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Research on the Measuring Methods of FDI Absorption Capacity in the Western Region: The Empirical Analysis of Eleven Target Places China

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Abstract: Foreign Direct Investment (FDI) is not allotted equally in different regions of China. Compared with the inward FDI in the eastern and mid region of China, the western region has attracted less FDI. Based on the AHP methodology, the study constructs the FDI absorption capacity hierarchical structure model for the eleven target places in western region China and concludes that the FDI absorption capacity is a complex chaos interconnected with the FDI attraction capacity, FDI utilization capacity and FDI extension capacity and it is an entangled combination of three self-organizing non-equilibrium subsystems with all concepts fundamental to economic leap.

Key words: The western region, FDI absorption capacity, analytical hierarchy process

INTRODUCTION

FDI (Foreign Direct Investment) can promote the economy development of China, yet it is not allotted equally in different regions of China. By the end of the year 2010, the eastern region took up the proportion of 83.3 and 86.5%, respectively in the foreign-sponsored enterprises and the actual utilized FDI and the mid-region 10.7 and 8.1%. The western region consists of 11 provinces as Sichuan, Guizhou, Yunnan, Tibet, Shanxi, Gansu, Qinghai, Xinjiang, Ningxia, Guangxi and Inner Mongolia and Chongqing city, only accounts for 6 and 5.4%, respectively.

Many scholars have empirically conducted their researches on the FDI location choice in China. The idea of FDI agglomeration in certain places was first proposed by Marshall (2010), who demonstrated that the internal and external economies of scale were reasons of FDI agglomeration. Redding and Schott (2004) pointed out that the geographic location, thus the degree of openness will affect the location choice of FDI. Many Chinese scholars with a long list of Cui (2010), Dou (2011), Wan (2011), Gao (2008) and Zhang and Wu (2005) conduct their research from differentiated perspectives. They focus their studies on the internal reasons of differentiated inward FDI flows, the correlations of FDI and the economic related to distances between origin growth, or narrowed standpoints of the FDI in western region China. Their conclusions are rather similar that FDI inflows may definitely generate potential gains and productivity initiatives for the host countries and regions.

The general literature review shows that the researchers come to a consensus that FDI inflows are engines for the economy development of the host countries or regions China, yet their findings are confined within the one-sidedness from the single-element perspective. The purpose of this study is not to examine an individual enhancing factor of FDI inflows, but outlines bundles of determinants. The main contributions of this study are: (1) the conception of the FDI absorption capacity is redefined as an entanglement of FDI attraction capacity, FDI utilization capacity and FDI extension capacity. (2) the FDI absorption capacity hierarchical structure model is constructed which outlines the key indicators in three differentiated layers and pioneers in the research perceptions.

THEORETICAL METHOD AND DATA

This article sides solidly with T•L•Saaty, a famous American professor in 1970s advocates analytical hierarchy process abbreviated as AHP. Based on the data from Statistical Yearbook China 2012 and other relative figures from the websites of local governments, every effort is made to address the question of the FDI absorption capacity of western region China. The figures being put in analysis are exactly the dominant determinants in the FDI absorption capacity of the chosen places and they are comparatively constant, numerically effective and thus objectively critical to the issue.

THE CONCEPTUAL FRAMEWORK OF COMPREHENSIVE FDI ABSORPTION CAPACITY

The conception of fdi absorption capacity: The FDI absorption capacity is a notion with rich implications and being affected by bundles of factors. It refers to the

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maximal inward FDI flows in a certain host country or region within a chosen time span which is the amount of foreign fund fully utilized or integrated with the host fund inputs. The FDI absorption capacity may be exemplified from the following three perspectives.

FDI attraction capacity: FDI attraction capacity states from the macro perspective the maximal amount of foreign funds sponsored in the host targets within the chosen time period. This is the foundation of the comprehensive FDI absorption capacity as being entangled with the labor cost, resources endowment, economy advancement, hi-tech, market scale etc.

FDI utilization capacity: FDI utilization capacity outlines from the industrial perspective how the host country or region may take in the newly imported techniques and knowledge and may further put them into innovative use. The core determinants are the urbanization level, ratio of R and D and GDP, transfer payment of the central government to the host place, market network etc.

