



Working Paper Series

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ECINEQ WP 2017 - 440

Evaluating the effectiveness of the Rural Minimum Living Standard Guarantee (Dibao) program in China*

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Abstract

China's Rural Minimum Living Standard Guarantee program (Dibao) is the largest social safety-net program in the world. Given the scale and the popularity of Rural Dibao, it is necessary to rigorously evaluate it so that policymakers know the extent to which the program meets its intended objective of reducing poverty. This paper develops some new methods and uses data from the 2013 Chinese Household Income Project (CHIP2013) to examine the targeting performance of the rural Dibao program. The paper has found that the Rural Dibao program suffers from very low targeting accuracy, high exclusion error, and inclusion error, and yields a significant negative social rate of return. It discusses possible causes and argues that the fundamental mechanism has to be redesigned to increase the effectiveness of the program. The paper makes some recommendations to reform Dibao that will significantly improve targeting and reduce the cost of running the program. That will help China to achieve its goal of eradicating extreme poverty by 2020.

Keywords: Dibao, policy effectiveness, poverty reduction, social rate of return.

JEL Classification: O11, 012, 023.

*The authors would like to thank Chuliang Luo for providing us the CHIP data.

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1. Introduction

A growing number of developing countries are investing in a variety of social programs to improve the welfare of their people, particularly those who are poor and vulnerable. In fact, these programs have become an important pillar of economic development policies. The number of targeted programs has increased many folds in developing countries. For example, Coady, Grosh, and Hoddinott (2004) have listed 85 programs in 36 countries. According to a World Bank report, *The State of Social Safety Nets 2015*, as many as 1.9 billion people are beneficiaries of safety net programs (Kakwani and Son 2016). By providing income to the poor or those who face a probable risk of falling into poverty, in the absence of the cash or in-kind transfers, such successful programs reduced poverty and increased social cohesion and welfare.

China's Minimum Living Standard Guarantee program (Dibao) is the largest social safety-net program in the world. The program was introduced in urban areas in the 1990s and was considered to be very effective in reducing urban poverty. Chinese government extended the Dibao program to rural areas in the early 2000s in the hope to alleviate the hardship of those under poverty and improve the livelihood of the poor in the countryside. Given that poverty in China concentrates in the rural areas, this could have a significant impact on poverty reduction and equality improvement. In 2013, Rural Dibao provided cash benefits to 12.28 million households covering 42.72 million individual beneficiaries.

Rural and urban areas have separate Dibao programs run by their respective local authorities; different regions have their Dibao line, qualifying criteria and ways of distribution, it is imperative to know the impact and effectiveness of this program. However, there is almost no evaluation of the program in the literature. Golan *et al.* (2017) provided some descriptive analysis of the program and some preliminary evaluation using the data from 2007 to 2009 when the program was in its early stage.

Given the scale and the popularity of the rural Dibao, it is necessary to rigorously evaluate it so that policymakers know the extent to which the program meets its intended objective of reducing poverty. Thus being able to reduce wasteful spending, increase target accuracy and improve policy effectiveness.

This paper proposes several methods for assessing the effectiveness of the government program and applies these methods on China's Dibao. It provides a comprehensive empirical evaluation of the rural Dibao program. It is part of a bigger study that the authors will undertake which aims to enhance our understanding of poverty and inequality reduction in theory and improve the targeting and targeting efficiency of the social program in practice.

Targeting is a means to improve program efficiency so that we can achieve the program objectives of maximizing poverty reduction with minimum cost. There are two distinct issues in designing targeted programs; first is identifying the deserving beneficiaries who are the neediest, and the second is deciding on how much transfers should be given to them so that we can meet their minimum basic needs. Accordingly, targeting efficiency is judged by two kinds of targeting methods that we derive from (i) beneficiary incidence and (ii) benefit incidence. We evaluate the rural Dibao using both beneficiary and benefit incidence analyses.

Cost is clearly necessary for any social program. Programs ought to be judged based on how much they contribute to a reduction in poverty in their respective operational costs. In the literature, many poverty measures have been developed having different welfare implications. Among them, the class of poverty measures proposed by Foster, Greer, and Thorbecke (1984) (popularly known as the FGT poverty measures) is the most widely used. We evaluate the Dibao using the idea of the social rate of return (SRR). In calculating SRR, we use social welfare functions that incorporate normative judgments implicit in the FGT poverty measures. The low or negative social rates of return signify that the program is not achieving its objective of reducing poverty with minimum cost.

We have organized the paper as follows: Section 2 provides a critical review of several targeting indicators. It also presents some new evaluation indicators. Section 3 provides a brief discussion of China's Dibao program. Section 4 discusses the evaluation methodology explaining household welfare measures and poverty line used. Section 5 presents our initial evaluation results analyzing the possible causes and consequences. Section 6 discusses the impact of Dibao on poverty reduction. Section 7 provides a new methodology for evaluating Dibao using the idea of the social rate of return (SRR). Finally, Section 8 concludes and discusses policy implications and recommendations.

2. Targeting Indicators

The primary challenge in designing social programs is that we often do not have the exact information about people's economic situation. In the absence of such information, we use targeting methods so that the poorest and most vulnerable members of society receive the maximum benefits. Targeting is a means of reaching the poor. Targeting indicators are also used to evaluate the existing programs, so that policy makers know if the current programs meet the intended objectives of maximizing the poverty reduction with minimum cost.

This paper provides a detailed evaluation of China's Dibao program using the following most comprehensive set of targeting indicators.

