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The impact of co-agglomeration of distributive trades and manufacturing industry on export ratio: A Tobit empirical study

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ABSTRACT

This paper makes empirical tests on the influences of co-agglomeration of distributive trades and manufacturing industry on the consumer goods manufacturers' export ratio using industry and enterprise data of 17 eastern cities in China for 2005-2009. The results show that the former is an significantly positive determinant of the latter, and there is a nonlinear "inverted U shape" relationship between them in the long term. The policy meaning lies in that strengthening the co-agglomeration helps raise export ratios of small and medium enterprises that produce consumer goods, but it should also be avoided that the negative effect of extra high co-agglomeration degree on export ratio.

Key words: co-agglomeration, distributive trades, export ratio, Tobit model

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INTRODUCTION

In recent years, China's exports developed rapidly and has become an important economic driving force. Among the promoting factors of China's exports, there is one factor that deserves special attention, namely co-agglomeration of distributive trades and manufacturing industry. Which means there are agglomeration of distributive trade and manufacturing agglomeration in the same region, and the co-agglomeration of them promotes the manufacturer's exports. This phenomenon is the most typical in Yiwu city of Zhejiang, and the export mode of market procurement also exists in other coastal areas. Therefore, research on the relationship between the co-agglomeration and manufacturer's export ratio is very necessary, but previous studies focused only on the relationship between manufacturing agglomeration and export, ignoring the co-agglomeration factor. This paper attempts to construct an empirical model using enterprises panel data, and also discusses the effects of co-agglomeration on manufacturer's export ratio by the tests of sub-samples divided by manufacturing sub-sectors and enterprise scales.

EXPERIMENTAL SECTION

Model construction

Based on the Barrios et al. (2003) model on the relationship between manufacturing agglomeration and manufacturer's export ratio, this paper constructs an empirical model including the co-agglomeration of distributive trades and manufacturing industry. In addition, because the relevant values may be zero, so the relevant values are pulsed 1 firstly and then take the natural logarithm, the empirical model is expressed as:

$$LCrexsa = \alpha_1 LIncoagg + \alpha_2 LIncoagg^2 + \alpha_3 LCage + \alpha_4 LCage^2 + \alpha_5 LCsize + \alpha_6 LCsize^2 + \alpha_7 LCpro + \alpha_8 LInex + \alpha_9 LInrd + \varepsilon$$

Crexsa is the manufacturer's export ratio, namely the enterprise's export delivery value / enterprise's sales value; Let Incoagg be the co-agglomeration value of distributive trades and manufacturing industry, which is calculated based on EG index proposed by Ellison et al. (1997)[1]. Cage (firm age) = statistical year - opening year; Csize (firm

[1] The EG co-agglomeration index is a measure of the average co-agglomeration of industries in a group. An

scale) is represented by the number of employees at the end of the year Csize; Cpro (firm productivity) =total output value/ the number of employees at the end of the year; Inex (export ratio of manufacturing industry) = manufacturing industry's export delivery value / manufacturing industry's sales value; Inrd (R & D ratio of manufacturing industry) take manufacturing industry's new products output ratio as an alternative variable, i.e. manufacturing industry's output value of new products / manufacturing industry's total output value; the mark L means that variables are added 1 firstly and then taking the natural logarithm. The statistical characteristics of variables are given in Table 1.

Table 1. The Statistical Characteristics of Variables

Variable	Mean	Standard Deviation	Minimum	Maximum
LCrexsa	0.20755	0.28951	0.00000	0.69315
LIncoagg	0.09790	0.07119	0.00528	0.36455
LIncoagg2	0.01737	0.02619	0.00003	0.17688
LCage	1.91176	0.66932	0.00000	4.74493
LCage2	3.51926	1.46357	0.00000	9.47247
LCsize	4.52558	1.00126	0.69315	11.98230
LCsize2	9.01744	2.03121	0.69315	23.96458
LCpro	5.59789	0.89249	0.32622	12.32660
LInex	0.22804	0.06638	0.07291	0.52382
LInrd	0.12132	0.05373	0.02659	0.29120

