type in region i, and S_(i,n) is the ratio of the number of persons employed in industry category n in the region to all persons employed in the region. The more evenly the regional employment is distributed across industries, the greater the Herfindahl–Hirschman Index and degree of diversity. When using the proportion of employed persons in various industries to measure the degree of diversity of all urban industries, one must consider the group size of employed people. The ratio of f_i is the number of people employed in the region to the total population of the region.

$$\mathrm{HHI} = f_i \cdot \left(1 - \sum_{n=1}^{N_i} S_{i,n}^2\right) \tag{8}$$

Locational condition was measured by the distance of the city from the expressway of the region's central city (selected as the provincial capital). For the central city itself, the locational condition was calculated by seeing the city as a circle and calculating the radius, using the area from the China Urban Construction Statistical Yearbook.

The regional specialization index is usually used to measure the specialization level of urban industries; that is, the industry with the most employed people in a city is selected as the specialized industry of the city, and the share of employed people in the industry among the total employed people in the city is used as the specialization index. We calculated the following:

$$ZZI_i = max_i(S_{ij}) \tag{9}$$

where ZZI_i measures the degree of specialization of city *i*. S_{ij} is the industry with the proportionately highest employment share in city *i* of total employment.

The elasticity of labor supply uses the urban floating population as the index, and we calculated the following:

$$Lab = P_a - P_h \tag{10}$$

where *Pa* is the urban resident population from the Economic Statistics Yearbook of Chinese provinces. *Ph* is an urban registered population, for which data are derived from the Statistical Yearbook of Chinese Cities.

The average wage comes from the Economic Statistics Yearbook of Chinese provinces. The housing-price data come from the China housing price quotations website (https://www.creprice.cn/rank/cityforsale.html). Tables 1 and 2 describes the variables selected in this paper, as well as their corresponding indicators, data sources, and descriptive explanations.

Table 1. Index selection, computing, and data sources.

	Index	Computing and Data Sources
City size	Urban population	Statistical Yearbook of each province
Diversity	HHI	Formula (8)
Location	Distance to central city	Distance to region's central city
Professionalization	ZZI	Formula (9)
Income	Wage	Economic Statistics Yearbook of each province
Housing costs	Housing price	https://www.creprice.cn/rank/cityforsale.html
Labor supply	Floating population	Formula (10)

Table 2. Descriptive statistics of variables.

	Max	Min	Mean	SD	Variance
Multiplier	2.27	0.31	1.67	1.04	14.08
City size	2479.00	30.54	204.02	259.10	6710.99
Diversity	0.85	0.03	0.17	0.09	0.009
Location	1936.00	12.00	227.54	192.10	36,918.90
Professionalization	0.458	0.010	0.027	0.310	1.270
Wage	13,434.00	3817.00	7018.21	4219.07	126,475.11
Housing costs	58,972.00	2638.00	18,256.24	15,127.03	243,657.37
Labor supply	969.17	2.97	128.08	83.94	25,713.14

4. Results

4.1. China's Urban Employment Multiplier

By calculation, the urban employment multiplier in China ranges between 0.31 and 2.27, with a mean of 1.67. This means that introducing enterprises or production activities in a different city leads to the prominence of leading role differences. In areas of high employment multipliers, a trade sector job can produce 2.27 non-tradable sectors of employment growth, and in some areas where the tradable sector shows a poorer stimulating effect, it can only lead to employment in the non-tradable sector. Therefore, the conclusion first affirmed the importance of the trade department to employment growth; some countries are set based on the specific employment policy with regards to this [14]. It turns out that expanding the trade department is an effective means of producing activities to promote employment. However, although the growth of the trade sector has a significantly positive effect on employment, the difference in effect degree in different cities warrants attention. Local governments should not only consider the development of the trade sector but also how to improve the driving effect of the trade sector. The average employment multiplier in cities during the national expansion is 1.67, which is higher than that of other developing countries but close to that of some developed countries [11,17,23]. Studies show that employment multipliers of 1.5–1.7 exist in American cities [20]. This proves the above hypothesis; that is, the employment multipliers of shrinking cities are smaller than those of expanding cities, and the estimated multiplier will be low if the analysis is not differentiated.

In terms of spatial distribution, as shown in Figure 2, the employment multipliers in central and western regions are generally higher than those of coastal cities, which is consistent with other studies [22]. Capital cities in Central China and medium-sized coastal cities, which are China's major manufacturing centers, have higher employment multipliers and have the advantage of productivity. In contrast, the employment multipliers in megacities are not linearly related to the expected size. This is because, when a city is large enough, the non-tradable department within the type and scale of change is less affected by trade department changes, and super megacities are given priority for finance and innovation; so, manufacturing changes brought about by urban employment are less volatile. The employment multipliers in small cities are relatively low; the market sizes and types of consumer goods in small cities are not as large as those in large cities, and the

consumer market-pull effect occasioned by the expansion of the trade sector is not as strong as in large cities. In addition, there is a less prominent employment multiplier in Northeast China, which has been related to emigration in recent years. The labor force outflow and the recession of the manufacturing industry make the labor force supply elasticity in Northeast China very low. Meanwhile, the income level in Northeast China also limits the realization of the employment multiplier.

