Journal of Environmental Sciences Vol.17, No.2, pp.344—349, 2005

ISSN 1001—0742
CN11—2629/X

Article ID: 1001-0742(2005)02-0344-06 **CLC number**: X22 **Document code**: A

Relationship between urban eco-environment and competitiveness with the background of globalization: Statistical explanation based on industry type newly classified with environment demand and environment pressure

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Abstract: Within the global urban system, the statistical relationship between urban eco-environment(UE) and urban competitiveness(UC) (RUEC) is researched. Data showed that there is a statistically inverted-U relationship between UE and UC. Eco-environmental factor is put into the classification of industries, and gets six industrial types by two indexes *viz*. industries' eco-environmental demand and pressure. The statistical results showed that there is a strong relationship, for new industrial classification, between the changes of industrial structure and evolvement of UE. The drive mechanism of the evolvement of urban eco-environment, with human demand and global work division was analyzed.

The conclusion is that the development strategy, industrial policies of cities, and environmental policies to cities must be fit with their ranks among the global urban system. At the era of globalization, so far as the environmental policies, their rationality could not be assessed with the level of strictness, but it can enhance cities' competitiveness when they are fit with cities' capabilities to attract and control some sections of the industry's value-chain. None but these kinds of environmental policies can probably enhance the UC.

Keywords: global urban system; urban competitiveness; urban eco-environment; industry structure

Introduction

With the background of globalization, cities have become nodes of the network for the factors to flow and mass on the earth. Cultivating nad upgrading cites competitiveness has also become the key way for countries and regions to gain global competitiveness. The industrial structure and life form in cities are also a focus of the topics on global environment and development. This topic is a question about "urban eco-environment and competitiveness" on the lay of urban.

It is a noticeable topic for academe on the inevitability and mechanism of Inverted-U Environmental Kuznets Curve between economic development and eco-environmental quality (Grossman, 1994; Stern, 1996; World Bank, 1992).

Shukla and Parikh (Shukla, 1992) validated the relation between urban scale and urban air pollution, and found that there was a inverted-U connection between urban air quality and urban scale.

According to a new-classicality theory, strict environmental regulation would result in capital fleeing so that the regional competitiveness would decline (Mulatu, 2001; Dowell, 2000; Zeghni, 2000). But Porter *et al*. thought eco-environmental quality and competitiveness could be amended by strict environmental regulation by placing a premium on industries' innovational potential (Porter, 1995; Frankel, 2001).

Urbanization (Frankel, 2001), international competitiveness measures (Goodstein, 2003), industries transform (Stern, 1996; Campall, 1996), political institution and rationality of income distribution (Parry, 2001) etc. are factors to affect eco-environment.

Based on the research of RUEC, the law of the evolvement of eco-environment quality among the urban ranks is discussed to supply theoretical consult for reasonably constituting the urban development stratagem, environmental policies, and industrial policies.

1 Concept and evaluation of UC and choice of urban samples

1.1 Concept of UC with the background of globalization

The concept of UC has been directly or indirectly defined in a lot of researches (Webster, 2003; Porter, 1995; Kresl, 1995; Lever, 1999; Begg, 1999). These concepts were raised from national competitiveness and enterprise competitiveness, so that the character, status and law of development of cities can not be exactly reflected. With this background, cities are as one of these sections, nodes or chains of these global or regional economic system networks, so as to surmount national urban system, becoming one of the nodes of the global urban system (Castell, 2000; Smith, 2002; Friedmann, 1986, 1995; Greffi, 1994; Krugman, 1995; Yusuf, 2001; Sassen, 1994; 2002; Taylor, 2002). Therefore, when defining UC, cities should be taken as nodes of the global urban system, and seeing about which node (section, chain) it has taken and the capability for cities to control other nodes in the system.

The definition of UC was defined as follows: In the global urban system, being as the nodes of the network, conforming its existent advantage, and setting up rational structure to transform factors, the capability for cities to allure, proliferate, control and affect other nodes in the system which is named UC.

The rank of UC represented is the capability to hold the industry structure to realize max the value of some taches of the global value chain, and allure and transform rare resource persistently (especial for the human resource and knowledge), and drive total factor productivity to enhance, and further allure, control higher value-added, commanding functional tensed value chain taches.

1.2 Evaluating indicators of UC and choice of samples

UC, with the back of globalization, is represented with its rank in the global urban system. Based on the classification of the world urban system of thirty swatch cities (Friedmann, 1995), and combining with other researches (Gu, 1999; Smith, 2002; Ni, 2003; Sassen, 1994; Friedmann, 1995; Taylor, 2002). The conclusion can be drawn that there were five ranks in the global urban system, such as "global cities", "sub-global cities", "domestically important cities", "domestically regional cities", and "domestically district cities" among global urban systems. The sample cities are chosen with the acquirability and displayable of data (Table 1).

