The Newest Poverty Targeting Program in Mongolia —Child Money Program— Evaluation and Assessment of Its Targeting Methodology

by

Uranbileg Batjargal*

Graduate School of Economics, University of Tokyo

January 2006

Abstract

This paper assesses implementation and targeting methodology of the newest poverty targeting program in Mongolia—Child Money Program. Using a household survey data and national and international poverty lines, the paper computes rates of undercoverage and leakage of the program. The Child Money Program uses a proxy-means testing method –Poverty Risk Ratio (PRR) method—to identify eligibility of applicants. Alternative methods such as: OLS regression on consumption (income) and Probit and Logit estimation of households' likelihood of being poor are assessed and their targeting performances are compared to the targeting accuracy of the PRR method. I find that the current targeting method has large inclusion and exclusion errors that could be improved through usage of alternative targeting tools that are proposed here.

Keywords: Poverty targeting; targeting accuracy; proxy means testing

Acknowledgements: I would like to thank Professor Yasuyuki Sawada and Professor Akihiko Matsui of the University of Tokyo and Caridad M. Araujo of the World Bank for useful advice and guidance. Household survey part of this paper was funded by the World Bank and the 21st Century Center of Excellence Program (COE) of the University of Tokyo through contracts with Professor Yasuyuki Sawada and Professor Akihiko Matsui. The World Bank was cooperative in providing information regarding the Child Money Program. I would also like to acknowledge contributions of all individuals who participated in the survey implementation. All mistakes in this paper are mine.

* E-mail: uranbileg@yahoo.com Student ID: 46027

1. Introduction

Reducing poverty has become one of the top priorities of the global society since the Millennium Declaration was signed in September 2000. One hundred eighty-nine United Nations' member countries agreed to work toward global poverty reduction by setting the Millennium Development Goals (MDGs). The Millennium Development Goals are specific numerical targets of poverty reduction that should be achieved by 2015. Target 1 of Goal 1 is to halve the number of people who live in extreme poverty (subsist on less than 1 U.S. dollar a day) by 2015. The Government of Mongolia has made poverty reduction one of its stated priorities and committed itself to Target 1 of the MDGs. The most recent governmental poverty-reduction initiative is implementation of the Child Money Program (CMP)—a conditional cash transfer to poor households with children. The CMP is the biggest poverty-targeting program in Mongolia in terms of both coverage and costs. At present, 608,638 children of 303,225 poor households are identified as beneficiaries. The number of beneficiaries is very large as the total population of 0-17 years olds in 2004 was 946,023. Based on that data, approximately 64.3% of the population aged 0-17 is classified as poor. This number is significantly larger than what the government estimated before the program was implemented. As a result, the fiscal feasibility of the CMP is being questioned. Targeting errors of the CMP also raise concerns.

The Child Money Program utilizes a new method of identifying a households' subsistence level. The new method employs a so-called proxy-means testing method, where a households' subsistence level is calculated based on several observable proxy indicators, instead of direct data on income or expense. Proxy means testing is a useful method especially in developing countries where verification of income and household consumption is difficult. In principle, conducting a means test (i.e. a test comparing a households' income or consumption with the minimum level of subsistence) is the best way to determine eligibility for welfare programs. However, applicants have incentives to deliberately understate their welfare level to qualify for benefits. Additionally, a reliable system of recording and verifying households' welfare does not exist in most developing countries. Thus, it is necessary to use other household characteristics as proxies for income (and consumption). Proxy means testing is premised on a few household characteristics that are: 1. highly correlated with income or consumption; 2. easy to measure and observe; and 3. difficult to manipulate. Once the variables are chosen, statistical methods are used to associate a weight with each variable. The success of the proxy means testing depends largely on the verifiability of the proxy variables and the existence of an information system that is capable of reliably gathering information from the households (human resources and information technology).

This paper analyzes the Child Money Program and its targeting methodology. By using national and international poverty lines and survey data on households' welfare, the paper assesses the targeting accuracy of the current methodology of the CMP. The paper also assesses several alternative tools to determine poverty and compares their targeting performance with the targeting performance of the CMP. Alternatives tools assessed include: Ordinary Least Squares regression models of household consumption and income and Probit and Logit estimations of households' likelihood of being poor. To ensure robustness, six different indicators for welfare are considered and compared. Benchmarks for targeting accuracy of the methods are rates of undercoverage and leakage. Rates of undercoverage and leakage are computed at both the household-level and the individual-level.

2. Child Money Program and its Targeting Methodology

The Child Money Program is a conditional cash transfer program that provides 3,000 MNT (about U.S. $2.6) per child per month, targeted for families with a living standard below the minimum subsistence level. To qualify for Child Money, households must satisfy all of the following conditions: 1.Earn income below the minimum subsistence level; 2. Have at least one child aged 17 years or younger[1]; 3. All children of official school age must be enrolled in school; 4. Children must have received their mandatory immunizations; 5. Children must live with their parents or legal custodians; and 6. Children must not be engaged in illegal child labor. The primary aims of the Child Money Program are to alleviate poverty, promote school enrollment and lower the incidence of illegal child labor.

The Government of Mongolia uses a special method for identifying the living standard of households to ensure better targeting and poverty reduction. The living standard of households eligible to receive Child Money is determined according to the Household Subsistence Level Assessment Methodology—a so called Poverty Risk Ratio (PRR) method--approved by a joint decree of the Minister of Social Welfare and Labor and the Chairman of the National Statistical Office. This methodology is thoroughly different from the previous methodology where khoroo[2], soum[3], and bagh[4]governors used monetary income indicators when determining households and citizens eligible for social welfare benefits and support. The PRR method uses 11 proxy indicators to evaluate the living standard of households instead of using the level of the household's income and expenses. The PRR method uses proxy-means testing method. Proxy indicators include 5 sets of indicators of households subsistence capacity (location, dwelling type, household size, education level and employment of household members); 4 sets of indicators of households' economical situation (ownership of monetary assets, the number of members with income, vehicle ownership, livestock ownership, and assistance receipt situation) and 2 sets of indicators of the social vulnerability status of the household (members with disabilities and other vulnerable members).

Each indicator consists of a set of dummy variables and the PRR is computed for each group using the Living Standard Measurement Survey (LSMS) and the official poverty line. The PRR is based on the ratio between the proportion of the poor within the given group among the total poor and the share of the group in the total population. In particular, the PRR for any given group of interest (J group) is estimated according to the following formula:

$$PRR_J = \frac{N_{PJ}}{N_P} \Big/ \frac{N_J}{N} \quad (1)$$

where N_{PJ} is the number of poor in group J, N_P is the number of poor in the country, N_J is the number of people in the group J, and N is the total population of the country. J is any given group of people of interest. For example, "Group UB" can consist of people who live in Ulaanbaatar and "Group AG" can refer to people who live in aimag centers. Poverty Risk Ratios are calculated for each group of interest using the LSMS 2002-2003 data. These ratios are taken as weights for each dummy variable and used to determine each household's living standard. Dummy variables included in the proxy-means testing and weights applied are described in the Table 2.1.

[1] Till the July 1st of 2005, CMP covered only poor households with 3 or more children of age between 0 and 18 years old.
[2] Khoroo is the smallest administrative unit in Ulaanbaatar
[3] Soum is an administrative unit in aimag (prefecture)
[4] Bagh is the smallest administrative unit in aimag

Table 2.1: Proxy indicators included in PRR method and weights

Category No.	Proxy indicators and weights		
I. Proxy indicators for household's subsistence capacity			
1	**Location**	**Urban Index**	**Rural Index**
	Ulaanbaatar	0.755	-
	Aimag[5] center	0.941	-
	Soum center	1.235	-
	Countryside	1.183	-
2	**Number of Household members**		
	1	0.120	0.120
	2	0.214	0.214
	3	0.431	0.431
	4	0.652	0.652
	5	0.951	0.951
	6	1.342	1.342
	7	1.586	1.586
	8 or more	1.916	1.916
3	**Education level**		
	Tertiary	0.322	0.322
	Diploma level higher education (technical college)	0.647	0.647
	Vocational	1.127	1.127
	Complete secondary (10^{th} grade)	0.968	0.968
	Incomplete secondary (8^{th} grade)	1.258	1.258
	Primary	1.261	1.261
	No education	1.286	1.286
4	**Employment status**		
	State-budget organization	0.715	0.715
	State-owned enterprise	0.585	0.585
	Owner of private business or company	0.628	0.628
	Employee at private company	0.963	0.963
	Herder	0.945	1.087
	Farmer, agricultural laborer	1.167	1.187
	Informal sector worker	0.788	0.788
	International organizations	0.522	0.522
	NGOs	0.829	0.829
	Temporary or seasonal worker	1.150	1.150
	Military person	0.749	0.749
	Pensioner	0.987	0.987
	Unemployed	1.333	1.333
	Incapable of working	1.423	1.423
5	**Housing condition**		
	Ger	1.319	1.125
	Comfortable residence	0.499	0.965
	Apartment	0.942	1.115
	Public house	0.975	1.145
	Renting	1.115	1.135
	Places not for inhabitance purposes	1.205	1.205
	Manholes, entrance halls of apartment	1.442	-

[5] Aimag is an administrative unit equivalent to a prefecture

II. Economical indicators of households			
6	**Assets**	**Urban Index**	**Rural Index**
	Monetary asset	0.342	0.542
	Livestock - (more than 4 livestock measured in large animal)	0.858	0.000
	Land /(income generating)	0.885	0.885
	Shop, Kiosk	0.625	0.625
	Restaurant, cafeteria	0.635	0.735
	Private company	0.458	0.458
	2 of the above	0.326	0.326
	More than 3 of the above	0.302	0.302
	None of the above	1.034	1.034
7	**Number of members with income**		
	1	0.963	-
	2	0.813	-
	3	0.763	-
	More than 4	0.613	-
	No member with income	1.113	-
	Livestock		
	Less than 4	-	1.113
	5-10	-	0.963
	11-20	-	0.763
	21-30	-	0.545
	30-50	-	0.382
	More than 50	-	0.245
	No livestock	-	1.425
8	**Vehicle ownership**		
	Car	0.502	0.502
	Motorcycle	0.781	0.780
	Tractor	0.825	0.820
	Carriage (horse pulled, ox pulled, camel pulled)	0.96	0.960
	No vehicle	1.113	1.113
9	**Social assistance and benefits**		
	Receives assistance from Social Assistance Fund	1.141	1.141
	Receives assistance from NGOs	1.125	1.125
	Receives assistance from relatives and other individuals	0.978	0.978
	Receives assistance from abroad	0.846	0.846
	No assistance	0.938	0.938
III. Indicators of social vulnerability of households			
10	**Members with disability or development difficulty**	**Urban Index**	**Rural Index**
	Speech or hearing impaired	1.364	1.364
	Sight-impaired /blind/	1.382	1.382
	Physically-handicapped /on wheel-chair or walks with crutches/	1.426	1.426
	Mentally- handicapped	1.432	1.432
	Bedridden /requires nursing/	1.456	1.456
	2 of the above	1.683	1.683
	3 of the above	1.824	1.824
	None of the above	0.826	0.826
11	**Household vulnerability**		
	Alcoholic	0.985	0.985
	Elderly (70 years and older)	1.085	1.085
	Orphan	1.167	1.167
	Single household head with 4 or more children	1.184	1.184
	Single elderly	1.216	1.216
	2 of the above	1.384	1.384
	3 of the above	1.582	1.582
	None of the above	0.852	0.852

When determining a household's living standard, values for each indicator in Table 2.1 is multiplied by the weights provided in the Table 2.1. The arithmetical average is then taken for each one of the 11 sets of indicators. An overall evaluation of a household's living standard is computed by adding the values of the 11 poverty risk ratios and dividing by 11. In particular, the following formula is applied:

$$PRR_{household} = \frac{1}{11} * \sum_{i=1}^{i=11} PRR_i \quad (2)$$

where PRR_i is the household's poverty risk ratio for category i in Table 2.1.

If $PRR_{household}$ is equal to 1, then the household is on the poverty line. If $PRR_{household}$ is greater than 1, then the household has a high risk for poverty. Finally, if $PRR_{household}$ is less than 1, then the household has a lower risk of falling into poverty[6]. The interval for identifying living standards is shown in Table 2.2.

Table 2.2: The living standard level of households and individuals

Living standard	$PRR_{household}$
1.Wealthy	Smaller than 0.650
2. Reasonable	0.651-0.800
3. Average	0.801-0.950
4. Poor	0.951-1.115
5. Severely poor	Bigger than 1.115

The Child Money Program (CMP) has several shortcomings at the implementation, monitoring and evaluation levels. The biggest problem is that proxy indicators and weights are widely known to the applicants, which makes manipulation of variables easy and diminishes the targeting accuracy of the program. To ensure successful poverty alleviation, all these issues are extremely important. However, this paper focuses on assessment of targeting methodology of the CMP. Thus, the analysis will focus on the PRR method. More details on the CMP are provided in the Appendix 1.

3. Data

The data used in this paper comes from a household survey conducted in April 2005 exclusively for the purpose of evaluating the Child Money Program and land privatization in Mongolia. That survey covered 415 households of 8 khoroos of 5 districts of Ulaanbaatar. Due to resource constraints, only Ulaanbaatar was covered. The survey questionnaire was designed according to standard LSMS survey design and samples were selected through a multi-stage stratified random sampling method. A full description of the survey and data is provided in Appendix 2. The survey dataset contains information on households' monthly food expense, income from various sources, social welfare receipt status, ownership of assets, consumption patterns, child money receipt status, education level and employment of each members, dwelling type and land ownership status. The original dataset contained almost all information needed to assess the current targeting methodology for the Child Money Program--Poverty Risk Ratio computation method. Many household level variables pertinent to the analysis were constructed using individual level dataset and/or through combining answers to several questions. For the purpose of getting accurate estimation, outliers and missing values were dropped and an even dataset of approximately 403 households was used for the final analysis.

[6] The method allows measurement errors of 5%, therefore the actual cut-off point for poverty is set at 0.95 rather than at 1.

4. Welfare Measurement and Poverty Lines

Welfare measurement

Although there are different ways to measure poverty, the most commonly used measures are head count and poverty gap ratios based on consumption and income information. These indicators are shown conveniently by the Foster, Greer, Thorbecke (1984)'s FGT poverty measure, $P(\alpha)$:

$$P(\alpha) = \int_0^Z \left(\frac{Z - C}{Z} \right)^{\alpha} f(C) dC, \alpha \geq 0 \tag{3}$$

where C is current consumption (or income) level, Z is poverty line, and f(C) is consumption (or income) density or distribution function. The FGT measure is a widely used static poverty measure and satisfies Sen (1976)'s criteria of poverty measure such as Monotonicity Axiom (when $\alpha > 0$), Transfer Axiom (when $\alpha > 1$). This measure takes standard static poverty measure as a special case. For example, $P(0)$ is head count ratio and $P(1)$ is poverty gap ratio.[7]

Consumption is usually the preferred measure because it is more likely to be accurate and useful measure of living standards. Our survey dataset contains information on monthly food expenditure of the household and monthly income of each individual. No information was gathered about expenditure other than food expenses. Also, the definition of "household" in our survey was different from typical household definitions. "Household" is defined as a group of individuals who live together and have a common budget for expenses, regardless of their registration with local administration or relationship with the head of the household. Therefore, in some cases, a friend living under the same roof and sharing a budget is counted as a member of the household. Also, co-residents (grandchildren, grandparents, or siblings) are counted as members of one household as long as they share the same budget for expenses. For these reasons, there is no "gold standard" to measure welfare of the households in the dataset. In order to assure robustness in my analysis, I consider 6 different indicators of poverty measurement:

1. Per capita food consumption for all members of a household;
2. Per capita food consumption for core members of a household (non-relatives and friends excluded);
3. Adult equivalent food expense for all members of a household;
4. Adult equivalent food expense for core members of a household;
5. Per capita income for all members of a household; and
6. Per capita income core members of a household.

To accurately portray the welfare situation of individuals from household level welfare indicators such as total consumption and total income, it is important to make two kinds of adjustments. The first relates to demographic composition. Household members have different needs based mainly on their age and gender. Therefore, equivalence scales need to be applied to correctly compare subsistence level of households. For example, if a comparison is made between two households with the same total consumption and equal number of members, but one has children while the other has only adult members, it would be expected that the former have a higher individual welfare than the later. Unfortunately, there is no consistent methodology to calculate adult equivalence scales. The second adjustment takes into account economies of scale in consumption within the household. The basic argument here is that some of the goods and services consumed by the households have properties of public goods. Thus, larger households may spend less to be as well-off as smaller households.

For the analysis in this paper, I use a per capita adjustment for household composition as well as adult equivalent scale adjustment using following weights per age group. Weights used are: for members 1-7 years old=0.2; members 8-15 years old=0.4; members 16-24 years old=0.8; and members 25 years

[7] Foster, James, Joel Greer and Erik Thorbecke (1984)

old and above=1.0.[8] I make no distinctions among different genders. I also ignore the adjustment for economies of scales of the consumption, as my welfare indicators are based on food consumption and food is considered a private good that cannot be consumed by two individuals at the same time.

