Targeting at the Margin: the 'Glass of Milk' Subsidy Programme in Peru

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This article evaluates the Vaso de Leche (VL) feeding programme in Peru in order to illustrate an evaluation methodology based on targeting criteria for a decentralised transfer programme. We find that the degree of overall targeting of poor individuals attributable to the central government's choice of districts is greater than that attributable to choice of participants within districts made by the municipalities and the mothers' committees. However, when we use a version of a targeting efficiency measure first introduced by Galasso and Ravallion [2003] which we modify to be defined on the values of allocations, the opposite is the case. The community-based decision makers appear to be targeting the poor in terms of the values of the transfers.

I. INTRODUCTION

There is a broad empirical literature investigating the ability of governments to target services, subsidies, or transfers to low income households [for a recent review see, *Coady, Grosh, and Hoddinott, forthcoming*]. One theme in this literature is whether decentralisation of service delivery can improve targeting by increasing the efficiency of information gathering or by better motivating the use of this information [*Conning and Kevane, 2002; Alderman, 2001; Galasso and Ravallion, 2003*]. Decentralisation makes targeting more complex since the criteria and effectiveness of targeting budgetary transfers from the centre to local governments may be very different than the allocation rules at the local level and their execution.

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The Journal of Development Studies, Vol.41, No.5, July 2005, pp.839 – 864
ISSN 0022-0388 print/1743-9140 online
DOI: 10.1080/00220380500145305

In this article we analyse the distribution of benefits from a community-based programme, Peru's programme to provide milk and milk substitutes to low income households called the *Vaso de Leche* (VL). In doing so, we employ an innovative evaluation methodology based on targeting criteria for a decentralised transfer programme. This study recognizes that the decision on targeting involves both a budgetary allocation from the central government to municipalities and one from municipalities to recipients. While this is a feature of studies by Alderman [*2001*] and Galasso and Ravallion [*2003*], the current article also considers the fact that the local targeting body has leeway on both the number of beneficiaries as well as the amount provided to each recipient. As these two choices are linked through the budget constraint, the allocation process involves a trade-off between: (a) providing a comparatively large number of households with a modest transfer; and (b) reducing the number of beneficiaries to be able to provide larger amounts to each targeted family. To address this, issue as well as to get a more complete picture of targeting between and within districts, we develop and apply a modified version of a targeting efficiency measure first introduced by Galasso and Ravallion [*2003*].

Moreover, since we observe targeting at an early stage of the programme as well as later when the programme was funded with additional resources, we are able to couple the possibility that distributional benefits may vary with programme size [*Lanjouw and Ravallion, 1999*] with considerations of multi-tier targeting and the trade-off between including more beneficiaries and providing more resources to those in the programme during an expansion. Younger [*2003*] points out that in some cases marginal benefits of a programme are similar to average benefits when such expansions occur. For example, when the price of a service is reduced, the distribution of gains by recipients could be in proportion to their current benefits. In other cases, expansion of services only occurs for those who do not yet participate. Thus, the marginal changes in benefits may look rather different from those implied by the average participation rates. However, when expansion takes place both by adding new entrants (extensive margin) and by increasing benefits for existing participants (intensive margin), the set of appropriate analytical tools differs from those that may offer empirical insights for marginal benefit incidence in other circumstances. In this article, we decompose the change in the expected transfer into changes at the extensive and intensive margins.

With growing decentralisation of many government services, there is increasing scope for community based targeting [*Conning and Kevane, 2002*]. This fact, in turn, increases the complexity of analysis of programme distribution and impact. Moreover, many such programmes reviewed by Conning and Kevane [*2002*] define the level of benefits as well as eligibility – for example, the mohalla programme in Uzbekistan, or Albania's Ndihme

Ekonomika. Similarly, communities often are asked to determine amounts of food aid in response to a drought or similar emergency and simultaneously to establish the number of recipients [*Yamano, Alderman, and Christiaensen. 2003*]. The approach employed in this article can assist in understanding such choices. The next section depicts the details of the VL programme. Section III describes the various data sources used in this analysis, and is followed by a discussion of methodologies used to assess the targeting efficiency of the programme. Section V presents the results.

