

A Study of the Regional Vocational Training Efficiency of Migrant Workers

Jianli GAO*, Lejie WANG

School of Business Administration, Donghua University, Shanghai 200051, China

Abstract Based on DEA – Tobit model, the efficiency of occupational training for rural migrant workers of 30 provinces and cities was studied in this paper. The results indicated that there are significant differences among these 30 provinces and cities. Technical efficiency of East areas is lower than average level. Moreover, there is a significant negative correlation between the efficiency and Average education attainment, and a significant positive correlation between the efficiency and proportion of rural population.

Key words Migrant workers, Vocational training, Efficiency, DEA – Tobit model

1 Introduction

The number of migrant workers in China has currently reached 250 million, and it still grows at the rate of 9 to 10 million annually. A large number of migrant workers not only provide a powerful impetus to China's economic development, but also make the whole society pay continued attention to their employment issues. 2011 *Monitoring Report on Migrant Workers* released by the National Bureau of Statistics showed that only 26.2% of migrant workers had received non-agricultural vocational training, and there were still 68.8% of migrant workers having not received any form of training (National Bureau of Statistics, 2012). A large number of migrant workers lack the necessary job skills, resulting in employment difficulties, and they find it difficult to integrate into the city. Workers' educational qualifications and vocational skills determined their ability to act, and were essential to their income, career prospects, job security and access to a variety of benefits (Liu Aiyu, 2012), so only when they mastered the necessary professional skills, could their employment status be improved and the social harmony be promoted. The Ministry of Agriculture, and the Ministry of Human Resources and Social Security of the People's Republic of China have implemented a series of projects for benefiting farmers, in order to provide appropriate skills training for migrant workers to improve their employability. Local governments also attached great importance to the vocational training for migrant workers, and the relevant inputs were increasing, but there were many problems on the capital use efficiency and training quality (The State Council, 2010; Gu Youlu, 2011). Then how is the current efficiency of vocational training for migrant workers in various regions? What is the underlying factor affecting the efficiency of the training? This paper attempts to adopt DEA –

Tobit two-stage analysis framework to study the relative efficiency of vocational training for migrant workers in different provinces and cities, and explore the underlying causes of differences in the efficiency between different regions, so as to provide a basis for the formulation of relevant policies and measures.

2 Research methods and indicator selection

2.1 Research methods In this study, we use DEA method and Tobit model. The principle of DEA method is to maintain the input or output of DMUs unchanged, determine the relative efficient production frontier through the mathematical programming and statistical data, and evaluate the relative effectiveness of DMUs according to the degree of their deviation from the frontier (Wei Quanling, 2004).

Although the DEA method can evaluate the relative efficiency of DMUs, the evaluation process only considers the inputs and outputs factors that can be controlled by the DMUs, but ignores the impact of other factors.

In fact, the vocational training for migrant workers is in a complex dynamic system, and there are some uncontrollable "environmental" factors. Although these "environmental" factors are not the input of DMUs, they can influence the output of DMUs, thereby affecting the vocational training efficiency.

Therefore, when conducting efficiency evaluation, it is necessary to treat the input variables and environment variables differently to identify the deep-seated reasons for the efficiency.

Scholars commonly use "two-stage method" proposed by Coelli (1998) to solve this problem:

(i) Using the traditional DEA method to calculate the relative efficiency value of DMUs;

(ii) With the efficiency values as the dependent variables and environmental factors as explanatory variables, establishing the regression model to judge the direction and intensity of impact of environmental factors on the efficiency value.

The range of efficiency value derived by the DEA model is a half-open closed interval $(0, 1]$, and in this case, if using ordina-

Received: April 2, 2014 Accepted: May 3, 2014

Supported by Shandong Provincial Natural Science Foundation (ZR2011GQ009); Shandong Provincial Soft Science Project (2013RKB01052); Humanities and Social Sciences Youth Fund Project of the Ministry of Education (12YJC880021).

