Agglomeration and total factor productivity of China's textile industry

DOI: 10.35530/IT.072.04.202013

ZHANG JIANLEI
AN NA
CHENG LONGDI

ABSTRACT – REZUMAT

Agglomeration and total factor productivity of China's textile industry

Agglomeration is an important characteristic in China's textile industry development. But regional textile industry is seriously unbalanced, only eastern location entropy (LQ) is greater than 1 and is the highest of all, followed by the central, western and north-eastern regions. Total factor productivity (TFP) is an important indicator to measure the economic growth efficiency. The average annual growth rate (AAGR) of eastern textile industry TFP is the least and central TFP growth rate is the fastest. In order to investigate the relationship between agglomeration and TFP of China's textile industry, especially at region level, this paper applies panel model to study how agglomeration influences TFP during 2005–2018. The results show that increasing agglomeration degree restrains the TFP growth of China's textile industry. The coefficients of LQ on textile industry in China and four regions are all negative. There exists crowded effect in eastern textile industry. It has not formed the significant agglomeration effect in western and north-eastern textile industry for very low agglomeration degree. So it implies that eastern textile industry can accelerate the implementation of industrial transfer and structural adjustment to lower agglomeration and maintain sustained profitability of textile enterprises. Western textile industry can strengthen agglomeration by undertaking industrial transfer from eastern region to form agglomeration effect to promote TFP growth.

***Keywords**: industrial agglomeration, location entropy, total factor productivity, DEA-Malmquist method, crowded effect*

Aglomerarea și productivitatea totală a factorilor aferenți industriei textile din China

Aglomerarea este o caracteristică importantă în dezvoltarea industriei textile din China. Dar industria textilă regională este grav dezechilibrată, doar entropia de localizare estică (LQ) este mai mare decât 1 și este cea mai ridicată dintre toate, urmată de regiunile centrale, vestice și nord-estice. Productivitatea totală a factorilor (TFP) este un indicator important pentru a măsura eficiența creșterii economice. Rata medie anuală de creștere (AAGR) a TFP din industria textilă din est este cea mai mică, iar rata de creștere a TFP din regiunea centrală este cea mai ridicată. Pentru a investiga relația dintre aglomerare și TFP-ul industriei textile din China, în special la nivel de regiune, această lucrare aplică modelul de panou, pentru a studia modul în care aglomerarea influențează TFP în perioada 2005–2018. Rezultatele arată că creșterea gradului de aglomerare limitează creșterea TFP a industriei textile din China. Coeficienții LQ pentru industria textilă din China și din cele patru regiuni sunt negativi. Există un efect de aglomerare în industria textilă din est. Nu s-a format efectul de aglomerare semnificativ în industria textilă din vest și nord-est, pentru un grad de aglomerare foarte scăzut. Prin urmare, rezultă faptul că industria textilă din est poate accelera implementarea transferului industrial și a ajustării structurale pentru a reduce aglomerarea și a menține profitabilitatea susținută a întreprinderilor textile. Industria textilă din vest poate întări aglomerarea prin efectuarea unui transfer industrial din regiunea estică cu scopul a forma efectul de aglomerare pentru a promova creșterea TFP.

***Cuvinte-cheie**: aglomerare industrială, entropie de localizare, productivitate totală a factorilor, metoda DEA-Malmquist, efect de aglomerare*

INTRODUCTION

Industrial agglomeration is the forming process of industrial cluster and it's one of the important characteristics of regional economic development. As a pillar industry of the national economy, China's textile industry progresses with the emergence of a large number of industrial clusters. But regional textile industry is seriously unbalanced. The agglomeration degree in the eastern region is much higher than that in the central and western regions, even a certain degree of crowded effect emergences at present.

Traditional views believe that factor input is the main force to drive the economic growth, textile industry, like other light industries, relies on high level of investment and extensive use of cheap labour to achieve rapid growth. But factor input cannot maintain for a long time with the decline of marginal productivity. China's textile industry, dominated by labour-intensive enterprises, is facing a series of pressures, seriously restricting its sustained profitability. Only efficiency-driven growth is the backbone to maintain textile industry long-term sustainable development.