II. DESCRIPTION OF THE VL PROGRAMME

Totalling $97 million in 2001, the VL is the largest social transfer in Peru and the second largest component of transfers from the central government to municipalities [*Instituto Apoyo and the World Bank, 2002*]. Introduced in 1984 by the Mayor of Lima for the metropolitan area, the programme has since expanded to national coverage (1985) and by 1998 reached 44 per cent of households with children aged three through 11 [*Younger, 2002*] through earmarked monthly transfer to municipalities. These municipalities are required by law to have an administrative committee that includes elected representatives of beneficiaries, the mayor, another local official, and a representative from the Ministry of Health.

In addition to this administrative committee, each community has an elected VL mothers' committee (*Club de Madres*). It is this committee, which has a substantial discretion over decision making [*Instituto Apoyo and the World Bank, 2002*], that determines who the beneficiaries are, the timing of deliveries and, to a degree, what commodities are distributed. Despite its name, the VL programme is not confined to the distribution of milk or even milk substitutes. In some cases cereals or a combination of commodities are distributed in lieu of, or in addition to milk products. In its current form, written into law in 2001 but remaining in the spirit of the original programme, priority is given to households with children six years of age and under, as well as to households with pregnant or lactating women. Once these first-tier beneficiaries are attended to by the mothers' committees, second-tier beneficiaries (children aged 7 to 13, and people with tuberculosis) may participate. Within these categories, priority is based on need. The monthly transfers received by the municipalities from the Ministry of Economy (MEF) are determined by an assignment formula that is based on community poverty and demographic criteria [*Apoyo and the World Bank, 2002; Grosh, 1994*].

There have been a number of excellent recent studies on the distribution of social expenditures in Peru and of VL in particular. For example, Ruggeri Laderchi [*2001*] uses one of the data sources employed in the current analysis – a 1997 household survey – to illustrate the overall distribution of food

transfers, as well as their impact on food consumption and nutrition. She finds that the transfers are slightly progressive although the poorest 40 per cent of households received only 46 per cent of total transfers. Using a different methodology, Younger [*2002*] also confirms the general pattern of progressive distribution and finds that the increases in coverage between 1994 and 1997 improved this targeting.

A recent Public Expenditure Tracking Survey (PETS) followed the budget trail from the central government to the beneficiaries [*Instituto Apoyo and the World Bank, 2002; World Bank and Inter-American Development Bank, 2002*]. The study confirmed that there was appreciable variation between communities regarding the timing of delivery, the commodities chosen and the administrative fees charged. Virtually all the funds released by the centre were transferred to municipal VL administrative budgets and further down to the level of the Mothers' Committees with only some documented small-scale leakage in the allocations. The PETS study did find, however, that there were discrepancies between the commodity allocations reported by the committees and by households. They could not account for a quarter of the total product transferred, though the majority of the unexplained gap is found in urban districts (particularly provincial capitals).[1]

III. DESCRIPTION OF DATA SOURCES

This evaluation of the VL programme benefits from a wealth of data sources available in Peru. The data used in this analysis come from four main sources: (a) information on the geographic allocation of VL expenditures; (b) national household living standard surveys; (c) national demographic and health surveys; and (d) the Public Expenditure Tracking Survey (PETS).

(A.) VL Expenditures The *Vaso de Leche* (VL) Programme has maintained monthly records of expenditures allocated to each administrative region (department, province, and district) in Peru since 1994. We use this information, along with district population sizes from the 1993 census and the 2000 pre-census, to determine real annual total and per capita VL expenditures in each of the recipient districts for the years 1994 to 2000.

(B.) Living Standard Surveys Two sources of household living standard surveys were available for this study. The first is the *Encuesta Nacional de Hogares* (ENAHO), collected by the *Instituto Nacional de Estadistica e Informatica* (INEI) in 1998, 1999 and 2000. These nationally representative surveys of over 6,500 households (2,000 for the 2000 survey) were carried out quarterly, with each quarter's survey focusing on a different theme. We concentrate on the second quarter module which focuses on social services,

and includes information on participation in the VL programme. Household income information is also available for each module.

