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Studies on Economic-risk Assessment in China's Regional Industrial Transferring ： Based on Improved TOPSIS Model

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Abstract: Focusing on regional industrial transferring, this paper introduces the “economic risk”concept to characterize the uncertainty of welfare effets which China’s regional industrial transferring can take. After establishment an unified framework of analysising risk,which includes eonomic welfare risk and social welfare risk, this paper tries to assess the eonomic risk in China’s regional industrial transferring by making use of improved TOPSIS model and 2010 China’s provincial-leved data.We find that the level of China’s overall regional economic risk is at a high level, reflecting that central and western areas are particularly acute, and that economic well-being risk is notable in developed areas, while economic well-being risk and environmental polllution of social well-being risk are very prominent in developing areas.

Keywords: Regional industrial transferring, Economic risk, Assessment, Improved TOPSIS model

1 INTRODUCTION

Against the background of Debt crisis spreading in Europe and economy recovering slowly in other developed nations, it is the main melody of our country economic development in next peroid of 5 years that we should strongly expand a local market and speed regional industrial upgrading to promote district economic development in a moderate way and improve people's livelihood more rapidly.

The practice of the international industrial transferring and a great deal of research focusing on it all express that the industrial transferring, industrial upgrading and the district economic developments are closly connected as an organic whole. However, when we introspect our pratice of regional industrial transferring for over 20 years,we can easily find that the problem of imbalance, immoderate and no-sustainable in economic development is still outstanding,which shows that there are a great quantities of economic risk in the process of our regional industrial transferring.They can produce great realistic or latent threats to our economic development leading in a stability and sustainable way.

2 THE ANALYTICAL FRAME OF ECONOMIC RISK IN CHINA’S REGIONAL INDUSTRIAL TRANSFERRING

Risk means indetermination which can lead to the future possible loss. We puts forward the concept of "economic risk", getting away from “negative effect” which is popular in academic circles, trying to point out the characteristic of uncertainty that the “negative effect”of problem can form,and we advocate to obstruct the occurrence of disadvantageous result by necessary prevention and control way,and let it to produce more economic and social welfare effect to region and the whole nation.

Based on welfare economics theory,there are two welfare effects pursued by economic activities: one is economic welfare effect which reflects economic stability and sustainability,the other one is social welfare effect which keens on improving of people’s lives.Accordingly, we can set up the analytical frame of economic risk in our regional industrial transferring,that is,the risk of economic welfare and the risk of social welfare. Then how to identify them? We should hold their important influencing factors by thorough analysis.

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3 THE INDEX SIGNS OF ECONOMIC RISKS IN CHINA'S REGIONAL INDUSTRIAL TRANSFERRING

3.1 Risk identification indicators of economic welfare risk

There are a lot of factors influencing the economic stability of a region. Here economic increases-factor theory provides solid theory foundation. Edward Fulton Denison, American economist,believed that there are two factors influencing economic growth,that is, the rate of production of production factors and the quantity of production factors thrown in. After analysizing the factors of To modern the economy increase, Kuznets held the opinion that the factors of economic growth mainly includes: the knowledge increasement, the improvement of labor rate of production and the variety of economic structure. Hollis B. Chenery also put forward that there is a closely related relation between the improvement of economic structure and economic growth. So Economic structure and technique progress are two decisive factors to the stable and sustainable economy for a region. Accordingly, industrial upgrading risk and technique progress risk will be introduced to be the index signs to identify economic welfare risk.

We mainly refer to industrial upgrading velocity index sign to identify industrial upgrading risk. There are various dynamic measurements, among which Moore and annal varibility of industrial strucure are more popular. Own to more simple and intuitive, we choose the method of annal change of industrial strucure. The formular is as follows:

$$k = \frac{\sum_{i=1}^{n} \left| q_{it} - q_{i0} \right|}{m}$$

In the formula, k is the average annual change in industrial structure value, q_{it} is the proportions of industry in the reporting period, q_{i0} is industry the proportions of industry in the base period. n is the number of industry, m Base period and the number of years between the reporting and base period. The greater the value of average annual change in industrial structure, the faster industrial upgrading, and sustained economic growth achieving may be greater, so the smaller the region's economic risk. On the contary, the smaller the value of average annual change in industrial structure, the slower industrial upgrading indicating, sustained economic growth achieving may be smaller, so the greater the risk of regional economies.