I also identify poverty status of households using first 4 measurements described above and a food poverty line as of April 2005 (when the data was collected). Poverty status based on income is also determined using different poverty lines.

Poverty lines

In order to assess the proportion of households and individuals that are poor, we need a reliable estimate of poverty line. Poverty line can be a domestic poverty line, which is commonly set by the local government agency, or an international poverty line, which is pegged at U.S. $1 per capita per day purchasing power parity (PPP) equivalent.[9] An international poverty line is important, as Mongolia is committed to accomplishing the Target 1 of the MDGs, i.e., to halve the proportion of people living in extreme poverty (below one dollar one person per day) by 2015. This poverty line was not applied carefully when Mongolia's progress on the MDGs was evaluated. I use a domestic poverty line for the analysis in this paper, and provide a sensitivity analysis using an international poverty line.

I calculated national poverty lines for April 2005 using national poverty lines in 2002 and inflation rates for 2003, 2004, and 2005. According to the LSMS/HIES 2002-2003, the food poverty line as of January 2003, calculated using bottom 40% of the population according to the "Cost of Basic Needs Method" was 14,386 MNT a month.[10] The lower poverty line was 24,743 MNT a month and the upper poverty line was 32,370 MNT a month. The inflation rates were 4.7% for 2003, 11% for 2004, and 5.5 % for the first two months of 2005. Thus, the food poverty line for April 2005 (when the data was collected) is estimated to be 17,639 MNT a month. The national poverty line is calculated to be 30,337 MNT a month. It would be best if adult equivalent poverty lines were available to correctly measure poverty status using adult equivalent food expenses. However, such data is not available, and I use national food poverty line when identifying households' poverty status based on adult equivalent consumption.

Setting a poverty line is a sensitive matter as people do not easily agree on what "minimum" is when measuring welfare. Conclusions based on usage of the national poverty line alone might be inaccurate. In order to ensure robustness, I conducted sensitivity analysis using global poverty line of U.S. $1.08 per capita per day. The use of consumption based purchasing power parity (PPP) exchange rate to convert the U.S. $1.08 a day global poverty line to local currency is generally considered acceptable. The World Bank provides the relevant values of PPP for each country in the world including Mongolia. First, I compute the purchasing power parity (PPP) exchange rate for April 2005. PPP for Mongolia for a period t is defined as:

$$\frac{P_t^{MG}}{P_{1993}^{US}}, \tag{4}$$

where P_t^{MG} is the overall price level in Mongolia at the period t and P_{1993}^{US} is the aggregate price level in the US in the benchmark year, 1993. PPP for 1993 is available from the World Bank. I utilize national level consumer price indices to compute the PPP for April 2005 (s) by employing the following formula:

$$\underbrace{\frac{P_s^{MG}}{P_{1993}^{US}}}_{\text{PPP in period s}} = \underbrace{\frac{P_{1993}^{MG}}{P_{1993}^{US}}}_{\text{Baseline PPP}} \times \underbrace{\frac{P_s^{MG}}{P_{1993}^{MG}}}_{\text{CPI for Mongolia}}, \tag{5}$$

[8] Quisumbing, A., L.Haddad, and C.Pena (2001)

[9] The international poverty line of US$ 1 per capita per day is estimated to be US$1.08 per capita per month when applied for 1993 prices. Source: Chen, Shaohua, and Martin Ravallion.

[10] National Statistical Office of Mongolia, World Bank, UNDP

Note that the PPP represented by equation (5) is "fixed" at real terms of the 1993 price level in the U.S. According to the World Bank's Global Poverty Monitoring homepage, PPP exchange rate in 1993 for Mongolia was U.S. $1=52.482 MNT. Using consumer price indices (CPI) extracted from the International Financial Statistics by International Monetary Fund, Mongolia's PPP in April 2005 was calculated to be 544.21 MNT per dollar. This suggests that the estimated international poverty line for Mongolia in April is 17,817 MNT a month. This international poverty line is much lower than the national poverty line of 30,337 MNT a month. Since our dataset contains information only on food consumption, rather than the total consumption, food poverty lines based on an international poverty line of U.S. $1.08 a day needed to be calculated. Shares of food components in national poverty line of 2002/2003 were 44.4% and 58.1% for upper and lower poverty lines, respectively. In order to draw more robust conclusions, I used 3 different food poverty lines based on the U.S. $ 1.08 a day poverty line, where the shares of food components in total poverty line were set at 50%, 60% and 70% respectively. Three scenarios of international food poverty line for Mongolia are set at 12472.1 MNT a month, 10690.4 MNT a month, and 8908.6 MNT a month, respectively. A sensitivity check of the analysis was conducted using these three different international food poverty lines and the results are reported in the section 8.

Methodology of the Analysis

Methodology of the analysis conducted in this paper is as follows:

Measuring "True" Welfare

First, I measure the "true" welfare of households using six welfare indictors described in the previous section. "True" poverty status is also measured using consumption, income and associated poverty lines. A household is classified as poor if W<Z, where W and Z are welfare indicator (consumption or income) and the associated poverty line, respectively.

Predicting Welfare

Second, I predict values of six welfare indicators using Ordinary Least Squares (OLS) regressions through varying sets of explanatory variables that are highly correlated with the welfare measures used. A stepwise function is used as it is designed to eliminate variables that are not statistically significant and that do not increase the model's overall explaining powers from the regressions.

Linear model for predicting the household's welfare can be written as:

$$Y_i^* = \beta_0 + X_i\beta + \varepsilon_i. \quad (6)$$

where Y_i^* is a continuous variable which indicate the welfare measurement (income or consumption), X_i is the vector of explanatory variables which determine the welfare and ε is the error term. Ordinary Least Squares (OLS) regressions minimize the squared errors between the "true" and predicted levels of welfare.

I also predict poverty status of households, using Probit and Logit estimation for the same sets of explanatory variables used in OLS regressions. Nonlinear statistical model that relates the choice of probability to explanatory variables in such a way that the predicted probability remains between 0 and 1 can be written as below:

$$P_i^* = \beta_0 + X_i\beta + \varepsilon_i. \quad (7)$$

where P_i^* is a continuous latent variable which indicates the degree of poverty, X_i is the vector of explanatory variables that determines the probability of living in poverty, and ε is the error term. When we run the Logit or Probit we do not observe P_i^* but a dummy variable that takes the following values:

$$P_i = 1 \text{ if } P_i^* > 0, \quad (8)$$
$$P_i = 0 \; P_i^* \leq 0$$

P_i is a discrete variable that takes the value of unity if the household welfare falls below the poverty line. Thus the probability that the household is poor, for each poverty line, can be written as

(9) $\Pr(P=1) = \Pr[\varepsilon > -\beta X] = 1 - F(-\beta X)$

where F is the cumulative distribution. Beta is estimated using maximum likelihood, which is equal to

(10) $\Pr(P=1) = \exp(-\beta X)/[1-\exp(-\beta X)]$ for logit estimation

(11) $\Pr(P=1) = \phi(\beta' x)$ for probit estimation

Selection of Variables and Models

When predicting welfare and poverty status, it is important to select variables that are closely correlated with welfare to ensure accuracy in prediction. I used five classes of independent variables—1. housing quality; 2. family characteristics (including characteristics of the head of a household); 3. ownership of durables assets; 4. vulnerability status of households; and 5. consumption patterns and behaviors of the household. For the process of the analysis more sets of variables were used such as characteristics of the oldest wage earner, credit constraint and borrowing patterns of households, and characteristics of the spouse. Seven sets of proxy variables are explored for each welfare indicator. Model 0 uses the same proxy variables that are used to determine households' eligibility for the Child Money Program and is estimated for all variables without dropping insignificant variables. Model 1-Model 6 uses step-wise method, which chooses only the best-fit variables. Model 1 uses dwelling characteristics, family characteristics and ownership of durable goods as explanatory variables. Model 2 adds proxies for vulnerability of the households to the variables used in the Model 1. Model 3 adds information about the consumption patterns of the households to the variables used in Model 2. Model 4 uses all variables used in Model 0 and additional proxies of family characteristics, ownership of durable goods and consumption patterns. Model 5 uses all variables used in Model 4 except proxies for consumption patterns. Model 6 uses only variables that are used to determine households' eligibility for the Child Money Program (thus, same as Model 0). Different combinations of models and explanatory variables were tried and targeting accuracy was compared. In the interest of efficiency, I report only the most significant and important results. Consumption proxies were treated as separate set of explanatory variables and tried in addition to other proxies (in Models 3 and 4) because they are powerful proxies to predict households' welfare but are very difficult to verify and easy to manipulate. For actual implementation of the targeting tools, consumption proxies might not be very useful. Nevertheless, I report the findings for comparison purposes. More complete description of models and explanatory variables is provided in the section 7.

Targeting Accuracy

One of the most common approaches to assess targeting accuracy of welfare programs is to look at "Errors of Inclusion" and "Errors of Exclusion". I calculated the "Undercoverage" and "Leakage" rates from the errors of inclusion and exclusion. Households are categorized in four groups according to whether their "true" and predicted welfare levels fall above or below the eligibility cutoff point. I used national poverty line as the cut-off line. Households whose "true" and predicted welfare levels both fall in the same side of the cut-off line are considered successfully targeted. When households' "true" welfare is above the poverty line but the predicted welfare falls below the poverty line, inclusion error has occurred. On the other hand, exclusion error occurs when households' welfare level is predicted to be above the poverty line (non-poor) when the "true" welfare level is below the poverty line (poor). In the Table 4.1, B_W (pink cell) shows the errors of exclusion and C_W (yellow cell) represents the errors of inclusion where W is the welfare measurement or method. A_W and D_W (light blue cells) are targeting successes.

Table 4.1: Errors of Inclusion and Errors of Exclusion

True Poverty Status		Predicted Poverty Status: Poor	Predicted Poverty Status: Non-poor	Total
	Poor	A_W	B_W	$(A_W + B_W)$
	Non-poor	C_W	D_W	$(C_W + D_W)$
	Total	$(A_W + C_W)$	$(B_W + D_W)$	

"Undercoverage" rate, which is calculated by dividing the exclusion error by the total number of households who should get the benefit, shows the percentage of those who are meant to be covered by the program, but are not covered. "Leakage rate" is the percentage of program benefits that are received by people who are not eligible to receive the benefits. It is calculated by dividing the inclusion errors by the total number of persons served by the program. In particular, using the notations in Table 4.1, rates of undercoverage (UR_W) and leakage (LR_W), when the welfare measurement is *W,* can be written as:

(12) $$UR_W = \frac{B_W}{A_W + B_W} * 100\%$$

(13) $$LR_W = \frac{C_W}{A_W + C_W} * 100\%$$

Undercoverage makes the program ineffective in changing the welfare level of the intended beneficiaries, but bears no budgetary costs. Leakage increases program costs by giving benefits to those whom the program is not intended to serve. Lower rates of undercoverage and leakage are preferable than higher rates. However, it is difficult to compare rates of undercoverage and leakage to each other. In general, the higher the priority to raise the welfare of the poor and eliminate poverty, the more important it is to eliminate undercoverage. When there is a limited budget available to achieve a certain degree of success in eliminating poverty, lowering leakage rates becomes more important.

The analysis of this paper is conducted on household-level not on individual-level. Thus, when determining a targeting accuracy of the program under a certain targeting method, the paper considers how many households' welfare was misclassified instead of looking at how many individuals' welfare was misclassified. Logical justification is: although the size of the benefit depends on the number of children in a household, the Child Money is provided to poor households (not poor individuals). Analysis on individual-level was also conducted and its results were compared to the results of a household-level analysis in section 9.

5. Assessment of Current Methodology for Child Money Program

By using six different indicators for poverty measurement, I explored undercoverage and leakage rates of the Child Money Program. Note that here undercoverage and leakage rates are based on the actual status of Child Money receipt. In particular, rates of undercoverage (UR_{CMP}) and leakage (LR_{CMP}) of the Child Money Program are calculated as:

(14) $$UR_{CMP} = \frac{\text{Poor households who don't receive the Child Money}}{\text{Total number of poor households}} * 100\%$$

(15) $$LR_{CMP} = \frac{\text{Non-poor households who receive the Child Money}}{\text{Total number of households who receive the Child Money}} * 100\%$$

Leakage rate is estimated to be 3.23%-24.18% depending on the welfare indicators selected to

measure the "true" welfare of the households. Undercoverage rate is estimated to be 68.97%- 72.12%. Since Child Money is a benefit for children, I calculate the undercoverage and leakage rate restricting the sample to households with at least one child aged 0-17 years old. Undercoverage and leakage rates are estimated to be 64.21%-67.57% and 3.3%-24.44%, respectively. At the time of the survey, Child Money was provided only for households with 3 or more children. Therefore, I calculated undercoverage and leakage rates restricting the sample to households with 3 or more children of 0-17 years old. Here again, leakage rate is estimated to be around 3.33%-23.6% and undercoverage rate is estimated to be around 20.93%-26.27%. More detailed information on inclusion and exclusion errors is provided in the Appendix 4.

Table 5.1: Undercoverage and Leakage Rates of Child Money Program[11]

	All households		Households with 3 or more children		All households with children	
Welfare indicator	Under coverage rate (UR_{CMP})	Leakage rate (LR_{CMP})	Under coverage rate (UR_{CMP})	Leakage rate (LR_{CMP})	Under coverage rate (UR_{CMP})	Leakage rate (LR_{CMP})
PC food expense for all members	71.52%	6.52%	24.32%	5.62%	67.57%	6.67%
PC food expense for core members	72.12%	5.43%	24.78%	4.49%	67.80%	5.56%
AE food expense for all members	70.00%	24.18%	20.93%	23.60%	64.21%	24.44%
AE food expense for core members	71.49%	24.18%	21.84%	23.60%	65.66%	24.44%
PC income for all members	68.97%	3.23%	26.27%	3.33%	64.66%	3.30%
PC income for core members	69.39%	3.23%	25.64%	3.33%	64.66%	3.30%

Undercoverage and leakages occur through two stages: household's living standard identification stage and actual program implementation stage. The former is associated with the properties of the targeting methodology while the later is resulted from implementation, monitoring and evaluation process of the program. I explore errors at each level separately.

Errors at Households' Living Standard Identification Level: Replica of Poverty Risk Ratio (PRR)

I tried to make a replica of PRR using same proxy indicators and weights as used in the actual calculation of PRR. It is not possible to do a perfect replica, as some of the variables in PRR are not included in my survey dataset. Appendix 3 describes the variables used to calculate PRR. Variables that were not used in my replication are marked with X. Poverty Risk Ratio (PRR) is replicated and the poverty status based on the PRR method is checked against the "true" welfare level. In particular, rates of undercoverage (UR_{PRR}) and leakage (LR_{PRR}) under the PRR method are calculated as:

$$(16) \qquad UR_{PRR} = \frac{\text{Number of poor households who are identified as non - poor by PRR method}}{\text{Total number of poor households}} * 100\%$$

$$(17) \qquad LR_{PRR} = \frac{\text{Number of non - poor households who are identifed as poor by PRR method}}{\text{Total number of households who are identified as poor by PRR method}} * 100\%$$

My analysis finds that the current method for determining the living standard of households (PRR method) has high inclusion and exclusion errors. Undercoverage and leakage rates are estimated to be 40%-43% and 11.71%-29.59% respectively, depending on the welfare indicators to which PRR is compared. The most significant problem is the existence of high undercoverage. During a qualitative assessment of the program, many households and social workers complained that PRR method was too strict and incorrectly identifies many poor households as non-poor. Therefore, many proxy indicators are deliberately misreported or manipulated as a result of pressuring and negotiating with social workers who actually calculate the PRR. Strict eligibility conditions for the program ultimately worsens its targeting performance through increasing households' incentives to provide false information and opening a room for social workers' to cooperate in manipulating household's data. In some cases, social workers feel

[11] Refer to Table A.4.1 for details

obliged to help the family "to become poor" because they feel that "they know that the household is actually poor, but the PRR method is wrong". It increases dispute over households' eligibility as well as the administrative costs of the program.

Table 5.2: Undercoverage and Leakage Rates Under PRR Method[12]

Welfare indicator	Undercoverage rate (UR_{PRR})	Leakage rate (LR_{PRR})
PC food expense for all members	43.05%	12.69%
PC food expense for core members	41.99%	11.71%
AE food expense for all members	40.00%	29.59%
AE food expense for core members	40.08%	28.92%
PC income for all members	41.72%	12.89%
PC income for core members	40.82%	13.86%

Errors at the Implementation Level

In order to check how much data manipulation and misreporting has occurred at the implementation level, I compared the actual child money recipient status of households to predicted living standard of the household according to the PRR method. Rates of undercoverage (UR_I) and leakage (LR_I) at the implementation level are calculated as:

$$(18) \qquad UR_I = \frac{\text{Households who are identified as poor by PRR method who don't receive Child Money}}{\text{Total number of households who are identified as poor by the PRR method}} * 100\%$$

$$(19) \qquad LR_I = \frac{\text{Households who are identified as non-poor by PRR method who receive Child Money}}{\text{Total number of households who receive Child Money}} * 100\%$$

Out of all the households who receive Child Money, 23.66%-25.81% are identified as non-poor by the PRR method while 66.5%-66.82% of the poor households are excluded from the benefit. For a sample consisting of households with children, undercoverage rate is calculated to be 62.64%-52.96% while leakage rate is estimated to be 23.08%-25.27%. This high exclusion error is associated with the eligibility condition of having 3 or more children (at the time of the survey). Therefore, I calculated inclusion and exclusion errors only for households with 3 or more children. Out of all the households who have 3 or more children and who are identified as poor by the PRR method, 30.61%-31.03% are excluded from the program. Leakage rate is estimated to be 22.22%-24.44%, which means that almost every fourth household that received the benefit was identified as non-poor by the PRR method. Moreover, while 10.95%-11.48% of the all households that were identified as non-poor by PRR method receive child money, 68.97%-70.97% of the households who have 3 or more children that were identified as non-poor by PPR method received the benefit[13]. This suggests that most of the households with 3 or more children were able to receive the benefit regardless of their living standard identified by the PRR method and implies the existence of serious data manipulation and misreporting at the program implementation level.