The second source is the 1994 and 1997 *Encuesta Nacional de Hogares sobre Medicion de Niveles de Vida* (ENNIV) surveys, collected by the *Instituto Cuanto*. These are nationally representative surveys of more than 3,500 households that collect multiple indicators of household and individual wellbeing (for example, education, housing, health, economic activity, consumption and assets). The 1994 ENNIV includes information on VL participation by the household, while the 1997 data also include estimates of the values of the transfers made to the household. Anthropometric measurements of heights and weights of young children were also recorded in the 1997 ENNIV survey.

(C.) Demographic and Health Surveys Demographic and Health Surveys (DHS) were carried out in Peru in 1996 and 2000. These nationally representative surveys of over 28,000 households each are part of a programme funded by USAID and implemented by Macro International Inc, which has included over 70 nationally representative household surveys in more than 50 countries. The DHS surveys are conducted in single rounds with two main survey instruments: a household schedule and an individual questionnaire for women of reproductive age (15–49). The household schedule collects information on household members, assets and access to public services. Since income or expenditure data are not collected, we use the asset data to construct household asset indices as measures of household wealth [*Sahn and Stifel, 2003*]. Child anthropometric measurements are recorded in the individual module.

(D.) Public Expenditure Tracking Survey The PETS for the VL programme was conducted by *Instituto Apoyo* at the end of 2001 and early in 2002 to quantify leakages and delays in the process of public expenditure disbursements and to assess the effects of deficiencies in the system on the quality of the services provided. Interviews were conducted at three levels – the municipality, the mothers' committee, and the household. One hundred municipalities were sampled, from which four mothers' committees each were selected randomly, and finally four beneficiary households were selected randomly from each mothers' committee in the sample. Because there are fewer than four committees in some municipalities, only 393 committees were interviewed, and 1,587 beneficiary households interviewed. The household survey includes information on household demographics, assets, and details about participation in the VL programme including values of transfers, types of products transferred and information on additional purchases.

We should note that comparability issues are unavoidable when handling a large number of different data sources. For example, the welfare indicators used to rank households and to identify poor households differ for the ENAHO (income), ENNIV (consumption) and PETS (wealth – see Section IV) data. This follows from differences in the availability of information in these data sources. While these measures capture different concepts of welfare, the value of using the full set of surveys in this analysis cannot be overstated provided that the reader is aware of the lack of comparability. The different data sources and their welfare measures provide a robustness check on the trends observed in the analysis. Nonetheless, changes over time are best evaluated using the same data types and welfare indicators.

IV. RESEARCH STRATEGY

(A.) Programme Targeting We first address the question of the incidence of distribution of the benefits to the poor. We ask not only what share of the poor – defined in terms of income or wealth as well as in terms of nutritional status of children – participate in the programme, but also what share of benefits accrue to different groups. This analysis provides a fair description of both errors of exclusion and inclusion. We also decompose the targeting efficiency into inter-district and intra-district components [*Galasso and Ravallion, 2003*].

To understand the targeting efficiency decomposition, we begin by categorising the shares of all households who are recipients and are poor ($n_{v,p}$) or non-poor ($n_{v,-p}$), and the shares of all households who are non-recipients and are poor ($n_{-v,p}$) or non-poor ($n_{-v,-p}$), as illustrated in Table 1. Given this notation, we can define the Galasso-Ravallion targeting coefficient (T) as the difference between the share of the poor in the programme ('coverage') and the share of the non-poor in the programme ('leakage'),

$$T = \frac{n_{v,p}}{n_p} - \frac{n_{v,-p}}{n_{-p}} = \frac{n_{v,p}n_{-v,-p} - n_{-v,p}n_{v,-p}}{n_p n_{-p}}.$$

TABLE 1
NOTATION FOR DECOMPOSITION OF TARGETING EFFICIENCY

	Poor	Non-poor	Total	
VL participant	$n_{v,p}$	$n_{v,-p}$	n_v	(Share in programme)
Not VL participant	$n_{-v,p}$	$n_{-v,-p}$	n_{-v}	(Share not in programme)
Total	n_p (Share poor)	n_{-p} (Share not poor)	1.0	

This targeting coefficient lies between –1 and 1. For example, a programme targeted perfectly to the poor is one in which all of the poor are in the programme (that is, full coverage where $n_{v,p} = n_p$) and none of the non-poor are in the programme (that is, no leakage where $n_{v,-p} = 0$). This has a targeting coefficient of 1. Conversely, a programme targeted perfectly to the non-poor is one in which none of the poor are in the programme (that is, no coverage where $n_{v,p} = 0$) and all of the non-poor are in the programme (that is, full leakage where $n_{v,-p} = n_{-p}$), and thus $T = -1$. The targeting coefficient takes on a value of zero if the programme coverage is exactly offset by the leakage.