2.1. Correlation between poverty status and selection of beneficiaries

Suppose N is the total population of individuals, among them, N_p are the poor, then the headcount ratio of poverty is given by

$$H = \frac{N_p}{N}$$

Assume that N_b are the total number of persons who are the beneficiaries of the program, then the probability of selecting a beneficiary in the population is given by

$$B = \frac{N_b}{N}$$

If we had perfect information about the poor, then all recipients of the program will be poor. We do not have this information in practice. Suppose among N_b beneficiaries, N_{bp} are poor, and the remaining $(N_b - N_{bp})$ are the non-poor beneficiaries. The probability of selecting a beneficiary among the poor is given by

$$B_p = \frac{N_{bp}}{N_p}$$

And similarly, the probability of selecting a beneficiary among the non-poor is given by

$$B_n = \frac{(N_b - N_{bp})}{(N - N_p)}$$

If there is no association between the actual poor and selection of a beneficiary, then the probability of choosing a beneficiary among the poor must be equal to the probability of selecting a beneficiary among the non-poor. Or the poor are as likely to be chosen as the non-poor, in which case $B_p = B_n$. We may characterize this situation as having no information as to who the poor are, so everyone has the same probability of being selected in the program.

A program may be classified as pro-poor if the probability of selecting a beneficiary among the poor is greater than that among the non-poor, i.e. when

$$B_p - B_n > 0.$$

We should design a program so that it is pro-poor: the poor are more likely to be selected in the program than the non-poor. The degree of pro-pooriness can be measured by how much higher the probability is of selecting a 'poor' in the program to the probability of selecting a non-poor in the program, which is as measured by the pro-poor index

$$\gamma = B_p - B_n \tag{1}$$

In the case of perfect targeting, we only select the poor as beneficiaries, and all non-poor are completely left out, which can happen only if $B_p = 1$ and $B_n = 0$, which gives the maximum value of pro-poor index γ equal to 1. The maximum value of γ cannot be attained unless the proportion of beneficiaries in the program is exactly equal to proportion of poor, i.e. $B=H$. If $B < H$, then some poor will be left out of the program and some non-poor will be included in the program i.e. $B_p < 1$ and $B_n > 0$. Similarly, if $B > H$, then all poor can be included in the program but all non-poor cannot be excluded, i.e. $B_p = 1$ and $B_n > 0$. Thus, the maximum value of γ cannot be attained unless $B=H$.

A program is said to mismatch if $B \neq H$. In almost all targeted programs we have encountered, B is never equal to H . An important implication of this is that even if we have perfect information about the poverty status of households (which

household is poor and which is non-poor), the power of a program is much diminished.

There are two kinds of mismatch. The most common mismatch is when $B < H$. The cost of any targeted program depends on what proportion of beneficiaries we include in the program; the larger is B is, the greater the cost of the program will be. Most governments in developing countries have budget constraints, so there is always a tendency to design programs that have B as small as possible. In this situation, we cannot evaluate the targeting efficiency by the pro-poor index given in (1) When there is a mismatch, then we can evaluate a program by measuring the association between poverty status and selection of beneficiaries. Using a 2×2 contingency table, we propose the following test statistics:

$$\varphi = (B_p - B_n) \sqrt{\frac{H(1-H)}{B(1-B)}} \quad (2)$$

When $\varphi = 0$, it implies that there is no association between poverty and selection of beneficiaries or in other words, the poor are just as likely to be selected in the program as the non-poor. In this case, $N\varphi^2$ follows a χ^2 distribution with 1 degree of freedom. This result allows us to test the null hypothesis of no association between poverty status and selection of beneficiaries.

The larger the value of φ , the greater is the association between poverty status and selection of beneficiaries. As we showed above, this statistics is also related to the degree of pro-poorness of the program; the larger, the φ greater the pro-poorness of the program. If the value of φ is found to be statistically insignificant, the program is not explicitly targeted to the poor. An implication of such a result is that the program will have no significant impact on poverty reduction.

2.2. Exclusion Error and Leakage

Exclusion error and leakage are commonly used indicators to evaluate targeting efficiency. The exclusion error is the percentage of poor whom we exclude from the program and is given by

$$E = 1 - B_p \quad (3)$$

The exclusion error informs what percentage of eligible persons we exclude from the program. It is a measure of horizontal inequity when we do not treat individuals in the same economic circumstances equally.

We define leakage as the percentage of all beneficiaries who are not poor (or not eligible for the program).

$$L = \frac{B - HB_p}{B} \quad (4)$$

It measures the resources going to unintended beneficiaries of the program.

Exclusion error and leakage are related such that

$$L = 1 - \frac{H}{B}(1 - E). \quad (5)$$

If the probability of selecting a beneficiary is equal to the headcount ratio of poverty ($B = H$), then leakage is equal to exclusion error ($L = E$). If $B < H$, $L < E$ and similarly, if $B > H$, then $L > E$. The difference between leakage and exclusion error is an indicative of degree of mismatch in the program.

While both errors are undesirable, we cannot simultaneously reduce them. If we increase the number of beneficiaries as the program expands, then we can reduce the exclusion error but then the leakage increases. A reduction in one error may cause the other to increase. There is no simple formula to evaluate how well-targeted a program is. There might be a trade-off between the two errors; therefore, we need some normative judgment in evaluating the program.