2 Concept and evaluation of UE

2.1 Concept of the UE

For UE, they are ones of the sections in regional so much as global

Foundation item: The Knowledge Innovation Program of the Chinese Academy of Sciences (No. KZCX3-SW-424)

eco-environment system that they are located in and there are special industrial actions and life fashion formed in the course for cities attaching themselves in the global competitiveness. There is a tight relationship between eco-environmental quality and industrial structure and economic structure(Batabyal, 1998; Stern, 1996; Donald, 2001; Parry, 2001; Porter, 1995; World Bank, 1992; Campall, 1996).

Table 1 Quality of eco-environment of swatch cities and their competitiveness

Swatch cities			TSP, mg/m^3	SO_2, mg/m^3	NOx, mg/m^3	Air pollution index	Urban park areas (m^2/per capita)
Rank1	Global cities	London, Tokyo, New York, Paris	0.030	0.023	0.075	75	28.210
Rank2	Sub-global cities	Singapotre, Osaka, Hong Kong	0.039	0.033	0.058	59	20.620
Rank3	Domestically important	Beijing, Shanghai, Shenzhen	0.201	0.047	0.066	82	3.950
Rank4	Domestically regional cities	Nanjing, Tianjin, Hangzhou, Qingdao	0.154	0.048	0.040	58	4.052
Rank5	Domestically district	Guiyang, Nanning, Qiqihaer, Chifeng, Siping	0.212	0.058	0.032	80	4.010

Data source: Data of urban air environmental indexes: Data of overseas cities from National Bureau of Statistics of China, 2002a; Chinese data from National Bureau of Statistics of China, 2002b. Data of Qiqihaer were estimated from Environmental Protection Bureau of Heilongjiang Province, 2002. Data of London, New York, Singapore were estimated data. Data of Chifeng were estimated with Environmental Protection Bureau of Inner Mongolia, 2002 and data of Qiqihaer. Thereinto, data of TSP in Nanjing, Hangzhou, Qingdao and Nanning were derived from National Bureau of Statistics of China, 2001 a; Urban park Areas: Data of Chinese cities from National Bureau of Statistics of China, 2002 c. Data of London, New York, Tokyo, Osaka were derived from National Bureau of Statistics of China, 1996. Data of Hong Kong was the ratio of forty percent of Hong Kong area and its general population(Web of window of Shenzhen, 2002); Notation: The conception of the cities in this table is administrative region. The method to classify urban ranks of 3, 4 and 5. The quantity of headquarters of the biggest five hundred enterprises in China (Market Research Information Web, 2002) are combined with to choose and evaluate swatch cities. By way of clearly expressing the distributing of the three ranks of cities, the strongest control capability figured "1", the control capability index of other cities can be get by accounting the ratio of each one them with the primacy city's quantity of the headquarters of enterprises

The definition of the urban eco-environment is defined as follows: The result that is, a substance condition of three actions such as production (industry structure), life (consumption fashion), metabolizing(discharge and disposal of pollutant) and that urban space was reconstructed by the three actions. It is formed when cities attach themselves to incise global industrial taches, under special economic, technologic and societal conditions.

2.2 Evaluation index of urban eco-environment, thought and evaluation way

At present, air, water, soil and area of greenbelt etc. are synthesized in the evaluation index system of UE. Evaluation model of UE includes the analytical hierarchy process and fuzzy comprehensive evaluation and so on. Thereinto, air pollution index (API) (Yang, 2002) is in common use to evaluate quality of urban air.

For the prominent effect for urban greenbelts on ameliorating quality of UE and on enhancing the humanity of urban etc.(Nath, 1996), the two indexes being compositive, furthermore, with the acquirability, comparability and economization of data, the new method was designed to evaluate the quality of UE in this paper, that is, the quality of UE is described by the ratio between the numerical value of API(TSP, SO_2 and NO_2 are chosen as indexes) and the per capita urban park areas. The ratio means that the air pollution pressure carried by urban unit park area, and the lower of the ratio, the better of the quality of the UE. In addition, RUEC is researched with three single UE indexes that gained with the ratio between concentration of contamination such as TSP, SO_2 and NO_2 and per capita urban park areas (Table 1).

3 Statistical relation between RUEC

The average value in each urban is accounted with compositive indexes of UE and the concentration of three main contaminations(Table 1). The trend line of RUEC(Fig. 1) and the trend line of relation between single UE index and urban ranks(Fig. 2) are protracted with them to describe the statistical RUEC.

Data in Table 1 and trend line of environmental indexes indicated that RUEC can be expressed statistically as inverted-U curve.