FDI extension capacity: FDI extension capacity pinpoints on how to motivate the technology spillovers and optimize the utilities of the imported technology. From the micro perspective, a bundle of factors may impose effects on FDI extension capacity, say, the level of market maturity, extension channels as the infrastructure of website or postal service etc.

In brief, the comprehensive FDI absorption capacity is a complex chaos interconnected with the FDI attraction capacity, FDI utilization capacity and FDI extension capacity of the development-oriented region.

THE MEASUREMENT MODEL FOR THE FDI ABSORPTION CAPACITY

Variables description: The author redefines the determinants of the FDI absorption capacity in three hierarchy clusters as the final objective, directive criteria and the decisive indexes. The final objective of the study is the FDI absorption capacity. The directive criteria hierarchy is FDI attraction capacity, FDI utilization capacity and FDI extension capacity. The hierarchy of decisive indexes is a family of eighteen area-based indicators. In the sampling process, ten provinces in western region China are the research targets as Inner Mongolia, Shanxi, Guangxi, Yunnan, Xinjiang, Guizhou, Gansu, Ningxia, Qinghai, Sichuan and one city Chongqing. The FDI absorption capacity hierarchy model is shown in Fig. 1.

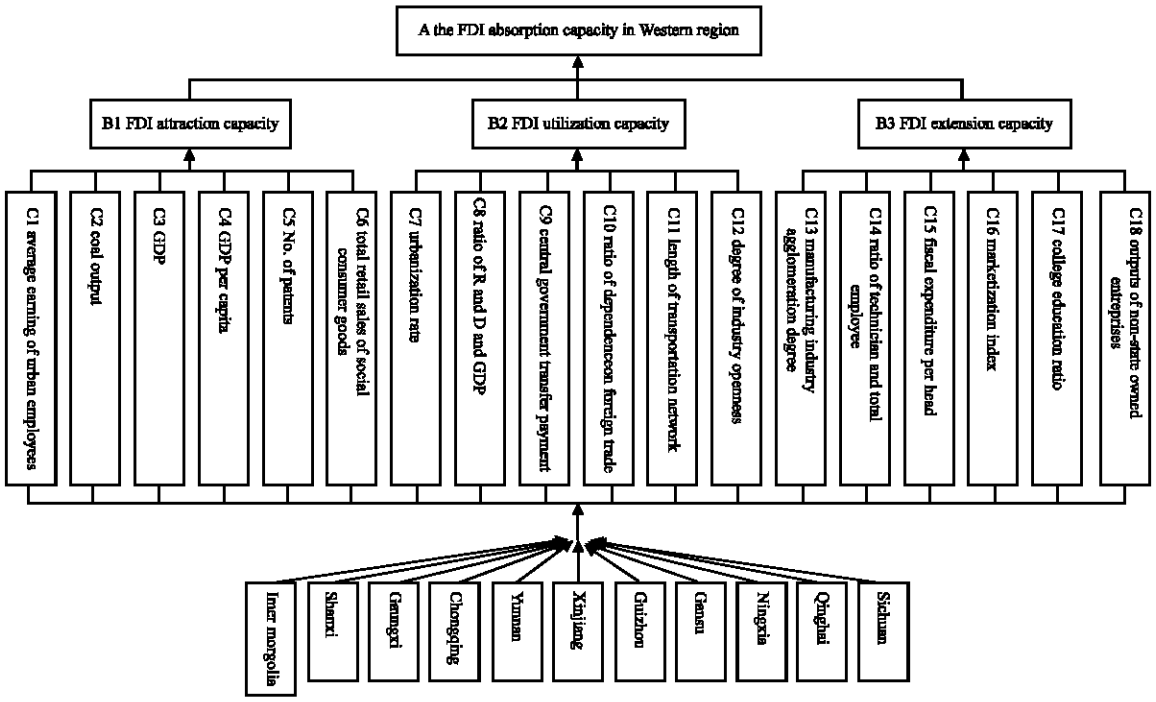

Fig. 1: The FDI absorption capacity hierarchical structure model for eleven places western region China