* Corresponding author. E-mail: gaojianli – 2002@163.com

ry least squares (OLS) for regression, the parameter estimates will be biased and inconsistent. One model with limited dependent variables (namely Tobit model) pioneered by Tobit (1958) can better solve this problem.

2.2 The building of evaluation indicator system

2.2.1 Efficiency evaluation indicator system. There studies on the migrant workers' training efficiency are rare in the existing literature, and only a few scholars evaluate the effect of vocational training for migrant workers.

Based on the training effect evaluation theory, Zhang Bilan and Du Jishu (2009) built a multi-level evaluation indicator system for the migrant workers' training effect. Shi Changluo (2011) used AHP to build the performance evaluation indicator system for the migrant workers' training from training investment, training mechanisms, training content, and actual effect. Meng Yingyu (2011) maintained that the evaluation system for the migrant workers' training effect should cover the whole process of training.

The vocational training for migrant workers is a complex system, and when studying its efficiency, it is necessary to not only consider the output, but also consider the input.

From a regional perspective, the input to vocational training for migrant workers mainly includes the fund and teacher, so the input indicators include the following two aspects:

- (i) The spending on vocational education and training;
- (ii) The number of full-time teachers for vocational education and training.

The direct results of vocational training for migrant workers mainly include the following two aspects:

- (i) The number of migrant workers who are trained is increased;
- (ii) The migrant workers' family income is increased.

Therefore, this paper selects the following output indicators:

- (i) The rural household's wage income;
- (ii) The number of rural workers receiving training in the vocational training institutions (including employment training centers and private vocational training institutions);
- (iii) The number of graduates from various secondary vocational schools (including secondary vocational schools, technical schools, vocational high schools).

2.2.2 Environment variable system. The environmental variables should select those factors having an impact on the vocational training efficiency of migrant workers but not within the control scope of DMUs. Taking into account the characteristics of vocational training for migrant workers, the paper selects the following factors as the environment variables:

- (i) GDP (Unit: 10^8 yuan) (representing the level of economic development of various provinces and cities and the economic strength for carrying out the vocational training for migrant workers);
- (ii) The proportion of rural population (representing the size of migrant workers in need of vocational training in various regions);

- (iii) The number of staff in employment agencies (representing the level of development of labor market in various regions);

- (iv) The average years of schooling of rural labor (representing the basic quality of migrant workers in various provinces and cities).

China Rural Statistical Yearbook gives the sampling data on five education levels (illiterate, elementary school, junior high school, senior high school, technical school and junior college or above) for every 100 rural labor forces in various regions. Based on the practice of Deng Bo *et al.* (2011), this paper calculates the weighted average of five kinds of years of schooling of labor, and the weight is set as 0 year, 5 years, 8 years, 11 years and 14.5 years, respectively.

3 Empirical study results

3.1 Evaluation of the vocational training efficiency of migrant workers In this paper, with various provinces, autonomous regions and municipalities as DMUs, we select a total of 30 DMUs, excluding Tibet with incomplete statistics.

When using DEA method to perform the relative effectiveness evaluation, it is necessary to consider the delay time from input to output. There must be some time lag in the vocational training for migrant workers from resource input to output, and this paper assumes the lag to be 1 year from input to output.

The input variable data are from *China Labor Statistical Yearbook* (2011), and *China Educational Finance Statistical Yearbook* (2011). And the output variable data are from *China Labor Yearbook* (2012). The data are processed using DEAP2.1 software, and the technical efficiency values are sequenced. The calculation results are shown in Table 1.

According to the distribution of technical efficiency, pure technical efficiency and scale efficiency of various regions in Table 1, based on the study method of Deng Bo *et al.* (2011), we take 0.9 as the critical point of efficiency value, and divide the 30 regions into the following four categories:

- (i) The first category is "double - high type", that is, both the technical efficiency value and scale efficiency value are higher than 0.9, including Beijing, Anhui, Jiangxi, Henan, Hubei, Ningxia, Xinjiang, Guizhou, Shaanxi and Hunan. Except Beijing City, all are the major provinces with considerable migrant workers, and the vocational training efficiency of migrant workers is high, requiring less room for improvement.