Concerning the risk indicators for the determination of technological progress, this paper agrees with the view of Chinese economist Hu Angang, choosing indicators to measure technological progress from two angles, that is, innovation and introduced technology. We use R&D personnel full-time equivalent per million population of medium-sized industrial enterprises to measure technological progress caused by the innovation, and choose the ratio of foreign direct investment (FDI) and self-financing in fixed asset investment in concerning area to measure the technological progress caused by the introduction of technology.

In summary, the formula for calculating regional technological progress indicators is as follows:

$$t = s \times i$$

In the formula, s is Technological progress indicator, i is the ratio of foreign direct investment (FDI) and self-financing in fixed asset investment. As a result of technological innovation and technological progress resulting from the introduction of technological have a mutual influence and mutual promotion of the role, so there will be two multiplied technological progress indicators. The greater Index value of technological progress is, the possibility of sustained economic growth may be greater, at the same time, the economic risk in regional

industrial transferring of areas will be more less; On the other hand, the smaller the index value of technological progress is, the smaller possibility of sustained economic growth may be, the higher economic risk in regional industrial transferring wil be.

3.2 Risk identification indicators of social welfare

An important part in the social choice theory in development economics is the measure of social welfare, which believing that the improving in social welfare or quality of life is the main indicator of social evolution. Many economists have done a useful exploration of a variety of methods to measure of social welfare, such as the standard method of national income, the adjusted income method, or composition of index methods, and so on. All these methods depend on the economic and social activities of value judgments. However, the common drawback of these methods is that it is difficult to clearly define the value judgments. To correct this shortcoming, economists have recently used the "social welfare function approach" as a measure of the concept and methodology of social welfare framework. This new approach is to create a comprehensive "social-ecological-economic(SEE)" system, using multiple variables to conduct a comprehensive measure of social welfare.

Based on above studies, combined with China's actual situation, following the importance of the principle, here we taks the unemployment risk and the risk of exposuring to environmental pollution as important identified variables to explain the influence of industrial transferring of on the quality of life.

As to risk of unemployment indicators, we will continue to use the rate of registered urban unemployment to assess the risk of harm as the level of regional economic risk, on the condition that we unable to obtain more accurate and realistic data on the situation

As to the risk of exposuring to environmental pollution, we add a new energy industry based on domestic scholars Zhao Xikang specific categories of polluting industries, the whole industry is divided into four categories: heavy-polluting industries, moderate-polluting industries, light-pollution industries and pollution-free industries, and give [1,10] interval assignment to reflect different ecological impact brought about by diffenent industries. The greater the value, the more serious pollution, to see Table 1

Table 1 Classification of Industrial Pollution and Ecological Environmental Factor

Pollution Industrial Classification	Environmental quality influence coefficient（λ）	Specific industry
Heavily polluted industries	10	Electricity, gas and water production and supply industry, mining, paper making, cement manufacturing, nonmetallic mineral manufacturing, black metal smelting and rolling industry
Moderately polluted industries	7	Non-ferrous metal industry, chemical fiber manufacturing, electronics, electrical
Light-polluted Industries	4	Food, medicine, textile, leather products, wood processing, rubber, metal products, machinery, chemicals and chemical products manufacturing
pollution-free industries	1	New energy, new materials industry

We can obtain regional industrial indicators for environmental pollution by the regional proportion of industry output according to the weighted sum. Environmental pollution index is calculated as follows:

$$e = \sum_{i=1}^{n} \lambda_i \frac{M_i}{M}$$

In the formula, e is indicators of environmental pollution, λ_i is the quality of environmental factor impacting by industry i. $\frac{M_i}{M}$ is the proportion of the total industrial output value of industry i. Environmental pollution index value is proportional to the size and economic risks, and quality of life of local people is inversely proportional to the index value. The greater the environmental pollution is , the greater the economic risk in the industrial transferring, the lower the local lquality of life wil be. On the contrary, the smaller economic risk is, the higher levels of local quality of life.