4 Analysis of influencing factors of quality of UE

As a sub-system of the global eco-system, the evolvement process of quality of UE among the urban ranks are effected by many factors such as external transfer of pollution, life fashion of resident (traffic, dietary), urban structure, natural emissions, industries pollution etc. (World Bank, 1992; Stern, 1996; Campall, 1996; Parry, 2001;

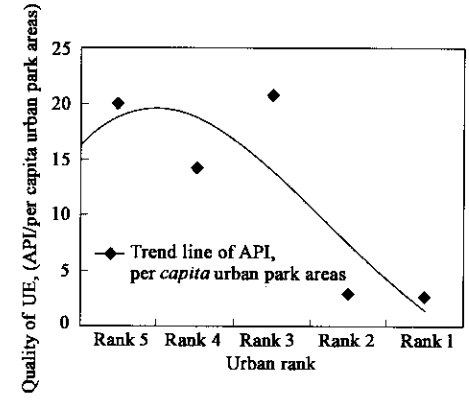

Fig. 1 Trend line of RUEC
(The trend line was pushed 0.5 unit backward)

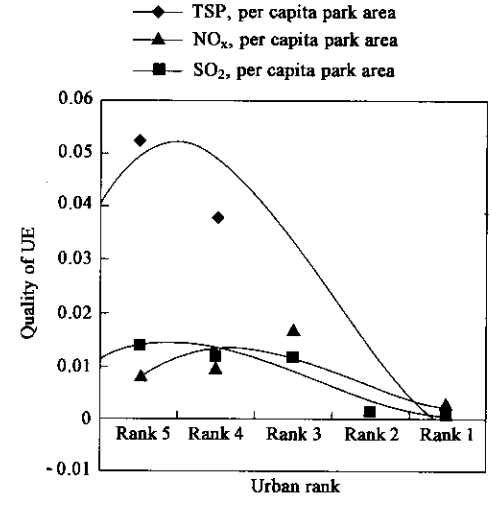

Fig. 2 Trend line of relation between single UE indes and urban rank
(The trend line of TSP(SO_2)/ per capita park areas was pushed 0.5 unit backward)

Batabyal, 1998; Donald, 2001; Nath, 1996; Fan, 1999).

It can be found by analyzing the data of Europe, America and Beijing, that the percent of volume of contamination emissions such as PM(TSP), SO_2, NOx etc., account for industries, are 46.0%—

72.0%, 76.9% and 7.9%—53.0%, respectively(Nath, 1996).

It can be concluded that the character of industrial structure has strong influence on UE. The environmental factor is introduced into the classification, and open out the statistical relation between the UC and urban industrial structure, to explain the caution of the existence of inverted-U of RUEC.

5 Statistical explanations on evolvement of UE based on industrial type newly classified

There are two inextricable matters for traditional classification of industries under the background of globalization. That is syllabify discriminating the difference with competitiveness on incising different taches of industrial chain for cities and the difference with the capability to choose, allure and control industries that are different with environmental demand and environmental pressure, that is, the relation between evolvement of urban industries and change of eco-environment.

The industries were classified with two indexes of environmental demand and environmental pressure, based on the need of research(Fig. 3). Environmental demand (ED) is embodied that industrial (flow) public's demand on urban environmental conditions; environmental pressure(EP) is embodied that the extent of industrial destroy on UE.

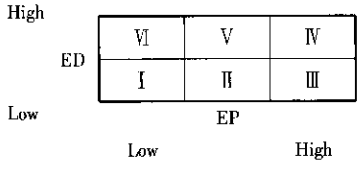

Fig.3 Industrial double attribution and industrial types

5.1 Industrial environmental pressure

Within a special time section, the low pollution industries(LP) are distinguished qualitatively at first, then the high pollution industries (HP) and middle pollution industries(MP) are distinguished in the rest industries by waste gas emission per ten thousand RMB Yuan.

The industrial pressure indexes were collated, with which the Radar Figure was made by excel(Fig.4). Fig.4 shows these trade such as the production and supply of electricity, gas and water and nonmetal mineral products etc. can be introduced into HP, and the others are MP.

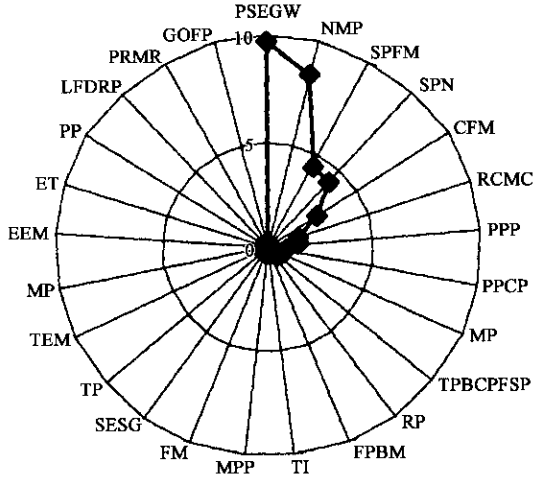

Fig.4 Pollution coefficient of trade unit production value
Data source: National Bureau of Statistics of China, 2001b; the letters in the figure are the abbreviation of each trade's name, e. g. production and supply of electricity, gas and water is abbreviated as PSEGW, detaild in Table 2

5.2 Industrial environmental demand

Some researches indicated that there is a positive correlation between human demand for eco-environmental quality and factors such as their educational level, and income level etc.(Parry, 2001; Dowell, 2000; Hong, 1998).