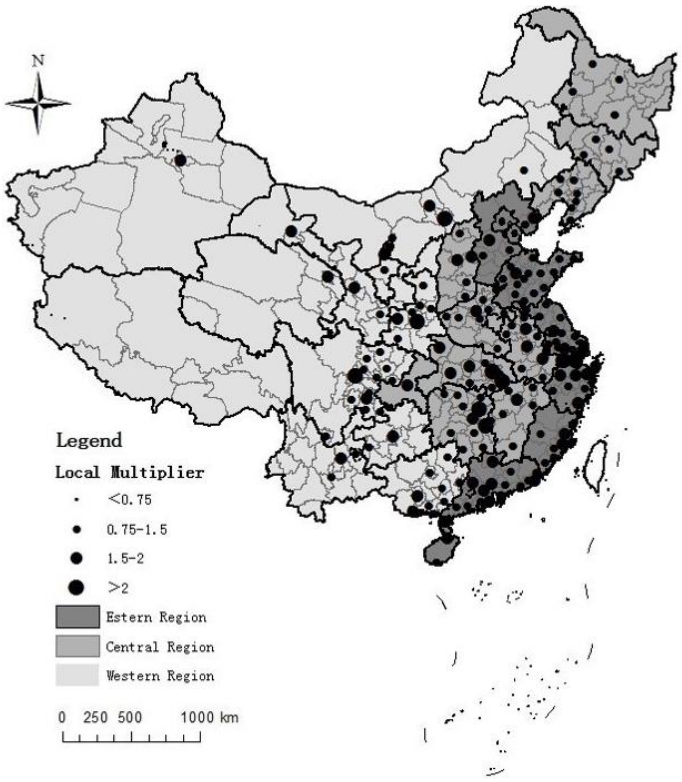

Figure 2. The employment multiplier distribution of expanding cities in China.

After identifying the characteristics of the spatial distribution of employment multiplier, the next obvious question is, how does this pattern connect with city size distribution? In fact, the relationship between city size and employment multiplier has attracted much scholarly attention and varied conclusions have been drawn in different places across the globe [21,27]. In order to have a preliminary understanding of this issue in the case of Chinese cities, we divided the cities into different levels, according to their population sizes, made a statistical description of the employment multiplier of each level of the city, and then made a tentative explanation with the help of the existing literature and theory.

Interesting patterns emerge from the statistics describing the results of the city-scale classification, as can be seen in Table 3. Cities with a population of less than 1 million have lower employment multipliers, with a mean of 0.81, a minimum of 0.31, and a maximum of 1.02. The employment multipliers show a slowly increasing trend with an increase in the city scale because most of these cities are economically underdeveloped within each provincial administrative unit in China. Although the degree of external contact is low, there will theoretically be lower employment spillover and a higher employment multiplier. However, the non-tradable sectors in these cities are small and single in type, which cannot maximize the employment effect brought about by the change in the trade sector. The employment multipliers of cities ranging from 1 million to 3 million are higher than those of the former, with a mean of 1.17, a maximum of 1.54, and a minimum of 0.57. The employment multiplier increased at a faster pace with the expansion of the scale. These cities generally have lower degrees of external contact than regional central cities and have certain levels of economic development and scales of local service

industries. Moreover, many of these cities are close to the central city and are affected by the spillover effect of the central city, thus having high employment multipliers. The urban employment multipliers for cities of 3–5 million decrease with the expansion of the urban scale. The employment multiplier reaches the maximum value, with a mean of 1.59, a maximum of 2.27, and a minimum of 1.09. This kind of city is a medium-sized city in China's urban system and is in the stage of rapid growth. Although it is large in scale, it is still at the stage of rapid polarization with a small spillover effect. Moreover, the trade sector based on the manufacturing industry is the main industry in such cities, so the expansion of the trade sector has a great impact on such cities. When the city population is larger than 5 million, the multiplier will start to decline with a mean of 1.08, a maximum of 1.26, and a minimum of 0.94, and the employment multiplier in the megalopolis is then relatively low. Most of these cities are China's regional hubs, with a declining share of manufacturing and a rising share of high-end services, such as financial innovation. Despite a significant employment multiplier, the driving effect of the manufacturing industry is weaker than that of small- and medium-sized cities. At the same time, the central roles of such cities mean that the spillover effect further weakens the employment multiplier.

Table 3. The multipliers of different city size levels.