4 ESTABLISHING ASSESSMENT MODEL OF ECONOMIC RISK IN REGIONAL INDUSTRIAL TRANSFERRING: BASED ON IMPROVED TOPSIS MODEL

Risk is an objective reality, but people's perception of risk is subjective, People often perceive the size of risk.through. In view of this, this paper sets up TOPSIS evaluation model to evaluate the economic risk of different regions, which is of the same level. By the size of the sort of economic risk , we can directly reflect the state of each regional economic risk and the relative severity of risk. And it is in line with the point of subjective risk theory : people recognize and judge risk only by comparing.

TOPSIS（Technique for Order Preference by Smi ilarity to Ideal Solution）was first proposed by Hwang and Yoon in 1981, which use the composite indicator of the evaluation object to evaluate object by calculating the proximity of the ideal solution. It is a multi-objective decision-making approach, dealing with statistics derived from the measured object, which can avoid subjective factors. So it can be used for scientific decision-making of a practical method. TOPSIS method has a lot of advantages, such as: Its ease of application, the data distribution, sample size, the number of non-restricted index, with wide range of applications, a small amount of computation, geometry and small information distortion and so on. And there are multiple indicators of identification of economic risk, we can be clearly recognized the level of economic risk by sorting on the basis of TOPSIS model.

In the specific evaluation process, this paper makes wishes improvements to TOPSIS model to let it meet the requirements of more stability of scientific

4.1 The improvement of positive and negative ideal vector

In the traditional TOPSIS evaluation method, the ideal vector and the negative ideal vector are directly selected from data matrix after normalized. Although this selection more convenient to operate, but will lead to a lack of stability of vector data. This is because when the judge's environment and its own conditions change, the index value will change accordingly, which is likely to lead to order changes with the change of ideal vector and ideal vector, which will lead to evaluation results are not unique. Thus we select positive and negative ideal vector data from a weighted matrix to ensure the uniqueness of the evaluation results.

4.2 The improvement of determining the weight of indicator

It is the most critical step to determining the weight of indicator in a multi-index comprehensive evaluation. Unreasonable weight of indicator may lead to weaken the impact of certain indicator and the distortion of the results of the evaluation. In view of this, we use coefficient of variation to evaluate the impact on the evaluation of the object. The greater a target coefficient of variation is, which means that the greater amount of information it can produce, accordingly, the greater weight of the indicator will be. In the evaluation of China's inter-regional transfer of economic risk in the industry, this method can objectively and accurately reflect the importance of the evaluation index, which can truly reflect regional differences in levels of economic development. This method is highly feasible, the economic significance of clear, both to avoid the possible indicators of regression

analysis coefficient is inconsistent with the economic significance of defects, but also to avoid the economic significance of factor analysis to empower ambiguous. Therefore, the use of this method to construct the weight of each index has its practical significance.

5 THE EXAMPLE OF ASSESSMENT OF ECONOMIC RISK IN CHINA'S REGIONAL INDUSTRIAL TRANSFERRING:BASED ON 2009 CHINA'S PROVINCIAL-LEVEL DATA

This paper tries to reflect the level of economic risk in China's inter-district transfer of industry risk by use of 2009 data of China's provincial areas on the basis of improved TOPSIS model after sorting through the index value, informing regional economic risks in the country's relative position. Then we try to divide different types of the severity of the economic risk according to the relative proximity to ideal value, in order to give a general assessment r to China's regional economic risk in industrial transferring.

5.1 The method of calculation to assessing economic risk

Based on above anaylsis about economic risk in China regional industrial transfer, we divide the economic risks into two categories: the risk of economic welfare and the risk of social welfare risk, respectively reflecting the possible adverse effects to regional economic growth brought by regional industrial transfer and the possible adverse effects to quality of life for people. According to previous analysis, the industry shift in economic risks identified four indicators: risk indicators of industrial upgrading I_1, risk indicators of technological progress I_2, risk indicators of unemployment I_3, risk indicators of environmental pollution I_4.