2.3. Benefit Incidence

The benefit incidence is concerned with how the program distributes total transfers among the poor and the non-poor. Suppose B is the average number of beneficiaries in the population and β is the average transfers given to each beneficiary, then the average benefits per person in the population will be given by $\bar{b} = \beta B$. Similarly, if β_p and β_n are the average transfers given to each beneficiary among the poor and the non-poor, respectively, then $\bar{b}_p = \beta_p B_p$ and

$\bar{b}_n = \beta_n B_n$ are the average benefits per person among the poor and the non-poor, respectively. Following Kakwani and Son (2016), we then have the relationship:

$$\bar{b} = H\bar{b}_p + (1 - H)\bar{b}_n$$

Which we can write as

$$\beta B = H\beta_p B_p + (1 - H)\beta_n B_n$$

Leakage of benefits (or resources) is the most important targeting indicator, which we define as the proportion of total transfers going to the non-poor:

$$l = \frac{\beta B - H\beta_p B_p}{\beta B}$$

Recall that L is the proportion of the total number of beneficiaries selected from the non-poor. The relationships between l and L is shown by

$$l = L + \frac{HB_p}{\beta B}(\beta - \beta_p)$$

Which implies that if $l > (<)L$, then $\beta > (<)\beta_p$. That is, if the leakage of benefits is higher (lower) than the leakage of beneficiaries, the benefits per beneficiary will be higher among the non-poor (poor). This suggests that the targeting efficiency should be judged on two accounts: (i) how beneficiaries are distributed among the poor and the non-poor and (ii) how much of the benefits are given to the poor and non-poor beneficiaries. If the poor and non-poor beneficiaries receive exactly the same benefits, the leakage of benefits will be exactly the same as the leakage of beneficiaries. The difference between leakage in benefits and leakage in beneficiaries indicates the degree of inequity in the benefits given to beneficiaries among the poor and the non-poor, respectively.

2.4. Universal Basic Income

A universal basic scheme is a form of social security in which all individuals in the society receive certain transfers from the government. The World Bank is now promoting this idea on its blog ‘Basic Income: Can we transfer our way out of poverty?’ Finland is currently testing this idea. This idea completely gets rid of

targeting the poor for all social transfers. The poor and rich are all equal beneficiaries of social programs.

Since the universal basic scheme includes all the poor, the exclusion error is always zero, but there will be high leakage. The probability of being a beneficiary is the same for the poor and the non-poor, then $B_p = B = 1$, which on substituting in (4) gives the leakage $L=(1-H)$. For instance, in China the official estimate of % of poor is about 10%, which means that if universal basic scheme is introduced in China, about 90% of beneficiaries will be non-poor. Similarly, since all beneficiaries receive exactly the same amount, the leakage of benefits or resources will also be about 90%. Thus, universal basic income schemes completely eliminates exclusion errors but it introduces exceptionally large leakage to the non-poor. This scheme is based on no targeting; it can be used as benchmark to evaluate Dibao. Since we want to know how Dibao performs in reducing poverty relative to the universal basic income scheme, we have to keep the same cost of the program, the benefits received by a person with income x will be given by

$$b(x) = \bar{b} \quad \text{for all } x \quad (6)$$

Where \bar{b} is the average transfers going to the population. We calculate the incidence of poverty using the transfer scheme in (6), which provides a bench mark under the universal basic income.

2.5. Perfect Targeting

If we can correctly identify every poor and give them exactly the difference between the income and poverty line, then we have a perfect targeting. Under this scenario, there will be no exclusion error and leakage in both beneficiaries and benefits. We will achieve the maximum reduction in poverty. We may describe perfect targeting as

$$b(x) = k(z - x) \quad \text{if } x < z \quad (7)$$

$$b(x) = 0 \quad \text{if } x \geq z$$

Per capita cost of such a program, (excluding administrative cost) will be given by

$$\bar{b}_f = k(zH - \mu^*H)$$

Since we want to assess the performance of Dibaoao against perfect targeting as a benchmark, we should keep the same per capita transfers to beneficiaries. We determine k so that $\bar{b}_f = \bar{b}$, which gives

$$k = \frac{\bar{b}}{H(z - \mu^*)}$$

The incidence poverty can be calculated under perfect targeting using the transfer scheme in (7), which provides a benchmark in assessing any program.

2.6. Social rate of return (SRR)

In practice, investors make decisions about their investments by how much return they generate. We assess how good investment is by its rate of return. A similar approach may be adopted when we make an investment in social programs.

Cost is clearly necessary for any social program. Programs ought to be judged based on how much social welfare they generate about their respective operational costs. Kakwani and Son (2016) proposed a method for evaluating programs using the idea of the *social rate of return* (SRR). In calculating SRR, we use a social welfare function that specifies normative judgments by assigning weights to different individuals.

We define the social rate of return (SRR) as the social welfare generated by a program as a percentage of the cost of the program. To measure the social rate of return, we need to specify a social welfare function that we measure in money metric. For instance, we should be able to say how much, as measured in a country's currency, the increase in social welfare is so that we can compare it with the cost of the program measured in the same currency. Logically, social welfare generated by the program should outweigh the operational cost of the program.

Since the primary objective of Dibao program is to reduce poverty, we should use social welfare functions that incorporate normative judgments implicit in some poverty measures. The FGT poverty measures are most widely used to measure

poverty. Kakwani and Son (2016, Ch3) have developed social welfare functions corresponding to the entire class of FGT poverty measures:

$$W_{\alpha} = \mu - Hz \left(\frac{\theta_{\alpha}}{H} \right)^{\frac{1}{\alpha}} \quad (8)$$

Where θ_{α} is the FGT class of poverty measures, which is the headcount ratio (H) if $\alpha = 0$, the poverty gap ratio if $\alpha = 1$, and the severity of poverty ratio if $\alpha = 2$, and z is the poverty line. This is the social welfare measured in money metric. For instance, Yuan per year. The second term in the right hand side of (8) is the loss of social welfare caused due to the existence of poverty. It depends on what poverty measure is used.