	Mean	Maximum	Minimum
Less than 1 million	0.81	1.02	0.31
1 million–3 million	1.17	1.54	0.57
3 million–5 million	1.59	2.27	1.09
Larger than 5 million	1.08	1.26	0.94

4.2. Factors Influencing Urban Employment Multipliers in China

As can be seen from the regression results, which are shown in Table 4, there is a significant correlation between the diversification level of the specialized non-tradable sector, average wage and labor-supply elasticity, and the employment multipliers in the urban-scale trade sector nationwide. However, there are obvious differences in the regression between the coastal east and remote west. Therefore, employment policy should not be formulated in accordance with uniform or fixed rules; this also confirms the significance of the study on urban differences.

Table 4. The regression results of influencing factors of employment multipliers.

	Nationwide	Eastern Region	Central Region	Western Region
City size	0.715 *** (0.185)	0.441 ** (0.257)	0.415 ** (0.207)	0.971 ** (0.308)
Diversity	0.169 * (0.026)	0.195 ** (0.021)	0.721	0.031
Location	−0.079 * (0.015)	−0.543 * (0.115)	−0.428	0.153
Professionalization	0.007 *** (0.002)	0.364 ** (0.169)	0.054	0.125
Income	0.281 ** (0.037)	0.034 ** (0.015)	0.513 *** (0.201)	−0.207
Housing costs	0.008	−0.019	0.389	0.009 * (0.003)
Labor supply	0.046 *** (0.021)	0.027 ** (0.003)	0.006 ** (0.003)	0.182
n	169	70	58	41
F	127.394	31.95	27.25	9.929
Adjustment R2	0.757	0.693	0.703	0.455
standard error	0.187	0.297	0.254	0.232

Note: * significance at the 0.05 level, ** significance at the 0.01 level, and *** significance at the 0.001 level. Standard errors are in parentheses.

There is a positive statistical relationship between city size and employment multiplier, nationwide and in the eastern and western regions. This contradicts the description of the full text. As mentioned above, the employment multiplier of a megalopolis tends to decline with the expansion of its scale. The reason for the positive statistical relationship here is that it is mainly medium-sized cities that are expanding in the regression process, and there are fewer megacities. City size has attracted much attention in the study of many

urban problems [44,50]. Concepts related to city size include the size and diversification of consumer goods markets into cluster economies and innovative activities [51]. However, a rich variety of consumer goods and large local service requirements are more important reasons for the employment multiplier in big cities than in small cities. City agglomeration and productivity levels mean that local trade department wages and purchasing power are higher than in other cities, which demonstrates an increasing consumer demand for local services. However, as shown in the regional regression results, the multiplier effect of scale is obvious in the western region, because the large cities tend to have greater administrative-level economic power, and the differences between city sizes are actually a reflection of city level and policy bias. In addition, there is a lower degree of external contact in Western China; the employment effect of the trade sector is more easily realized at a local level, and the expansion of the local consumption scale brought about by the expansion of the urban scale is also more obvious. Therefore, to promote urban development and create jobs in the western region, more attention should be paid to the leading role of big cities.

Employment structure is closely related to industrial structure; economic structure and industrial structure decide employment and affect the employment multiplier. As can be seen from the regression results, the degree of tradable sector specialization and the degree of diversification of the non-tradable sector and employment multiplier have positive influences on the employment multiplier. In other words, the more specialized the tradable sector, and the more diversified the non-tradable sector, the higher the urban employment multiplier will be, which is consistent with the theoretical speculation of scholars and empirical research [23,24,32]. However, this rule is not significant in all cities. This pattern is most obvious in the economically developed eastern regions but is not prominent in the central or western regions because of the higher share of agriculture in these regions; this means there is a larger gap between urbanization level and productivity than in the eastern coast. The realization of the employment multiplier is based on the threshold of a certain income level and market size [31], which means that the employment multiplier will be significant when the population size and economic level reach the corresponding levels.

The regression results on wages confirm that income levels are highly correlated with the employment multiplier. The result shows that, the higher the income level of urban residents, the greater the employment multiplier. This correlation is because the multiplier effect in cities is based on consumption [11], and urban residents' incomes are the source of consumer spending; so, the high wage level of the urban employment multiplier is relatively large. The difference between regions shows that, in the central region, the difference in income level is most correlated with the employment multiplier, but this is not significant in the remote western region. Scholars think that the share of residents in local consumer spending is not fixed but changes with the diversity of the local market and scale [31]; there is a larger gap in the size of the market and the types of consumer goods in the western region than in the eastern region.

In previous studies, scholars believed that changes in housing costs would affect the decision-making behavior of job seekers, and if housing costs were high, it would crowd out local services and employment [14]. Thus, in theory, housing costs should present a negative correlation with the employment multiplier, but in Western China, the regression result is positive. The reason is that areas with high housing costs in Western China are those with higher economic and urban scales than in other cities. Although these areas have high housing costs, they show a significantly positive correlation because of their income levels and urban scales.

