Implementation Effect of Targeted Poverty Alleviation in City D Measured by the Satisfaction Degrees of Poverty-stricken Households

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Abstract. This paper quantifies the implementation effect of targeted poverty alleviation in city D based on survey data using analytic hierarchy process (AHP) and fuzzy comprehensive evaluation (FCE). On the basis of defining the concepts of poverty, targeted poverty alleviation, and implementation effect, it introduces four criterion layers (satisfaction degree with targeted identification, satisfaction degree with targeted assistance, satisfaction degree with targeted poverty relief, and satisfaction degree with management of special fiscal funds for poverty alleviation), and adopts pairwise matrices to perform consistency check, thus analyzing the implementation effect of targeted poverty alleviation and the satisfaction degrees of poverty-stricken households in city D. In the end, it proposes targeted measures and suggestions.

1. Introduction

For the purpose of this paper, poverty refers to economic poverty, that is, below the national poverty line (annual per capita disposable household income less than 4,000 yuan).

Targeted poverty alleviation is a targeted way of relieving poverty-stricken households from poverty by means of targeted identification and targeted assistance following scientific and effective procedures, with a view to the specific environment of different regions and the specific status of different households. Specifically, targeted identification, targeted assistance, and targeted poverty relief are the beginning, process, and expected result of targeted poverty alleviation, respectively.

Implementation means to carry out targeted measures by various methods according to specified requirements, so as to achieve intended targets or goals. In this paper, implementation means that workers stationed in villages or cadres responsible for targeted poverty alleviation combine the policies formulated by higher authorities with local realities, take targeted poverty alleviation measures according to local conditions and changing circumstances, and put them into practice.

Existing studies mostly focus on the means and modes of targeted poverty alleviation, but only a few of them have explored the implementation effect of targeted poverty alleviation policies. In this context, this paper starts with the satisfaction degrees of poverty-stricken households, and probes into the implementation effect of targeted poverty alleviation policies from the angle of the whole process of targeted poverty alleviation, that is, from the four dimensions of targeted identification, targeted assistance, targeted poverty relief, and special fiscal funds for poverty alleviation.
2. Poverty Status of City D and Sample Selection

2.1. Poverty status

City D, located in the hinterland of the Qinling-Daba Mountains in central China, is a key county for poverty alleviation and development, and one of the nine deeply impoverished counties (cities) in province H. It has a total population of 460,000, 98,600 of whom are registered as living below the poverty line (based on statistics in 2014). The poverty alleviation work of city D not only affects the progress of targeted poverty relief in province H, but also seriously restricts the building of a moderately prosperous society in all respects. The poverty-stricken people of city D were identified according to the established criteria: annual per capita disposable household income below the national poverty line (2,736 yuan in 2013); lack of security in terms of food, clothing, education, healthcare, and housing. In 2014, the number of people registered as living below the poverty line was 98,600 in city D. Due to household registration transfer, death, and other causes over a period of three years, this number declined to 97,200 at the end of 2017, as shown in Tab.1:

Tab.1 Statistics of poverty-stricken households in city D

| Registration status | Number of households | Number of people | Number of people relieved from poverty in 2016 | Number of people relieved from poverty in 2017 |
|---------------------|---------------------|-----------------|---------------------------------------------|---------------------------------------------|
|                     |                     |                 | Number of households | Number of people | Number of households | Number of people |
| People registered as living below the poverty line | 30,213 | 97,223 | 4,350 | 15,462 | 5,065 | 18,557 |
| 1. People still in poverty | 18,115 | 53,606 |
| (1) “Households enjoying the five guarantees” | 2,286 | 2,559 |
| (2) “Households enjoying the minimum living guarantee” | 5,933 | 18,798 |
| (3) Average poverty-stricken households | 9,896 | 32,249 |
| 2. People relieved from poverty | 12,098 | 43,617 | 4,350 | 15,462 | 5,065 | 18,557 |
| (1) “Households enjoying the five guarantees” | 9,605 | 35,133 | 3,211 | 11,557 | 4,406 | 16,221 |
| (2) “Households enjoying the minimum living guarantee” | 2,304 | 8,247 | 1,068 | 3,809 | 617 | 2,289 |
| (3) Average poverty-stricken households | 189 | 237 | 71 | 96 | 42 | 47 |

As of the end of 2017, a cumulative total of 79,600 people had been relieved from poverty in city D, and it was estimated that the remaining 19,000 poverty-stricken people would have been stably relieved by the end of 2018, thus realizing “poverty relief for households, poverty alleviation for villages, and removal of the label of poverty for the county”.
2.2. Sample selection
One major poverty-stricken village was sampled from each of the 12 major poverty-stricken towns (townships) of city D according to the questionnaire survey method. 10% of poverty-stricken households were selected from each village for the questionnaire survey. Ultimately, a total of 218 poverty-stricken households, 15~25 (18 on average) from each village, were investigated in the survey.