Table 5.3: Undercoverage and Leakage Rates of Child Money Program[14]

	All households		Households with 3 or more children		All households with children	
Welfare indicator	Under coverage rate (UR_I)	Leakage rate (LR_I)	Under coverage rate (UR_I)	Leakage rate (LR_I)	Under coverage rate (UR_I)	Leakage rate (LR_I)
PRR for All members	66.50%	25.81%	30.61%	24.44%	62.64%	25.27%
PRR for Core members	66.82%	23.66%	31.03%	22.22%	62.96%	23.08%

[12] Refer to Table A.4.2 for details
[13] Refer to Table A.4.3 for details.
[14] Refer to Table A.4.3 for details

The fact that the undercoverage rates decline once the sample is restricted to households with 3 or more children suggests that this eligibility condition is worsening the targeting accuracy of the program. It is widely known that household size is highly correlated with poverty. However, having number of children as a separate eligibility condition for the program, on top of including proxies for household size in the PRR calculation might be over restrictive. Many researchers including the World Bank experts pointed this out and the Government of Mongolia decided to further extend the program to households with 1 or 2 children. Since the July 1st of 2005, the Child Money Program started serving all poor households with children. However, no refinements were made to the PRR method and no significant improvements were made to the implementation, monitoring and evaluation process of the program. As a result, the program has come to face financial difficulties due to sudden expansion of the beneficiaries.

6. Description of Alternative Targeting Tools

Alternative targeting tools that are assessed are summarized in Table 6.1. Twenty one models were tried and their targeting properties are compared to those of the PRR method. Models 0, 1, 2, 3, 4, 5 and 6 are ordinary least squares (OLS) regressions on the logarithm of welfare indicators. Models 0A, 1A, 2A, 3A, 4A, 5A and 6A use probit estimation of the likelihood of being poor. Finally, Models 0B, 1B, 2B, 3B, 4B, 5B and 6B use logit estimation of the likelihood of being poor. Models 0, 0A and 0B uses all explaining variables for the estimation, while all other models select subsets of explanatory variables that best explain each welfare indicator.

Table 6.1: Summary of Alternative Targeting Tools

	Method	Explanatory variables	Criteria for variable selection
Model 0	OLS regression on consumption (income)	Same as PRR	All variables
Model 1	OLS regression on consumption (income)	Dwelling characteristics, family characteristics and ownership of durable goods	Best fit
Model 2	OLS regression on consumption (income)	Same as Model 0+ vulnerability of the households	Best fit
Model 3	OLS regression on consumption (income)	Same as Model 2+ consumption patterns of the household	Best fit
Model 4	OLS regression on consumption (income)	Same as PRR + family characteristics, ownership of durable goods and consumption patterns	Best fit
Model 5	OLS regression on consumption (income)	Same as Model 4 except consumption patterns	Best fit
Model 6	OLS regression on consumption (income)	Same as PRR	Best fit
Model 0A	Probit regression on poverty status	Same as Model 0	All variables
Model 1A	Probit regression on poverty status	Same as Model 1	Best fit
Model 2A	Probit regression on poverty status	Same as Model 2	Best fit
Model 3A	Probit regression on poverty status	Same as Model 3	Best fit
Model 4A	Probit regression on poverty status	Same as Model 4	Best fit
Model 5A	Probit regression on poverty status	Same as Model 5	Best fit
Model 6A	Probit regression on poverty status	Same as Model 6	Best fit
Model 0B	Logit regression on poverty status	Same as Model 0	All variables
Model 1B	Logit regression on poverty status	Same as Model 1	Best fit
Model 2B	Logit regression on poverty status	Same as Model 2	Best fit
Model 3B	Logit regression on poverty status	Same as Model 3	Best fit
Model 4B	Logit regression on poverty status	Same as Model 4	Best fit
Model 5B	Logit regression on poverty status	Same as Model 5	Best fit
Model 6B	Logit regression on poverty status	Same as Model 6	Best fit

For example, when Model 1 is applied to estimate per capita consumption for all members of the household, it selects variables that best explain per capita consumption from sets of variables about dwelling characteristics, family characteristics, and ownership of durable goods. This is done using a backwards step-wise estimation procedure, where the significance level of variable removal from the model is pre-set at 0.2 and the significant level of variable adding to the model is pre-set at 0.1. Each model is applied to estimate six different welfare indicators (and poverty status based on those indicators) described in the Section 3. Regression results of 126 models are provided in the Appendix 5. Description

of the explanatory variables used for the PRR replica is provided in the Appendix 3. Description of other explanatory variables used for models is summarized in the Table 6.2.

Table 6.2: Variables used in Models (by categories)

DWELLING CHARACTERISTICS
Dummy variables for ger; house and apartment
Dummy variables for existence of fence
Water source (1=pipeline; 2=well; 3=water vendor; 4=river and others)
Distance to the water source
FAMILY CHARACTERISTICS
Education level of the household head (Dummies for None; Primary; Lower Secondary; Upper Secondary; Vocational; Diploma; Bachelor degree; and Postgraduate)
Household size (dummy variables for 1; 2; 3; 4; 5; 6; 7 ; 8 and more)
Number of working members by education level (None; Primary; Lower Secondary; Upper Secondary; Vocational; Diploma; Bachelor degree; and Postgraduate)
Number of working age members by employment status (Employed in the public sector; Employed by private companies; Self-employed; Employed part-time or seasonally; Retired; Unemployed)
Number of members with income (Dummies for 1; 2; 3; and 4 or more)
Percentage share of non adult (0-17 years olds) members
Percentage share of school age (8-17 years olds) members
Percentage share of working age (16-55 for female and 16-60 for male) members
Percentage share of elderly (70 years old and older) members
Percentage share of male members
Number of members without registration with the local administration
Migrated to UB within last 5 years
Has registration with the local administration
Female headed
Single parented
VULNERABILTY OF THE HOUSEHOLD
Single elderly
Single head of a large household
A disabled member
Two vulnerable members
No vulnerable members
Receives assistance from NGOs
Receives assistance from relatives
Receives assistance from other
OWNERSHIP OF DURABLE GOODS
Ownership of a Black & White TV
Ownership of a color TV
Ownership of a cell phone
Ownership of an electric stove
Ownership of a video player
Ownership of a car
Ownership of a truck
Ownership of vehicle (car or truck)
Ownership of a refrigerator
Ownership of a fence around the ger
Ownership of a land permit
Ownership of a land
CONSUMPTION PATTERN AND BEHAVOUR OF A HOUSEHOLD
Frequency of fruit consumption (1=2 or more times a week; 2= once a week; 3=once a month; 4=on special occasions; 5=never)
Frequency of ham consumption (1=2 or more times a week; 2=once a week; 3=once a month; 4=on special occasions; 5=never)
Frequency of milk tea consumption (1=everyday; 2= 3-4times a week; 3=once a week; 4=on special occasions; 5=never)
Frequency of internet usage (1=everyday; 2= few times a week; 3=few times a month; 4=on special occasions; 5=never)
Frequency of phone usage (1=everyday; 2= few times a week; 3=few times a month; 4=on special occasions; 5=never)
Bathing frequency

7. Results

Rates of undercoverage and leakages are calculated using the "true" and estimated values of welfare indicators and poverty status for all models. In particular, rates of undercoverage (UR_{M_J}) and leakage (LR_{M_J}) under the Model J are calculated as:

$$UR_{M_J} = \frac{\text{Poor households who are identified as non - poor by Model J}}{\text{Total number of poor households}} * 100\% \quad (20)$$

$$LR_{M_J} = \frac{\text{Non - poor households who are identified as poor by Model J}}{\text{Total number of households are identifed as poor by Model J}} * 100\% \quad (21)$$

Alternative methods significantly improve the undercoverage rate of the program, regardless of what indicator is chosen to measure welfare. Undercoverage rates for the PRR method were 40.00%-43.05% while new models lower this value to 5.07%-23.08%. Models 4, 3A, 4A, 3B, 4B are especially powerful in accurately identifying poor households. The lowest value of undercoverage rates for different welfare indicators are 5.26% (Model 4) for per capita food consumption for all members; 5.44% (Model 4) for per capita food consumption for core members; 15.91% (Model 4A and 4B) for adult equivalent food consumption for all members; 13.38% (Model 4B) for adult equivalent food consumption for core members; 5.09% (Model 4) for per capita income for all members; and 5.32% (Model 4A) for per capita income for core members. These values are impressive as corresponding undercoverage rates using the PRR method were 43.05%; 41.99%; 40.00%; 40.08%; 41.72% and 40.82% respectively.

Table 7.1: Undercoverage and Leakage Rates under Alternative Targeting Tools[15]

Models	Welfare indicators	PC consumption for all members	PC consumption for core members	AE consumption for all members	AE consumption for core members	PC income for all members	PC income for core members
Model 0	Leakage rate	18.15%	16.57%	26.50%	25.20%	13.67%	13.03%
	Undercoverage rate	7.64%	7.05%	22.17%	19.40%	8.16%	6.64%
Model 1	Leakage rate	17.90%	15.11%	29.75%	23.89%	12.79%	10.07%
	Undercoverage rate	7.32%	5.07%	23.08%	18.61%	5.34%	6.29%
Model 2	Leakage rate	16.77%	14.94%	27.12%	22.86%	12.16%	10.37%
	Undercoverage rate	6.29%	5.74%	22.17%	18.18%	6.14%	5.96%
Model 3	Leakage rate	16.46%	**14.51%**	26.38%	23.69%	11.60%	11.71%
	Undercoverage rate	7.37%	**5.78%**	21.36%	17.75%	5.82%	6.05%
Model 4	Leakage rate	**16.15%**	**14.72%**	**24.89%**	22.98%	**10.62%**	**9.86%**
	Undercoverage rate	**5.26%**	**5.44%**	**20.45%**	16.96%	**5.09%**	**5.69%**
Model 5	Leakage rate	16.72%	14.77%	25.22%	**21.46%**	10.74%	10.63%
	Undercoverage rate	7.69%	6.10%	22.17%	**16.02%**	5.34%	5.61%
Model 6	Leakage rate	17.74%	16.01%	26.41%	25.59%	13.77%	13.92%
	Undercoverage rate	6.60%	6.71%	23.08%	18.53%	6.74%	6.99%

Notes: Values for the first best models are marked with bold letters, values for the second-best models are highlighted with shadows.

While improving undercoverage rate is an important issue and alternative models were extremely successful in accomplishing this goal, this alone does not determine the targeting accuracy of the models. Lower undercoverage comes hand in hand with higher leakages. Therefore, one has to consider the leakage rates as well. Leakage rates under PRR method were 11.71%-29.59% depending on the welfare indicator. Under the alternative methods, leakage rates are estimated to be 8.48%- 29.75% depending on the welfare indicators and models used for estimation. When per capita food consumption is used as the welfare indicator, leakage rates under the new methods are slightly higher than that of PRR

[15] Refer to Table A.4.4 for details

method. However, when adult equivalent food consumption and per capita income are used as welfare indicators, leakage rates under the alternative models are in most cases lower than the leakage rates under the PRR method. Specifically, lowest values of leakage rates for different welfare indicators are 12.83% (Model 3B) for per capita food consumption for all members; 11.33% (Model 4B) for per capita food consumption for core members; 20.60% (Model 4B) for adult equivalent food consumption for all members; 20.40% (Model 4B) for adult equivalent food consumption for core members; 8.42% (Model 5B) for per capita income for all members; and 8.93% (Model 4B) for per capita income for core members. The corresponding leakage rates using PRR method were 12.69%; 11.71%; 29.59%; 28.92%; 12.89% and 13.86% respectively. Here again, alternative methods perform significantly better than the PRR method. The first best values of undercoverage and leakage rates are marked with bold letters in the Table 7.1 and Table 7.2.

Table 7.2: Undercoverage and Leakage Rates under Alternative Targeting Tools[16]

Models	Welfare Indicator	Poverty Status based on PC consumption for all members	Poverty Status based on PC consumption for core members	Poverty Status based on AE consumption for all members	Poverty Status based on AE consumption for core members	Poverty Status based on PC income for all members	Poverty Status based on PC income for core members
Model 0A	Leakage rate	18.21%	16.04%	25.52%	25.40%	10.92%	13.92%
	Undercoverage rate	6.91%	6.32%	19.46%	18.97%	6.45%	6.01%
Model 1A	Leakage rate	17.03%	14.60%	25.74%	22.80%	12.04%	10.07%
	Undercoverage rate	6.62%	7.41%	20.36%	16.81%	6.74%	6.29%
Model 2A	Leakage rate	14.84%	14.51%	26.58%	23.51%	12.04%	10.37%
	Undercoverage rate	7.69%	8.45%	20.91%	16.88%	6.74%	5.96%
Model 3A	Leakage rate	**14.61%**	**11.65%**	24.49%	21.37%	10.07%	10.85%
	Undercoverage rate	**7.39%**	**6.83%**	15.91%	15.22%	6.16%	6.41%
Model 4A	Leakage rate	15.06%	11.94%	**20.94%**	**21.05%**	**9.25%**	**9.80%**
	Undercoverage rate	7.02%	7.14%	**15.91%**	**15.22%**	**7.61%**	**5.32%**
Model 5A	Leakage rate	15.56%	13.08%	22.94%	21.86%	**9.12%**	9.80%
	Undercoverage rate	7.32%	5.74%	19.09%	16.45%	**6.16%**	6.32%
Model 6A	Leakage rate	16.88%	15.36%	25.64%	25.79%	12.96%	13.78%
	Undercoverage rate	7.64%	5.70%	21.27%	19.40%	7.09%	5.94%
Model 0B	Leakage rate	17.63%	15.41%	25.10%	24.80%	13.00%	13.64%
	Undercoverage rate	6.55%	5.61%	19.00%	18.97%	6.45%	6.01%
Model 1B	Leakage rate	17.03%	14.72%	26.14%	22.89%	9.49%	10.03%
	Undercoverage rate	6.62%	6.40%	19.46%	17.24%	5.32%	5.94%
Model 2B	Leakage rate	14.47%	13.10%	26.97%	23.60%	9.49%	9.40%
	Undercoverage rate	6.99%	8.11%	20.00%	17.32%	5.32%	5.26%
Model 3B	Leakage rate	**12.83%**	**11.78%**	24.69%	21.72%	8.54%	10.70%
	Undercoverage rate	**6.69%**	**5.78%**	16.82%	16.59%	6.20%	4.98%
Model 4B	Leakage rate	**14.70%**	**11.33%**	**20.60%**	**20.40%**	**8.48%**	**8.93%**
	Undercoverage rate	**6.32%**	**6.48%**	**15.91%**	**13.48%**	**6.16%**	**6.03%**
Model 5B	Leakage rate	13.36%	11.75%	23.11%	21.05%	**8.42%**	9.52%
	Undercoverage rate	6.99%	6.08%	16.82%	15.58%	**6.12%**	5.34%
Model 6B	Leakage rate	17.28%	15.15%	25.33%	25.98%	12.96%	13.92%
	Undercoverage rate	6.94%	6.04%	22.62%	18.97%	7.09%	4.90%

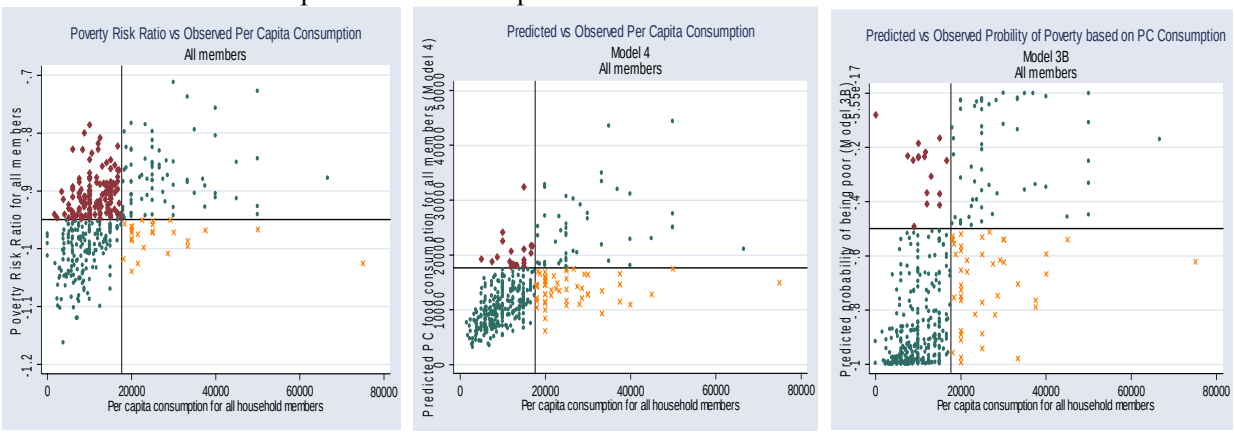
Notes: Values for the first best models are marked with bold letters, values for the second-best models are highlighted with shadows.