THE MEASUREMENT OF THE FDI ABSORPTION CAPACITY

Indicators non-dimensionalization: Since the eighteen indexes get different dimensions such as percentage, numerical figures and even monetary units, it is rather important to make indexes being dimensionless to facilitate calculations and deductions. The possible resultant FDI absorption capacity will be ranging between 0-1 on the redirected methodology, that is, the minimal indexes as min x_{ij}, $x' = 1$, the maximal indexes as max x_{ij}, $x' = 1$. The medians are classified as positive indicators and negative indicators and the former are quantified as higher semi-trapezium fuzzy membership function as:

$$x'_{ij} = \frac{x_{ij} - \min x_{ij}}{\max x_{ij} - \min x_{ij}}$$

while the latter as lower semi-trapezium fuzzy membership function as:

$$x'_{ij} = \frac{\max x_{ij} - x_{ij}}{\max x_{ij} - \min x_{ij}}$$

In this equation, x_{ij} stands for the index value of j factors while x_{ij}' as j factor scores ranging between 0-1. Consequently, groups of standardized data are obtained as parameters of the influencing factors of the FDI absorption capacity of eleven chosen places of the western region China.

Construction of judgment matrix: The involving directive criteria in the hierarchy structure do not hint the equal importance to the final objective. To finalize the exact influencing forces of the listed factors supposed as $x = \{x_1, x_2,..., x_n\}$ to the target factor z, the pair-comparison matrix method by T•L•Saaty is adopted. That is, to pick out two factors x_i and x_j, nominate a_{ij} to represent the proportion between the pair of x_i and Z and x_j and Z in light of the influencing forces as in respective comparison cases. Then compute the total results by summing all the figures in a pair-comparison matrix A of all the relative X and Z in the following equation $A = (a_{ij})_{n\times n}$ and the scales of a_{ij} may be shown in the Arabic numerals 1-9 and their respective reciprocals as evidenced by 1-9 Levels Scale Method. Theoretically, this method is a useful guidance for a judgment matrix. On the supposition that λ is the special radical, W is eigenvector, the judgment matrix is HW = λW and the results of max(λ)and the corresponding W are obtained, thus get the weight values of directive criterion after the normalization processing of the varied eigenvectors. The consistency adjustment in the AHP model is put to use to avoid inconsistency of the judgment matrix H. The concept of consistency index is calculated by the equation:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

While λ_{max}, CI = 0, this implies the judgment matrix is perfectly consistent. The larger the figures of CI result, the lower consistency of the judgment matrix.

Since the assessments by the participants may be possibly subjective, the proportion scaling of the pair comparison may affect the consistency of the judgment matrix. The average random consistency index is applied to make the consistency indexes revised. The revised result CR should be CR = CI/RIλ100 (Table 1).

Generally, for judgment matrix of $n \geq 3$ order, it owes highly acceptable consistency in the case $CR \leq 0.1$. Whist $CR > 0.1$ alleges the clear deviation from the harmonious consistency and further indicators amendment is thus indispensable for the satisfactory research results.

RESULTS AND DISCUSSION

The pair-comparison judgment matrixes of the directive criteria in the AHP model are portrayed as follows (Table 2-5).

The results of Table 3 are $\lambda_{max} = 3.066$, CI = 0.032, RI = 0.580 and the relevant CR = 0.055<0.1, thus high acceptability in the consistency of the judgment matrix.

Table 1: Revised consistency index resultant from the average random consistency index

n	1	2	3	4	5	6	7	8	9	……
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	……

RI, the Random Consistency Index, is used to make the consistency index revised for the high consistency of the judgment matrix

Table 2: Pair comparison judgment matrix between A-B

A	B1	B2	B3	Wi
B1	1	5	7	0.731
B2		1	3	0.188
B3			1	0.081

Pair-comparison judgment matrix of the final objective A and the directive criteria B

Table 3: Pair comparison judgment matrix between B1-C

B1	C1	C2	C3	C4	C5	C6	Wi
C1	1	3	1/5	1/3	1/7	3	0.075
C2		1	1/7	1/6	1/9	2	0.039
C3			1	2	1/2	5	0.266
C4				1	1/3	3	0.162
C5					1	7	0.419
C6						1	0.038

Pair-comparison judgment matrix of the directive criteria B and decisive index C1-6