The elasticity of the labor supply is positively correlated with the employment multiplier, which is consistent with the relevant research conclusions. Labor supply is a relatively important factor in the framework of employment city interpretation proposed by Moretti [11,14], which empirical evidence has also confirmed [17]. Since the employment multiplier is job creation, if a significant local multiplier exists, the city has created more jobs, as well as labor and job matching, which need a large enough labor pool to ensure the realization of an employment multiplier. Moretti believes that if labor-supply elasticity

is insufficient, it will cause a non-tradable sector job increase that is not obvious or even decreases with the increase in the trade sector [11].

5. Discussion and Conclusion

This study combines the employment multiplier theory with the theory of urban development stage and selects cities in the process of growth as the research unit to estimate the employment multiplier. It not only has significance for policymaking, but also improves the employment multiplier theory. The change in non-tradable sector employment caused by manufacturing growth in each city is calculated by using the sub-industry data of Chinese prefectural cities, and the difference in this multiplier among different cities is explained by taking city size and trade sector specialization degree as the main explanatory variables. It is of great practical significance to confirm and estimate the differences in employment multipliers between cities. Local differences should be considered in the relevant policies formulated by local governments to promote employment. The multipliers in terms of countries or large regions affirm the importance of changes in the trade sector to regional development, but these are insufficient to answer the question of how to increase the employment multiplier in a city. This study weakened the error range by distinguishing expanding cities from cities which had different multipliers when expanding or shrinking. The multipliers would be underrated if all cities were put into one model.

According to the calculations in this study, the average multiplier of Chinese cities is 1.67, which is close to the previous research results [22]. However, a slightly higher value, not surprisingly, suggests the importance of dividing cities into expanding and shrinking cities. The situation by region and scale is consistent with the research conclusions of other scholars [17,23,32]. It also proves the robustness of the sub-city calculation. Furthermore, it confirms the employment multiplier in the expansion and contraction of the difference between the process and the expansion of the larger number.

In the study of urban problems, urban size once again played an important role. Regression results confirmed the size of the cities in the process of employment change. This is because of the expansion of the city scale and the change in the types of consumer-market scales. The consumption expenditure of urban residents increases with the expansion of the local consumption market. Furthermore, the more significant multilevel employment promotion effect was brought about by the job increase in the trade sector. City size is important not only in the general sense, but also in different regions. It can be seen from the regression results that the coefficient of urban size in the western region is larger than that in other regions, indicating that the efficiency advantage of large cities should be brought into play in the western region with sparse population; this is also revealed laterally, so small cities have greater difficulty in realizing the same multiplier effects. The specialization of the tradable sector is the guarantee of employment multipliers and even urban development. This is reflected in employment level, and urban residents' incomes have far-reaching influences on the speed and sustainability of urban development; this is consistent with Michael Stoper's conclusion [41]. Therefore, the ability to produce tradable products professionally warrants close attention.

China differs from developed countries regarding the impact of factors such as labor costs and housing costs on the employment multiplier. In Moretti's explanation of the multiplier, factors such as labor cost and housing cost have a correction and adjustment effect on the employment multiplier [11,14]. The results show that these factors are not significant in China, which is also one of the differences between developing countries and developed countries. The low level of urbanization in developing countries means that many agricultural workers can enter the labor pool in cities, thus improving the elasticity of the urban labor supply. This weakens the crowding-out effect of housing costs and other factors, even showing a positive correlation between housing costs and multipliers in some regions. We should consider learning from the experiences of developed countries in the process of regional development. The differences between China and developed countries in terms of institutional urbanization level, labor force structure, urban system,

industrial structure, and other aspects mean that the influencing mechanism of China's urban employment problem is different from that of developed countries.

According to the research conclusions of this study, the following policy recommendations are proposed. The difference in the employment multiplier determines the difference in employment promotion policy, which should be considered when making this policy. Specifically, in the central and western regions, the trade sector is the main driving force for employment. Therefore, in the central and western regions, efforts should be made to develop the scale of the trade sector and promote the expansion of the urban scale. In large cities and eastern regions, the employment effect of the trade sector is still significant, but the degree of effect is not as great as that of small- and medium-sized cities. Therefore, the degree of specialization of the trade sector and diversification of the service industry should be improved to maximize the employment effect of the trade sector in the urban consumption scale.

In this study, time-series data were used to calculate the employment multiplier of a single city, which may have led to different degrees of error because the contribution of spatial variables differs between different cities. Therefore, the model needs to be further improved. As an extension and sublimation of this study, the other study uses panel data to explore the periodic changes in employment multipliers in cities, according to their development stages, also analyzing the mechanisms of employment multipliers in shrinking cities [45].

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