This shows that alternative methods significantly improve undercoverage of the program without significantly increasing the leakage. For some welfare indicators, alternative models improve both undercoverage and leakage, which is an ideal success of improving the targeting accuracy. Models that significantly improve the targeting accuracy (both in terms of undercoverage and leakage) are marked in bold letters. Models 4, 4A, 4B perform well regardless of the welfare indicator used for the estimation. Comparisons of the targeting accuracies of the best performing models and PRR method for each welfare indicator are illustrated in graphs. The best performing model from each estimation method

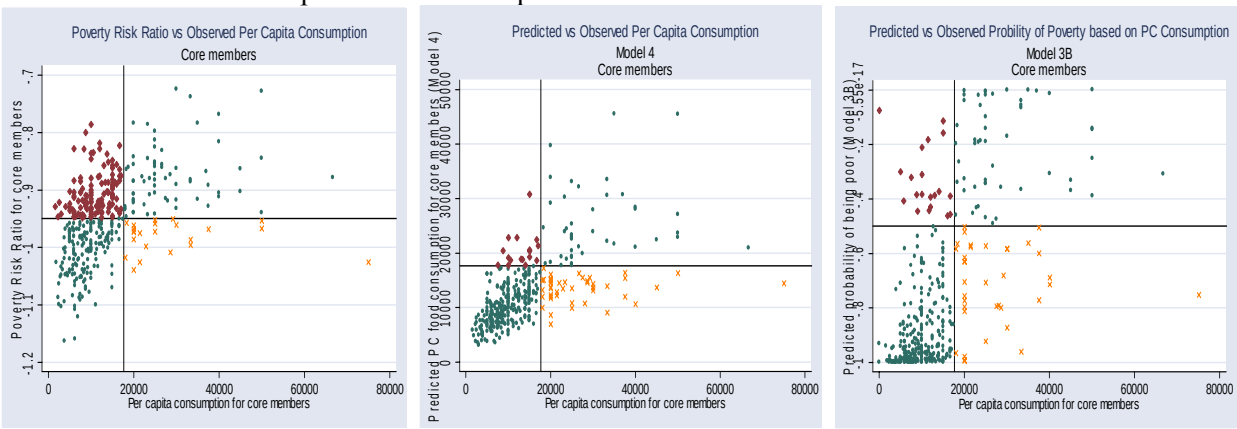
[16] Refer to Table A.4.5 and Table A.4.6 for details

(OLS and Probit or Logit) is compared to the PRR method. More detailed comparisons are provided in the Appendix 4. Each graph refers to one particular targeting indicator. "True" (observed) value of the welfare indicator (consumption, income) is taken horizontally, while the vertical axis depicts the predicted value of the welfare indicator (consumption, income, likelihood of being poor) through each method. All measures were normalized so that the welfare increases as dots move away from the origin. A vertical line is drawn at the poverty line for food consumption (income) and a horizontal line is drawn at the cut-off point where a household is to be poor or non-poor according to each targeting method. For example, when PRR method is applied, horizontal line is drawn at 0.95 because households whose PRR is above 0.95 are classified as poor. Each household in the survey is represented by a dot. Households that fall into NE and SW quadrants of a graph (colored in emerald) are targeting successes whose welfare is predicted accurately. Those dots that fall into the NW quadrant (colored in red) represent poor households that were mistakenly classified as non-poor, i.e. exclusion error. Finally, the orange dots in the SE quadrant show non-poor households that were mistakenly classified as poor by methodology, thus, indicate inclusion error.

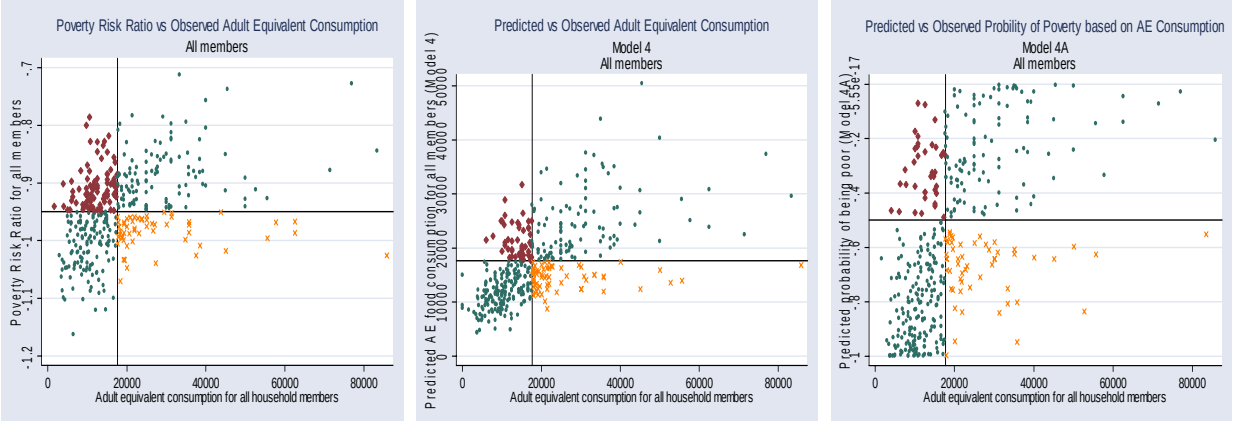
Welfare indicator: Per Capita Food Consumption for All Members



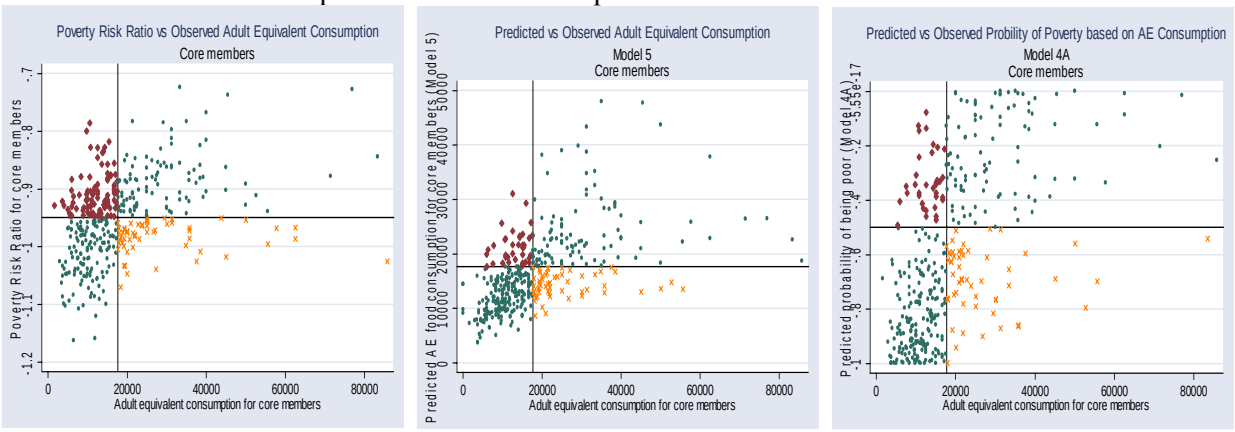
Welfare indicator: Per Capita Food Consumption for Core Members



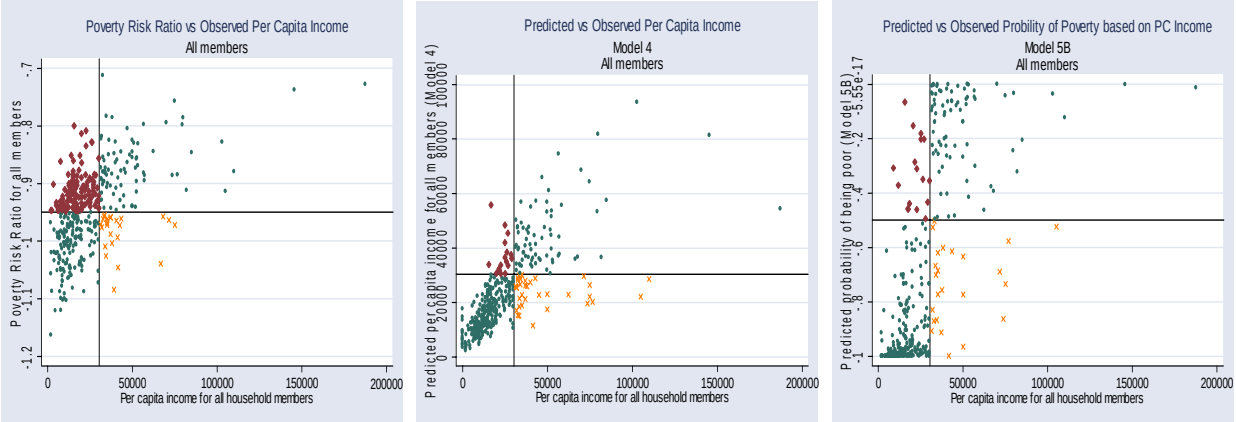
Welfare indicator: Adult Equivalent Food Consumption for All Members



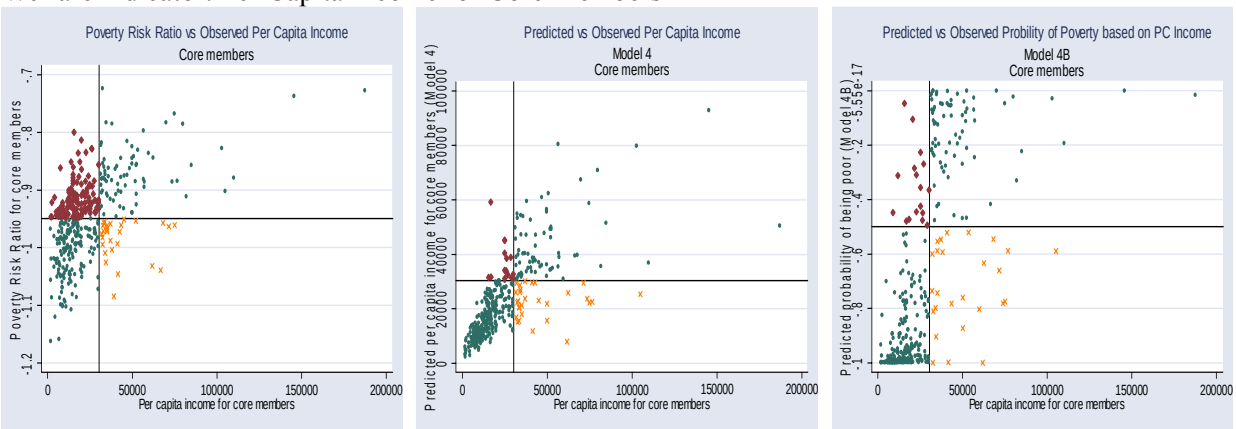
Welfare indicator: Adult Equivalent Food Consumption for Core Members



Welfare indicator: Per Capita Income for All Members



Welfare indicator: Per Capita Income for Core Members



Models 4, 4A and 4B are powerful tools for improving the accuracy of the program. However, when identifying welfare level of households and individuals with proxy variables, it is important to select variables that are difficult for households to manipulate and easy for the administrators to verify. Targeting accuracy is dependant on the verifiability of the variables. Variables such as dwelling characteristics and family characteristics (education levels, household size, demographics of the household) are easily verified by documents and home visits. Ownership of durable goods can be distorted by removing the goods from home during visits by the social workers. It is easier to do with small or mobile items such as cellular phones, video players, cars and trucks, while it might be more difficult for larger items, i.e. fixtures such as refrigerator, electric stove, fence and house. Land ownership, land permit, household registration, drinking water source and distance to water is also relatively easy to verify. Vulnerability proxies (except the assistance from relatives which can be invisible) of the households can be verified as most of the assistance is handled through the local administration.

Verifiability is more problematic for variables regarding consumption patterns and behaviors. Although consumption patterns such as milk tea consumption, ham consumption, and internet and phone usage are powerful proxies to predict welfare, they are not very useful for the actual implementation. Models with the best targeting accuracy (Models 4, 4A, 4B, 3A and 3B) incorporate consumption variables. Nevertheless, models that use only verifiable explanatory variables (such as Models 2, 2A, 2B, 5, 5A, 5B) perform much better than the PRR method. In particular, lowest rates of undercoverage estimated by methods excluding the models with consumption variables are: 6.29% (Model 2) for per capita food consumption for all members; 5.74% (Model 2 and 5A) for per capita food consumption for core members; 16.86% (Model 5B) for adult equivalent food consumption for all members; 16.02% (Model 5) for adult equivalent food consumption for core members; 5.34% (Model 5) for per capita income for all members; and 5.26% (Model 2B) for per capita income for core members. Lowest values of leakage rates are 14.47% (Model 2B) for per capita food consumption for all members; 11.75% (Model 5B) for per capita food consumption for core members; 22.94% (Model 5A) for adult equivalent food consumption for all members; 21.05% (Model 5B) for adult equivalent food consumption for core members; 8.42% (Model 5B) for per capita income for all members; and 9.40% (Model 2B) for per capita income for core members. This second best values are highlighted with shadows in the Table 7-1 and Table 7-2. Note that targeting accuracy under these second-best models are almost as good as the best models that use consumption variables and significantly better than the targeting accuracy of the PRR method.

Explaining powers of the models are also worth comparing. The higher the R square of a model, the better it explains variations in the dependant variable. Explaining powers of models analyzed are estimated to be 21.3-63.4 percent. Models 4A, 5A, 4B and 5B are powerful models to explain poverty status of a household. Explaining powers of the best performing models are estimated to be 33.6-56.9 percent, depending on the choice of a dependant variable. Models 4 and 5 explain 34.6-66.0 percent of the variations in consumption (or income) of a household. This number is considerably high. Explaining powers of models that best explain households' welfare is highlighted with bold letters in Table 7.3 and Table 7.4. Most of these models incorporate consumption patterns and behavours of households. Therefore, second-to-best powerful models were also identified. They are highlighted with shadow in Table 7.3 and Table 7.4.

.

Table 7.3: Explaining Powers of the Alternative Targeting Tools

Dependant variable	Poverty Status based on PC consumption for all members	Poverty Status based on PC consumption for core members	Poverty Status based on AE consumption for all members	Poverty Status based on AE consumption for core members	Poverty Status based on PC income for all members	Poverty Status based on PC income for core members
Models:	Pseudo R square					
Model 0A	0.265	0.289	0.225	0.226	0.501	0.404
Model 1A	0.297	0.360	0.230	0.278	0.461	0.462
Model 2A	0.316	0.355	0.241	0.283	0.461	0.518
Model 3A	**0.400**	0.416	0.280	0.303	0.495	0.485
Model 4A	0.381	0.418	**0.324**	**0.336**	0.563	0.526
Model 5A	0.307	0.383	0.274	0.303	0.566	0.517
Model 6A	0.248	0.276	0.213	0.219	0.412	0.395
Model 0B	0.266	0.300	0.224	0.225	0.419	0.404
Model 1B	0.292	0.347	0.246	0.276	0.500	0.478
Model 2B	0.321	0.364	0.236	0.281	0.500	0.529
Model 3B	0.386	0.417	0.284	0.308	0.501	0.479
Model 4B	0.381	**0.428**	0.322	0.326	**0.569**	**0.547**
Model 5B	0.330	0.399	0.286	0.302	0.564	0.529
Model 6B	0.248	0.276	0.208	0.213	0.41	0.395

Notes: Values for the first-best models are marked with bold letters and values for the second-to-best models are highlighted with shadows.

Table 7.4: Explaining Powers of the Alternative Targeting Tools

Dependant variable	PC consumption for all members	PC consumption for core members	AE consumption for all members	AE consumption for core members	PC income for all members	PC income for core members
Models:	Adjusted R-squared					
Model 0	0.344	0.356	0.265	0.275	0.579	0.568
Model 1	0.399	0.417	0.336	0.352	0.606	0.575
Model 2	0.408	0.423	0.337	0.362	0.600	0.586
Model 3	0.442	0.453	0.38	0.396	0.621	0.603
Model 4	**0.447**	**0.457**	**0.390**	**0.400**	**0.660**	**0.634**
Model 5	0.411	0.433	0.346	0.368	0.640	0.617
Model 6	0.359	0.373	0.276	0.292	0.586	0.577

Notes: Values for the first-best models are marked with bold letters and values for the second-to-best models are highlighted with shadows.