The targeting coefficient is simply a measure of association related to the 2×2 contingency table that appears in Table 1. As such it is directly related to the well known 'phi coefficient'.

$$\phi = \frac{n_{v,p}n_{-v,-p} - n_{-v,p}n_{v,-p}}{\sqrt{n_p n_{-p} n_v n_{-v}}} = T\sqrt{\frac{n_p n_{-p}}{n_v n_{-v}}},$$

This coefficient is commonly used to test independence in a contingency table (since $N\phi^2 \sim \chi^2(1)$). We use this statistic to test the null hypothesis of untargeted programme allocations ($H_0{:}\phi = 0$).

Given the decentralised, community-based nature of targeting for the VL programme, we want to know more about how various stages of the allocation of benefits contributes to the national level of targeting. We address just this by decomposing this targeting coefficient into an inter-district ('between') component and an intra-district ('within') component. Galasso and Ravallion [*2003*] show that the national targeting coefficient can be decomposed as follows,

$$T = \underbrace{\sum_{d=1}^{N_D} \frac{N_d}{N}\left(\frac{n_{p,d}}{n_p}\right)\left(\frac{n_{-p,d}}{n_{-p}}\right)T_d}_{\text{Within district}} + \underbrace{\sum_{d=1}^{N_D} \frac{N_d}{N}\left(\frac{(n_{v,d} - n_v)(n_{p,d} - n_p)}{n_p n_{-p}}\right)}_{\text{Between district}}.$$

where N_d is the number of households in district d, N is the overall number of households, and N_D is the number of districts. Thus the intra-district contribution to overall targeting is simply the weighted average of the district targeting coefficients where the weights are the product of the district population share, the share of all the poor in the country who live in the district, and the share of all the non-poor in the country who live in the district. To interpret these weights, consider the extremes. If the entire population of a particular district is poor, then the weight placed on this

district is zero (the share of the non-poor is zero, $n_{-p,d}=0$) because intra-district targeting is irrelevant to overall targeting. The targeting of the district itself is what matters. Conversely, if the entire population in a district is non-poor, the weight place on the district is also zero ($n_{p,d}=0$) by the same reasoning.

These targeting coefficients and decompositions are estimated using both poverty and malnutrition as targeting criteria. The poverty targeting coefficients are estimated using the ENNIV and ENAHO data where households are defined as poor if their incomes fall below the official poverty line. The malnutrition targeting coefficients are estimated using the ENNIV and DHS data where children are defined as malnourished if their height-for-age z-scores are less than -2.

The Galasso-Ravallion targeting coefficient, however, is defined over the shares of participants in the VL programme, not over the shares of benefits accruing to different groups. This follows from their assumption of equal transfer values to all recipients, an assumption in keeping with the programme they were investigating. When we have differential transfer values for each of the recipient households – as is the case for many of the programmes reviewed by Coady, Grosh and Hoddinott [*forthcoming*], we need to redefine the targeting measure and how to decompose it into inter- and intra-district contributions. The motivation for this approach is that, under such circumstances, the degree of programme targeting is the product of two decisions: (a) who should participate; and (b) what should be the value of transfers to each of the participants. Since the Galasso-Ravallion targeting coefficient captures the former and not the latter, we extend their methodology to define a targeting coefficient that captures both.[2] We then apply it to the 1997 ENNIV data – the only data source with information on household level VL transfer values. As we shall see, these two targeting coefficients taken together can provide additional insights into targeting behaviour:

Begin by defining the average transfer received by the poor:

$$\overline{VL}_p = \frac{1}{N_p}\sum_{i=1}^{N_p} VL_{p,i}$$

where, $VL_{p,i}$ is the value of the VL transfer received by a poor household i, and N_p is the total number of poor households. The average transfer received by the non-poor is defined analogously as:

$$\overline{VL}_{-p} = \frac{1}{N_{-p}}\sum_{i=1}^{N_{-p}} VL_{-p,i}$$

The targeting differential (t) can then be defined as the difference between the average amount going to the poor and the average amount going to the non-poor:

$$t = \overline{VL}_p - \overline{VL}_{-p}$$

The targeting differential, in turn, can be decomposed into inter- and intra-district components. To see this, first note that the average transfers to the poor and non-poor can be expressed as weighted averages of the district-level averages:

$$t = \sum_{d=1}^{N_D} \frac{N_d}{N} \left(\frac{n_{p,d}}{n_p}\right) \overline{VL}_{p,d} - \sum_{d=1}^{N_D} \frac{N_d}{N} \left(\frac{n_{-p,d}}{n_{-p}}\right) \overline{VL}_{-p,d}.$$

Some manipulation of this gives the following:

$$\underbrace{t = \sum_{d=1}^{N_D} \frac{N_d}{N} \left(\frac{n_{p,d}}{n_p}\right) \left(\frac{n_{-p,d}}{n_{-p}}\right) \left(\overline{VL}_{p,d} - \overline{VL}_{-p,d}\right)}_{\text{Within district}}$$

$$\underbrace{+ \sum_{d=1}^{N_D} \frac{N_d}{N} \left(\frac{n_{p,d}}{n_p}\right) \left(\frac{n_{-p} - n_{-p,d}}{n_{-p}}\right) \overline{VL}_{p,d} - \sum_{d=1}^{N_D} \frac{N_d}{N} \left(\frac{n_{-p,d}}{n_{-p}}\right) \left(\frac{n_p - n_{p,d}}{n_p}\right) \overline{VL}_{-p,d}}_{\text{Between district}}$$

The first component is simply the weighted average of the district-level targeting differentials where the weights are defined analogously to those in the Galasso and Ravallion decomposition. As such, this component is the contribution of intra-district targeting to the total targeting differential. The second component, the weighted averages of the district average transfers to the poor and to the non-poor, represents the contribution of inter-district targeting to the total differential.

Finally, the targeting differential is normalised by the average transfer to the poor. This gives us a modified 'targeting coefficient' (T):

$$T = 1 - \frac{\overline{VL}_{-p}}{\overline{VL}_p}.$$

Thus for a programme targeted perfectly to the poor, the targeting coefficient will take on a value of 1 since the average transfer value

received by the non-poor is zero (that is, $\overline{VL}_{-p} = 0$). A programme that distributes the benefits perfectly randomly will result in equal values going to the poor and non-poor and a targeting coefficient equal to zero (that is, $\overline{VL}_{-p} = \overline{VL}_{p}$). Finally, the targeting coefficient takes on a value of negative infinity when the programme is targeted perfectly to the non-poor (that is, $\overline{VL}_{p} = 0$).

(B.) Computing Targeting according to Wealth Rankings As reported above, of all the data sets we are using, only the ENNIV 1997 has information on both household expenditures/incomes and values of VL benefits received. While this implies that we can only assess targeting across expenditure groups with the ENNIV dataset, we can still indicate the degree of targeting according to household *wealth* using the PETS data. However, to do this, we also have to consider the nature of the PETS sample. This data set has information on value of transfers at the household level conditional upon participation in the VL programme. However, the PETS data do not include household expenditures or incomes. Nonetheless, we can indicate the share of the total programme that is received by different wealth quintiles using the asset data in the PETS (and expenditure data in the ENNIV 1997).