- (ii) The second category is "high - low type", that is, the pure technical efficiency is high but the scale efficiency is low, including Chongqing, Guangdong, Qinghai and Shandong. The pure technical efficiency of these regions is higher than 0.9, but the scale efficiency is less than 0.9, thereby resulting in very low technical efficiency value.

In these regions, the management level and resource allocation efficiency of vocational training for migrant workers are high, so in the future, it is necessary to focus on the adjustment of the scale of vocational training for migrant workers, to make it match

the management level and input resources.

(iii) The third category is "low – high type", that is, the pure technical efficiency is low but the scale efficiency is high, including Shanxi, Hebei, Hainan, Fujian, Guangxi, Heilongjiang, Tianjin, Gansu, Yunnan, Jilin, Inner Mongolia, Liaoning, Shanghai and Zhejiang.

These regions should focus on improving the management level of vocational training for migrant workers. Especially in Inner Mongolia, Liaoning, Shanghai and Zhejiang, the pure technical efficiency is less than 0.6, indicating that the management level of vocational training for migrant workers lags behind the training scale.

Table 1 The calculation results of DEA model

Regions	Technical efficiency value	Pure technical efficiency value	Scale efficiency value	Returns to scale
Beijing	1.00	1.00	1.00	–
Anhui	1.00	1.00	1.00	–
Jiangxi	1.00	1.00	1.00	–
Henan	1.00	1.00	1.00	–
Hubei	1.00	1.00	1.00	–
Ningxia	1.00	1.00	1.00	–
Xinjiang	0.95	1.00	0.95	drs
Guizhou	0.95	1.00	0.95	irs
Shaanxi	0.91	0.91	1.00	–
Hunan	0.91	1.00	0.91	drs
Chongqing	0.86	1.00	0.86	drs
Shanxi	0.78	0.79	0.99	irs
Hebei	0.78	0.79	0.98	drs
Guangdong	0.77	1.00	0.77	drs
Hainan	0.77	0.77	1.00	irs
Qinghai	0.77	1.00	0.77	irs
Sichuan	0.75	0.88	0.85	drs
Shandong	0.71	0.93	0.76	drs
Fujian	0.71	0.71	0.99	drs
Guangxi	0.70	0.71	1.00	drs
Heilongjiang	0.70	0.74	0.94	irs
Tianjin	0.70	0.70	0.99	irs
Gansu	0.66	0.70	0.94	irs
Yunnan	0.63	0.69	0.91	drs
Jiangsu	0.62	0.84	0.74	drs
Jilin	0.58	0.65	0.90	irs
Inner Mongolia	0.54	0.58	0.94	irs
Liaoning	0.54	0.55	1.00	drs
Shanghai	0.54	0.55	0.98	drs
Zhejiang	0.53	0.54	0.98	drs

Note: irs denotes increasing returns to scale; drs denotes decreasing returns to scale; – denotes constant returns to scale.

(iv) The fourth category is the "double – low type", that is, both the pure technical efficiency and scale efficiency are less than 0.9. Especially for Jiangsu and Sichuan, in the future vocational training for migrant workers, it is necessary to strive to improve the management level and also increase the scale of vocational training.

However, the efficiency of vocational training for migrant workers in the two provinces is not the lowest, and the technical

efficiency of Sichuan is at the middle level, with the management level and scale close to those of the "double – high type".

3.2 The regional differences in the vocational training efficiency of migrant workers According to the division of regions (eastern, central and western regions) by the National Bureau of Statistics, this paper calculates the average DEA efficiency in different regions (see Table 2).

From the national data, the vocational training efficiency of migrant workers is not high in China, and the technical efficiency value is less than 0.8. The training efficiency of the central and western regions is higher than the national average, while the efficiency of the eastern regions is below the national average.

In terms of the pure technical efficiency, it is lowest in the eastern regions, followed by the central and western regions, indicating that although the eastern regions are economically developed, the management level of vocational training for migrant workers is not the highest. In terms of scale efficiency, there are not obvious differences between the three regions.