Data illustration

Because the co-agglomeration of distributive trades and manufacturing industry mainly exists in the eastern area, therefore this paper selects the enterprise data of 17 eastern cities for discussion, including Qingdao, Yantai city of Shandong province; Foshan, Huizhou, Jieyang city of Guangdong province; Changzhou, Lianyungang, Nantong, Wuxi city of Jiangsu province; Hangzhou, Huzhou, Jinhua, Ningbo, Quzhou, Shaoxing, Taizhou, Wenzhou city of Zhejiang province. In addition, according to the investigation of co- agglomeration, the sample covers only 7 sub-sectors of manufacturing industry, incldling C17 the textile manufacturing; C18 the clothing and other textile products manufacturing; C19 the leather, fur, feather and related products manufacturing; C24 the cultural and sports products manufacturing; C30 the plastic products manufacturing; C34 the metal products manufacturing; C39 the electrical machinery and equipment manufacturing.

All data are from the China Statistical Yearbook of Commodity Trading Markets, Chinese Industrial Enterprises Statistics Database, Zhejiang Statistical Yearbook, and 17 cities' Statistical Yearbook for the time span of 2005-2009, involving 161,457 observations.

RESULTS AND DISCUSSION

The overall sample

This paper employs the random effects Tobit estimation method, and the empirical results in Table 2 presents that the first degree coefficient of co-agglomeration is positive, indicating that it has a significantly positive relationship with manufacture's export ratio. However, its quadratic coefficient is negative, indicating that the co-agglomeration degree exceeding a certain limit will produce negative spillover effects on export ratio, which shows a "inverted U shape". Among the control variables, age and size have a promoting effect on the export ratio and have "inverted U shape" relationship with it in the long run. Productivity has showed a negative relationship with the export ratio but the coefficient is quite small. "Exporting by learning" and "knowledge spillover" effects have significantly positive relationship with export ratio.

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equivalent formula for the EG co-agglomeration index when $I = 2$ is

$$Incoagg = \frac{\sum_{m=1}^{M}(s_{m1} - x_m)(s_{m2} - x_m)}{1 - \sum_{m=1}^{M} x_m^2}$$

Consider two industries i=1, 2. Suppose that a geographic whole is divided into M subareas and suppose that s_{1i}, s_{2i}, . . . , s_{Mi} are the shares of industry i's employment contained in each of these areas. Let x_1, x_2, . . . , x_M be some other measure of the size of these areas, each area's share of population is chosen in this paper.

As can be seen from the marginal effect, LIncoagg increased by 1%, the manufacturer's export ratio tend to raise 0.247%; LCsize and LInex increased by 1%, the manufacturer's export ratio tend to raise 0.455% and 0.320% respectively; the marginal effect of other variables are lower than the three factors. Accordingly it can be seen that the co-agglomeration of distributive trades and manufacturing industry is a key influence factor of manufacturer's export ratio.

Table 2. The Tobit estimation results of total sample

	Coefficient	Marginal effect
LIncoagg	0.322***	0.247***
	(0.022)	(0.017)
LIncoagg2	-0.364***	-0.279***
	(0.048)	(0.037)
LCage	0.041***	0.032***
	(0.008)	(0.006)
LCage2	-0.014***	-0.011***
	(0.004)	(0.003)
LCsize	0.593***	0.455***
	(0.055)	(0.042)
LCsize2	-0.268***	-0.205***
	(0.027)	(0.021)
LCpro	-0.006***	-0.004***
	(0.001)	(0.001)
LInex	0.417***	0.320***
	(0.011)	(0.008)
LInrd	0.108***	0.083***
	(0.010)	(0.008)
_cons	-0.207***	
	(0.009)	
log likelihood	37487	
Number of obs	161457	161457

*Notes: The standard errors are shown in parenthesis. *p<0.1, **p<0.5, ***p<0.01.*

Table 3. The Tobit estimation results of manufacturing sub-sectors samples (coefficient)