Total factor productivity (TFP) is an important indicator to measure the economic growth efficiency, which refers to the contribution of the technical factors and non-technical factors, including technical progress,

management improvement and institutional innovation, to economic growth after deducting labour and capital input. Industrial agglomeration brings scale economies to promote the industrial efficiency. It is proved that the promotion effect of industrial agglomeration on total factor productivity is mainly through the external economic effect [1, 2], specialization division [3, 4], technology spill over [5–7], optimizing resource allocation [8], adsorption of labour resources [9] and so on to achieve the improvement of production efficiency ultimately. And Duranton and Puga [10] summarize that into three types of mechanisms for why productivity may be enhanced in industrial agglomerations: sharing, matching and learning. The bulk of the existing literature is based on aggregate spatial or sector data [11]. However, some studies have noticed that industrial excessive agglomeration may cause crowded effect and have negative influence on regional economic development [12, 13]. The crowded effect is mainly manifested that the relative scarcity of production factors in a certain region leads to the rise of the price and the decline of production efficiency at last.

Through searching the literature, there are many researches on textile industrial agglomeration, but the scholars pay less attention to TFP of China's textile industry [14–16]. Only Liu et al. [17] analysed the relationship between agglomeration and labour productivity of Jiangsu textile industry, lack of national data comparative study.

Given that the relevant research is inadequate and regional textile industry is seriously unbalanced, it's meaningful to investigate the relationship between agglomeration and TFP of China's textile industry, especially at region level. So this paper firstly measures the agglomeration degree by LQ and TFP by nonparametric DEA-Malmquist method of China's textile industry at region and province level during 2005–2018. According to the classification standard of the National Bureau of Statistics, China is divided into the four regions: eastern region (Beijing, Tianjin, Hebei, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Hainan), central region (Shanxi, Anhui, Jiangxi, Henan, Hunan, Hubei), north-eastern region (Liaoning, Jilin, Heilongjiang), western region (Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang). Then it studies how industrial agglomeration influences the TFP of textile industry with panel model. Finally, some relevant policy suggestions are put forward.

METHODOLOGY AND DATA SOURCES

Measurement of agglomeration

The main indicators of agglomeration are location entropy (LQ), Gini coefficient, industry concentration ratio, Herfindahl-Hirschman Index (HHI) and so on. Industry concentration ratio and HHI are calculated with the data at the enterprise level. Gini coefficient doesn't take into account the scale differences of the enterprises; even it's greater than 0, which doesn't indicate the existence of agglomeration. The LQ can eliminate the scale differences and reflect the spatial distribution of geographical factors more realistically. So LQ is applied in this study to measure textile industrial agglomeration degree at region and province level. The equation is as follows:

$$LQ_{it} = \frac{Textile\ Industry\ Total\ Assets_{it} / Industry\ Total\ Assets_{it}}{Textile\ Industry\ Total\ Assets_{t} / Industry\ Total\ Assets_{t}} \quad (1)$$

where LQ_{it} represents the location entropy of region i in t period and it's the ratio of textile industry total assets proportion of region i and the proportion of China in t period. If $LQ_{it}>1$, the agglomeration degree of textile industry in region i is higher than the national average and it has a tendency to agglomerate.

Measurement of TFP

Since the concept of TFP has been proposed, Solow production function analyses, stochastic frontier analysis (SFA) and data envelopment analysis (DEA) are developed to the most commonly used methods to measure TFP. The disadvantage of Solow production function analysis is that perfect competition, constant returns to scale and Hicks neutral technological progress are hardly compatible with the actual conditions. SFA is a parametric method based on the regression analysis. The production function and the probability distribution of the stochastic disturbance term should be assumed in advance in SFA. But DEA doesn't require any assumptions about the production function, avoiding the problems caused by the wrong function.

So the nonparametric DEA-Malmquist method is applied in this study. This method is used to dynamically analyse TFP change based on the nonparametric DEA model. At given technology frontier, TFP change is obtained by calculating the ratio of Shephard distance function of two production units. In order to avoid the random selection of technology frontier, Fare et al. [18] constructed the TFP Malmquist index (TFP index) from t to t+1 period:

$$M_0(x_t,y_t,x_{t+1},y_{t+1}) = \\ = \left[\frac{D_0^{t+1}(x_{t+1},y_{t+1})}{D_0^{t+1}(x_t,y_t)} \times \frac{D_0^{t}(x_{t+1},y_{t+1})}{D_0^{t}(x_t,y_t)} \right]^{\frac{1}{2}} \quad (2)$$

TFP index represents the ratio of TFP in period t+1 and period t. If $M_0(x_t,y_t,x_{t+1},y_{t+1})>1$, it indicates that *TFP* increases from period t to period t+1, otherwise decreases.