The trade environmental quality demand(ED) was substituted with the relative income of each trade to access, on basis of human capital theory (Equation (1)). ED can be embodied approximately by the relative income of each trade. But, the flow index cannot be used for the accessibility of data.

Account equation is expressed as follows:

$$ED_t = \sum_{j=1}^{7} [ELP_{tj} \times (1+\alpha)_j^n]. \quad (1)$$

Where, ED_t is the environmental quality demand of t trade; ELP_{tj} is the percent of stuff whose educational level is j in t trade; $(1+\alpha)_j^n$ is the income level of stuff whose educational level j, accounted with α which is Mincer educational yield rate; n is the educated number of year of the stuff, and the income of stuff that are educated primary school and hereinafter were supposed as 1. And, $t = 1, 2\cdots40$, $j = 1, 2\cdots7$, $n = 1, 2\cdots21$. α is taken as 10%(Chen, 1998).

Based on the data of "Industry composition of urban employment by educational level" (National Bureau of Statistics of China, 2002d), the value of ED_t is calculated. The composing of trades classified in each industry are based on Chinese statistical yearbook, and combined with the industrial classifications in other countries(Castell, 2000). Some trades in manufacturing and social services are refined, considering the environmental demand difference among internal sub-trade and integrating the difference of capability with incising the value chain for cities in globalization. Because of the absence of educational level of the stuff in these trades, the trade average wage per capita is used to be the substituted index to weigh its environmental demand. According to the analysis above, Beijing is located in the turning point of environmental quality in the urban system, so the trade environmental demand is classified by trade average wage in Beijing. Wuyuping's research about Beijing indicated that the turning point of concentration of SO_2, NO_2, TSP etc. are between 14979 and 24965 International Dollars (1999 Price, RMB: International Dollar = 1 : 1.76)(World Bank, 2000). Combining with the trade average wage and educational level yield, the two types of "high demand(HD), low demand(LD)" for environmental quality could be gotten.

Based on analysis above, six type of industries can be gotten such as Ⅰ (low demand and low pollution(LDLP)), Ⅱ (low demand middle pollution(LDMP)), Ⅲ (low demand high pollution(LDHP)) middle, Ⅳ (high demand high pollution(HDHP)), Ⅴ (high demand middle pollution(HDMP)), Ⅵ (high demand low pollution(HDLP))(Table 2).

5.3 Statistical relationship between UC and urban industrial structure

According to the standard of industrial classification, the averages of industrial structures in of each rank are accounted too(Table 3). The trend lines between six type industries and urban ranks in Table 3 are protracted(Fig.5 and Fig.6).

Conclusions can be drawn as follows: (1) With the urban rank increasing by degrees, the total industrial eco-environmental pressures improve then reduce; (2) the industral eco-environmental demand increase step by step; (3) the proportion of high-eco-environmental industries reduces quickly; (4) it is lagging for the proportion of middle-eco-environmental pressure industries reduces, comparing with high-eco-environmental pressure industries. This indicated that with urban rank increasing by degrees, the proportion of lower-pollution but technology-tensed industries reduces, on the other hand, those pollution-denseness industries are transferred to lower-rank cities. In fact, for pollution-controlled technology used, it is much lower for these middle-eco-environmental pressure industries in high rank cities than in low one.

Table 2 Industrial types and their trades

Ⅰ (LDLP)	Ⅱ (LDMP)	Ⅲ (LDHP)	Ⅳ (HDHP)	Ⅴ (HDMP)	Ⅵ (HDLP)
Farming, forestry, animal husbandry & fishery	Traditional equipment manufacturing[2]	Smelting & pressing of ferrous metals	Production and supply of electricity, gas and water	Electric equipment and machinery	Scientific research and polytechnic services
Construction	Printing & record medium reproduced	Raw chemicals materials & chemical	Petroleum processing and coking	Electronic and telecommunication	Education, culture, sporting and social welfare
Whole & retail trade & catering services	Food and beverage[3]	Chemical fibers manufacturing		Medical & pharmaceutical products	Finance
Low grade social services[1]	Rubber products	Paper making and paper products		Tobacco processing	Insurance
	Metal products	Smelting & pressing of nonferrous			Government agencies and social organizations
	Plastic products	Nonmetal mineral products			Real estate
	Textile trade				Transport, storage, post and telecommunications[4]
	Leather, furs, down and related products				Geological prospecting and water conservancy
	Garments and other fiber products				Commercial brokerage and agencies
	Logging & transport of wood & bamboo				Information and consultancy services
	Furniture manufacturing				Computer appliance
	Stationery, educational and sport goods				Tourism
	Mining and auarrying				Health care, sporting and social welfare