3. Empirical Analysis

3.1. Selection of models
The factors influencing the implementation effect of targeted poverty alleviation in city D are analyzed using analytic hierarchy process (AHP), with the purpose of preparing an AHP chart that adopts the implementation effect of targeted poverty alleviation in city D as the target layer and takes the four dimensions as criterion layers. Detailed evaluation is performed on this basis, and weights are determined by means of expert scoring and construction of judgment matrices. The main steps are as follows: (1) preparation of AHP chart; (2) construction of pairwise matrices; (3) performing of consistency check; (4) determination of weights.

Fuzzy comprehensive evaluation (FCE) is an evaluation method based on fuzzy mathematics that converts qualitative analysis into quantitative analysis by a certain approach. Thus, the implementation effect of targeted poverty alleviation is analyzed based on the satisfaction degrees of poverty-stricken households, and quantified in combination with the index weights calculated by AHP. Conclusions are drawn on this basis.

3.2. Construction of index system
To study the targeted assistance work in city D using AHP based on the satisfaction degrees of poverty-stricken households, the system for evaluating the implementation effect of targeted poverty alleviation is adopted as the target layer. To reach this target, four criterion layers are introduced, that is, implementation effect of targeted identification, implementation effect of targeted assistance, implementation effect of targeted poverty relief, and implementation effect of management of special fiscal funds for poverty alleviation.

To be more precise, the implementation effect of targeted identification further consists of satisfaction degree with identification criteria, satisfaction degree with policy publicity, satisfaction degree with identification justice, and satisfaction degree with identification results.

The implementation effect of targeted assistance further consists of satisfaction degree with poverty alleviation through developing local industries, satisfaction degree with educational poverty alleviation, satisfaction degree with health poverty alleviation, satisfaction degree with housing poverty alleviation, satisfaction degree with policy-based poverty alleviation, satisfaction degree with financial poverty alleviation, and satisfaction degree with implementation of assistance work.

The implementation effect of targeted poverty relief further consists of satisfaction degree with income increase, satisfaction degree with poverty relief effect, and satisfaction degree with targetedness (recognition) of poverty relief.

The implementation effect of management of special fiscal funds for poverty alleviation further consists of satisfaction degree with transparency in use of funds, satisfaction degree with fund availability, and satisfaction degree with fund management system.

Satisfaction degree is measured in AHP by five levels, namely, very satisfactory, relatively satisfactory, generally satisfactory, unsatisfactory, and very unsatisfactory.

3.3. Determination of weights
The indices selected above are then used to prepare the AHP chart (step 1) with one target layer and four criterion layers, and satisfaction degree indices are refined on this basis, as illustrated in Fig.1:
Fig.1 AHP chart of the system for evaluating the implementation effect of targeted poverty alleviation in city D

3.3.1. Construction of judgment matrices
The importance of the indices in Fig.1 is judged by Satty’s scale numbers 1~9, and pairwise matrices are constructed using indices Ci and Cj, as provided in Tab.7:

| Ci/Cj | Equal | Slightly strong | Strong | Very strong | Absolutely strong |
|------|-------|----------------|--------|-------------|-------------------|
| aij  | 1     | 2              | 3      | 4           | 5                 |

Four experts are invited to judge the importance of indices at various layers using the above scale numbers 1~9, and the following pairwise matrices are constructed:

1) System for evaluating the implementation effect of targeted poverty alleviation (matrix A)
2) Implementation effect of targeted identification (matrix B1)

\[ B_1 = \begin{bmatrix}
1 & 3 & 3 & 6 \\
\frac{1}{3} & 1 & 1 & 3 \\
\frac{1}{3} & 1 & 1 & 3 \\
\frac{1}{6} & \frac{1}{3} & \frac{1}{3} & 1 \\
\end{bmatrix} \]