Table 4: Pair comparison judgment matrix between B2-C

B2	C7	C8	C9	C10	C11	C12	Wi
C7	1	1/9	1/4	1/6	1/2	1/7	0.300
C8		1	5	3	7	2	0.404
C9			1	1/3	3	1/4	0.088
C10				1	3	1/2	0.166
C11					1	1/5	0.049
C12						1	0.262

Pair-comparison judgment matrix of the directive criteria B and decisive index C7-12

Table 5: Pair comparison judgment matrix between B3-C

B3	C13	C14	C15	C16	C17	C18	Wi
C13	1	1/3	5	3	1/2	4	0.187
C14		1	6	3	2	5	0.364
C15			1	1/5	1/6	1/3	0.034
C16				1	1/3	2	0.108
C17					1	2	0.232
C18						1	0.074

Pair-comparison judgment matrix of the directive criteria B and decisive index C13-18

Table 6: Weight distribution of index layer C to target layer A

	B1	B2	B3	
A	0.731	0.188	0.081	Wi
C1	0.075			0.0538
C2	0.039			0.0285
C3	0.266			0.1655
C4	0.162			0.1164
C5	0.419			0.2863
C6	0.038			0.0298
C7		0.3		0.0564
C8		0.404		0.076
C9		0.088		0.0165
C10		0.166		0.0312
C11		0.049		0.0092
C12		0.262		0.0493
C13			0.187	0.0151
C14			0.364	0.0295
C15			0.034	0.0028
C16			0.108	0.0087
C17			0.232	0.0188
C18			0.074	0.0062

Table 7: Evaluation sequence of the FDI absorption capacity of eleven target places

Provinces	Inner Mongolia	Shanxi	Guangxi	Chongqing	Yunnan	Xinjiang	Guizhou	Gansu	Ningxia	Qinghai	Sichuan
Score	0.4373	0.5390	0.2860	0.5290	0.2044	0.2756	0.1364	0.1538	0.2288	0.1781	0.6865
Sequence	4	2	5	3	8	6	11	10	7	9	1

The results of Table 4 are λ_{max} = 6.039, CI = 0.062, RI = 1.24 and the relevant CR = 0.05<0.1, thus highly acceptable consistency of the judgment matrix.

The results of Table 5 are λ_{max} = 6.193, CI = 0.039, RI = 1.24 and the relevant CR = 0.031<0.1, thus the judgment matrix owes high acceptability in the consistency.

The results of Table 6 are λ_{max} = 6.354, CI = 0.71, RI = 1.24 and the relevant CR = 0.05<0.1. As indicated in the results of Table 3-5, all of the single values of CR are below 0.1, therefore the weight distribution in the judgment matrixes has the best consistency. For further test of the consistency, indices for the levels of total order are deducted in the following equation (Table 6).

On conditions that CI = 0.082, RI = 1.237, CR = 0.066<0.1, Cr_{sum} = 0.066<0.1. The Table 6 has acquired satisfactory feasibility and validity. On the previous calculations and deductions, the weight sum method is employed to further define the FDI absorption capacity of the eleven chosen places of western region China (Table 7).

Analysis reflections: The analysis confirms that Sichuan province ranks first in its FDI absorption capacity. This owes greatly to the reason that the FDI attraction capacity and extension capacity of Sichuan province pose rather strong positions as adduced by the related indices. Shanxi, Inner Mongolia and Chongqing rank the second, the third and the forth positions in their FDI absorption capacity respectively. The majorities of the directive indices are at the medium range and a few are below the average and encumber the resultant levels, thus may be obstacles of the FDI inflows. Guangxi, Xinjiang and Ningxia with the great majority of indices below the average, are the fifth, sixth and seventh in the comprehensive FDI absorption capacity. With few indices lingering at the medium range and great majority nearly hitting the rock-bottom, Yunnan, Qinghai, Gansu and Guizhou rank the last four in the sequence.

CONCLUSION

In a finite region, the FDI absorption capacity is an entangled chaos of three independent subsystems as FDI attraction capacity, FDI utilization capacity and FDI

extension capacity. These would assist host regions to compute their true development accounts, not only care for the net amount of FDI inflows, but also monitor the optimal utilization of the foreign fund and further ensure the extension of knowledge and techniques to maximize the aggregate technology spillovers. This fresh-defined analysis supports argument to shift the emphasis in FDI inflows from the mere figure of the money injection, to the aggregate effect of factors integration.

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