To calculate the SSR, we have to determine how much the program increases social welfare. The change in social welfare due to the program is given by:

$$\Delta W_{\alpha} = \Delta \mu - z \Delta \left[H \left(\frac{\theta_{\alpha}}{H} \right)^{\frac{1}{\alpha}} \right] \quad (9)$$

Which is the social benefit of the program. To calculate the SSR, we should compare the social benefit of the program with its cost. There are two kinds of costs: (1) the amount of money transferred to beneficiaries and (2) the administrative cost. For simplicity, we can assume that administrative cost is proportional to the total transfers going to the household. This assumption may not always be valid because for any program; there is a fixed initial cost when the program starts and then there is a variable cost which depends on how many beneficiaries are selected and how much benefits transferred. The cost also depends on how intensive targeting is. If targeting is intense, it will generate greater social welfare, but then the administrative cost will also be higher. There is always a tradeoff between the degree of targeting and administrative cost. The idea of SRR incorporates such trade-offs. In the measurement of the impact of a program on poverty, it is important to calculate the administrative cost, which takes account of both fixed and variable. The targeting literature seldom uses administrative cost in evaluating the efficacy of social programs.

Suppose T is the total transfers going to the beneficiaries and ϵ is the administrative cost per Yuan transferred to beneficiaries, then the total program cost will be $(1+\epsilon)T$ which yields the SRR:

$$SSR = \frac{\Delta W_{\alpha}}{(1+\epsilon)^T} - 1 \quad (10)$$

For instance, a hypothetical program generates the total welfare equal to 30 Billion Yuan per year and the total transfers to going to beneficiaries is 19 Billion Yuan per year. And if 5% of the transfers is the administrative cost, then the SRR of return will be 50% implying a social investment of 1 Yuan generates social welfare of 1.50 Yuan.

We must emphasize that the assumption of the administrative cost being a fixed proportion of total transfers is too simplistic. The relationship between administrative cost and total transfers is not linear. When a program starts, it requires developing a social infrastructure which requires large fixed cost, but over time, the variable cost becomes more important. When several local governments run the program, we cannot assume that all will have the same levels efficiency. The calculation of administrative cost is highly complex but to calculate it accurately we do require taking into account of all its complexities. We can calculate the SRR under the three alternative transfer schemes:

- (i) Actual transfers are under the program.
- (ii) Transfers are under the universal basic income (no targeting).
- (iii) Transfers are under perfect targeting.

A comparison of these three SRR provides a new evaluation method of social programs.

3. The Minimum Living Standard Guarantee Program in China: Di Bao

The minimum living standard guarantee program (Dibao) is a major component of the social assistance program in China. It was launched in the 1990s by the more developed urban regions in China to assist some urban workers during the period of economic reform and structural change. The Dibao program aims to provide cash support to help those whose income is lower than a certain level and has played a significant role in poverty reduction and social stability improvement in urban China. (Ravalion 2006)

The success of the Dibao program in the urban areas also promoted the experiment of Dibao program in the rural areas since 2007. Rural and Urban Dibao programs are similar in design, but with different minimum living standards among local areas. Golan *et al.* (2017) provided a detailed description of Rural Dibao.

Both the central and local governments provide the funding for the program. The central government allocates funds for a province based on an estimation of the number of people in poverty and the extent of their poverty. Provincial governments then give the funds to its subdominant, until it gets into the hands of those in need.

For a household to get the Dibao in the local area, a household registration (Hukou) is required. In principle, a household is eligible to apply for the Dibao assistance as long as her/his income is lower than the threshold level in the local area without having to satisfy any other conditions. The amount of cash transfer received is usually the difference between the income threshold level and the household's income, so as to close the gap between them. Since actual household incomes are not known to officials, there will be a possibility of a high degree of inequity in the distribution of cash transfers.

Implementation remains decentralized. The local authorities determine eligibility thresholds, beneficiary selection, and transfer payment amounts. The income threshold level set by the local governments usually depends on the economic conditions of local areas such as the consumption level, capacity, and funding for the local areas. Due to the fiscal interactions among regions, local governments tend to reduce the level of minimum living standard guarantee in its jurisdiction if there is a decrease in the minimum living standard in its neighbors. Thus, regions race to the bottom regarding the expenditure on these welfare spending (Zhang *et al.*, 2016).

The income threshold level varies across regions and is different between urban and rural areas. It is higher in the urban areas than that in the rural areas. Regions with better economic conditions tend to have a higher income threshold level than those with worse economic conditions. Poor counties tend to have lower Dibao thresholds and transfer amounts than do rich counties. Thus, there exists no uniform criterion for identifying the poor. The transfers that are given to beneficiaries also vary across counties.

The management of Dibao is highly decentralized, based on a de facto quota system. In practice, authorities estimate the number of poor in a region and then

distribute the fund accordingly. For a given amount of funds, county level officials decide the Dibao line and accordingly, distribute certain funds to their subsidiaries up to the villages, where local cadre or villagers decide who should get the money. It is possible that a richer village gets more quota than it needs and another region may get much less, which can only barely cover the extremely poor.

At the village level, it is often the case that Dibao households were not means tested, but democratically decided by villagers based on their perception. For instance, in some places, the recipients are selected by counting off incomes ranked from highest to lowest and choosing from the poorest, while in other places; it is decided by villagers through voting.

In our field studies and interviews with many local officials and villagers, we found it is often the case that villagers gather together to discuss and decide who should get it. Very often, it is easy to identify a couple of extremely poor households who should get the money, but difficult to settle the households who should get the rest of the money. If there are more numbers of households that are equally poor than the number of the household can be supported by Dibao, then it is often decided that some households would rotate yearly to get Dibao subsidy.

That is, it is often the case that villagers decided a pool of households and give them Dibao based rotation. When this is happening, our 2013 data would only pick those who get Dibao in that year and would have no information about the others who might have or will benefit. Thus, the targeting shown from our data may not be accurate.