3) Implementation effect of targeted assistance (matrix B2)

\[ B_2 = \begin{bmatrix}
1 & 2 & 2 & \frac{1}{2} & 4 & 3 & \frac{1}{2} \\
\frac{1}{2} & 1 & \frac{1}{2} & \frac{1}{4} & 2 & 3 & \frac{1}{4} \\
\frac{1}{2} & 2 & 1 & \frac{1}{2} & 4 & 2 & \frac{1}{2} \\
2 & 4 & 2 & 1 & 8 & 4 & 2 \\
\frac{1}{4} & \frac{1}{2} & \frac{1}{4} & \frac{1}{8} & 1 & \frac{1}{2} & \frac{1}{8} \\
\frac{1}{3} & \frac{1}{3} & \frac{1}{2} & \frac{1}{4} & 2 & 1 & \frac{1}{4} \\
2 & 4 & 2 & 1/2 & 8 & 4 & 1 \\
\end{bmatrix} \]

4) Implementation effect of targeted poverty relief (matrix B3)

\[ B_3 = \begin{bmatrix}
1 & 3 & 2 \\
\frac{1}{3} & 1 & 2 \\
\frac{1}{2} & \frac{1}{2} & 1 \\
\end{bmatrix} \]

5) Implementation effect of management of special fiscal funds for poverty alleviation (matrix B4)

\[ B_4 = \begin{bmatrix}
1 & 6 & 7 \\
\frac{1}{6} & 1 & 3 \\
\frac{1}{7} & \frac{1}{3} & 1 \\
\end{bmatrix} \]

3.3.2. Consistency check

Consistency check is performed by formula CI=(λ_max-n)/(n-1). A smaller CI value means a lower degree of deviation from consistency, i.e., a higher consistency. When CI=0, the pairwise matrices are consistent, i.e., consistent matrices.

Ratio CR=CI/RI is also introduced. When the value of CR is less than 0.1, it can be held that the pairwise inverse matrices are acceptable; otherwise, they will be regarded as unacceptable. RI is the random consistency index introduced, as shown in Tab.3:

| n  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| RI | 0.089 | 0.58 | 0.89 | 1.12 | 1.26 | 1.36 | 1.41 | 1.46 | 1.49 | 1.52 | 1.54 | 1.56 | 1.58 | 1.59 |

According to calculation results:

A : λ_max=4.2638, CI=0.0879, RI=0.89, CR=0.0988<0.1
B1: λ_max=4.2539, CI=0.0846, RI=0.89, CR=0.0951<0.1
B2: λ_max=7.2132, CI=0.0355, RI=1.36, CR=0.0261<0.1
B3: λ_max=3.1141, CI=0.0571, RI=0.58, CR=0.0984<0.1
B4: $\lambda_{\text{max}}=3.0999$, CI=0.0500, RI=0.58, CR=0.0861<0.1

Calculation results show that the CR values of A, B1, B2, B3, and B4 are all less than 0.1, so pairwise matrices can be deemed as consistent.

### 3.3.3. Calculation of weights

The eigenvectors obtained from the above pairwise matrices are then substituted into formula $w_i = \frac{\alpha_i}{\sum_{i=1}^{n} \alpha_i}$ $(i=1, 2, 3 \ldots n)$ to calculate the weights of the evaluation indices of the implementation effect of targeted assistance work in city D, as shown in Tab.4:

**Tab.4 Weights of the evaluation indices of the implementation effect of targeted poverty alleviation and assistance work in city D**

| Target layer A | Criterion layer B | Weight coefficient Index layer C | Weight coefficient |
|----------------|-------------------|----------------------------------|--------------------|
| Implementation effect of targeted identification B1 | Satisfaction degree with identification criteria C1 | 0.5337 |
| | Satisfaction degree with policy publicity C2 | 0.1969 |
| | Satisfaction degree with identification justice C3 | 0.1969 |
| | Satisfaction degree with identification results C4 | 0.0726 |
| Implementation effect of targeted assistance B2 | Satisfaction degree with poverty alleviation through developing local industries C5 | 0.1595 |
| | Satisfaction degree with educational poverty alleviation C6 | 0.0798 |
| | Satisfaction degree with health poverty alleviation C7 | 0.1235 |
| | Satisfaction degree with housing poverty alleviation C8 | 0.3011 |
| | Satisfaction degree with policy-based poverty alleviation C9 | 0.0341 |
| | Satisfaction degree with financial poverty alleviation C10 | 0.0550 |
| | Satisfaction degree with implementation of assistance work C11 | 0.2470 |
| Implementation effect of targeted poverty relief B3 | Satisfaction degree with income increase C12 | 0.5472 |
| | Satisfaction degree with poverty relief effect C13 | 0.2631 |
| | Satisfaction degree with targetedness (recognition) of poverty relief C14 | 0.1897 |
3.4. FCE