Data source: Indexes of Trade Environmental Pressure are account based on data of National Bureau of Statistics of China, 2001; b. The data of Average Wage in Beijing from National Bureau of Statistics of China, 2002e.

Notes: [1] The average of public facilities services, resident services, hotels, leasing services, recreational services and others; [2] The average of ordinary machinery manufacturing, special purpose equipment manufacturing, transportation equipment manufacturing and instrument meteres, cultural and machinery etc.; [3] The average of food manufacturing, processing and beverage manufacturing; [4] Transportation is an important source for urban air pollution and is considered as HDPL, for most statistical data could not be refined

Table 3 Industrial distribution in different urban ranks

Rank	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅴ	Ⅵ
1	28.90	6.18	0.81	0.25	1.53	62.32
2	37.31	9.45	1.86	0.75	4.34	46.30
3	22.96	30.25	5.70	1.42	12.30	27.36
4	23.34	22.98	7.42	2.91	12.82	30.53
5	59.59	9.73	4.98	1.39	2.18	22.14

Data source: Web of Learning and Skills Council, 2002; Department of Commerce of USA, 2002; Web of Edinburgh Government of UK, 2001; National Bureau of Statistics of China 2001c; 2002a; 2003; National Bureau of Statistics of Japan 2002b; Ministry of Manpower of Singapore, 2003; UN-HABITAT, 2003;

Notes: The proportion of Ⅱ, Ⅲ, Ⅳ, Ⅴ industrial types of Paris, Nanning and Qiqihaer were calculation according to Singapore, Guiyang and Chifeng. The stuff of Farming, Forestry, Animal Husbandry & Fishery in the country is included in the Ⅰ type industries. The weight of Ⅱ, Ⅲ, Ⅳ, Ⅴ industrial types were accounted by combining the production value

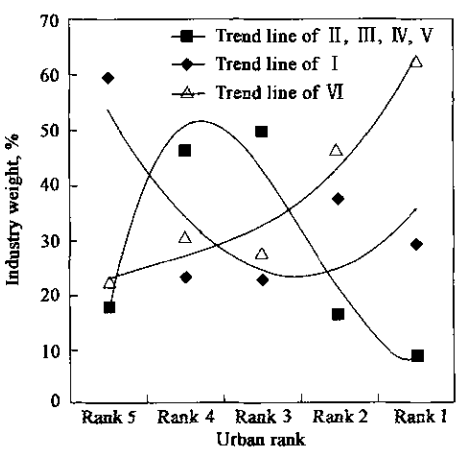

Fig.5 Trend line between Ⅰ, Ⅵ and industrial total value of Ⅱ, Ⅲ, Ⅳ, Ⅴ and urban ranks

5.4 Lucubrating about the influence of industrial character on the evolvement of UE

As stated above, there are two approaches for industrial change to influence the evolvement of UE: the industrial structure composing with industries of different ED and EP; the discrepancy of pollution pressure

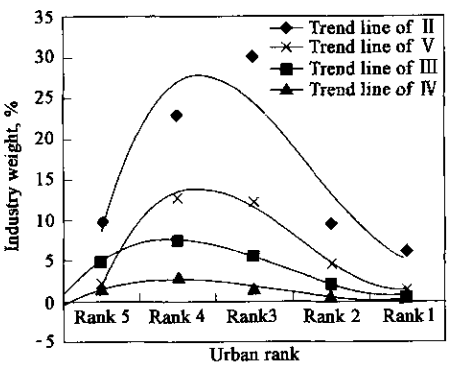

Fig.6 Trend line of the weight of Ⅱ, Ⅲ, Ⅳ, Ⅴ among urban ranks (The trend line of Ⅲ, Ⅳ was pushed 0.5 unit backward)

indexes of the same industrial for the gap of the capability to adopt new technology among cities in different urban ranks. Under the peculiar conditions, the change extent of pollution pressure caused by different technical development coefficient is likely to be higher than the change extent of pollution pressure caused by the change of industrial structure. For the limit with the data, the simulation account is carried on the limited data, under the premise of supposing that the speed of technique development among urban ranks is as follows:

$$TEPP_g = W_{g,i} \times \sum_{i=1}^{5} (EPP_i \times P_{i,g}). \quad (2)$$

Where, $TEPP_g$ (total environmental pollution pressure) is the total industrial pollution pressure in g urban rank; $W_{g,i}$ is the technique development coefficient of i industry in g urban rank, the numerical value is calculated according to the data(1989) of "Emission of CO_2 per million dollars GDP" (World Bank, 1992). The ration of the data in high-income countries, middle-income countries and low-income countries is 1.0 : 2.3 : 3.0 : 5.0. Because the urban system is classified to five ranks, and the cities of rank1 and rank2 can be put into high-income type; rank3, rank4, rank5 are approximately part of superior middle-income type, subordinate middle-income type and low-income type. Considering the difference among urban ranks, the average of the weight of the high-income and superior middle-income cities was taken as the industrial pollution coefficient of the cities in rank2. So the

industrial pollution coefficient in each urban ranks is in turn 1:1.7:2.3:3:5; EPP_i is the industrial environmental pollution pressure, the industrial pollution pressure is expressed by the average of each trade pollution pressure indexes. The pollution pressure of Ⅰ, Ⅱ, Ⅲ, Ⅳ, Ⅴ, Ⅵ is in turn 0.00: 0.28:3.80:5.30:0.20: 0.00; $P_{i,g}$ is the distribution of i industry in g rank cities; $i = 1,2\cdots6$; $g = 1,2\cdots5$. After calculating, the trend line of total industrial pollution pressure among urban ranks can also be gotten(Fig.7).

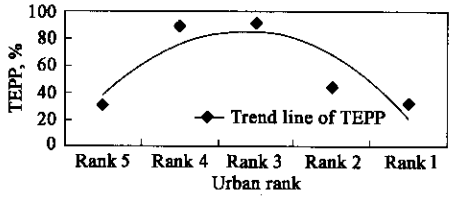

Fig.7 Trend line of the total industrial pollution pressure among urban ranks

The analysis in this fraction indicated that, if the urban industrial pressure, industrial structure and the technique difference among ranks etc. are considered, it will be more stronger for the capability of the change of urban industries to explain the RUEC.

6 Dynamical mechanism for the quality evolvement of UE

There is a statistical inverted-U curve for quality of UE as the impetus among the global urban system. It is human demand to put the statistical relation into reality and there are two mechanisms among cities that are different with competitiveness, one is the regular transfer of industries and the other is the discrepancy for cities to adopt the up-to-date environmental protection technology.

The Maslow Demand Theory considers that it is delaminated for the human demand and enhancing stage by stage. There is a tightened correlation between income level and environmental quality demand (Parry, 2001; Dowell, 2000; Hong, 1998). At the low level for UC, for urban public, the basic demand for clothes, food and traffic etc. are more important than the demand for quality of UE. Some cities have comparative advantage with nature resource and infrastructure etc. so as to can develop the industries that are transferred out from the high-level cities, with their competitiveness enhancing, but the quality of UE become deteriorating for the up-to-date environmental protection technology being not able to be adopted in these cities.

With the development of the UC (total economy) level, the structure of urban public are changing while the weight of high-level income (education) persons is increasing. The LP industries are inclinable to be developed, and these cities have economical abilities to do this, when the environmental demand arrived at the turning point and become the realistic demand. There are also some HP(or MP) industries in cities whose competitiveness are high, but the pollution pressure of these industries have been decreased to the level accepted by the urban public with the up-to-date environmental protection technology adopted. In this way, the quality of UE are able to be amended, when their competitiveness arrived at the turning point.

The base is established by the globalization to bring the industrial transfer mechanism to play. There are two approaches viz. Production Division and Value Chain Incision for the industries to search for the optimal location in the world. Cities attach themselves to global work division (or excluded from the globalization) basing on their own comparative advantage. Industries are clustered in different spaces of urban in term of principles such as advantage complementarities and return maximization. In the cities whose competitiveness are the highest, there are taches with controlling and commanding functions, that is, HQ, R&D etc. and industries with global service functions viz. finance, law etc. But in cities whose competitiveness is low there are industries (or taches) such as resource exploitage and machining and so on. Because of the difference of environmental pressure of different industries and the capacity discrepancy of cities to adopt the up-to-date environmental protection technology, there are discrepancies for quality of UE among different cities. The discrepancies of environmental demand that drive the evolvement of UE among the global urban system is a result of the difference of the level of income(education) of different industrial public and urban inhabitant whose main body are these industrial publics.

In fact, within the international lay the environmental problem is not an environmental pollution matter but a competitive and attracting matter(Zeghni, 2000). Cities whose competitiveness are lower have to made looser environmental policies to allure industries that are devastating on environment, however, cities whose competitiveness are higher could allure and control industries that pollution pressure are lower but value-added are higher, and they could also reduce pollution pressure of industries with technological capability.