4. Evaluation Methodology

The evaluation of Rural Dibao carried out is based on the fifth round of the Chinese Household Income Project (CHIPs) covering rural households in the year 2013 (CHIP 2013) These surveys were carried out by the China Institute of Income Distribution supported by the Beijing Normal University.

The rural survey sample contains more than 10,000 households in 12 provinces and two province-level municipalities, which are representative of China, across eastern, middle and western regions. These are Beijing, Liaoning, Jiangsu, Shandong, Guangdong, Shanxi, Anhui, Henan, Hubei, Hunan, Gansu, Sichuan, Chongqing, and Yunnan. The sample is a subset of the National Bureau of Statistics (NBS) annual rural household survey (approximately 65,000 rural households).

The CHIPs surveys are the best publicly available data source on Chinese household income and expenditures (Riskin, Zhao, and Li, 2001). These data remain the only source of household level information on income and other individual and household characteristics that are representative of China as a whole. (Gustafsson, Li, and Sicular, 2008).

The primary objective of social assistance programs is to reduce poverty. It is, therefore, important to be able to identify the genuine poor who need help from the government. To identify the poor in an objective way, we need to know a metric of household welfare, which informs the economic situation of households of different size accurately. In most countries, per capita income is used to measure household welfare. The household welfare should include all income components that contribute to household welfare. The households also make transfers to other households and pay taxes which do not contribute to their welfare, so we have to deduct these expenditures from their gross income. So the household welfare is determined by their disposable income which is the net income available to households for consumption.

Many developing countries use per capita expenditure as a measure of household welfare. In these countries, it is difficult to accurately measure income due to the existence of large informal sector. But from the welfare point of view, consumption is regarded as the better basis for determining who is poor who is not. Which is because in any given month or year there is much greater fluctuation in income than in actual household consumption, Households tend to smooth their consumption across periods by saving or dissaving as needed. So households' consumption during the survey period provides a better measure of their permanent standard of living than their current income.

The CHIPs survey provided both income and consumption. Since there are both pros and cons of using income or consumption as measures of household welfare, we have used both as a basis for evaluating Dibao program. Since the cost of living varies across provinces, we adjusted welfare measures by deflating the incomes by the spatial price indices for different provinces of China (numeraires equals national average consumption basket). Thus, our two alternative household welfare measures are the real per capita disposable household income and real per capita household consumption.

To measure poverty among individuals, we need to know the welfare of individuals. To derive the individuals' welfare, we assume that all individuals

belonging to the household enjoy the same level of standard of living. If we identify a household as poor, then all individuals belonging to this household are also poor. Which is a common assumption in the measurement of poverty because we do not know the intra-household distribution of household resources. The poverty estimates presented here, therefore, relate to the poverty among individuals (not households).

An evaluation can be carried out against some benchmark. As pointed out, Dibao is a highly decentralized program in which each local authority determines eligibility thresholds and transfer payments. Each county has its poverty line for identifying the poor. Should we then evaluate Dibao separately for each county? A problem with this approach is that counties do not have clear criteria. They do not use any clear poverty line to identify the beneficiaries. They make their decisions on an ad hoc basis. Since Dibao is a national program, so our purpose in this paper is to evaluate it using some national benchmark. An obvious national benchmark is a national poverty for the rural areas.

We have used the rural official poverty line of 2736 Yuan per person per year for 2013 which is about 28% of the average per capita real income. The 2011 PPP exchange rate for the Chinese Yuan per dollar was 3.545 in 2013, which gave the per person per day official poverty line equal to \$2.11 in 2011 PPP. The World Bank has recommended poverty line of \$1.90 in 2011 PPP for the extremely poor. Thus, the Chinese official poverty line is about 11% higher than the World Bank's poverty line for the extremely poor. Which is a reasonable poverty line because, given the Chinese level of economic development, we should not be using extreme poverty line.

5. Evaluation of Dibao (2013)

Table 1 presents the estimates of various targeting indicators (discussed in Section 2). As pointed out, we will base our evaluation on two alternative welfare measures: (i) per capita real disposable income and (ii) per capita real household consumption. The estimates of targeting indicators are presented separately for the two welfare measures. The total rural population of China is estimated equal to 620.22 million. According to the *2014 Statistical Yearbook* published by the National Bureau of Statistics, the total rural population in 2013 was 630 million, which is close to our estimate of 620.22 million obtained from the CHIP survey.

Per capita real disposable income in 2013 prices is estimated equal to Yuan 9850 per year whereas per capita real household consumption is estimated equal to Yuan 7731 per year. The household consumption is about 78% of the household disposable income. The two welfare measures also have different inequality as measured the Gini index. The Gini index of per capita consumption is estimated equal to 36.44%, which is much lower than that of the per capita disposable income calculated equal to 40.73%. It is quite common that inequality of consumption welfare is lower than that of income welfare.

Although we have used the same poverty line for the two welfare measures, we obtain different poverty estimates. The percentage of poor based on per capita disposable income is 10.12, while that for per capita consumption is 9.40. The consumption poverty is lower than the income poverty because consumption has lower inequality than income. In most situations, poverty gap and severity of poverty have lower values than the percentage of poor because they take account of not only who are the poor but also how poor they are. We find somewhat unusual estimates of poverty gap and severity of poverty, whose values based on per capita income are 4.85% and 13.33%, respectively. The main reason for these unusual estimates is that about 70 sample households in the CHIP had high negative incomes. Although negative income is common in many household surveys, such high negative incomes are somewhat unusual. We have kept all the negative incomes because we could not know whether households with such high negative incomes were genuinely poor or they were not poor but had temporary setbacks. The main advantage of using consumption welfare is that it cannot have negative values. Poverty gap and severity of poverty based on consumption welfare are 1.98% and 0.63%, respectively, which seem reasonable when we compare them with estimates obtained from many other countries.