Another relevant indicator for comparing the assessment tools is the number of beneficiaries that are estimated under each method. This indicator is important if the tools are being used to get accurate estimates of potential beneficiaries. Policy makers are generally more concerned with this indicator as it provides important implications for the program's budget. However, the purpose of this paper is not to estimate number of beneficiaries, but to point out issues of the current targeting methodology through revealing alternative methods that perform better in terms of targeting accuracy. As can be seen from the graphs presented earlier, the number of beneficiaries (poor households) is higher than that of PRR method. But we should not forget that the actual number of beneficiaries is much higher than the number estimated by the PRR method, due to data manipulation. The data manipulation is induced and intensified by the high exclusion errors of the PRR method. Thus, improving the undercoverage will be a powerful and a necessary tool to improve leakages at the implementation level if combined with a better monitoring and administration techniques.

8. Sensitivity Analysis for Poverty Lines

Results of the above assessments are somewhat dependent on the choice of poverty line. In this section, I conduct a sensitivity analysis using a global poverty line of U.S. $1.08 per day per capita. As explained in section 4, three types of international food poverty lines for Mongolia are utilized and set at 12472.1 MNT a month, 10690.4 MNT a month, and 8908.6 MNT a month, respectively. I repeat the analysis described in sections 5-7, using these 3 scenarios of international poverty lines. When applied to the international poverty lines, the undercoverage rate of the Child Money Program is estimated to be 59.85%-68.81 and the leakage rate is estimated to be 18.48%-74.73%. When I restrict the sample to households with children, the undercoverage rate is estimated at 55.65%-62.39% and the leakage rate is estimated at 18.89%-74.44%, depending on the choice of poverty line and welfare indicator. For households with 3 or more children, 18.52%-21.35% of the poor households do not receive Child Money, while 17.98%-74.16% of the Child Money recipients are non-poor households. This finding proves that the targeting accuracy of the CMP is low even when the international poverty line is applied. Results are provided in Table 8.1.

Next, I assess the targeting accuracy of the PRR method using international poverty lines. As can be seen from Table 8.2, the undercoverage rate of the PRR method is 20.29%-35.6% and the leakage rate is 29.76%-71.94%, depending on the choices of food poverty lines and welfare indicators used as measurements of the "true" subsistence level of a household. When the national poverty line was applied, undercoverage and leakage rates were estimated to be 40%-43% and 11.71%-29.59%, respectively. Thus, even when international poverty lines are applied, undercoverage and leakage rates remain high.

Table 8.1: Undercoverage and Leakage Rates of Child Money Program (U.S. $ 1.08 a day poverty line)[17]

Welfare Indicators	All households		Households with 3 or more children of age of 0-17		Households with 1 or more children of age of 0-17	
	Under coverage rate (UR_{CMP})	Leakage rate (LR_{CMP})	Under coverage rate (UR_{CMP})	Leakage rate (LR_{CMP})	Under coverage rate (UR_{CMP})	Leakage rate (LR_{CMP})
Food poverty line: 12,472.1 MNT a month						
PC food expense for all members	63.77%	18.48%	19.78%	17.98%	59.67%	18.89%
PC food expense for core members	66.22%	18.48%	20.65%	17.98%	61.78%	18.89%
AE food expense for all members	67.16%	51.65%	18.87%	51.69%	60.91%	52.22%
AE food expense for core members	68.75%	50.55%	18.52%	50.56%	62.39%	51.11%
Food poverty line: 10,690.4 MNT a month						
PC food expense for all members	62.16%	23.91%	19.05%	23.60%	57.76%	24.44%
PC food expense for core members	63.92%	23.91%	19.05%	23.60%	59.28%	24.44%
AE food expense for all members	67.65%	63.74%	19.51%	62.92%	59.26%	63.33%
AE food expense for core members	68.81%	62.64%	19.05%	61.80%	60.47%	62.22%
Food poverty line: 8,908.6 MNT a month						
PC food expense for all members	59.85%	42.39%	20.31%	42.70%	55.65%	43.33%
PC food expense for core members	62.68%	42.39%	20.31%	42.70%	57.85%	43.33%
AE food expense for all members	66.67%	74.73%	20.69%	74.16%	58.18%	74.44%
AE food expense for core members	67.11%	72.53%	19.35%	71.91%	57.63%	72.22%
Poverty line: 17,817 MNT a month						
PC income for all members	62.30%	22.58%	21.35%	22.22%	57.23%	21.98%
PC income for core members	62.76%	21.51%	21.11%	21.11%	57.14%	20.88%

Notes: Poverty line=17,817 MNT a month is calculated using global poverty line of 1.08 dollar a day (32.04 dollars a month) and PPP of 1 U.S.$=544.21 MNT. Food poverty lines 12472.1 MNT; 10690.4 MNT; and 8908.6 MNT are calculated using the poverty line 17,917 MNT a month and share of food in total consumption 70%; 60%; and 50%, respectively.

Table 8.2: Under-coverage and leakage rates of PRR method (U.S. $ 1.08 a day poverty line)[18]

Welfare Indicators	Undercoverage rate (UR_{PRR})	Leakage rate (LR_{PRR})
Food poverty line: 12,472.1 MNT a month		
PC food expense for all members	34.78%	31.47%
PC food expense for core members	35.14%	29.76%
AE food expense for all members	31.34%	53.06%
AE food expense for core members	30.56%	50.98%
Food poverty line: 10,690.4 MNT a month		
PC food expense for all members	34.05%	38.07%
PC food expense for core members	34.02%	37.56%
AE food expense for all members	27.45%	62.24%
AE food expense for core members	28.44%	61.76%
Food poverty line: 8,908.6 MNT a month		
PC food expense for all members	28.79%	52.28%
PC food expense for core members	28.87%	50.73%
AE food expense for all members	20.29%	71.94%
AE food expense for core members	23.68%	71.57%
Poverty line: 17,817 MNT a month		
PC income for all members	35.60%	36.60%
PC Income for core members	35.20%	37.13%

Notes: Poverty line=17,817 MNT a month is calculated using global poverty line of 1.08 dollar a day (32.04 dollars a month) and PPP of 1 U.S.$=544.21 MNT. Food poverty lines 12472.1 MNT; 10690.4 MNT; and 8908.6 MNT are calculated using the poverty line 17,917 MNT a month and share of food in total consumption 70%; 60%; and 50%, respectively.

[17] Refer to Table A.6.1, Table A.6.2, Table A.6.3 and Table A.6.4 for details
[18] Refer to Table A.6.5, Table A.6.6, Table A.6.7 and Table A.6.8 for details

The second step is to assess whether alternative tools described in section 6 perform better than the PRR method when international poverty lines are applied. I consider each type of poverty line separately. When a food poverty line of 12472.1 MNT per capita per month is used, alternative tools perform better than the PRR method. The lowest value of undercoverage rates for different welfare indicators are: 19.07% (Model 4) for per capita food consumption for all members; 15.24% (Model 6) for per capita food consumption for core members; 38.06% (Model 4A) for adult equivalent food consumption for all members; 30.77% (Model 3B) for adult equivalent food consumption for core members; 10.12% (Model 1A) for per capita income for all members; and 12.82% (Model 1A) for per capita income for core members. Corresponding undercoverage rates using PRR method were 34.78%; 35.14%; 31.34%; 30.56%; 35.6% and 35.2% respectively. Thus, alternative models improve undecoverage in all choices of welfare indicators except adult equivalent consumption. When adult equivalent consumption is used as a welfare indicator, undercoverage rates under alternative models are slightly higher than that of PRR method. However, leakage rates under these models are much lower than the leakage rate of the PRR method.

Table 8.3: Undercoverage and Leakage Rates under Alternative Tools (U.S. $ 1.08 a day poverty line)[19]

Models	Welfare Indicators	PC consumption for all members	PC consumption for core members	AE consumption for all members	AE consumption for core members	PC income for all members	PC income for core members
Model 0	Leakage rate	28.63%	32.82%	37.50%	35.66%	12.98%	13.79%
	Undercoverage rate	19.32%	15.94%	44.03%	42.36%	26.70%	25.51%
Model 1	Leakage rate	27.83%	27.43%	34.26%	30.58%	13.00%	14.36%
	Undercoverage rate	21.94%	17.70%	44.96%	38.69%	24.04%	25.00%
Model 2	Leakage rate	26.57%	**25.43%**	30.19%	28.04%	14.00%	14.36%
	Undercoverage rate	22.45%	**17.22%**	42.64%	43.80%	24.18%	23.94%
Model 3	Leakage rate	**24.63%**	24.66%	**28.57%**	**25.42%**	**11.50%**	11.86%
	Undercoverage rate	**21.13%**	18.84%	**37.98%**	**35.77%**	**23.89%**	22.99%
Model 4	Leakage rate	**25.24%**	**24.22%**	**26.85%**	26.09%	**12.00%**	**11.86%**
	Undercoverage rate	**19.07%**	**18.36%**	**38.76%**	37.96%	**23.33%**	**20.86%**
Model 5	Leakage rate	27.75%	26.20%	32.38%	29.41%	13.86%	13.20%
	Undercoverage rate	22.56%	18.75%	44.96%	38.69%	23.24%	24.21%
Model 6	Leakage rate	29.82%	**26.75%**	32.08%	34.65%	14.36%	13.71%
	Undercoverage rate	21.94%	**15.24%**	44.19%	39.42%	26.88%	25.65%

Notes: Values for the first best models are marked with bold letters and values for the second-best models are highlighted with shadows. Poverty line=17,817 MNT a month is calculated using global poverty line of 1.08 dollar a day (32.04 dollars a month) and PPP of 1 U.S.$=544.21 MNT. Food poverty line 12472.1 MNT is calculated using the poverty line 17,917 MNT a month and share of food in total consumption 70%.

When an international food poverty line of 12472.1 MNT per capita per month is applied, leakage rates under the PRR method were 29.76%-53.06%, depending on the welfare indicator. Under the alternative methods, leakage rates are estimated to be 11.55%-37.5% depending on the welfare indicators and models used for estimation. Specifically, the lowest values of leakage rates for different welfare indicators are 22.75% (Model 4A) for per capita food consumption for all members; 22.17% (Model 4A) for per capita food consumption for core members; 26.85% (Model 4) for adult equivalent food consumption for all members; 23.26% (Model 3A) for adult equivalent food consumption for core members; 11.5% (Model 3) for per capita income for all members; and 11.86% (Model 4) for per capita income for core members. The corresponding leakage rates using the PRR method were 31.47%; 29.76%; 53.06%; 50.98%; 36.6% and 37.13%, respectively. Here, alternative methods perform significantly better than the PRR method. The first best values of undercoverage and leakage rates are marked with bold letters in the Table 8.3 and Table 8.4.

[19] Refer to Table A.6.9 for details

Table 8.4: Undercoverage and Leakage Rates under Alternative Tools (U.S. $ 1.08 a day poverty line)[20]

Models	Welfare Indicators	Poverty Status based on PC consumption for all members	Poverty Status based on PC consumption for core members	Poverty Status based on AE consumption for all members	Poverty Status based on AE consumption for core members	Poverty Status based on PC income for all members	Poverty Status based on PC income for core members
Model 0A	Leakage rate	24.75%	31.36%	33.03%	31.78%	18.18%	22.44%
	Undercoverage rate	26.57%	21.74%	45.52%	38.89%	13.83%	17.62%
Model 1A	Leakage rate	24.64%	24.23%	27.88%	28.13%	**15.23%**	**15.84%**
	Undercoverage rate	24.64%	22.17%	42.31%	36.11%	**10.22%**	**12.82%**
Model 2A	Leakage rate	23.79%	23.93%	31.13%	28.91%	16.06%	16.02%
	Undercoverage rate	24.15%	19.46%	45.11%	36.81%	14.29%	10.82%
Model 3A	Leakage rate	23.04%	24.14%	31.93%	**23.26%**	16.75%	19.00%
	Undercoverage rate	23.41%	20.36%	39.55%	**30.77%**	12.30%	17.35%
Model 4A	Leakage rate	**22.75%**	**22.17%**	**27.19%**	24.19%	19.27%	19.90%
	Undercoverage rate	**20.87%**	**19.00%**	**38.06%**	34.27%	16.67%	17.01%
Model 5A	Leakage rate	**23.72%**	22.47%	28.83%	26.83%	18.52%	18.81%
	Undercoverage rate	**20.77%**	20.36%	40.60%	37.50%	16.76%	15.90%
Model 6A	Leakage rate	24.39%	26.67%	32.71%	34.35%	22.61%	23.81%
	Undercoverage rate	25.12%	20.72%	46.27%	40.28%	19.37%	18.37%
Model 0B	Leakage rate	29.82%	26.75%	32.08%	34.65%	14.36%	13.71%
	Undercoverage rate	21.94%	15.24%	44.19%	39.42%	26.88%	25.65%

Notes: Values for the first best models are marked with bold letters and values for the second-best models are highlighted with shadows. Poverty line=17,817 MNT a month is calculated using global poverty line of 1.08 dollar a day (32.04 dollars a month) and PPP of 1 U.S.$=544.21 MNT. Food poverty line 12472.1 MNT is calculated using the poverty line 17,917 MNT a month and share of food in total consumption 70%.

When a food poverty line of 10690.4 MNT per capita per month is used, alternative tools also perform better than the PRR method. The lowest values of undercoverage rates are: 28.11% (Model 4A) for per capita food consumption for all members; 26.8% (Model 5A) for per capita food consumption for core members; 44.12% (Model 4A) for adult equivalent food consumption for all members; and 41.28% (Model 3A) for adult equivalent food consumption for core members. Corresponding undercoverage rates using the PRR method were 34.05%; 34.02%; 27.45%; and 28.44%, respectively. Thus, alternative models improve undercoverage when the welfare indicator is per capita consumption and diminish it when the welfare indicator is adult equivalent consumption. However, alternative models significantly improve leakage rates when the adult equivalent consumption is used as a welfare indicator.

Table 8.5: Undercoverage and Leakage Rates under Alternative Tools (Food Poverty line=10690.4 MNT)[21]

Models	Welfare Indicators	PC consumption for all members	PC consumption for core members	AE consumption for all members	AE consumption for core members
Model 0	Leakage rate	31.36%	32.43%	33.87%	33.78%
	Undercoverage rate	37.30%	32.43%	59.80%	55.05%
Model 1	Leakage rate	26.25%	26.52%	25.49%	31.94%
	Undercoverage rate	32.95%	27.32%	60.82%	52.43%
Model 2	Leakage rate	**22.73%**	24.14%	31.03%	27.94%
	Undercoverage rate	**32.39%**	27.87%	58.76%	52.43%
Model 3	Leakage rate	25.15%	25.71%	**26.23%**	**27.40%**
	Undercoverage rate	30.29%	28.96%	**53.61%**	**48.54%**
Model 4	Leakage rate	**23.90%**	**22.02%**	**25.42%**	**27.40%**
	Undercoverage rate	**30.86%**	**28.42%**	**54.64%**	**48.54%**
Model 5	Leakage rate	23.72%	**22.67%**	28.33%	31.82%
	Undercoverage rate	32.00%	**26.92%**	55.67%	56.31%
Model 6	Leakage rate	31.29%	28.74%	32.50%	39.66%
	Undercoverage rate	36.36%	32.61%	72.16%	66.02%

Notes: Values for the first best models are marked with bold letters and values for the second-best models are highlighted with shadows. Food poverty line=10690.4 MNT a month is calculated using global poverty line of 1.08 dollar a day (32.04 dollars a month), PPP of 1 U.S.$=544.21 MNT and share of food in total consumption 60%.

[20] Refer to Table A.6.10 for details
[21] Refer to Table A.6.11 for details

The lowest values of leakage rates, when international food poverty line of 10690.4 MNT per capita per month is applied, are: 22.73% (Model 2) for per capita food consumption for all members; 22.02% (Model 4) for per capita food consumption for core members; 25.0% (Model 4A) for adult equivalent food consumption for all members; and 26.44% (Model 3A) for adult equivalent food consumption for core members. These results are impressive as the corresponding leakage rates under the PRR method were 38.07%; 37.56%; 62.24%; and 61.76%, respectively. The first best values of undercoverage and leakage rates are marked with bold letters in Table 8.5 and Table 8.6.

Table 8.6: Undercoverage and Leakage Rates under Alternative Tools (Food Poverty line=10690.4 MNT)[22]

Models	Welfare Indicators	Poverty Status based on PC consumption for all members	Poverty Status based on PC consumption for core members	Poverty Status based on AE consumption for all members	Poverty Status based on AE consumption for core members
Model 0A	Leakage rate	26.99%	32.79%	30.77%	35.71%
	Undercoverage rate	35.68%	33.51%	55.88%	50.46%
Model 1A	Leakage rate	27.98%	27.64%	25.97%	27.50%
	Undercoverage rate	34.59%	25.77%	44.12%	46.79%
Model 2A	Leakage rate	26.32%	27.55%	27.78%	26.67%
	Undercoverage rate	31.89%	26.80%	48.51%	49.54%
Model 3A	Leakage rate	24.12%	26.46%	26.92%	**26.44%**
	Undercoverage rate	29.89%	27.98%	44.12%	**41.28%**
Model 4A	Leakage rate	**23.56%**	**24.73%**	**25.00%**	27.27%
	Undercoverage rate	**28.11%**	**27.84%**	**44.12%**	41.28%
Model 5A	Leakage rate	26.14%	27.18%	27.14%	29.63%
	Undercoverage rate	29.73%	**26.80%**	49.50%	47.71%
Model 6A	Leakage rate	28.40%	28.19%	34.62%	31.75%
	Undercoverage rate	34.59%	30.41%	50.00%	60.55%
Model 0B	Leakage rate	27.11%	32.61%	31.88%	35.29%
	Undercoverage rate	34.59%	32.97%	53.92%	49.54%

Notes: Values for the first best models are marked with bold letters and values for the second-best models are highlighted with shadows. Food poverty line=10690.4 MNT a month is calculated using global poverty line of 1.08 dollar a day (32.04 dollars a month), PPP of 1 U.S. $=544.21 MNT and share of food in total consumption 60%.