The technical efficiency value is only 0.7 in the eastern regions, significantly lower than in the central and western regions, and its pure technical efficiency is 0.76, well below the level of scale efficiency, which further demonstrates that the low pure technical efficiency is the main reason for the low vocational training efficiency of migrant workers in the eastern regions.

Both the technical efficiency and pure technical efficiency in the western regions are higher than in the eastern regions, and also higher than the national average, but the technical efficiency is only 0.83, indicating that the efficiency of vocational training for migrant workers has not reached the desired level. For the western regions, it is necessary to continue to improve the management level and scale of vocational training for migrant workers in the future.

The central regions are China's densely populated regions and major regions transferring migrant workers, with high pure technical efficiency and scale efficiency, but the pure technical efficiency is lower than scale efficiency. Therefore, most of the provinces and cities in the central regions should continue to improve the management level of training.

Meanwhile, it can be found from Table 2 that many provinces and cities in the central regions are at the stage of decreasing returns to scale, and the current training scale has exceeded the optimal level, so it is necessary to focus on improving the management level of vocational training for migrant workers on the basis of controlling the training scale in the future.

3.3 The impact of environmental factors on the vocational training efficiency of migrant workers As can be seen from the results of DEA model, there is a significant difference in the vocational training efficiency of migrant workers between different regions. Now we analyze the reason for this difference. The vocational training efficiency of migrant workers in different regions is affected by the economic strength, population structure, quality of migrant workers, labor market development level and other envi-

ronmental factors. In this paper, we use Tobit regression to study the direction and extent of impact of environmental factors on the vocational training efficiency of migrant workers.

The Tobit regression model is established, with DEA technical efficiency value as the dependent variable, GDP, the proportion of rural population, the average years of schooling of rural labor and the number of staff in employment agencies as the independent variables. EViews 6.0 software is used for operation. The data on average years of schooling of rural labor are from *China Rural Statistical Yearbook* (2012), and the remaining independent variable data are from *China Statistical Yearbook* (2011)

Table 3 Regression results of Tobit model

Variable	Coefficient	Std. Error	z - Statistic	Prob.
GDP	4.78E -06	3.52E -06	1.358 200	0.174 4
The proportion of the rural population	0.506 414	0.165 525	3.059 449	0.002 2
The average years of schooling of rural labor	-0.077 408	0.026 469	-2.924 481	0.003 5
The number of staff in employment agencies	-0.198 672	0.127 018	-1.564 129	0.117 8
Constant term	1.158178	0.240 911	4.807 500	0.000 0

From the regression results of Tobit model in Table 3, it can be found that:

(i) GDP is not significantly correlated with the vocational training efficiency of migrant workers. That's to say, there is no significant correlation between the level of economic development and the vocational training efficiency of migrant workers. This also confirms the results in Table 1, for example, the migrant workers absorbed by four economically developed provinces, Guangdong, Jiangsu, Shandong and Zhejiang, accounted for nearly half of the country's total migrant workers (National Bureau of Statistics, 2011), but the technical efficiency value in these provinces was much lower than in many economically backward provinces.

The reason may be that GDP represents the level of regional economic development and the economic strength for carrying out vocational training for migrant workers, but the high economic strength and greater efforts in training investment may not be equal to the high efficiency. The improvement of GDP could lead to the reduction of resource allocation efficiency (Yu Xiaoyu, Xie Fuji, 2011).

On the contrary, the underdeveloped provinces and cities will regard the vocational training for migrant workers as an important way to increase the employment rate and farmers' income.

(ii) There is a significant positive correlation between the proportion of rural population and the vocational training efficiency of migrant workers. The reasons include two aspects.

In the first place, the provinces and cities with high proportion of rural population are faced with more pressure in terms of farmers' income increase and rural labor transfer, so they lay more emphasis on the vocational training for migrant workers.