The number of poor in Rural China is 62.79 million based on per capita disposable income and 58.29 million based on per capita consumption.

As discussed in Section 2, exclusion error and leakage are commonly used indicators to evaluate targeting efficiency. The exclusion error is the percentage of poor that we exclude from the program. Meanwhile, leakage is the percentage of all beneficiaries who are not poor (or not eligible for the program). Therefore, leakage measures the resources going to unintended beneficiaries of the program.

Of 62.79 million poor, only 7.61 million were the program beneficiaries, which mean that 55.18 million poor not included in the program. Thus, Dibao excludes 87.89% poor from receiving any benefit, which is a very high degree of exclusion

error. Exclusion error based on per capita consumption is 86.6%, which is slightly lower but still very high in comparison with many international social assistance programs. Thus the program is generating a high degree horizontal inequity.

Of the total number of 42.72 million beneficiaries, 35.11 million are non-poor, which give the leakage of beneficiaries in the program equal to 82.2%. Leakage is also very high at 82.07% when we use per capita consumption as a welfare measure. High leakage of this magnitude amounts to substantial resources going to unintended beneficiaries of the program.

Both exclusion error and leakage are extremely high in comparison with international standards. It seems that in the selection of beneficiaries, the program did not use the poverty status of individuals. In Section 2 we developed a test statistic ϕ , which measures the association between poverty status and selection of beneficiaries. When $\phi=0$, it implies that there is no association between poverty and selection of beneficiaries or in other words, the poor are as likely to be selected in the program as the non-poor. It was shown that $N\phi^2$ is distributed as a χ^2 distribution with 1 degree of freedom. This result allows us to test the null hypothesis of no association between poverty status and selection of beneficiaries.

From the data, ϕ for the Dibao is calculated to 0.07 based on income welfare measure and 0.08 based on consumption welfare, both of which are not statistically significant at the 5% level of significance. Thus, we cannot reject the hypothesis of no association, whatever welfare measure we use. We may thus conclude that in the selection of individuals, the program did not use the poverty status of the individual. The program selected beneficiaries by factors other than their poverty status.

The benefit incidence is concerned with how the program distributes total transfers among the poor and the non-poor. The average transfers from Dibao to the whole population is Yuan 31.96 per person per year. Multiplying this by the total rural population of 620.22 million gives the total transfer cost of the program equal to 19.8 billion per year. Also, there may be some administrative cost of running the program. Although we do not know the exact amount of administrative cost of Bi Bao, its funding came from both the central government and local governments. Official Statistics for China's Rural Di program reported that the total transfers going to Dibao from all levels of government were about Yuan 87 Billion in 2013 (Golan, Sicular and Umapathi 2017). Given the actual transfers going to

beneficiaries is 19.8 Billion, the non-transfer (or administrative) cost of the program is about 67.2 Billion which is the extraordinary cost of running a program. It means that every Yuan transferred to beneficiaries, Yuan 3.4 is eaten away as the administrative cost.

We may calculate the average transfers going to each beneficiary by dividing the total transfers to the population by the number of beneficiaries, which gives the average transfers per beneficiary equal to Yuan 464.02 per year. The poor and non-poor have a different number of beneficiaries and therefore will have different amounts of transfers per beneficiary. The average amount of transfers going to the poor beneficiaries is calculated to Y348.43 per year while that going to the non-poor beneficiaries is Yuan 489.06 per year, which shows that there is a large inequity in the payment of program benefits to the poor and non-poor. Thus, Dibao suffers from serious inequity in the distribution of benefits going the poor and non-poor, where on average, the poor beneficiaries get much less than those non-poor beneficiaries who were not supposed to get in the first place.

We may also define leakage as the percentage of total benefits going to the non-poor. This indicator measures the percentage of resources in monetary terms that are going to unintended beneficiaries. The number of non-poor beneficiaries in Dibao is equal to 35.11 million, and each non-poor beneficiary receives an amount of 489.06 which gives the total resources leaked to the non-poor equal to Yuan 17.37 billion. The total transfer cost of the program is Yuan 19.8 billion. Thus the percentage of total funds leaked out to the non-poor is equal to 86.63, which is the leakage rate of resources. This leakage is even greater than the leakage of beneficiaries which was calculated to be equal 82.2%. The leakage is 85.11% when welfare measured is per capita consumption, which is also high by any international standard.

Table 1: Targeting indicators of China's Rural Dibao Program 2013

Targeting Indicators	Per capita real disposable income	Per capita real consumption
Total Rural Population (mil)	620.22	620.22
Gini index:	40.73	36.44
Poverty indicators		
Official poverty line (Yuan per year)	2736	2736
% of poor	10.12	9.40
Poverty gap ratio %	4.85	1.98

Severity of poverty %	13.33	0.63
Number of poor(million)	62.79	58.29
Number of non-poor (million)	557.43	561.93
Welfare indicators		
Per capita household welfare: Yuan per year	9850	7731
Per capita household welfare of poor: Yuan per year	1425	2160
Per capita household welfare of Non- poor: Yuan per year	10799	8309
Per capita welfare of Dibao beneficiaries: Yuan per year	6080	5382
Beneficiary Incidence		
% of beneficiaries	6.89	6.89
Number of beneficiaries(million)	42.72	42.72
Number of poor included in Dibao (million)	7.61	7.66
Number of poor excluded from Dibao (million)	55.18	50.63
Exclusion error(% of poor excluded)	87.89	86.86
Number of non-poor included in Dibao (million)	35.11	35.06
% of beneficiaries among the poor	12.11	13.14
% of beneficiaries among non-poor(inclusion error)	6.30	6.24
Leakage (% of all beneficiaries from non-poor)	82.20	82.07
Benefit incidence		
Average transfer in the population Yuan per year	31.96	31.96
Average transfer among the poor Yuan per year	42.20	50.63
Average transfer among the non-poor	30.81	30.02
Total transfers going to beneficiaries per year (billion)	19.8	19.8
Total transfers going to poor beneficiaries (billion)	2.6	3.0
Total transfers going to non-poor beneficiaries (billion)	17.2	16.9
Leakage: Proportion of total transfers going to non-poor%	86.63	85.11
Average transfer per beneficiary (Yuan per year)	464	464
Average transfer per beneficiary among the poor	348	385
Average transfer per beneficiary among the non-poor	489	481