Finally, I compare the targeting accuracy of alternative models with the targeting accuracy of the PRR method using a food poverty line of 8908.6 MNT per capita per month. Leakage rates under the PRR method are 52.28% for per capita food consumption for all members; 50.73% for per capita food consumption for core members; 71.94% for adult equivalent food consumption for all members; and 71.57% for adult equivalent food consumption for core members. The lowest corresponding values under the alternative models are 21.62% (Model 2A); 24.35% (Model 3); 21.74% (Model 5); and 24.39 % (Model 5A), respectively. Thus, the alternative models significantly improve the leakage of the program.

Undercoverage rates tell a slightly different story. When the PRR method was used, undercoverage rates were 28.79% for per capita food consumption for all members; 28.87% for per capita food consumption for core members; 20.29% for adult equivalent food consumption for all members; and 23.68% for adult equivalent food consumption for core members. However, the lowest corresponding values under the alternative models are 31.5% (Model 2A); 31.69% (Model 4A); 50.72% (Model 5A); and 54.79 % (Model 4A), respectively. Thus, alternative models raise leakage rates slightly when per capita consumption is used as a "true" welfare indicator of a household. When adult equivalent consumption is used to measure the "true" welfare of a household, alternative models diminish undercoverage rates within the program, compared to the PRR method. But we should not forget that the poverty line is based on per capita consumption rather than adult equivalent consumption. This may underestimate poverty rates. Moreover, the food poverty line of 8908.6 MNT per capita per month is calculated using an international poverty line of 1.08 U. S. dollars per day and 50% food share in consumption. The global poverty line of 1.08 U.S. dollars per capita per day is used as a benchmark of extreme poverty and for extremely poor households the share of food in total consumption is generally very high. Thus, the poverty line of 8908.6 MNT per capita per month is an extremely low approximation

[22] Refer to Table A.6.12 for details

of the poverty line and is expected to underestimate poverty. When we consider all these factors, it is reasonable to conclude that alternative models improve the overall targeting accuracy of the CMP even when an international poverty line is applied. More detailed information on the calculation of inclusion and exclusion errors are provided in Appendix 6.

Table 8.7: Undercoverage and Leakage Rates under Alternative Tools (Food Poverty line=8908.6 MNT)[23]

Models	Welfare Indicators	PC consumption for all members	PC consumption for core members	AE consumption for all members	AE consumption for core members
Model 0	Leakage rate	31.43%	35.54%	34.78%	34.48%
	Undercoverage rate	45.45%	40.91%	78.26%	75.00%
Model 1	Leakage rate	25.51%	26.13%	30.00%	**30.30%**
	Undercoverage rate	42.06%	38.81%	78.13%	**67.61%**
Model 2	Leakage rate	28.16%	25.23%	26.92%	35.29%
	Undercoverage rate	41.27%	38.06%	70.31%	69.01%
Model 3	Leakage rate	**25.49%**	**24.35%**	33.33%	41.03%
	Undercoverage rate	**39.68%**	**35.07%**	**68.75%**	67.61%
Model 4	Leakage rate	26.21%	**24.79%**	40.00%	36.11%
	Undercoverage rate	39.68%	**34.33%**	71.88%	67.61%
Model 5	Leakage rate	**24.49%**	25.44%	**21.74%**	34.38%
	Undercoverage rate	**40.80%**	36.09%	**71.88%**	70.42%
Model 6	Leakage rate	32.29%	31.78%	31.25%	42.11%
	Undercoverage rate	48.41%	45.52%	82.81%	84.51%

Notes: Values for the first best models are marked with bold letters and values for the second-best models are highlighted with shadows. Food poverty line=8908.6 MNT a month is calculated using global poverty line of 1.08 dollar a day (32.04 dollars a month), PPP of 1 U.S. $=544.21 MNT and share of food in total consumption 50%.

Table 8.8: Undercoverage and Leakage Rates under Alternative Tools (Food Poverty line=8908.6 MNT)[24]

Models	Welfare Indicators	Poverty Status based on PC consumption for all members	Poverty Status based on PC consumption for core members	Poverty Status based on AE consumption for all members	Poverty Status based on AE consumption for core members
Model 0A	Leakage rate	27.88%	35.83%	33.33%	29.41%
	Undercoverage rate	43.18%	41.67%	71.01%	68.42%
Model 1A	Leakage rate	24.55%	27.87%	29.03%	30.00%
	Undercoverage rate	37.12%	38.03%	68.12%	63.16%
Model 2A	Leakage rate	**21.62%**	25.83%	28.57%	19.05%
	Undercoverage rate	**31.50%**	35.51%	63.77%	53.42%
Model 3A	Leakage rate	26.13%	**24.60%**	34.88%	36.36%
	Undercoverage rate	37.88%	**33.10%**	59.42%	61.64%
Model 4A	Leakage rate	23.68%	28.15%	33.33%	**25.00%**
	Undercoverage rate	32.03%	**31.69%**	53.62%	**54.79%**
Model 5A	Leakage rate	25.00%	27.20%	**22.73%**	**24.39%**
	Undercoverage rate	32.03%	35.92%	**50.72%**	57.53%
Model 6A	Leakage rate	31.00%	32.48%	34.78%	37.04%
	Undercoverage rate	47.73%	44.37%	78.26%	77.63%
Model 0B	Leakage rate	27.88%	34.75%	38.24%	26.47%
	Undercoverage rate	43.18%	41.67%	69.57%	67.11%

Notes: Values for the first best models are marked with bold letters and values for the second-best models are highlighted with shadows. Food poverty line=8908.6 MNT a month is calculated using global poverty line of 1.08 dollar a day (32.04 dollars a month), PPP of 1 U.S. $=544.21 MNT and share of food in total consumption 50%.

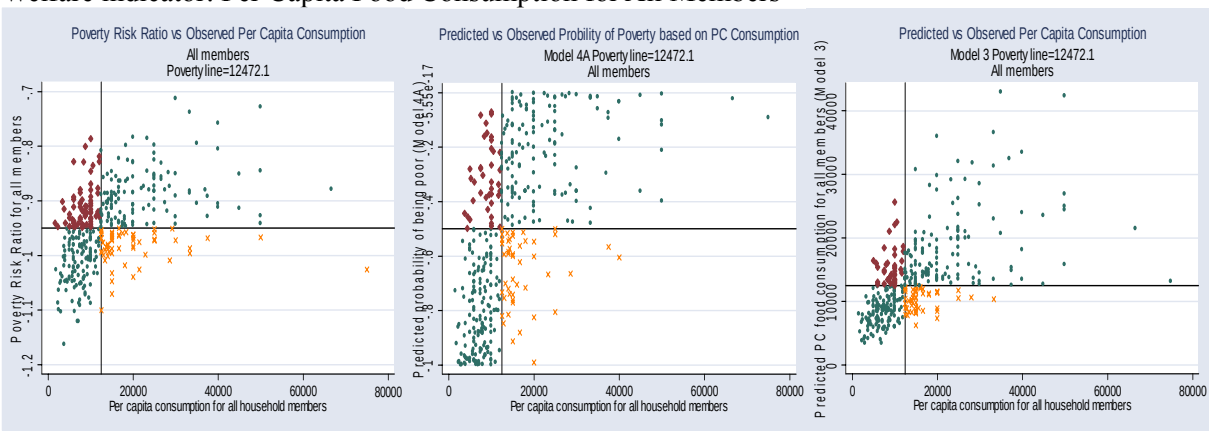
Some of the best-performing alternative models incorporate proxy variables for consumption pattern and behaviors of a household. As explained in section 7, such models might not be appropriate for practical usage. Thus, it is better to look at the second-best models that use relatively easy to verify variables. Undercoverage rates and leakage rates under such models are highlighted with shadows in Table 8.3 through Table 8.8. In some cases, the best and the second-best values are the same. Even

[23] Refer to Table A.6.13 for details
[24] Refer to Table A.6.14 for details

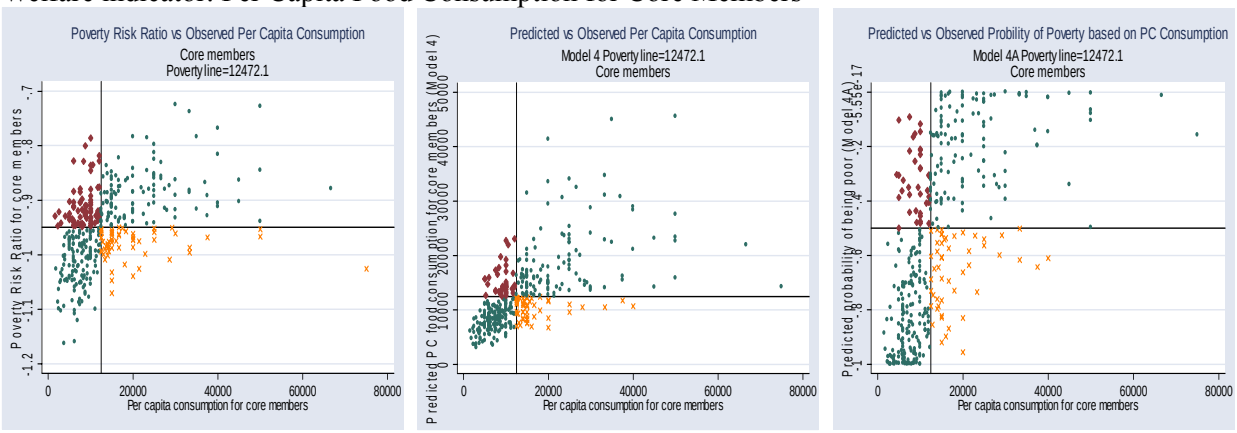
second-best models perform better than the PRR method, when targeting accuracy is concerned.

Next, I provide some graphical illustrations of inclusion and exclusion errors under the RRR method and the best-performing alternative tools when an international poverty line of 1.08 U. S. dollar per day per person is applied. For efficiency reasons, I display results under a scenario of food poverty line= 12472.1 MNT per capita per month and poverty line=17,917 MNT per capita per month. Results of other scenarios are found in Appendix 6.

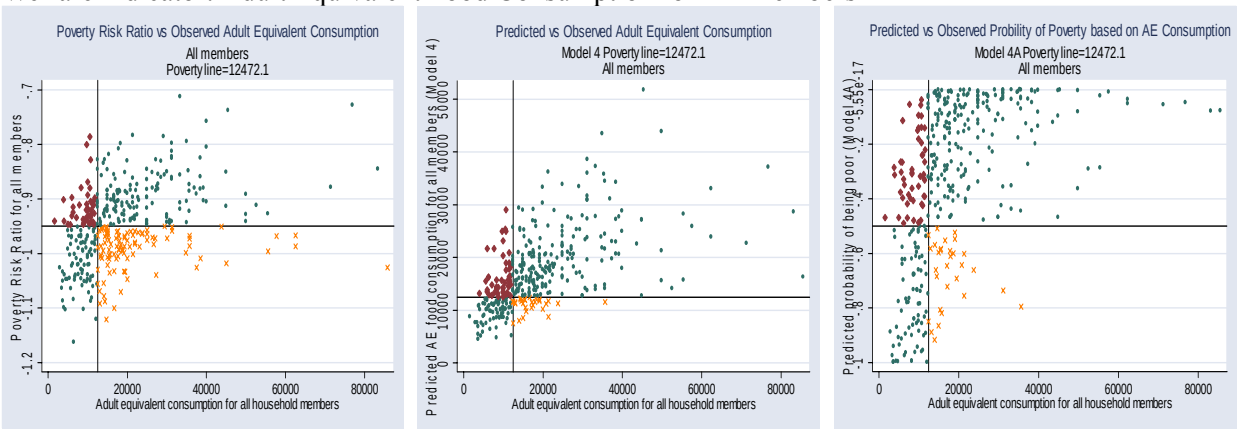
Welfare indicator: Per Capita Food Consumption for All Members



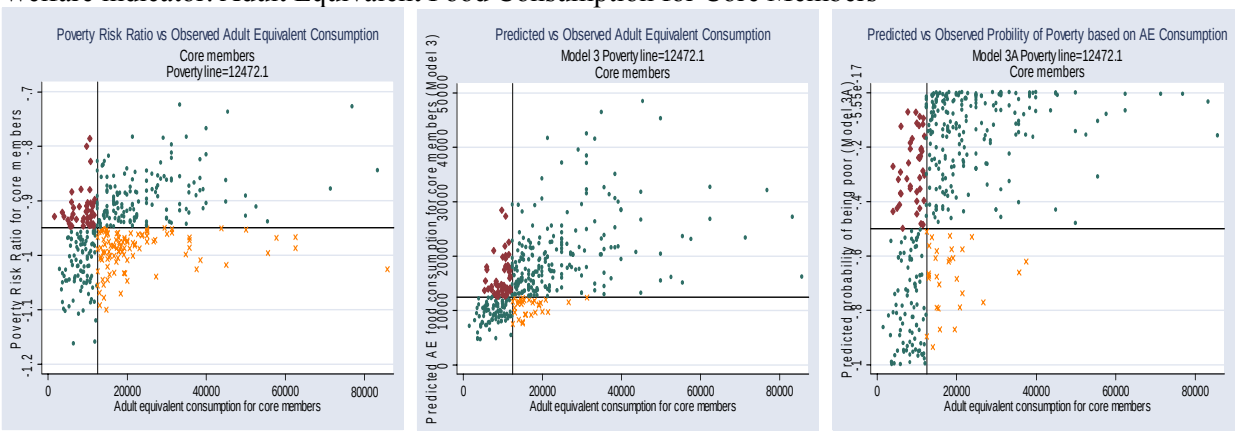
Welfare indicator: Per Capita Food Consumption for Core Members



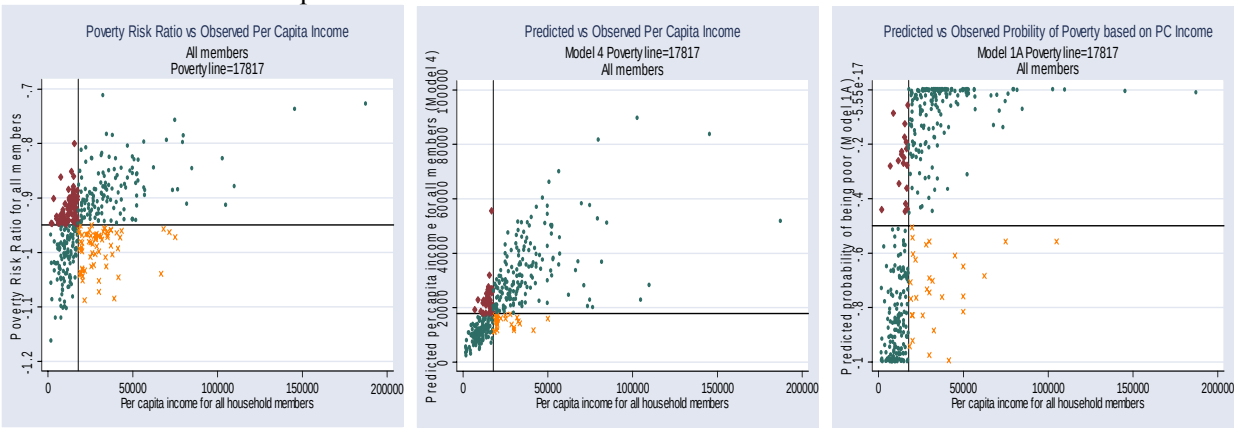
Welfare indicator: Adult Equivalent Food Consumption for All Members



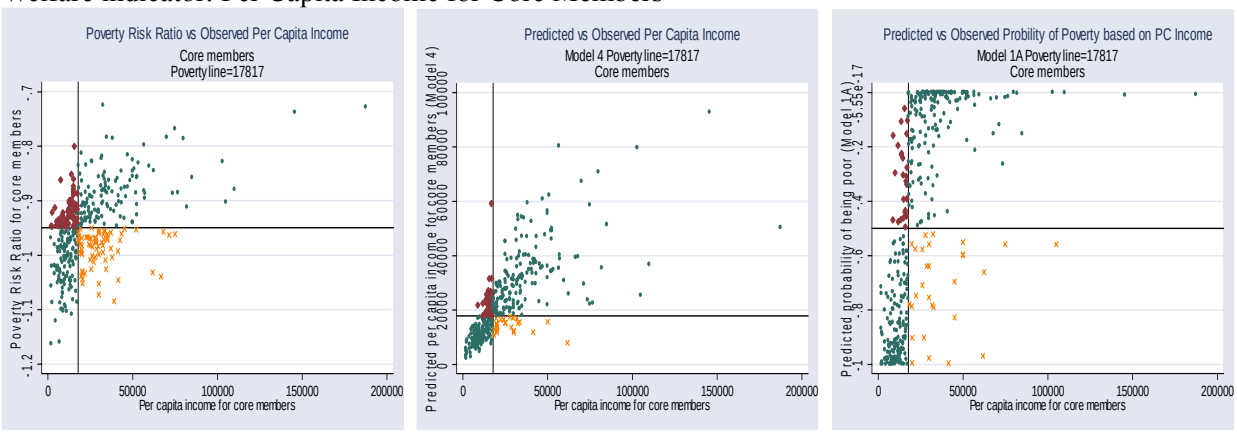
Welfare indicator: Adult Equivalent Food Consumption for Core Members



Welfare indicator: Per Capita Income for All Members



Welfare indicator: Per Capita Income for Core Members



9. Comparison of Household-level Analysis and Individual–level Analysis

The analysis in this paper was conducted at the household level. Inclusion errors and exclusion errors were based on the number of households (not individuals) whose welfare level was misclassified. However, it is important to assess targeting accuracy of the program at the individual level. The program may not determine a households' true welfare, but the severity of such errors depends on the number of individuals whose welfare is misclassified. For example, consider a scenario where a certain benefit is to be provided to all individuals who are a member of poor households. In this case, mistakenly classifying the welfare of a household with 10 members will have a more severe impact on the programs' success than misclassifying a household with 3 members. In case of inclusion error, the program will have to cover 10 people who were not supposed to be included in the program instead of mistakenly covering only 3 people. In case of exclusion, 10 poor people will be left out the program instead of only 3. Although the size of the benefit depends on the number of children in the household, the Child Money

Program was targeted at all poor households with children instead of poor individuals. Thus, it was more appropriate to look at the number of households whose welfare was misclassified instead of the number of individuals. However, the Government of Mongolia is considering the use of PRR method to determine eligibility for other benefits that are targeted at individuals. Therefore, in this section I provide some analysis on individual-level. The national poverty line is used as the cut-off point where households' welfare is classified from poor and non-poor. Analysis in sections 5 through 7 was repeated.