According to the subjective risk theory, we can obtain the level of provincial economic risk by sorting index value. As for the calculation of index values, statistically, there are two ways to use: First, absolute value, and the other is a relative value. Against the background of China's regional transfer of industry accelerating, we choose the relative value of past decade of economic risk.On the one hand, it helps horizontal comparison which eliminate the impact between regions having different the scale of industrial transfer. On the other hand,it helps to let four indicators of risk sharing more common caliber, that is, we can perceive risk level of provincial through the vertical comparison. Based on this understanding, we obtain the data by the reporting period compared with the base period to obtain the data, calculated as follows:

$$\delta_i = \frac{I_{i1} - I_{i0}}{I_{i0}}, \ i = 2,3,4 \quad ,$$

I_{i1} is index value of indicator i of the reporting period, I_{i0} is Base period index value of indicator i, δ_i is the rate of change of indicator i. As risk indicators I_1 for the industry to upgrade itself is already the rate of change indicators, so do not adjust. To reflect economic risk in China's regional transfer over the past decade, we choose 2000 data as base data and 2010 data as reporting data. Risk indicators of industrial upgrading and risk indicators of technological progress is a contrarian indicator , which the smaller the index value is, the greater the economic risk will be. The risk indicators of unemployment and the risk indicators of environmental pollution is a positive indicator, which the greater the index value is , the greater the economic risk will be.

5.2 The computing process of economic risk assessment

we use data of 29 provincial-level regions exclude Tibet and Chongqing for incomplete data of the two

areas. All data comes from ”China Statistical Yearbook 2001,2011”,” China Industrial Economy Statistical Yearbook 2001,2011”. The initial matrix evaluation is set up, to see Table 2

Table 2 the risk assessment table about China's 29 provincial-level regions in 2010

Region		Indicators of assessment economic welfare risk		Indicators of assessment social welfare risk	
		Risk indicator of industrial upgrade(%)	The risk indicator of technological progress (%)	Risk indicator of unemployment（%）	Risk indicators of environmental pollution（%）
	Beijing	1.55898	581.225	2.8571	2.658
	Tianjing	0.403321	301.6326	-7.692	32.276
The	Hebei	0.268548	82.8195	9.1667	37.913
eastern	Liaoning	0.529373	244.1739	-40.462	34.267
region	Shanghai	1.355	489.2275	-11.25	25.691
	Jiangsu	0.38108	140.7165	-23.33	33.172
	Zhejiang	0.21311	104.3545	-22.381	9.414
	Fujian	0.308232	94.7584	-7.143	4.132
	Shandong	0.424404	149.6715	-5.556	40.939
	Guangdong	0.73236	254.6641	-16.129	7.905
	Hainan	0.610011	84.7125	12.2581	33.321
	Shanxi	0.32217	69.82304	13.5294	53.302
	Jilin	0.482072	176.7871	9.7222	47.239
The	Heilongjiang	1.00942	220.6087	-12.857	18.537
central	Anhui	0.308232	483.7763	-2.01	41.569
region	Jiangxi	1.119533	114.2613	1.1765	26.124
	Henan	0.872542	124.3006	20.6897	40.616
	Hunan	0.26763	153.5501	3.5	23.742
	Hubei	0.688728	179.1046	-2.093	35.428
	Neimenggo	1.029916	144.9143	-3.171	48.587
The	Guangxi	0.963948	84.679	1.0811	15.277
western	Sichuan	0.83844	424.2217	-3.556	20.979
region	Guizhou	0.71693	77.719	-7.073	48.561
	Yunnan	0.31054	45.42	6.5	41.792
	Shanxi	0.66291	134.1855	19.3939	28.413
	Gansu	0.31074	154.8907	1.5625	49.526
	Qinhai	0.854182	63.3602	5.5556	16.538
	Ningxia	0.2323	90.3044	0	81.375
	Xinjiang	0.380135	101.747	3.7838	46.843

Note：As to risk indicators of industrial upgrading, we select a sample of 27 major industrial inspection in the yearbook.

As the unemployment rate in the original indicators are more negative indicators, in order to meet the requirements of TOPSIS to the value of unity, while the gap between regions does not change, Firstly, we make a positive change to let the minimum value of the indicator 0, Secondly, make initial matrix transformations using data in Table2 , Then make the same trend and normalized of data, And then use the formula

$V_j = \frac{S_j}{X_j}$ to calculate the weight of four indicators:

$W_j = |0.270116 \quad 0.292457 \quad 0.17109 \quad 0.266388|$, This model approach is consistent with the point of subjective risk theory: even higher the risk of unemployment areas, but little difference in the level of regional unemployment, people's subjective experience of the risk will be less intense, thus the model will be the risk of unemployment assigned a smaller weight. But, overall, the risk of economic welfare and social welfare major cause risk weighting each half, setting the weights better reflect fundamental economic risks to the overall situation.