6. Impact of Dibao on Poverty Reduction

The primary objective of Dibao is to reduce poverty. How much does the program contribute to the poverty alleviation?. To answer this question, we calculated poverty with and without program transfers going to beneficiaries. Table 2 presents the actual magnitude of poverty reduction separately for the two alternative welfare measures: per capita disposable income and per capita consumption. The program contributes to a reduction in % of poor by 0.42 percentage points when welfare measure is per capita real disposable income. The reduction in the percentage of poor is greater at 0.63 percentage points when welfare measure is per capita consumption. We may conclude from the results in Table 2 that Dibao does

contribute to poverty reduction, but we cannot infer from this, how effective the program is in reducing poverty without comparing it with some benchmark. Our benchmark is the universal basic income given to every resident with no targeting but keeping the same transfers to beneficiaries. Table 3 presents the magnitudes of poverty reduction under the universal basic income.

Table 2: Contribution of Dibao to Poverty Reduction

Poverty Measure	Per capita real disposable income	Per capita real consumption
% of poor	-0.42	-0.63
Poverty gap ratio %	-0.22	-0.27
Severity of poverty %	-0.20	-0.16

Comparing the magnitude of poverty reduction in Tables 2 and 3, we note that Dibao has greater poverty reduction than would be under no targeting when all individuals receive the same amounts of transfers but with the same total transfers going to beneficiaries. We also note that differences in magnitudes of poverty reduction are not that different. Any program under no targeting has the least administrative cost. As pointed out earlier, according to Official Statistics for China's Rural Dibao program, the total transfers going to Di Bao from all levels of government was about Yuan 87 Billion in 2013. The actual transfers going to beneficiary households is estimated equal to about Yuan 19.8 Billion (Table1), which gives the non-transfer cost of the program is about 67.2 Billion, which is the extraordinary cost of running a program. Since Dibao did not make much contribution to the poverty reduction compared to no targeting scenario, it cannot receive high marks for its targeting efficiency. It would then be better to replace it with the universal basic income program which will have almost negligible administrative cost. The main advantage of a universal basic income program is that it has zero exclusion error and hence it does not suffer from horizontal inequity. Leakage of it will be about 90%, but Dibao also has a high leakage rate of about 86%. Thus, Dibao does not have much advantage over the universal basic income scheme.

Table 3: Poverty Reduction under universal targeting

Poverty Measure	Per capita real disposable income	Per capita real consumption
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% of poor	-0.30	-0.50
Poverty gap ratio %	-0.16	-0.21
Severity of poverty %	-0.14	-0.12

7. Social Rate of Return

Social rate of return (SRR) is the social welfare generated by a program as a percentage of the cost of the program. The social welfare can be calculated using (8), which takes into account the deprivation suffered by the population due to the existence of poverty.

Table 4 presents values of social welfare for four alternative scenarios: first is the current situation when Dibao is operational, second if there did not exist, Dibao, third if Dibao had perfect targeting and fourth when Di Bao had no targeting; everyone receiving the same transfer. In the calculation of social welfare under first, third and fourth scenarios the total transfers going to beneficiaries are kept the same equal to Yuan 19.8 billion. We explain the calculation of social welfare as follows:

Per capita, disposable income is Yuan 9850 per year, which when multiplied by the rural population of 620.22 million, gives the total disposable income available to the rural population equal to 6109 billion, which includes the total transfers of 19.8 billion to beneficiaries of the program. The existence of poverty incurs a loss of social welfare, the magnitude of which depends on the poverty measure used. The loss of social welfare for the poverty gap ratio, as calculated from (8), is equal to 82 billion which when subtracted from the total disposable income gives social welfare equal to 6027 billion, which is the social welfare of the rural population when Di Bao is operational.

Let us now consider the counterfactual if Dibao had not existed, in which case the total disposable income will be reduced by the total program transfers of 19.8 billion. If the program is not operational, then the incidence of poverty will also be higher, which will lead to greater loss of social welfare due to poverty. We calculated this loss equal to Yuan 86 billion, which when subtracted from the disposable income available to the population without program gives social welfare equal to Yuan 6003 billion. The calculation of social welfare under the perfect targeting and universal basic income follows the same procedure.

Table 4: Social Welfare under various scenarios (Yuan billion per year)

Poverty Measure	Per capita real disposable income	Per capita real consumption
Dibao operational		
Poverty gap ratio %	6027	4761
Severity of poverty %	5912	4754
With no Dibao		
Poverty gap ratio %	6003	4737
Severity of poverty %	5887	4727
Perfect Targeting		
Poverty gap ratio %	6043	4777
Severity of poverty %	5955	4770
No Targeting		
Poverty gap ratio %	6024	4758
Severity of poverty %	5908	4749

Each scenario generates a different value of social welfare. A scenario which creates the highest level of social welfare will contribute most to the poverty reduction. The difference in social welfare with the program and without program provides the contribution of that program. For instance, Dibao generates social welfare equal to Yuan 6027 billion while social welfare without a program is Yuan 6003, which implies that Dibao contributes social welfare equal to Yuan 24 billion per year.