3.4.1. Single-factor analysis
Taking into account the research contents, the five levels of “very satisfactory”, “relatively satisfactory”, “generally satisfactory”, “unsatisfactory”, and “very unsatisfactory” are assigned scores of 10, 8, 6, 4, and 2, respectively. Normalization processing is performed on this basis, as provided in Tab.5:

| Implementation effect of management of special fiscal funds for poverty alleviation B4 | Satisfaction degree with transparency in use of funds C15 | Satisfaction degree with fund availability C16 | Satisfaction degree with fund management system C17 |
|---|---|---|---|
| 0.0878 | 0.7504 | 0.1713 | 0.0782 |

Tab.5 Single-factor analysis on the implementation effect of targeted poverty alleviation in city D

| Implementation effect of targeted identification | Very satisfactory | Relatively satisfactory | Generally satisfactory | Unsatisfactory | Very unsatisfactory | Total |
|---|---|---|---|---|---|---|
| Satisfaction degree with identification criteria | 44.72 | 31.22 | 16.10 | 7.15 | 0.81 | 100.00 |
| Satisfaction degree with policy publicity | 30.89 | 33.20 | 17.95 | 14.29 | 3.67 | 100.00 |
| Satisfaction degree with identification justice | 32.45 | 30.02 | 20.69 | 12.98 | 3.85 | 100.00 |
| Satisfaction degree with identification results | 30.80 | 31.61 | 21.74 | 13.41 | 2.90 | 100.00 |

| Implementation effect of targeted assistance | Very satisfactory | Relatively satisfactory | Generally satisfactory | Unsatisfactory | Very unsatisfactory | Total |
|---|---|---|---|---|---|---|
| Satisfaction degree with poverty alleviation through developing local industries | 32.00 | 36.00 | 20.00 | 8.00 | 4.00 | 100.00 |
| Satisfaction degree with educational poverty alleviation | 32.00 | 32.00 | 18.00 | 12.00 | 6.00 | 100.00 |
| Satisfaction degree with health poverty alleviation | 34.00 | 32.00 | 20.00 | 10.00 | 4.00 | 100.00 |
| Satisfaction degree with housing poverty alleviation | 28.00 | 30.00 | 30.00 | 8.00 | 4.00 | 100.00 |
| Satisfaction degree with policy-based poverty alleviation | 32.00 | 32.00 | 28.00 | 6.00 | 2.00 | 100.00 |
| Satisfaction degree with financial poverty alleviation | 32.00 | 40.00 | 22.00 | 4.00 | 2.00 | 100.00 |
| Satisfaction degree with implementation of assistance work | 36.54 | 30.00 | 17.31 | 13.85 | 2.31 | 100.00 |
3.4.2. Results of criterion layer evaluation

By processing the above data on the satisfaction degrees of poverty-stricken households, we obtain four new matrices:

1) Implementation effect of targeted identification

\[
R1 = \begin{bmatrix}
0.45 & 0.31 & 0.16 & 0.07 & 0.01 \\
0.31 & 0.33 & 0.18 & 0.14 & 0.04 \\
0.32 & 0.30 & 0.21 & 0.13 & 0.04 \\
0.31 & 0.32 & 0.22 & 0.13 & 0.02 \\
\end{bmatrix}
\]

As can be known from the above table, the weight vector of the implementation effect of targeted identification is:

\[w1=(0.5337,0.1969,0.1969,0.0726);\]

According to calculation:

\[B1=w1 \times R1=(0.3867,0.3127,0.1782,0.0999,0.0225)\]

After normalization processing, we have:

\[B1'=(0.3867,0.3127,0.1782,0.0999,0.0225)\]

According to the maximum membership principle and the conclusions, seen from the perspective of poverty-stricken households, the implementation effect of targeted identification was very satisfactory in this region.