In addition, if the *TFP* index in the base period is 1, the accumulated *TFP* ($ATFP_t$) in the t period also can be calculated. The equation is as follows:

$$ATFP_t = \prod_{t=0}^{n} TFP_n\ index \quad (3)$$

Two sets of input data (labour and capital) and one set of output data (effective output) are required to calculate the *TFP* index. Gross industrial output value represents the effective output and is adjusted flat down to the price in 2004 by the industrial producer price index. Average number of regional textile

industry workers represents labour factor, instead of working time, due to the missing items of China's statistical system, compared with developed countries. And capital stock represents capital factor and is calculated by perpetual inventory method. The equation is as follows:

$$k_t = k_{t-1}(1-\delta) + I \quad (4)$$

where k_{t-1} and k_t represent capital stock at constant price of t–1 and t period, δ – depreciation rate, 9.6% [19] and I represents fixed capital investment at current fixed price. Similar to most of the relevant literature, fixed capital formation represents fixed capital investment and is adjusted flat down to the price in 2004 by the fixed asset investment price index. Referring to Cao Yuequn's research on capital stock of service industry, fixed capital formation in base period(2004) dividing 10% is used as the initial capital stock [20].

Empirical model

This study constructs the following panel model to analyse the effect of agglomeration on total factor productivity at region and nation level, for its advantages of large sample size, more reliable parameter estimation and reduced multi-collinearity:

$$\ln(ATFP_{it}) = C + \beta_1 \ln(LQ_{it}) + \beta_2 \ln(OPN_{it}) + \\ + \beta_3 \ln(URB_{it}) + \beta_4 \ln(INF_{it}) + \beta_5 \ln(MRT_{it}) + \mu_{it} \quad (5)$$

where i and t represent the region i and period t, respectively.

The explained variable *ATFP* represents the accumulated *TFP*. The explanatory variable *LQ* represents location entropy. The control variables *OPN* represents the opening-up level and is the ratio of total value of imports and exports to GDP. *URB* represents the urbanization rate and is the ratio of the urban population to the total population. *INF* represents the infrastructure construction level and is the ratio of length of highways to area. *MRT* represents the market opening level and is marketization index. The timing length of the above data is 2005–2018. All the data are obtained from China Statistical Yearbook, China Industry Economy Statistical Yearbook, Provincial Statistical Yearbook, China Statistical Yearbook on Science and Technology and Marketization Index of China's Provinces: Neri Report (2006–2019). The statistical description of the data is shown in table 1.

Table 1

DESCRIPTIVE STATISTICS OF VARIABLES (2005–2018)

Statistics	ATFP	LQ	OPN	URB	INF	MRT
Max	181.778	3.159	0.896	1.721	2.111	11.710
Min	0.337	0.015	0.207	0.017	0.036	0.000
Mean	8.129	0.597	0.526	0.302	0.817	6.354
S.D.	15.747	0.664	0.146	0.370	0.495	2.092
Obs.	434	434	434	434	434	434

RESULTS AND DISCUSSIONS

Results of LQ

Regional textile industry LQ during 2005–2018 is shown in table 2. Due to space limitation, provincial textile industry LQ is not listed.

LQ of the four regions is in ladder distribution, the highest is eastern region, followed by the central and western region, and the lowest is north-eastern region. Eastern LQ is greater than 1, indicating that eastern agglomeration degree is higher than the national average, for its large industry scale and advanced technology. Eastern LQ rises from 1.374 in 2005 to 1.521 in 2010, but decreases to 1.253 in 2018. This shows that eastern textile industry began to ease agglomeration degree through industrial transfer under the pressure of rising production cost. Central LQ has been rising from 0.576 in 2005 to 0.851 in 2018, benefitting from actively undertaking industrial transfer from eastern region. But it's still below the national average and has a large gap with eastern region. Western LQ is less than half of the national average, much smaller than eastern region, indicating that it has a long way to catch up with eastern region. North-eastern LQ is very low, only 0.2 or so. Because north-eastern region is the concentration area of heavy chemical industry and textile industry is less developed, compared with other regions.