Targeting Accuracy of the Child Money Program

Definition of the undercoverage and leakage is slightly different. In particular, rates of undercoverage (UR_{CMP}) and leakage (LR_{CMP}) of the Child Money Program are calculated as:

$$UR_{CMP} = \frac{\text{Poor non - adults who don't receive the Child Money}}{\text{Total number of poor non - adults}} * 100\% \quad (22)$$

$$LR_{CMP} = \frac{\text{Non - poor non - adults who receive the Child Money}}{\text{Total number of poor non - adults who receive the Child Money}} * 100\% \quad (23)$$

As can be seen from Table 9.1, 50.20%-55.48% of poor children (non-adults) do not receive Child Money, while 2.74%-23.38% of the Child Money beneficiaries are non-poor children. When the sample is restricted only to children from households with 3 or more children, the undercoverage rate is estimated at 22.12%-26.19%, and the leakage rate is estimated at 2.79%-23.13%. These results are consistent with the results of the analysis based on household–level poverty status. Targeting accuracy of the CMP is far from satisfactory even when misclassification of individual-level welfare is concerned. Tables containing detailed information inclusion and exclusion errors of the CMP based on individuals' welfare are provided in Appendix 7.

Table 9.1: Undercoverage and Leakage Rates of Child Money Program (Individual level)[25]

	All non-adults		Non-adults who are members of households with 3 or more children		Non-adults who are members of households with a child	
Welfare Indicators	Under coverage rate (UR_{CMP})	Leakage rate (LR_{CMP})	Under coverage rate (UR_{CMP})	Leakage rate (LR_{CMP})	Under coverage rate (UR_{CMP})	Leakage rate (LR_{CMP})
PC food expense for all members	53.47%	5.92%	24.69%	5.38%	53.72%	5.97%
PC food expense for core members	55.48%	4.92%	25.18%	4.38%	54.80%	4.97%
AE food expense for all members	50.20%	23.36%	22.12%	23.10%	52.87%	23.60%
AE food expense for core members	53.46%	23.38%	23.13%	23.13%	63.98%	24.51%
PC income for all members	51.16%	3.23%	26.19%	3.33%	51.40%	2.80%
PC income for core members	52.32%	2.74%	25.59%	2.79%	51.68%	2.77%

Next, I assess targeting accuracy of the PRR method, using number of individuals whose welfare level is misclassified. Rates of undercoverage (UR_{PRR}) and leakage (LR_{PRR}) under the PRR method are calculated as:

$$UR_{PRR} = \frac{\text{Number of poor individuals who are identified as non - poor by PRR method}}{\text{Total number of poor individuals}} * 100\% \quad (24)$$

$$LR_{PRR} = \frac{\text{Number of non - poor individuals who are identifed as poor by PRR method}}{\text{Total number of individuals who are identified as poor by PRR method}} * 100\% \quad (25)$$

Findings show that 31.31%-34.98% of the poor individuals were identified as non-poor by the

[25] Refer to Table A.7.1 for details

PRR method, while 10.02%-28.45% of the individuals who were identified as poor by the PRR method are non-poor. While these numbers are slightly smaller than the results under the household-level estimation, the causes, results and implications are the same as that of household-level analysis.

Table 9.2: Undercoverage and Leakage Rates Under PRR Method (Individual-level)[26]

Welfare indicator	Undercoverage rate (UR_{PRR})	Leakage rate (LR_{PRR})
PC food expense for all members	34.98%	11.93%
PC food expense for core members	33.61%	10.02%
AE food expense for all members	32.20%	28.45%
AE food expense for core members	31.31%	26.68%
PC income for all members	32.81%	12.51%
PC income for core members	31.84%	13.31%

In order to check how much data manipulation and misreporting has occurred at the implementation level, I compared the actual Child Money recipient status of non-adults (0-17 year olds) to their predicted living standard according to the PRR method. Rates of undercoverage (UR_I) and leakage (LR_I) at the implementation level are calculated as:

$$(26) \qquad UR_I = \frac{\text{Non - adults who are identified as poor by PRR method who don't receive Child Money}}{\text{Total number of non - adults who are identified as poor by the PRR method}} * 100\%$$

$$(27) \qquad LR_I = \frac{\text{Non - adults who are identified as non - poor by PRR method who receive Child Money}}{\text{Total number of non - adults who receive Child Money}} * 100\%$$

Out of all non-adult individuals who receive Child Money, 21.04%-23.15% are identified as non-poor by the PRR method while 51.37%-53.25% of the poor non-adult individuals are excluded from the benefit. When the sample is restricted to households with 3 or more children, the undercoverage rate is estimated at 30.43%-30.83% and the leakage rate is estimated to be 19.81%-21.94%. This result is the same as the results based on household-level misclassification. More complete results are provided in the Appendix 7.

Table 9.3: Undercoverage and Leakage Rates of Child Money Program (Individual-level)[27]

	All households		Households with 3 or more children		All households with children	
Welfare indicator	Under coverage rate (UR_I)	Leakage rate (LR_I)	Under coverage rate (UR_I)	Leakage rate (LR_I)	Under coverage rate (UR_I)	Leakage rate (LR_I)
PRR for All members	51.37%	23.15%	30.83%	21.94%	51.18%	22.43%
PRR for Core members	53.25%	21.04%	30.43%	19.81%	52.04%	20.31%

Targeting Accuracy of the Alternative Models

The next step is to assess whether the alternative models perform better than the PRR method when accurate identification of individuals is concerned. Rates of undercoverage and leakage are calculated using the "true" and estimated values of welfare indicators and the poverty status of individuals for all models. In particular, rates of undercoverage (UR_{M_J}) and leakage (LR_{M_J}) under the Model J are calculated as:

[26] Refer to Table A.7.2 for details
[27] Refer to Table A.7.3 for details

(28) $$UR_{M_J} = \frac{\text{Poor individuals who are identified as non - poor by Model J}}{\text{Total number of poor individuals}} * 100\%$$

(29) $$LR_{M_J} = \frac{\text{Non - poor individuals who are identified as poor by Model J}}{\text{Total number of individuals who are identifed as poor by Model J}} * 100\%$$

Even when the errors of inclusion and exclusion are measured at the individual level, the alternative methods perform significantly better than the PRR method, regardless of what indicator is chosen to measure welfare. Undercoverage rates for the PRR method were 31.31%-34.98% while alternative models lower this value to 3.01%-18.24%. The lowest value of undercoverage rates for different welfare indicators are 3.1% (Model 4) for per capita food consumption for all members; 3.01% (Model 1) for per capita food consumption for core members; 12.47% (Model 3A) for adult equivalent food consumption for all members; 10.14% (Model 4B) for adult equivalent food consumption for core members; 5.45% (Model 2) for per capita income for all members; and 4.18% (Model 6B) for per capita income for core members. These values are impressive, as corresponding undercoverage rates using PRR method were 34.98%; 33.61%; 32.2%; 31.31%; 32.81% and 31.84%, respectively.

Table 9.4: Undercoverage and Leakage Rates under Alternative Targeting Tools (Individual-level)[28]

Models	Welfare indicators	PC consumption for all members	PC consumption for core members	AE consumption for all members	AE consumption for core members	PC income for all members	PC income for core members
Model 0	Leakage rate	15.78%	14.12%	23.91%	23.38%	12.07%	12.07%
	Undercoverage rate	6.07%	5.30%	**16.35%**	14.51%	9.40%	7.69%
Model 1	Leakage rate	15.55%	12.90%	27.77%	22.99%	10.76%	10.85%
	Undercoverage rate	4.75%	**3.01%**	17.81%	16.00%	6.24%	6.52%
Model 2	Leakage rate	14.65%	12.73%	25.55%	22.04%	9.75%	10.96%
	Undercoverage rate	4.16%	3.70%	18.06%	14.09%	**5.45%**	5.99%
Model 3	Leakage rate	14.18%	12.35%	24.31%	22.24%	10.78%	10.47%
	Undercoverage rate	4.99%	3.62%	17.80%	15.38%	6.23%	7.40%
Model 4	Leakage rate	**13.74%**	**12.60%**	**23.13%**	21.60%	**9.38%**	**8.44%**
	Undercoverage rate	**3.10%**	**3.17%**	**16.85%**	13.84%	**5.52%**	**5.79%**
Model 5	Leakage rate	14.53%	12.79%	22.10%	**19.91%**	9.38%	9.80%
	Undercoverage rate	5.17%	3.84%	18.24%	**12.26%**	6.24%	**5.72%**
Model 6	Leakage rate	15.43%	13.33%	24.63%	23.61%	11.78%	12.74%
	Undercoverage rate	4.27%	5.23%	17.98%	13.80%	7.88%	7.76%

Notes: Values for the first best models are marked with bold letters, values for the second-best models are highlighted with shadows.

When individuals' welfare classifications are concerned, leakage rates under PRR method were 10.02%-28.45%, depending on the welfare indicator. Under alternative methods, leakage rates are estimated to be 7.89%-27.77% depending on the welfare indicators and models used for estimation. Leakage rates under the alternative models are in most cases lower than the leakage rates under the PRR method. Specifically, the lowest leakage rates for different welfare indicators are: 11.61% (Model 3B) for per capita food consumption for all members; 9.86% (Model 5B) for per capita food consumption for core members; 16.98% (Model 4B) for adult equivalent food consumption for all members; 18.76% (Model 4B) for adult equivalent food consumption for core members; 7.89% (Model 5B) for per capita income for all members; and 8.44% (Model 4) for per capita income for core members. The corresponding leakage rates using the PRR method were 11.93%; 10.02%; 28.45%; 26.68%; 12.51% and 13.31%, respectively. Once again, alternative methods perform significantly better than the PRR method. The first best values of undercoverage and leakage rates are marked with bold letters in the Table 9.4 and Table 9.5.

[28] Refer to Table A.7.4 for details

Table 9.5: Undercoverage and Leakage Rates under Alternative Targeting Tools (Individual-level)[29]

Models	Welfare Indicator	Poverty Status based on PC consumption for all members	Poverty Status based on PC consumption for core members	Poverty Status based on AE consumption for all members	Poverty Status based on AE consumption for core members	Poverty Status based on PC income for all members	Poverty Status based on PC income for core members
Model 0A	Leakage rate	15.38%	13.26%	23.24%	23.72%	9.72%	13.52%
	Undercoverage rate	4.81%	3.90%	14.90%	14.04%	6.31%	4.97%
Model 1A	Leakage rate	14.94%	12.84%	24.00%	21.23%	12.06%	9.82%
	Undercoverage rate	5.09%	5.75%	15.15%	13.48%	5.74%	6.17%
Model 2A	Leakage rate	13.81%	12.38%	23.84%	22.26%	12.06%	9.43%
	Undercoverage rate	6.51%	6.66%	17.88%	14.09%	5.74%	5.39%
Model 3A	Leakage rate	12.42%	10.13%	22.29%	19.94%	9.78%	10.14%
	Undercoverage rate	5.61%	5.73%	**12.47%**	12.47%	6.28%	6.33%
Model 4A	Leakage rate	12.56%	10.19%	17.38%	19.13%	8.65%	9.41%
	Undercoverage rate	5.26%	5.46%	12.55%	11.58%	7.62%	4.49%
Model 5A	Leakage rate	13.85%	11.33%	20.72%	20.09%	8.18%	9.28%
	Undercoverage rate	5.49%	4.65%	13.87%	13.22%	5.92%	5.72%
Model 6A	Leakage rate	14.62%	13.00%	23.19%	24.14%	11.44%	13.37%
	Undercoverage rate	5.40%	3.68%	16.61%	14.51%	5.81%	4.58%
Model 0B	Leakage rate	14.92%	12.77%	22.61%	23.23%	11.48%	12.98%
	Undercoverage rate	4.53%	**3.25%**	14.73%	14.04%	5.40%	4.97%
Model 1B	Leakage rate	14.94%	12.62%	24.05%	21.32%	8.95%	9.60%
	Undercoverage rate	5.09%	5.19%	16.44%	13.96%	**5.11%**	5.70%
Model 2B	Leakage rate	13.37%	11.36%	24.14%	22.06%	8.95%	9.08%
	Undercoverage rate	5.17%	6.41%	16.77%	15.05%	5.11%	4.72%
Model 3B	Leakage rate	**11.61%**	**10.25%**	22.88%	19.71%	8.03%	10.19%
	Undercoverage rate	**4.80%**	**4.95%**	13.07%	14.46%	6.33%	5.11%
Model 4B	Leakage rate	12.28%	**10.03%**	**16.98%**	**18.76%**	8.14%	**8.65%**
	Undercoverage rate	**4.72%**	5.10%	**12.55%**	**10.14%**	6.00%	5.77%
Model 5B	Leakage rate	12.26%	**9.86%**	19.73%	19.25%	**7.89%**	**8.67%**
	Undercoverage rate	5.31%	5.21%	13.59%	13.14%	**6.08%**	**5.05%**
Model 6B	Leakage rate	14.70%	12.85%	22.95%	23.73%	11.44%	13.42%
	Undercoverage rate	4.87%	4.05%	17.21%	14.12%	5.81%	**4.18%**

Notes: Values for the first best models are marked with bold letters, values for the second-best models are highlighted with shadows.

In general, lower undercoverage results in higher leakage. Thus, it is important to see whether the alternative targeting models improve both undercoverage and leakage rates at the same time. My findings show that alternative methods significantly improve undercoverage of the program without increasing the leakage. For most welfare indicators, alternative models improve both undercoverage and leakage rates at the same time. Models that significantly improve the targeting accuracy (both in terms of undercoverage and leakage) are marked in bold letters in Table 9.4 and Table 9.5. Models 4, 4A, 4B and 5B perform well regardless of the welfare indicator used for the estimation. Here again, some of the best performing models incorporate consumption patterns of the household. Since consumption patterns are difficult to verify, models that do not use such explanatory variables are desirable. Therefore, second-best performing models were also identified and rates of leakage and undercoverage are marked with shadows in Table 9.4 and Table 9.5. As can be seen from here, even the second-best models have significantly better targeting accuracy than the PRR method.

Results of the individual-level analysis are very similar to results of the household-level analysis. While specific values of undercoverage rates and leakage rates are slightly different for the 2 types of analysis, the main implication remains consistent. I find that the PRR method is not an appropriate tool to determine the welfare of households and individuals.