	C17	C24	C19	C39	C34	C30	C18
LIncoagg	0.677***	0.538***	0.333***	0.354***	0.194***	0.187***	0.071
	(0.046)	(0.138)	(0.112)	(0.041)	(0.049)	(0.045)	(0.086)
LIncoagg2	-0.580***	-1.047***	-0.504**	-0.452***	-0.149	-0.073	0.047
	(0.110)	(0.315)	(0.208)	(0.089)	(0.110)	(0.088)	(0.215)
LCage	0.025	-0.020	0.013	0.049***	0.043***	-0.020	0.072***
	(0.016)	(0.044)	(0.040)	(0.015)	(0.017)	(0.017)	(0.025)
LCage2	-0.008	0.032	0.006	-0.021***	-0.012	0.012	-0.016
	(0.007)	(0.020)	(0.018)	(0.007)	(0.008)	(0.008)	(0.012)
LCsize	0.391***	-0.283	0.313	0.602***	0.490***	0.456***	0.149
	(0.094)	(0.350)	(0.308)	(0.104)	(0.129)	(0.125)	(0.233)
LCsize2	-0.172***	0.164	-0.125	-0.278***	-0.222***	-0.202***	-0.045
	(0.046)	(0.172)	(0.152)	(0.051)	(0.064)	(0.061)	(0.115)
LCpro	0.004**	0.004	-0.013***	-0.003*	-0.003	0.006***	0.002
	(0.002)	(0.005)	(0.004)	(0.001)	(0.002)	(0.002)	(0.003)
LInex	0.407***	0.432***	0.290***	0.404***	0.517***	0.347***	0.550***
	(0.020)	(0.057)	(0.052)	(0.022)	(0.024)	(0.023)	(0.036)
LInrd	0.066***	0.179***	0.025	0.194***	0.071***	0.144***	0.018
	(0.018)	(0.055)	(0.057)	(0.024)	(0.022)	(0.024)	(0.037)
_cons	-0.223***	-0.104**	-0.064	-0.214***	-0.229***	-0.260***	-0.195***
	(0.017)	(0.052)	(0.041)	(0.016)	(0.020)	(0.021)	(0.029)
log likelihood	12633	760	170	11712	8055	9502	409
Number of obs	44566	6194	10659	31280	25806	21811	21141

*Notes: The standard errors are shown in parenthesis. *p<0.1, **p<0.5, ***p<0.01.*

Manufacturing sub-sectors samples

From Table 3 it can be seen that co-agglomeration has significantly positive relationship with the manufacturer's export ratio in nearly all sub-sectors with the except of C18, and in the sub-sectors C17, C24, C19 and C39 there are long-term "inverted U shape" relationship between them. For control variables, age has significantly positive effect on the export ratio in sub-sectors C39, C34 and C18; size has positive relationship with it in sub-sectors C17, C39, C34 and C30; productivity has significantly positive relationship with it in sub-sectors C17 and C30, and has significantly negative correlation with it in sub-sectors C19 and C39, but has no significantly effect on it in other sub-sectors; "exporting by learning" effect has significantly correlation with the export ratio in all sub-sectors; and

"knowledge spillover" effect has a significantly positive influence on it in nearly all sub-sectors with the except of C19 and C18.

For the marginal effect showed in Table 4, it can be seen that LIncoagg increased by 1%, from high to low, the manufacturer's export ratio tend to raise 0.515%, 0.479%, 0.284%, 0.261%, 0.142% and 0.133% in sub-sectors C17, C24, C19, C39, C34 and C30. This shows that the influence of co-agglomeration on export ratio is the greatest in the textile manufacturing, the least in the plastic products manufacturing, and no significantly effect in the clothing and other textile products manufacturing.