Results of TFP

Also due to space limitations, provincial textile industry TFP index and ATFP are no longer listed. Regional textile industry TFP index and ATFP during 2005–2018 are shown in table 2.

The average annual growth rate (AAGR) of TFP in the eastern, north-eastern, central and western regions are 6.95%, 9.92%, 16.12% and 15.26%, respectively, showing that TFP of all the regions has been growing during 2005–2018. Average annual growth rate (AAGR) refers to the average annual growth rate of an indicator in a certain period of time and its computing method is:

$$AAGR = \left(\frac{Ending\ Value}{Beginning\ Value}\right)^{\frac{1}{n}} - 1 \quad (6)$$

Central TFP growth rate is the fastest and the eastern has the slowest growth, illustrating the distribution trend of "middle in the high and low on both sides", obviously different from that of LQ. Eastern TFP declines only in 2017–2018 and keeps growing in the rest, for the advanced technical and management level of local enterprises. But its average TFP index is only 1.089, the lowest in four regions, showing that eastern TFP growth encounters a certain bottleneck problem. The average TFP index and AAGR of central region are both the highest, followed by western region, because central enterprise actively eliminates backward production capacity gradually, accelerates the upgrading of machinery and equipment and improves management level. North-eastern textile industry is easier to achieve the rapid and

Table 2

THE LQ, TFP INDEX AND ATFP OF REGIONAL TEXTILE INDUSTRY DURING 2005-2018

Year	LQ				TFP index				ATFP			
	ER	CR	NER	WR	ER	CR	NER	WR	ER	CR	NER	WR
2005	1.374	0.576	0.249	0.397	1.035	1.217	1.092	1.210	1.035	1.217	1.092	1.210
2006	1.376	0.578	0.241	0.390	1.088	1.139	1.328	1.134	1.126	1.386	1.450	1.372
2007	1.381	0.588	0.221	0.392	1.015	1.205	1.367	1.211	1.143	1.670	1.982	1.662
2008	1.433	0.563	0.209	0.357	0.988	1.186	1.223	1.009	1.129	1.981	2.424	1.677
2009	1.430	0.604	0.195	0.367	1.082	1.121	1.231	1.180	1.222	2.221	2.985	1.978
2010	1.521	0.638	0.193	0.373	1.049	1.076	1.146	1.067	1.282	2.389	3.420	2.111
2011	1.398	0.716	0.182	0.368	1.043	0.996	0.952	0.969	1.337	2.380	3.256	2.046
2012	1.440	0.787	0.194	0.388	1.155	1.250	0.927	0.988	1.544	2.975	3.018	2.021
2013	1.403	0.844	0.212	0.392	1.124	1.025	1.101	1.022	1.736	3.049	3.323	2.065
2014	1.383	0.860	0.197	0.418	1.212	1.137	0.969	1.048	2.103	3.467	3.220	2.165
2015	1.277	0.831	0.191	0.389	1.162	1.242	1.465	1.753	2.444	4.306	4.718	3.795
2016	1.340	0.894	0.189	0.463	1.178	1.262	1.345	1.193	2.879	5.434	6.345	4.527
2017	1.319	0.920	0.187	0.465	0.656	1.698	0.256	0.998	1.889	9.227	1.624	4.518
2018	1.210	0.851	0.138	0.464	0.789	0.880	1.442	0.892	1.490	8.120	2.342	4.030
Mean	1.253	0.679	0.210	0.398	1.089	1.176	1.166	1.175	1.597	3.559	2.943	2.513

Note: ER is short for Eastern Region, CR for Central Region, NER for North-eastern Region, WR for Western Region.

coordinated development, due to its small scale and poor foundation.

Empirical analysis

This study applies Durbin-Wu-Hausman test to estimate both fixed effect model and random effect model of every region and test which one is more appropriate. The test results are shown in table 3. Due to space limitations, results of robustness check are not listed. Estimation results of the effect of agglomeration on textile industry ATFP are shown in table 3.

Firstly, increasing agglomeration degree restrains the TFP growth of China's textile industry. The coefficients of LQ on textile industry ATFP in China and four regions are all negative, illustrating that industrial agglomeration does not promote textile industry TFP nationwide, but inhibits it on the contrary. The main reason lies in the crowded effect of China's textile industry, especially in the eastern region which accounts for the largest proportion.