[29] Refer to Table A.7.5 and Table A.7.6 for details

10. Conclusions

This paper attempted to assess the targeting accuracy of the Child Money Program. The findings show that the Poverty Risk Ratio (PRR) method has larger exclusion and inclusion errors compared to other targeting methods proposed in the paper. When the national poverty line is applied, the PRR method has an undercoverage rate of 40%-43% and a leakage rate of 11.71%-29.59%. With alternative models, undercoverage rates and leakage rates can be lowered to 5.09%-15.91% and 8.42%-20.6%, respectively. Models that maximize the likelihood of being poor using best-fit explanatory variables among indicators of household characteristics, family characteristics, ownership of durable goods and consumption patterns have the best targeting accuracy. When an international poverty line of 1.08 dollar per person per day is applied, rates of undercoverage and leakage under the PRR method are estimated to be 20.29%-35.6% and 29.76%-71.94%, respectively. Here again, alternative models significantly increase the targeting accuracy. These numerical values are based on misclassification of household welfare. When misclassification of individual welfare is concerned, 31.31%-34.98% of the poor individuals were identified as non-poor by the PRR method, while 10.02%-28.45% of the individuals who were identified as poor by the PRR method are non-poor. Alternative models lower these values to 3.01%-12.27% and 7.89%-18.76%, respectively. Thus, it can be concluded that the PRR method has low targeting accuracy regardless of what indicator is used as a benchmark measure of welfare and can be improved utilizing other models.

The Child Money Program has large errors at the implementation level. I find that even if the PRR method perfectly predicted the true welfare of the household, 30.61%-31.03% of the poor households are excluded from the program and 22.22%-24.44% of the beneficiaries are non-poor. These errors occur through exclusion of poor households who cannot meet the administrative burdens such as registration and documentation and by inclusion of non-poor households who manipulate the values of the proxy indicators. In terms of implementation, the Child Money Program could benefit from making proxy indicators less visible for the applicants. For example, instead of using all information collected from the applicants for the proxy means testing, the government could collect more information than needed and use only a subset of those indicators to calculate the index of household subsistence levels. Poverty targeting programs in Mexico and Colombia utilize such methods. It is also important to update the proxy indicators and weights periodically through collecting new data. Finally, follow -up assessments should be done frequently to assess the impact of the program on poverty and the program should be updated based on those assessments. This would help the Child Money Program to accomplish its goal of reducing poverty instead of being merely a political tool.

The purpose of this paper was not to propose an alternative targeting method that should replace the PRR method. Such an ambitious goal cannot be achieved based on a sample survey data. The household survey data analyzed here covered only Ulaanbaatar and its sample size is relatively small. Although the households were selected through a random sampling method, the data is not representative of the whole country. A similar analysis could be done using survey data capable of representing more parts of Mongolia. This would include necessary information to assess the PRR method. I would suggest that the Government of Mongolia collect such data and conduct relevant analyses before expanding the usage of the PRR method for other poverty-targeting programs. Another important indicator that was not discussed in this paper is how much impact the program has on poverty. It is important to test whether 3,000 MNT per child per month has a significant effect in reducing poverty. If so, the Government should evaluate the extent of poverty reduction. If not, the Government could focus on supporting extremely poor households and increase the size of the benefit per beneficiary. 3,000 MNT accounts for only one-tenth of the national poverty line in 2005 and the effect of the CMP benefit on poverty reduction is questionable. Future analysis of the Child Money Program could include impact evaluation of the program.

References

Akerof, George. "The Economics of "Tagging" as Applied to the Optimal Income Tax, Welfare Programs, and Manpower Planning." *American Economic Review* 68, no. 1 (1975): 9-19.

Albert Park, Sangui Wang, Guabao Wu. "Regional Poverty Targeting in China." *Journal of Public Economics* 86 (2002): 123-53.

Alderman, Harold. "Multi-Tier Targeting of Social Assistance: The Role of Intergovernmental Transfers." *The World Bank Economic Review* 15, no. 1 (2001): 33-53.

———. "Do Local Officials Know Something We Don't? Decentralization of Targeted Transfers in Albania." *Journal of Public Economics* 83 (2002): 375-404.

Atal, Yogesh. "Poverty in Transition and Transition in Poverty: Recent Developments in Hungary, Bulgaria, Romania, Georgia, Russia, Mongolia." edited by Yogesh Atal (ed), 1999.

———. *Poverty in Transition and Transition in Poverty: Recent Developments in Hungary, Bulgaria, Romania, Georgia, Russia, Mongolia*, 1999.

Baker, Judy L. *Evaluating the Impact of Development Projects on Poverty: A Handbook for Practitioners*. Washington, D.C.: The World Bank, 2000.

Banerjee, A. "A Theory of Misgovernance." *Quarterly Journal of Economics* 62 (1997): 1289-332.

Bardhan, Pranab. "Efficiency, Equity and Poverty Alleviation: Policy Issues in Less Developed Countries." *The Economic Journal* 106, no. 438 (1996): 1344-56.

Bardhan, Pranab, and Dilip Mookherjee. "Decentralizing Antipoverty Program Delivery in Developing Countries." *Journal of Public Economics* 89 (2005): 675-704.

Batjargal, Uranbileg, Yasuyuki Sawada, and Akihiko Matsui. "Social Assistance and Welfare in Mongolia: An Overview and an Analysis of the Child Money Program." Final Report submitted to the World Bank, 2005.

Besley, Timothy, and Ravi Kanbur. "The Principles of Targeting." 69-90.

Bhalotra, Sonia, and Cliff Attfield. "Intrahousehold Resource Allocation in Rural Pakistan: A Semiparametric Analysis." *Journal of Applied Econometrics* 13, no. 5, Special Issue: Application of Semiparametric Methods for Micro-Data (1998): 463-80.

Blackorby, Charles and David Donaldson. "Cash versus Kind, Self-Selection, and Efficient Transfers." *American Economic Review* 78, no. 4 (1988): 691-700.

Canning, Jonathan and Michael Kevane. "Community-Based Targeting Mechanisms for Social Safety Nets: A Critical Review." *World Development* 30, no. 3 (2002): 375-94.

Castaneda, Tarsicio. "Targeting Social Spending to the Poor with Proxy-Means Testing: Colombia's SISBEN System." *Social Protection Discussion Paper Series*, no. 0529 (2005).

Chen, Shaohua, and Martin Ravallion. "How Have the World's Poorest Fared since the Early 1980s?" edited by Development Research Group. Washington D.C.: The World Bank, 2004.

Coady, David, Margaret Grosh, and John Hoddinott. *Targeting of Transfers in Developing Countries: Review of Lessons and Experience, World Bank Regional and Sectoral Studies*. Washington, D.C: The World Bank, 2004.

Coate, Stephen. "Altruism, the Samaritan's Dilemma, and Government Transfer Policy." *American Economic Review* 85, no. 1 (1995): 46-57.

Cox, D. and E. Jimenez. "Social Security and Private Transfers in Developing Countries: The Case of Peru." *World Bank Economic Review* 6 (1992): 155-69.

Dasgupta, Indraneel, and Ravi Kanbur. "Community and Anti-Poverty Targeting." 2003.

Deaton, Angus. *The Analysis of Household Surveys: A Microeconometric Approach to Development Policy*: The World Bank, the Johns Hopkins University Press, 1997.

Deaton, Angus, and Salman Zaidi. "Guidelines for Constructing Consumption Aggregates for Welfare Analysis." Paper presented at the Living Standards Measurement Study Working Paper, Washington, D.C. 2002.

Duclos, Jean-Yves. "Vulnerability and Poverty Measurement Issues for Public Policy." *Social Protection Discussion Paper Series*, no. 0230 (2002).

Erdene, Uuganbileg. "Social Assistance Program Assessment for Mongolia Part 1: Coverage and Cost, Draft." The World Bank, 2004.

Filmer, Deon, and Lant H. Prichett. "Estimating Wealth Effects without Expenditure Data or Tears: An Application to Education Enrollments in States of India." *Demography* 38, no. 1 (2001): 115-32.

Finan, Frederico, Elisabeth Sadoulet, and Alain de Janvry. "Measuring the Poverty Reduction Potential of Land in Rural Mexico." *Journal of Development Economics* 77 (2005): 27-51.

Foster, James, Joel Greer, and Erik Thorbecke. "A Class of Decomposable Poverty Measures." *Econometrica* 52, no. 3 (1984): 761-66.
Galasso, Emanuela, and Martin Ravallion. "Decentralized Targeting of an Anti-Poverty Program." *Journal of Public Economics* 89 (2005): 705-27.
Gibson, John. "Measuring Chronic Poverty without a Panel." *Journal of Development Economics* 65 (2001): 243-66.
Glewwe, Paul. "Targeting Assistance to the Poor Efficient Allocation of Transfers When Household Income Is Not Observed." *Journal of Development Economics* 38 (1992): 297-321.
Government of Mongolia.
———. "Law on Social Welfare (in Mongolian)."
———. "Interim Poverty Reduction Strategy Paper." Ulaanbaatar: Government of Mongolia, 2001.
———. "Economic Growth Support and Poverty Reduction Strategy." Ulaanbaatar: Government of Mongolia, 2003.
Griffin, Keith. "Poverty and the Transition to a Market Economy in Mongolia." edited by Keith Griffin.
Grosh, Margaret E. *Administering Targeted Social Programs in Latin America: From Platitudes to Practice*. Washington, D.C. The World Bank, 1994.
Grosh, Margaret E., and Judy L. Baker. "Proxy Means Tests for Targeting Social Programs: Simulations and Speculations." *Living Standards Measurement Study Working Paper*, no. 118 (1995).
Gundsambuu, Kh., Ch.Dagvadorj, N. Tungalag, Ya.Shuurav, and T.Burenjargal. "Study of the Current Methodology for Identifying Living Standard of Households and Citizens and Its Comparison with Some Countries at Similar Level of Development: Survey Report." Ulaanbaatar: Human Resource and Social Welfare Foundation of Mongolia, UNDP Mongolia, Ministry of Finance, 2005.
Hammer, Jeffrey, and William Jack. "Designing Incentives for Rural Health Care Providers in Developing Countries." *Journal of Development Economics* 69, no. 1 (2002): 297-303.
Harper, Caroline. “An Assessment of Vulnerable Groups in Mongolia: Strategies for Social Policy Planning." In *World Bank Discussion Papers*. Washington, D.C: East Asia & Pacific region series / China and Mongolia Department, The World Bank, 1994.
Holmstrom, B. and P. Milgrom. "Multi-Task Principal-Agent Analyses: Linear Contracts, Asset Ownership and Job Design." *Journal of Law, Economics and Organization* 7 (1991): 24-52.
International Monetary Fund. *International Financial Statistics Yearbook.* Washington D.C.: IMF, 2003.
———. *International Financial Statistics.* Washington D.C: IMF, 2005.
Isham, Jonathan, Deepa Narayan, and Lant Pritchett. "Does Participation Improve Performance? Establishing Causality with Subjective Data." *World Bank Economic Review* 9, no. 2 (1995): 175-200.
Jean-Yves Duclos, Paul Makdissi, Quentin Wodon. "Poverty-Dominant Program Reforms: The Role of Targeting and Allocation Rules." *Journal of Development Economics* 77 (2005): 53-73.
Jere Behrman, Piyali Sengupta, Petra Todd. "Progressing through Progresa: An Impact Assessment of Mexico's School Subsidy Experiment." International Food Policy Research Institute, 2001.
Joel Greer, Erik Thorbecke. "A Methodology for Measuring Food Poverty Applied to Kenya." *Journal of Development Economics* 24 (1986): 59-74.
John Newman, Menno Pradhan, Laura B. Rawlings, Geert Ridder, Ramiro Coa, and Jose Luis Evia. "An Impact Evaluation of Education, Health, and Water Supply Investments by the Bolivian Social Investment Fund." *The World Bank Economic Review* 16, no. 2 (2002): 241-74.
Jonathan Conning, Micheal Kevane. "Community-Based Targeting Mechanisms for Social Safety Nets: A Critical Review." *World Development* 30, no. 3 (2002): 375-94.
Justin A. Odulana, Joseph A. Olomajeye. "The Impact of Government's Alleviation of Poverty Program on the Urban Poor in Nigeria." *Journal of Black Studies* 29, no. 5, Special issue: Political Strategies of Democracy and Health Issues and Concerns in Global Africa (1999): 695-705.
Jyotsna Jalan, Martin Ravallion. "Are the Poor Less Well Insured? Evidence on Vulnerability to Income Risk in Rural China." *Journal of Development Economics* 58 (1999): 61-81.
Keen, Micheal. "Needs and Targeting." *The Economic Journal* 102, no. 410 (1992): 67-79.
King, Elizabeth M., Peter F. Orazem and Darin Wohlgemugh. "Central Mandates and Local Initiatives: The Columbia Education Voucher Program." *World Bank Economic Review* 13, no. 3 (1999): 467-92.
Maitra, Pushkar, and Ranjan Ray. "The Effect of Transfers on Household Expenditure Patterns and Poverty in South Africa." *Journal of Development Economics* 71 (2003): 23-49.
Ministry of Social Welfare and Labor of Mongolia. "Social Security Sector Strategy Paper." Ulaanbaatar: MSWL, 2003.

———. "Social Welfare Measures Being Implemented by the Government." Ulaanbaatar: MSWL, 2005.
Montgomery, Mark R., Michele Gragnolati, Kathleen A. Burke, and Edmundo Paredes. "Measuring Living Standards with Proxy Variables." *Demography* 37, no. 2 (2000): 155-74.
Nancy Birdsal, Juan Luis Londono. "Asset Inequality Matters: An Assessment of the World Bank's Approach to Poverty Reduction." *The American Economic Review* 87, no. 2, Papers and Proceedings of the Hundred and Fourth Annual Meeting of the American Economic Association (1997): 32-37.
National Statistical Office of Mongolia, World Bank, UNDP. "Main Report of "Household Income and Expenditure Survey/ Living Standards Measurement Survey 2002-2003"." Ulaanbaatar: National Statistical Office of Mongolia, World Bank, UNDP, 2004.
Paul, Satya. "A Model of Constructing the Poverty Line." *Journal of Development Economics* 30 (1989): 129-44.
Quisumbing, A., L.Haddad, and C.Pena. "Are Women Overrepresented among the Poor? An Analysis of Poverty in 10 Developing Countries." *Journal of Development Economics* 66 (2001): 225-69.
Rai, Ashok. "Targeting the Poor Using Community Information." *Journal of Development Economics* 69 (2002): 71-84.
Ravallion, Martin. "Measuring Social Welfare with and without Poverty Lines." *The American Economic Review* 84, no. 2, Papers and Proceedings of the Hundred and Sixth Annual Meeting of the American Economic Association (1994): 359-64.
———. "Issues in Measuring and Modeling Poverty." *The Economic Journal* 106, no. 438 (1996): 1328-43.
———. "The Mystery of the Vanishing Benefits: An Introduction to Impact Evaluation." *The World Bank Economic Review* 15, no. 1 (2001): 115-40.
Ravallion, Martin, and Kalvin Chao. "Targeted Policies for Poverty Alleviation under Imperfect Information: Algorithms and Application." *Journal of Policy Modeling* 11, no. 2 (1989): 213-24.
Reinikka, Rivta, and Jacob Sevenson. "Local Capture, Evidence from a Central Government Transfer Program in Uganda." *Quarterly Journal of Economics.* forthcoming (2004).
Rozenweig, Mark R., and Kenneth I. Wolpin. "Evaluating the Effects of Optimality Distributed Public Programs: Child Health and Family Planning Interventions." *The American Economic Review* 76, no. 3 (1986): 470-82.
———. "Migration Selectivity and the Effects of Public Programs." *Journal of Public Economics* 37 (1988): 265-89.
Schultz, T. Paul. "School Subsidies for the Poor: Evaluating the Mexican Progresa Poverty Program." *Journal of Development Economics* 74 (2004): 199-250.
Skoufias, Emmanuel, Davis Benajmin, De La Vega, Sergio. "Targeting the Poor in Mexico: An Evaluation of the Selection of Households into Progresa." *World Development* 29, no. 20 (2001): 1769-84.
Skoufias, Emmanuel, Benajmin Davis, and Jere Behrman. "Final Report: An Evaluation of the Selection of Beneficiary Households in the Education, Health, and Nutrition Program (Progresa) of Mexico." Washington D.C.: International Food Policy Research Institute, 1999.
Slesnick, Daniel T. "Consumption and Poverty: How Effective Are in-Kind Transfers?" *The Economic Journal* 106, no. 439 (1996): 1527-45.
Sorensen, Elaine, and Sandra Clark. "A Child-Support Assurance Program: How Much Will It Reduce Child Poverty and, and at What Cost?" *The American Economic Review* 84, no. 2, Papers and Proceedings of the Hundred and Sixth Annual Meeting of the American Economic Association (1994): 114-19.
Subbarao, K., and Kene Ezemenari. "Transition, Poverty and Social Assistance in Mongolia." In *ESP Discussion Paper Series*, 1995.
Thorbecke, Erik, and Hong-Sang Jung. "A Multiplier Decomposition Method to Analyze Poverty Alleviation." *Journal of Development Economics* 48 (1996): 279-300.
USAID. "Assessment of Corruption in Mongolia, Final Report." Ulaanbaatar: USAID, 2005.
Walle, Dominique van de. "Targeting Revisited." *The World Bank Research Observer* 13, no. 2 (1998): 231-48.
Wooldridge, Jeffrey M. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, Massachusetts, London England: The MIT Press, 2002.