According to the matrix having been constructed, the columns are multiplied by the corresponding weight, to determine the index of the positive values Z^+ and negative values Z^-, as follows:

Z+	0.013177	0.010025	0	0.003578
Z-	0.096391	0.12829	0.04774	0109544

Then determine the distance D^+, D^-, coming to the evaluation of the object proximity C_i. The greater C_i is, the greater the economic risk will be, to see Table3:

Table 3 the sort of economic risk assessment of 2009 China's provincial regions in regional transferring

Region		D+	D-	Ci	Economic risks in order
	Beijing	0.179816	0.033819	0.158302	2
	Tianjing	0.137116	0.061286	0.308898	7
The	Hebei	0.085183	0.106782	0.556257	26
eastern	Liaoning	0.143254	0.051564	0.264679	6
region	Shanghai	0.16243	0.038587	0.191959	4
	Jiangsu	0.121429	0.067156	0.356104	12
	Zhejiang	0.125555	0.096465	0.434488	20
	Fujian	0.128961	0.078665	0.378879	15
	Shandong	0.116922	0.07399	0.387562	16
	Guangdong	0.162449	0.028235	0.148072	1
	Hainan	0.108176	0.085268	0.440788	22
	Shanxi	0.067339	0.119895	0.640351	27
	Jilin	0.119017	0.080802	0.404377	18
The	Heilongjiang	0.154927	0.035233	0.185281	3
central	Anhui	0.132602	0.080671	0.378252	14
region	Jiangxi	0.133525	0.061318	0.314706	9
	Henan	0.122251	0.079722	0.394717	17
	Hunan	0.121435	0.082495	0.404525	19
	Hubei	0.1332	0.060225	0.311363	8
	Neimenggo	0.126084	0.075014	0.373022	13
The	Guangxi	0.131629	0.069731	0.3463	10
western	Sichuan	0.158932	0.039754	0.200085	5
region	Guizhou	0.099258	0.094635	0.488078	24
	Yunnan	0.062262	0.14461	0.69903	29
	Shanxi	0.128701	0.069414	0.350374	11
	Gansu	0.105827	0.092844	0.467325	23
	Qinhai	0.119627	0.092044	0.434845	21
	Ningxia	0.066259	0.144429	0.685512	28
	Xinjiang	0.095775	0.092912	0.492414	25

Using the same method, we can calculate and sort regional economic risks of different years, so that dynamic process of regional economic risk will be clear, but here we will not go.

6 ASSESSMENT ANALYSIS ON ECONOMIC RISK OF CHINA'S REGIONAL TRANSFER OF INDUSTRIES

In this paper, based on TOPSIS model and the relative proximity to the negative ideal value, the region's economic risk can be divided into four categories: the high-risk type, the higher-risk type, the relative-low risk, the low-risk type (see Table 4). We can see from the table that regional economic risk above the higher-risk level accounts for 41%, including high-risk areas nearly 13.8% of the total, the overall economic risk is quite high.

Table 4 the classification of economic risk of 2010China's 29 provincial regions

Types	the ideal value of the relative proxim（Ci）	Region	Total
the high-risk type	$C_i \geq 0.5$	Hebei,Shanxi,Ningxia,Yunnan	4
The higher-risk type	$0.4 \leq C_i < 0.5$	Jilin,Hunan,Zhejiang,Qihai,Hainan,Gansu, Guizhou,Xinjiang	8
The relative-low risk	$0.2 \leq C_i < 0.4$	Sichuan,Niaoning,Tianjin,Hubei,Jiangxi, Guangxi,Shanxi,Jiangsu,Neimenggu,Anhui,Fujian,Shandong,Henan	13
The low-risk type	$C_i < 0.2$	Guangdong,Beijing,Henongjiang,Shanghai	4

Using the improved TOPSIS model, this paper sorts of economic risk in China's regional transfer of industries, which can help us hold the general level of regional economic risk in transfer of industries, and also help us identify risk indicators from specific regions, which provide an empirical basis for further analysizing the formation mechanism of the economic risk. This method not only can apply for a province or a prefecture-level city within the industrial transfer of economic risk determination, but also can be used for the transfer of industries in different countries to measure the level of economic risk, but it needs to add some other indicators of economic risk appropriately according to the certain circumstances.

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