Excessive industrial agglomeration leads to the rise of factor cost such as labour, land, electricity and seriously restricts the sustained profitability of textile enterprise. So it's unable to maintain the factor-driven growth and should be transferred to the efficiency-driven growth. The coefficient of central region has not passed the check and it's unable to make the effective analysis. The coefficients of western and northe-astern are –0.516 and –1.201. They have the least textile industry scale and the mean LQ are 0.398 and 0.210, far below the national average level. It has not formed the significant

Table 3

THE ESTIMATION RESULTS OF THE EFFECT OF AGGLOMERATION ON TEXTILE INDUSTRY ATFP

ln(ATFP)	National	Eastern	Central	North-eastern	Western
ln(LQ)	–0.337***	–0.387***	–0.099	–1.201***	–0.516***
	–10.265	–6.852	–0.998	–4.184	–10.277
ln(URB)	0.055	0.426	0.612	15.977***	1.337***
	0.251	0.847	0.779	7.240	4.591
ln(OPN)	0.274***	–0.265*	–0.029	0.051	0.173***
	4.959	–1.874	–0.171	0.149	2.318
ln(INF)	–0.236***	–0.050	0.195	–1.533***	–0.245***
	–3.969	0.258	0.768	–5.069	–4.464
ln(MRT)	0.340**	0.194	–0.080	–0.428	0.200*
	2.481	0.429	–0.102	–0.475	1.788
C	0.588*	0.871	0.799	7.370***	1.506***
	1.686	0.841	0.484	3.452	3.599
Obs.	432	140	84	42	166
R^2	0.731	0.872	0.434	0.895	0.863
Model	FE	FE	FE	FE	FE

Note: ***, **, * represent significance levels of 1%, 5% and 10%, respectively, *t* values are shown in the second row.

agglomeration effect, so increasing agglomeration degree doesn't promote TFP growth, but restrains it because of various cost input, instead.

Secondly, the effect of control variables on textile industry TFP varies from region to region. Increasing opening-up level and marketization level promotes the TFP growth of textile industry nationwide. This means that the reform & opening up and the development of non-public economy are of great significance to improve textile industry TFP. But it also can be seen that increasing opening-up level restrains the TFP growth of eastern region. The reason may lies that FDI of eastern textile industry does not bring obvious spill over effect. The more intense market competition and higher agglomeration degree lead to a certain degree of crowded effect and restrain the TFP growth. The coefficients of urbanization rate on TFP in north-eastern and western China are both greater than 1, showing that with the increase of urban population, the number of skilled labour force is also expanding and it's helpful for the TFP growth of textile industry.

CONCLUSIONS

This paper firstly measures the agglomeration degree by LQ and TFP by DEA-Malmquist method of China's textile industry, respectively, at region and province level during 2005–2018. Then it investigates how industrial agglomeration influences the TFP of textile industry with panel model. The following conclusions are obtained:

LQ of the four regions was in ladder distribution, the highest is eastern region, followed by the central and western region, and the lowest is north-eastern region. Only eastern LQ is greater than 1. The AAGR of TFP in the eastern, north-eastern, central and western regions are 6.95%, 9.92%, 16.12% and 15.26%, respectively during 2005–2018. And central TFP growth rate is the fastest.

Increasing agglomeration degree restrains the TFP growth of China's textile industry. The coefficients of LQ on textile industry ATFP in China and four regions are all negative. There exists crowded effect in eastern textile industry. It has not formed the significant agglomeration effect in western and north-eastern textile industry for very low agglomeration degree. So it implies that eastern textile industry can accelerate the implementation of industrial transfer and structural adjustment to lower agglomeration and maintain sustained profitability of textile enterprises. Western textile industry can strengthen agglomeration by undertaking industrial transfer from eastern region to form agglomeration effect to promote TFP growth.

ACKNOWLEDGEMENTS

This work was supported by the National Key R&D Program of China (2017YFB0309100).