Table 4. The Tobit estimation results of manufacturing sub-sectors samples (marginal effect)

	C17	C24	C19	C39	C34	C30	C18
LIncoagg	0.515***	0.479***	0.284***	0.261***	0.142***	0.133***	0.060
	(0.035)	(0.123)	(0.096)	(0.031)	(0.036)	(0.032)	(0.073)
LIncoagg2	-0.441***	-0.933***	-0.430**	-0.333***	-0.109	-0.052	0.040
	(0.084)	(0.281)	(0.178)	(0.065)	(0.080)	(0.063)	(0.183)
LCage	0.019	-0.018	0.011	0.036***	0.032***	-0.015	0.061***
	(0.012)	(0.039)	(0.034)	(0.011)	(0.012)	(0.012)	(0.021)
LCage2	-0.006	0.029	0.005	-0.015***	-0.009	0.009	-0.014
	(0.005)	(0.018)	(0.016)	(0.005)	(0.006)	(0.006)	(0.010)
LCsize	0.297***	-0.252	0.267	0.444***	0.358***	0.325***	0.127
	(0.071)	(0.312)	(0.263)	(0.076)	(0.095)	(0.089)	(0.197)
LCsize2	-0.131***	0.146	-0.107	-0.205***	-0.162***	-0.144***	-0.038
	(0.035)	(0.154)	(0.130)	(0.038)	(0.046)	(0.044)	(0.098)
LCpro	0.003**	0.004	-0.011***	-0.002*	-0.002	0.004***	0.002
	(0.001)	(0.004)	(0.003)	(0.001)	(0.001)	(0.001)	(0.002)
LInex	0.310***	0.385***	0.247***	0.298***	0.378***	0.247***	0.467***
	(0.015)	(0.051)	(0.045)	(0.016)	(0.017)	(0.017)	(0.030)
LInrd	0.050***	0.160***	0.021	0.143***	0.052***	0.102***	0.016
	(0.013)	(0.049)	(0.049)	(0.017)	(0.016)	(0.017)	(0.031)
Number of obs	44566	6194	10659	31280	25806	21811	21141

Notes: The standard errors are shown in parenthesis. $^{*}p<0.1$, $^{**}p<0.5$, $^{***}p<0.01$.

Table 5. The Tobit estimation results of sub-samples divided by enterprise scale (coefficient)

	Micro	Medium	Small	Large
LIncoagg	0.486***	0.317***	0.357***	0.208
	(0.079)	(0.073)	(0.025)	(0.148)
LIncoagg2	-0.783***	-0.488***	-0.412***	-0.453
	(0.193)	(0.171)	(0.053)	(0.344)
LCage	0.009	-0.038	0.045***	0.022
	(0.028)	(0.036)	(0.008)	(0.081)
LCage2	-0.005	0.022	-0.015***	-0.005
	(0.013)	(0.016)	(0.004)	(0.038)
LCsize	0.529*	0.025***	0.432**	0.004
	(0.281)	(0.006)	(0.179)	(0.010)
LCsize2	-0.240*	0	-0.188**	0
	(0.128)	(omitted)	(0.088)	(omitted)
LCpro	0.005*	-0.030***	-0.006***	-0.047***
	(0.003)	(0.003)	(0.001)	(0.006)
LInex	0.216***	0.485***	0.405***	0.579***
	(0.039)	(0.034)	(0.012)	(0.070)
LInrd	0.184***	0.061*	0.118***	0.085
	(0.038)	(0.035)	(0.011)	(0.075)
_cons	-0.226**	0.189***	-0.203***	0.398***
	(0.088)	(0.044)	(0.016)	(0.088)
log likelihood	3046	2807	29423	829
Number of obs	7541	16132	134930	2854

Notes: The standard errors are shown in parenthesis. $^{*}p<0.1$, $^{**}p<0.5$, $^{***}p<0.01$.