2) Implementation effect of targeted assistance

\[
R2 = \begin{bmatrix}
0.32 & 0.36 & 0.20 & 0.08 & 0.04 \\
0.32 & 0.32 & 0.18 & 0.12 & 0.06 \\
0.34 & 0.32 & 0.18 & 0.12 & 0.06 \\
0.28 & 0.30 & 0.30 & 0.08 & 0.04 \\
0.32 & 0.32 & 0.28 & 0.06 & 0.02 \\
0.32 & 0.40 & 0.22 & 0.04 & 0.02 \\
0.37 & 0.30 & 0.17 & 0.14 & 0.02 \\
\end{bmatrix}
\]

In the same vein, its weight vector can be known from Tab.4.9:

\[w2=(0.1595,0.0798,0.1235,0.0311,0.0341,0.0550,0.2470);\]
Similarly, 
\[ B_2 = w_2 \times R_2 = (0.3228, 0.3198, 0.2249, 0.0729, 0.0349) \]
Normalization yields:
\[ B_2' = (0.3310, 0.3279, 0.2306, 0.0747, 0.0358) \]
According to the maximum membership principle and the conclusions, seen from the perspective of poverty-stricken households, the implementation effect of targeted poverty alleviation and assistance work was very satisfactory in this region.

3) Implementation effect of targeted poverty relief

\[ R_3 = \begin{bmatrix} 0.36 & 0.26 & 0.20 & 0.15 & 0.02 \\ 0.30 & 0.29 & 0.23 & 0.16 & 0.03 \\ 0.27 & 0.30 & 0.17 & 0.14 & 0.02 \end{bmatrix} \] (8)

The results of the above calculation indicate that the weight vector of the implementation effect of targeted poverty relief is:
\[ w_3 = (0.5472, 0.2631, 0.1897) \]
Further calculation obtains:
\[ B_3 = w_3 \times R_3 = (0.3271, 0.2755, 0.2022, 0.1507, 0.0226) \]
After normalization processing, we have:
\[ B_3' = (0.3344, 0.2816, 0.2067, 0.1541, 0.0231) \]
According to the maximum membership principle, seen from the perspective of poverty-stricken households, the implementation effect of targeted poverty relief work was very satisfactory in this region.

4) Implementation effect of management of special fiscal funds for poverty alleviation

\[ R_4 = \begin{bmatrix} 0.36 & 0.28 & 0.20 & 0.14 & 0.04 \\ 0.30 & 0.30 & 0.22 & 0.14 & 0.03 \\ 0.38 & 0.25 & 0.18 & 0.15 & 0.04 \end{bmatrix} \] (9)

The results of the above calculation indicate that its weight vector is:
\[ w_4 = (0.7504, 0.1713, 0.0782) \]
Calculation obtains:
\[ B_4 = w_4 \times R_4 = (0.3513, 0.2811, 0.2018, 0.1408, 0.0308) \]
Normalization yields:
\[ B_4' = (0.3493, 0.2795, 0.2007, 0.1400, 0.0306) \]
According to the maximum membership principle, poverty-stricken households were very satisfactory with the implementation effect of management of special fiscal funds for poverty alleviation in city D. That is, seen from the perspective of poverty-stricken households, the implementation effect of targeted poverty relief work was very satisfactory in this region.

3.4.3. Results of target layer evaluation

Target layer evaluation means to constitute a new matrix using the normalization results of criterion layers, and combine it with the weight of the target layer, as shown below:

\[ R = \begin{bmatrix} 0.3867 & 0.3127 & 0.1782 & 0.0999 & 0.0225 \\ 0.3310 & 0.3279 & 0.2306 & 0.0747 & 0.0358 \\ 0.3344 & 0.2816 & 0.2067 & 0.1541 & 0.0231 \\ 0.3493 & 0.2795 & 0.2007 & 0.1400 & 0.0306 \end{bmatrix} \] (10)

Its weight vector \( w = (0.2088, 0.5660, 0.1374, 0.0878) \)
\( A = w \times R = (0.3447, 0.3141, 0.2137, 0.0966, 0.0308) \)
Normalization yields:
\( A' = (0.3447, 0.3141, 0.2137, 0.0966, 0.0308) \)
As can be ascertained from the normalized value according to the maximum membership principle, poverty-stricken households in city D were very satisfactory with the implementation effect of targeted poverty alleviation.
4. Conclusions
As revealed by the above data analysis, poverty-stricken people in city D were very satisfactory with the implementation effect of targeted poverty alleviation and assistance work. Cadres at various levels were all able to conscientiously implement established systems and policies, and this constituted the basis for the targeted poverty alleviation and assistance work of city D to be recognized by the masses. In general, the targeted assistance work of city D is representative to some extent. The development of targeted poverty alleviation has greatly improved the overall economic level of city D, and given rise to a green ecological tendency in its industrial development based on local conditions.

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