Thereby, with urban rank increasing by degrees, the total industries' eco-environmental pressure improves at first then reduces, and the industries' eco-environment demand increase step by step. It turned out that there is a statistically inverted-U of RUEC.

7 Conclusions

With the increasing of urban ranks, there is a statistical inverted-U curve. There are a lot of factors to influence the evolvement of urban eco-environment among ranks, one of the important factors is the change of industrial structure that are different with eco-environmental pressure and demand.

So the development stratagem, industrial policies, and environmental policies must be fit with their rank among the global urban system. At the era of globalization, so far as the environmental policies, we can not assess their rationality with the level of strict, but can enhance cities' competitiveness when them are fit with cities' capabilities to attract and control some section of the industry's value-chain.

References:

Batabyal A A, 1998. Games governments play: An analysis of national environmental policy in an open economy[J]. Ann Reg Sci, 32: 237—251.

Begg I, 1999. Cities and competitiveness[J]. Urban Studies, 36: 759—809.

Campall S, 1996. Green cites, growing cities, just cities? The urban planning and the contradiction of sustainable development[J]. Journal of the American Planning Association, 62(3): 17—27.

Castell M, 2000. The rise of the network society (Translation by Xia Z. J., Wang Z. H. *et al*. ed., 2001) [M]. Social Science Literature Publishing. 91—171; 387—391.

Chen X Y, 1998. Research on individual yield of Chinese higher education[J]. Higher Education Research, 6: 33—37.

Donald D, 2001. Economic competitiveness and quality of life in city regions: A review of the literature[EB]. Williams Research com INC.

Dowell G, Hart S, 2000. Do corporate global environmental standards create or destroy market value? [J]. Management Science, 46(8): 1059—1074.

Environmental Protection Bureau of Heilongjiang Province, 2002[EB]. http://www.hljepb.gov.cn/untitled-2.htm.

Environmental Protection Bureau of Inner Mongolia, 2002: Annals of Environment [EB]. http://www.nmhbj.com/gongbao.htm.

Fan X Y, 1999. Chinese pollution condition of auto trail gas and analysis of countermeasure[J]. Environmental Sciences, 20(5): 102—108.

Frankel J A, 2001. The environment and economic globalization, written for globalization: What is new[EB]. http://www.nber.org/paper/w10090.

Friedmann J, 1986. The world city hypothesis[J]. Development and Change, 17 (1). 69—83.

Friedmann J, 1995. Where we stand: a decade of world city research[M]. In: World cities in a world system(Knox P. L., Taylor P. J. ed.). Cambridge: Cambridge University Press.

Goodstein E, 2003. A new look at environmental protection and competitiveness [Z]. Economic Policy Institution Briefing Paper.

Greffi G, Korzeniewicz M, 1994. Commodity chains and global capitalism[M]. Westport: Praeger.

Grossman G M, Krueger A B, 1994. Economic growth and the environment[Z]. National Bureau of Economic Research, Working Paper No 4634.

Gu C L, 1999. Economic globalization and Chinese urban development[M].

Beijing: Commerce Publishing. 225—243.

Held D, 1999. Global transformations-politics, economics and culture(Translated by Yang X. D., 2001)[M]. Beijing: Social Science Literature Publishing. 325—390.

Hong D Y, 1998. Exploration on Chinese public environmental consciousness [M]. Beijng: China Environmental Science Press. 25—35

Kresl P, 1995. The determinants of urban competitiveness [M]. In: North America cities and the global economy: Challenge and opportunities (Kresl P., Gappert G, ed.). London: Sage Publication. 45—68.

Krugman P, 1995. Growing world trade: causes and consequences[Z]. Booking papers on Economic Activity. 327—362.

Lever W F, Turok I, 1999. Competitive cities : Introduction to the review[J]. Urban Studies, 36: 791—792.

Market Research Information Web, 2002. The quantity of headquarters of the biggest five hundred enterprises in China[EB]. www.3see.com.

Ministry of Manpower of Singapore, 2003[EB]. http://www.mom.gov.sg/mom/mRSD/others/2003/LF.t18.pdf..

Mulatu A, Florx R J G M, Withagen C A A M, 2001. Environmental regulation and competitiveness[R]. Tibergen Institute Dicussion Paper, 2001 - 039/3.

National Bureau of Statistics of China, 2001a. Environmental yearbook of China 2001[M]. Beijing: Chinese Statistical Press. 588—589.

National Bureau of Statistics of China, 2001b. Environmental yearbook of China 2001[M]. Beijing: Chinese Statistical Press. 526—551.

National Bureau of Statistics of China, 2001c. Labor structure and unempolyment in Hong Kong [EB]. http://chinadatacenter.org/chinadata/guest/yb1996/uml.html.