Sub-samples divided by enterprise scale

According to the test results from sub-samples divided by enterprise scale[2] (Table 5), it is shown that co-agglomeration has significantly promoting impacts on export ratio and there are long-term "inverted U shape" relationships between them in the micro, small and medium enterprises sub-samples, but it has no significant effect

[2]According to the classification standard of the Chinese National Bureau of Statistics, micro enterprises are the ones with employees < 20; small enterprises are the ones with 20 ⩽ employees < 300; medium enterprises are the ones with 300 ⩽ employees < 1000; large enterprises are the ones with employees ⩾ 1000.

on the export ratio of large enterprise. Among the control variables, age only has significantly positive relationship with the export ratio of small enterprise; size has significantly positive influence on the export ratios of micro, small and medium enterprises; productivity has promoting effect on the export ratio of micro enterprise, but has negative correlation with the export ratios of small, medium and large firms; "Learning by exporting" effect has positive correlation with four kinds of enterprises' export ratios; but "knowledge spillover" effect only has positive correlation with the export ratios of micro, small and medium enterprises.

For the marginal effect in Table 6, it is showed that LIncoagg increased by 1%, from high to low, the export ratio of manufacturer tend to raise 0.313%, 0.277% and 0.270% in micro, medium and small enterprises sub-samples. Accordingly it can be seen that the co-agglomeration's effect is the greatest on the export ratio of micro enterprise, the least on the export ratio of small enterprise, and no significant effect on the export ratio of large enterprise.

Table 6. The Tobit estimation results of sub-samples divided by enterprise scale (marginal effect)

	Micro	Medium	Small	Large
LIncoagg	0.313 ***	0.277***	0.270***	0.189
	(0.051)	(0.064)	(0.019)	(0.135)
LIncoagg2	-0.504 ***	-0.426***	-0.311***	-0.412
	(0.124)	(0.150)	(0.040)	(0.312)
LCage	0.006	-0.033	0.034***	0.020
	(0.018)	(0.031)	(0.006)	(0.074)
LCage2	-0.003	0.019	-0.011***	-0.005
	(0.008)	(0.014)	(0.003)	(0.034)
LCsize	0.340 *	0.021***	0.326**	0.003
	(0.181)	(0.005)	(0.135)	(0.009)
LCsize2	-0.155*	0	-0.142**	0
	(0.083)	(omitted)	(0.066)	(omitted)
LCpro	0.003 *	-0.027***	-0.004***	-0.043***
	(0.002)	(0.002)	(0.001)	(0.005)
LInex	0.139 ***	0.424***	0.306***	0.526***
	(0.025)	(0.030)	(0.009)	(0.064)
LInrd	0.119 ***	0.053*	0.089***	0.077
	(0.025)	(0.031)	(0.009)	(0.068)
Number of obs	7541	16132	134930	2854

Notes: The standard errors are shown in parenthesis. $^{*}p<0.1$, $^{**}p<0.5$, $^{***}p<0.01$.

CONCLUSION

This paper makes empirical tests on the influences of co-agglomeration of distributive trades and manufacturing industry on the consumer goods manufacturers' export ratio using industries and enterprises data of 17 cities in China for 2005-2009. The results show that the former has significantly positive effect on the latter, and there is a nonlinear "inverted U shape" relationship between them in the long term. For manufacturing sub-sectors sub-samples, it shows that the influence of co-agglomeration on export ratio is the greatest in the textile manufacturing, the least in the plastic products manufacturing, and no significantly effect in the clothing and other textile products manufacturing. For sub-samples divided by enterprise scale, it can be seen that the co-agglomeration's effect is the greatest on the export ratio of micro enterprise, the least on the export ratio of small enterprise, and no significant effect on the export ratio of large enterprise.

The policy implications of the study can be concluded as the following: the co-agglomeration of distributive trades and manufacturing industry has promoting effect on the export ratio of micro, small and medium enterprises involving in consumer goods manufacturing. During the transition period of China's manufacturing industry restructuring and upgrading, we should further strengthen this co-agglomeration. But it should also be avoided that the negative effect of extra high co-agglomeration degree on export ratio. Future research should pay attention to the changes of economic environment. Firstly, the structure of China's export products will constantly changing in the future, for instance, the proportion of electromechanical and high-tech exports will increase. Secondly, the use of e-commerce to promote exports becomes more and more common. So the export mode of market procurement that promote by the co-agglomeration will face challenges, and may gradually disappear in some areas. It is worthy of further study on how to improve the way of co-agglomeration in promoting export ratio.

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