REFERENCES

[1] Ciccone, A., *Agglomeration effects in Europe*, In: European Economic Review, 2002, 46, 2, 213–227

[2] Graham, D., *Identifying Urbanisation and Localisation Externalities in Manufacturing and Services*, In: Papers in Regional Science, 2009, 88, 63–84

[3] Beeson, P., *Total Factor Productivity Growth and Agglomeration Economies in Manufacturing: 1959–1973*, In: Journal of Regional Science, 1987, 27, 2, 183–19

[4] Shu, H., Zhou, X, Lin, X., *Concentration of Logistics Industry and the Increase in TFP in China: Spatial Econometric Analysis on Provincial Panel Data*, In: Journal of Central University of Finance & Economics, 2014, 3, 98–105

[5] Onder, A., Deliktas, E., Lenger, A., *Efficiency in the manufacturing industry of selected provinces in Turkey – A stochastic frontier analysis*, In: Emerging Markets Finance and Trade, 2003, 39, 2, 98–113

[6] Guo, Y., Zhong, T., An, Y., *The Effects of Agglomeration on the Total Factor Productivity of China's Tourism Industry: An Empirical Study Based on China's Provincial Panel Data*, In: Tourism Tribune, 2015, 30, 5, 14–22

[7] Wu, M., Tong, B., *Industrial Agglomeration and Total Factor Productivity of Enterprise: Evidence from China's Manufacturing*, In: Industrial Economic Review, 2016, 4, 30–44

[8] Porter, M., *Clusters and new economics of competition*, In: Harvard Business Review, 1998, 11, 77–91

[9] Fan, J., *Industrial Agglomeration and Difference of Regional Labor Productivity: China's Evidence with International Comparison*, In: Economic Research Journal, 2006, 11, 72–81

[10] Duranton, G., Puga, D., Handbook of regional and urban economics, Elsevier, Amsterdam, 2004, 4, 2063–2117

[11] Andersson, M., Lööf, H., *Agglomeration and productivity: evidence from firm-level data*, In: The Annals of Regional Science, 2011, 46, 601–620

[12] Futagami, K., Ohkusa, Y., *The Quality Ladder and Product Variety: Larger Economies May Not Grow Faster*, In: Japanese Economic Review, 2003, 54, 3, 336–351

[13] Sun, H., Zhu, Q., *The Research on the Effect of China's Resources Industry Agglomeration on Total Factor Productivity Growth*, In: China Population, Resources and Environment, 2016, 26, 1, 121–130

[14] Zhang, J., Yao, M., *Total Factor Productivity, Technical Efficiency and Technical Progress of China's Textile and Garment Industry Change*, In: Journal of Wuhan Textile University, 2014, 4, 8–11

[15] Zhang, Y., *The Research on the Total Factor Productivity of Textile, Garment and Leather Industry*, In: Journal of Jiangsu Second Normal University (Social Science), 2015, 4, 27–31

[16] Ye, M., Ni, W., *The Impacts and Implications of Technology Advancement to Competitiveness of China's Textile and Garments Industry – With Micro Perspective by Using DEA – Malmquist Index Model*, In: Journal of Industrial Technological Economics, 2012, 228, 10, 71–77

[17] Liu, C., Lu, Z., Wang, G., *Empirical Study on Relationship between Degree of Industrial Concentration and Labor Productivity: Based on Data about Textile Industry in Jiangsu Province*, In: Technology Economics, 2012, 31, 1, 60–66

[18] Fare, R., Crosskopf, S., Norris, M., *Productivity growth, technical progress and efficiency change in industrialized countries*, In: American Economic Review, 1994, 84, 1, 66–83

[19] Zhang, J., Wu, G., Zhang, J., *The Estimation of China's provincial capital stock: 1952–2000*, IN: Economic Research Journal, 2004, 10, 35–44

[20] Cao, Y., Liu, J., *Regional difference of the Capital Stock in Tertiary Industry and the Cause*, In: The Journal of Quantitative & Technical Economics, 2008, 11, 72–84

Authors:

ZHANG JIANLEI[1], AN NA[1], CHENG LONGDI[2]

[1] Jiaxing University, Faculty of Marketing, College of Business,
No.56 South Yuexiu Rd, 314001, Jiaxing, China
e-mail: jxxymktan@163.com

[2] Donghua University, Faculty of Textile Industry Economics, College of Textile,
2999 North Renmin Rd, 201620, Shanghai, China
e-mail: ldch@dhu.edu.cn

Corresponding author:

ZHANG JIANLEI
e-mail: zjl200640256@163.com