Table 5 presents the contributions to social welfare for three alternative scenarios. As expected, perfect targeting generates much larger social welfare than the other two. Although Dibao creates more social welfare than the universal basic income, the difference between them is small which may not be significant. A critical policy question is: should a universal basic income replace the currently run Dibao? The answer depends on the costs of running the two programs.

Table 5: Contribution to social welfare for three alternative scenarios

Poverty Measure	Per capita real disposable income	Per capita real consumption
Existing Dibao		
Poverty gap ratio %	24	24
Severity of poverty %	25	26
Perfect Targeting		
Poverty gap ratio %	40	40
Severity of poverty %	68	42
No Targeting Universal targeting		

Poverty gap ratio %	21	21
Severity of poverty %	21	21

The SRR takes into account the operational costs of running a program. The universal basic income does not explicitly target the poor. It makes equal transfers to all individuals in the population, so the administrative cost as a share of total transfers will almost be negligible. It does not require identifying the poor. It is reasonable to assume that the administrative cost of sending transfers to all citizens will not be more than 5% of the total transfers. The total transfers going to beneficiaries are Yuan 19.8 billion, and with 5% administrative cost, total program cost will be Yuan 20.8 billion. So the social rate of return will be 0.01% ($21/20.8-1$), which is slight. Thus, universal basic income generates an insignificant social rate of return.

As pointed out earlier, the total transfers going to Dibao from all levels of government was about Yuan 87 Billion in 2013 as reported by Official Statistics for China's Rural Dibao program. Assuming that Yuan 87 billion is the correct cost of running Dibao, which is justified because it is an official figure, then social rates of returns for Dibao are highly negative around -70% as shown in Table 6. Any program with such high negative rates of return cannot sustain in the long run. There is an urgent need for reforming targeting methodology used for Dibao. If the local governments followed a universal basic scheme, which does not require targeting the poor, Rural Dibao could have avoided such high negative rates of return.

We could not present the estimates of SRR under the scenario of perfect targeting because we have not got any idea of how much the administrative cost of perfect targeting would be. We are even skeptical whether it is at all possible to achieve perfect targeting. Even the developed countries do not have perfect targeting in their social programs. Surely developed countries have evolved more efficient targeting than developing countries still they have some degree of leakage. To aspire for perfect targeting is an unachievable goal, which we do not recommend for Dibao but targeting can be improved substantially.

Table 6: Social Rates of Return for Dibao

Poverty	Per capita real	Per capita real
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Measure	disposable income	consumption
Poverty gap ratio %	-72.99	-71.89
Severity of poverty %	-70.81	-69.87

8. Concluding Remarks and Recommendations

This paper developed some new methods for evaluating the targeting efficiency and the social rate of return for social programs and applied them for rural Dibao using CHIP2013 data. We found that there have been serious problems with targeting efficiency, yielding significant negative social rate of return. Specifically, 1) The selection of an individual in the Dibao program is almost random, not determined by the poverty status of the individual. 2) It excluded almost 87% of the poor while including about 82% of the non-poor. 3) There is large inequity in the payment of program benefits to the poor and non-poor, where the poor beneficiaries get much less than those non-poor beneficiaries. 4) The percentage of total resources leaked out to the non-poor is even greater than the leakage of beneficiaries. 5) It yielded high negative social rate of return for both the poverty gap ratio and the severity of poverty.

The evaluation of Dibao was performed using the two alternative household welfare: (i) real per capita disposable income and (ii) real per capita household consumption. Both welfare measures tell the same story that Dibao does not achieve its primary objective of reducing poverty with minimum cost. The cost of running Dibao is extraordinarily high with an insignificant impact on poverty reduction. If China is aiming to eliminate poverty by 2020, then Dibao needs to be urgently reformed by improving its targeting efficiency and reducing its administrative cost.

The central message emerging from this paper is that the Rural Dibao is in need of an efficient mechanism and methodology for identifying the poor and determining the amount of subsidy needed. The management of Dibao is highly decentralized, and the local governments do not follow any precise targeting system. We are not arguing that Dibao should be completely centralized. The program should be run by local authorities because they are more familiar with the local conditions. What they may lack is the technical capacity to implement targeting methodology, which can be rather complex. We recommend that there should be some central authority,

which develops a consistent targeting framework which could be used by local governments. The implementation of such a framework should be carried out by local governments. The central authority can provide training from time to time on targeting methods to the local administration officials and communities involves the operation of Dibao. It can also develop some monitoring system to ensure that the program is running smoothly at the local level.

Given the limitations of obtaining people's income or consumption accurately, many developing countries use the proxy means test as a targeting framework. The basic idea of a proxy means test is to identify beneficiaries by easily identifiable variables that accurately predict a household to be in poverty. A nationally representative household survey makes it possible to design such a proxy means test.

The first step in designing a proxy means testing is to identify a set of variables highly correlated with the poverty status of households. These selected variables must be easy to measure but at the same time should be able to predict with reasonable accuracy the poverty status of households. To accomplish this objective, we develop a formula to calculate a correlation coefficient between any proxy variable with the poverty status of households. This correlation coefficient helps in identifying the proxy variables.

We are experimenting and developing a new proxy means test for Dibao. Our proposed proxy means test will design a decision rule that determines which household we should or should not include in the program. One can arrive at such a decision rule by a set easily identifiable by proxy variables at the household level. The local authorities can collect information on proxy variables from households using a small questionnaire,

Such a system will be an objective way of selecting beneficiaries of the program. We believe that such a system will significantly improve targeting and reduce the cost of running the program. That should help China to achieve its goal of eradicating extreme poverty by 2020.

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