In the second place, the proportion of rural population represents the size of migrant workers who need to receive the vocational training. Some migrant workers lacked sufficient driving force for participating in training, but the high proportion of rural population meant that there were a large number of migrant workers

and *China Labor Yearbook* (2011). The regression results are shown in Table 3.

Table 2 The average vocational training efficiency of migrant workers in China's eastern, central and western regions

	Technical efficiency	Pure technical efficiency	Scale efficiency
Nationwide	0.78	0.83	0.94
Eastern regions	0.7	0.76	0.93
Central regions	0.82	0.85	0.97
Western regions	0.83	0.91	0.91

who needed to receive the vocational training, the training institutions could have more room to choose the migrant workers with stronger desire to learn and higher quality for training, and it was easier to expand the scale of training, so that limited resources were used efficiently (Sun Xiwang, 2006).

(iii) There is a significant negative correlation between the average years of schooling of rural labor and the vocational training efficiency of migrant workers. The education level of migrant workers directly affected the quality of their participation in job training (Chen Hao, Yang Xiaojun, 2009). We usually think that the higher the education level of migrant workers, the better the vocational training effect.

Most migrant workers in China only had the education level of junior high school, they were mainly engaged in manufacturing, construction and service industry, and ordinary workers and logistics staff were always the main role for them (Wang Beibei, Chen Wanming, 2010). The current training model does not apply to the migrant workers receiving many years of education and having high education level, so there will be the phenomenon of the more the years of education received, the lower the training efficiency.

(iv) The number of staff in employment agencies has a negative impact on the vocational training efficiency of migrant workers, but the impact is not significant. The migrant workers were limited by the social security, family separation, lack of equal education rights and other obstacles (Liu Aiyu, 2012), and they found it difficult to integrate into the city, so most migrant workers working in the city was a short-term behavior, and they would return to rural areas after the short-term working (Wang Wenxin, Xu Yun, 2008).

This paper uses the number of staff in employment agencies to represent the level of development of labor market. In the provinces with developed labor market, the job search costs of migrant workers were relatively low, so that they could not fully understand the important role of learning vocational skills (Song Lizhi,

2005), lacking enthusiasm for vocational training, and they paid more attention to the short-term gains, which was not conducive to raising the level of job and income level, thus affecting the efficiency of vocational training.

4 Conclusions and policy recommendations

4.1 Conclusions In this paper, we use DEA-Tobit two-stage model to evaluate the vocational training efficiency of migrant workers in China's 30 provinces, autonomous regions and municipalities (except Tibet), and analyze the influencing factors. We draw the following conclusions:

(i) There are significant differences in the vocational training efficiency of migrant workers between different regions of China. There are 20 regions with technical efficiency value of less than 0.9, indicating that the overall vocational training efficiency of migrant workers in China is not ideal, and there is still large room for improvement. The eastern and central regions should focus on strengthening the management level of training, in order to improve the pure technical efficiency, while the western regions should further improve the management level and training scale.

(ii) In the environmental factors influencing the vocational training efficiency of migrant workers, the average years of schooling of rural labor have a significant negative impact while the proportion of rural population has a significant positive impact.

4.2 Policy recommendations Based on the above analysis, we propose the following policy recommendations:

(i) The provinces and municipalities should adjust the focus of vocational training for migrant workers according to their characteristics. The 4 "high - low type" regions have low scale efficiency and are mostly at the stage of decreasing returns to scale, indicating that the scale of vocational training for migrant workers has exceeded the optimum level, and if continuing to increase investment, they can not improve the training efficiency but cause a waste of resources. The 14 "low - high type" regions have deficiencies in the management level of vocational training for migrant workers, so it is necessary to focus on strengthening the resource allocation and training management, and improving the resource utilization rate.

(ii) The local governments in the migrant worker transfer-in areas and transfer-out areas should strengthen the linkage and cooperation to carry out the training. The migrant worker transfer-out areas should be based on local resources and economic and social development needs of the migrant worker transfer-in areas, to carry out the comprehensive training of laws and regulations, ethics, preliminary vocational skills and special skills for the migrant workers. The migrant worker transfer-in areas should get rid of the concept of migrant workers as the "external population", treat the migrant workers as "citizen" and "townsfolk" without discrimination, and carry out the higher level of professional training for the migrant workers in accordance with the actual requirements of employers and jobs, to further improve their professional quality and ability.