National Bureau of Statistics of China, 2002a. International statistical yearbook [M]. Beijing: Chinese Statistical Press. 39—40.

National Bureau of Statistics of China, 2002b. Environmental yearbook of China 2002[M]. Beijing: Chinese Statistical Press. 695—698.

National Bureau of Statistics of China, 2002c. Bejing, Shanghai etc. cities statistical yearbook 2002[M]. Beijing: Chinese Statistical Press.

National Bureau of Statistics of China, 2002 d. Chinese Labor Statistical Yearbook2002[M]. Beijing: Chinese Statistical Press. 58—59.

National Bureau of Statistics of China, 2002e. Chinese labor statistical yearbook 2002[M]. Beijing: Chinese Statistical Press. 202—212.

National Bureau of Statistics of China, 2003. Beijing, Shanghai etc. cities statistical yearbook 2002[M]. Beijing: Chinese Statistical Press.

National Bureau of Statistics of China, 1996. International statistical yearbook [M]. Beijing: Chinese Statistical Press. 572—573.

National Bureau of Statistics of Japan, 2002a[EB]. http://www.stat.go.jp/english/data/nenkan/ zuhyou/y0805000.xls.

National Bureau of Statistics of Japan, 2002b[EB]. http://www.stat.go.jp/english/data/nenkan/ zuhyou/y1607000.xls.

Nath B, 1996. Environmental management(Translated by Lv Y L *et al.*)[M]. Beijing: Chinese Environmental Science Press. 138—140.

Ni P F, 2003. Chinese urban competitiveness report[R]. Beijing: Social Science Literature Press. 1—12.

Parry I W H, 2001. How large are the welfare gains from technological innovation induced by environmental Policies? [EB]. http://www.rff.org/parry/Papers/AERE

Porter M, vander Linde C, 1995. Toward a new conception of the environment-competitive relationship[J]. Journal of Economic Relationship, 9(4): 97—118.

Sassen S, 1994. Cities in a world economy[M]. London: Pine Forge Press.

Sassen S, 2002. Global networks, linked cities[M]. New York: Routledge.

Shukla V, Parikh K, 1992. The environmental consequences of urban growth: cross-national perspectives on economic development, air pollution, and city size[J]. Urban Geography, 13(5): 422—449.

Smith D, Timberlake M, 2002. Hierarchies of dominance among world cities: a network approach[M]. In: Global networks, linked cities(Sassen S. ed.). New York: Rout Ledge. 117—141.

Stern D I, Common M S, Barbler E B, 1996. Economic growth and environmental degradation: The environmental Kuznets curve and sustainable development[J]. World Development, 24(7): 151—160.

Taylor P J, Walker D R F, Beaverstock J V, 2002. Firms and their global service networks[M]. In: Global networks, linked cities (Sassen S ed.). New York: Routledge. 93—115.

UN-HABITAT, 2003[EB]. http://www.unhabitat.org/habrdd/Statannex/ B—7.pdf.

United States Department of Commerce, 2002[EB]. http://www.lda.gov.uk/document/ manufacturinginlondon.pdf.

Wang J C, 2001. Innovative spaces: enterprise clusters and regional development [M]. Beijing: Peking University Press. 1—14.

Webster D, Muller L, 2003. Urban competitiveness assessment in developing country urban region the road forward[EB]. http://www.worldbank.org/.

Web of Window of Shenzhen, 2002[EB]. http://sports.szptt.net.cn/ 2002 - 09 - 19/nw 2002091900372. shtml.

Web of Learning and Skills Council, 2002[EB]. http://www.lsc.gov.uk

Web of Edinburgh Government of UK, 2001[EB]. http://download.edinburgh.gov.uk/Census 2001 City Comparisons/CCTable11EmpStrucTotal.pdf.

World Bank, 2000. 1999/2000 World development report[M]. Beijing: Chinese Finance Economic Press.

World Bank, 1992. World development report 1992[M]. UK: Oxford University Press. 205.

Wu Y P, Song J F, 2002. Modeling economic growth and environmental degradation of Beijing[J]. Journal of Geographical Sciences, 21(2): 240—248.

Yang S H, 2002. Urban eco-environment[M]. Beijing: Science Press. 236—238.

Yeung Y M, 2000. Globalization and the new urbanization[C]. Keynotes address prepared for the South Asia Urban and City Management course organized by the World Bank Institute hold in Goa , India. 9—21 January 2000.

Yusuf. S, 2001. Globalization and the challenge for developing countries[C]. World Bank DECRG, June 2001.

Zeghni S, Fabry N, 2000. FDI and environment: Is China a polluter haven? [Z]. Universite de Marne-la-Vallee. Working Paper 2000 - 2.

(Received for review April 5, 2004. Accepted July 8, 2004)