(iii) It is necessary to vigorously innovate upon the training model. On the one hand, based on the characteristics of local vocational training for migrant workers, all regions should innovate upon the input ways of training resources and mobilize social forces to participate so that more migrant workers receive the vocational training. On the other hand, all regions should innovate upon the training methods and training content, and adopt flexible market-oriented ways to implement the vocational training for migrant workers, which not only meets the job requirements of enterprises, but also takes into account the characteristics and requirements of migrant workers. In addition, it is necessary to strengthen the follow-up service for the migrant workers taking part in the training, keep abreast of the training needs, and timely adjust training programs, to improve the use efficiency of training resources.

References

- [1] Investigation monitoring report of migrant workers in China, 2011[EB]. National Bureau of Statistics of the People's Republic of China, 2012 - 04 - 27. (in Chinese).
- [2] LIU AY. The research on peasant-workers urbanization progress problem[J]. Chinese Public Administration, 2012, (1): 112 - 118. (in Chinese).
- [3] General Office of the State Council. Guiding ideas for migrant workers' training by General Office of the State Council[EB]. www.gov.cn, 2010 - 01 - 25. (in Chinese).
- [4] GU YL. Study on the training approaches of migrant workers based on urban and rural overall development[J]. Agricultural Economy, 2011(11): 95 - 96. (in Chinese).
- [5] ZHANG BL, DU JS. Evaluation model of training effectiveness on migrant workers and its application[J]. Journal of Chongqing Technology and Business University(Social Science Edition), 2009, 19(6): 20 - 24. (in Chinese).
- [6] SHI CL. On the establishment of performance model for migrating workers training: An analysis on the performance of government-paid training in Gaoyou[J]. China Agricultural Education, 2011(2): 91 - 96. (in Chinese).
- [7] MENG YY. Theoretical logic and establishing system of evaluation of migrant workers' training[J]. Journal of Anhui Agricultural Sciences, 2011, 39(20): 12605 - 12606. (in Chinese).
- [8] WEI QL. Data envelopment analysis[M]. Beijing: Science Press, 2004: 13 - 45. (in Chinese).
- [9] YU XY, XIE FJ. A research on optimizing strategy of RIS resource allocation based on DEA-Tobit[J]. R&D Management, 2011(2): 1 - 10. (in Chinese).
- [10] TJ Coelli, DSP Rao, CJ O'Donnell, GE Battese. An introduction to efficiency and productivity analysis[M]. Boston Kluwer, 1998.
- [11] LIU SZ, GUAN JC. The evaluation of the innovating performance of regional innovation systems[J]. Chinese Journal of Management Science, 2002, 10(1): 75 - 78. (in Chinese).
- [12] DENG B, ZHANG XJ, GUO JH. Research on ecological efficiency based on three-stage DEA model[J]. China Soft Science, 2011(1): 92 - 99. (in Chinese).
- [13] SUN XW. Barrier factors and solving method of the migrant workers' training [J]. Journal of Anhui Agricultural Sciences, 2006, 34(7): 1443 - 1445. (in Chinese).
- [14] CHEN H, YANG XJ. Investigation and analysis on the rural migrant workers' employment training[J]. Population Journal, 2009, (2): 27 - 33. (in Chinese).
- [15] WANG WX, XU Y. Analysis of influencing factors on migrant workers' job [J]. Issues in Agricultural Economy, 2008(1): 85 - 90. (in Chinese).
- [16] WANG BB, CHEN WM. Discussion on farmers' training oriented by employment stability[J]. Rural Economy, 2010(10): 104 - 107. (in Chinese).
- [17] SONG LZ, HU HB. Problems faced by migrant workers' training and the countermeasures in China[J]. On Economic Problems, 2005(10): 43 - 45. (in Chinese).