In order to do this for the PETS data, we create a wealth ranking following a methodology that has been regularly applied to DHS data sets [*Sahn and Stifel, 2003*]. In particular, we construct a wealth index from households' asset information. This index is the outcome of a factor analysis of various assets about which the survey asks: household characteristics (water source, toilet facilities, and construction material) and durables (ownership of radio, television, refrigerator, bicycle, motorcycle and/or car), as well as education of the household head. We assume that there is a common factor, 'wealth', that explains the variance in the ownership of these assets, and allow the factor analysis to define that factor as a weighted sum of the individual assets.[3]

By using the weights derived from the 2000 DHS to construct a wealth index for the PETS sample, we are able to determine how the households sampled in the latter survey rank relative to the overall national population. Although the PETS used a sample frame of recipients, we have sample weights and municipal populations and, therefore, can derive the proportion of VL recipients in each jurisdiction. Since our unit of analysis is the household, the assumption necessary to derive the proportion of VL households in each jurisdiction is that the share of beneficiary households for a particular committee to all households is the same as the share of beneficiaries in the committee to all individuals.

V. RESULTS

Targeting

We confirm that the VL programme is reasonably well targeted to households in terms of their income status. This is initially done by comparing the coverage rates of households according to their per capita income levels[4] for five household surveys (Table 2). The percentage of all households that receive VL transfers declines sharply with the level of income. For example, coverage rates declined from 30 per cent of the households in each of the two poorest quintiles to less than 5 per cent in the richest in 1994. As the coverage for all households with children increased over time from 20 per cent in 1994 to 32 per cent in 2000 ($t = 10.26$), coverage in each of the two poorest quintiles rose from just over 30 per cent to 50 per cent during this period ($t = 9.56$). While there was a concurrent increase for the more well-off people in the population, the poorest 40 per cent of the eligible households nonetheless received over three times as much as the richest 20 per cent on average. A similar pattern is observed for households with children of age six and under (Tier 1 target group).

Table 3 shows that using the Galasso-Ravallion targeting coefficient, the null hypothesis of no targeting is confidently rejected in the direction of targeting toward the poor (that is, a positive targeting coefficient). Despite the increase of the share of the well off in the programme as it expanded, the targeting coefficient increased from 24 to 35 ($t = 2.50$).[5] Although the levels of coverage and leakage are lower when we evaluate targeting based on poverty among *all* households, not just those with young children, their

TABLE 2
PERCENTAGE OF HOUSEHOLDS BENEFITING FROM VASO DE LECHE TRANSFERS

	*Quintiles of weighted per capita income**					Transfers per capita (1997 soles)
	ENNIV 1994	ENNIV 1997	Enaho 1998	Enaho 1999	Enaho 2000	ENNIV 1997
Quintiles						
Poorest	35.0%	52.1%	55.8%	56.1%	57.6%	23
2	29.3%	43.4%	43.7%	45.2%	48.6%	25
3	20.9%	30.4%	32.1%	34.0%	26.1%	20
4	9.3%	19.3%	20.7%	24.9%	19.3%	16
Richest	4.3%	5.9%	9.2%	8.2%	8.7%	4
Total	19.7%	30.2%	32.3%	33.7%	32.1%	18

* Consumption for ENNIV 1994 and 1997.
Note: Domain is the set of households in the samples.

TABLE 3
TARGETING PERFORMANCE OF VASO DE LECHE EXPENDITURES
INCIDENCE OF TRANSFERS

Dataset and year	Percentage of 'poor' in the programme (Coverage)	Percentage of 'nonpoor' in the programme (Leakage)	Targeting coefficient	Probability of untargeted
Targeting based on poverty among households with children of age six and under...				
ENNIV 1994	36.02	12.43	23.59	< 0.001
ENNIV 1997	52.55	23.49	29.07	< 0.001
Enaho 1998	58.34	28.34	30.49	< 0.001
Enaho 1999	60.95	30.19	30.76	< 0.001
Enaho 2000	61.83	27.03	34.80	< 0.001
Targeting based on poverty among all households...				
ENNIV 1994	29.94	8.25	21.69	< 0.001
ENNIV 1997	45.42	16.31	29.11	< 0.001
Enaho 1998	47.50	18.25	29.24	< 0.001
Enaho 1999	48.86	19.64	29.22	< 0.001
Enaho 2000	48.58	16.84	31.74	< 0.001
Targeting based on child malnutrition				
ENNIV 1994	42.47	26.24	16.23	< 0.001
DHS 1996	40.23	24.57	15.66	< 0.001
ENNIV 1997	63.45	39.62	23.83	< 0.001

relative magnitudes do not differ much. As such, the positive targeting coefficients are quite similar.

Targeting of expenditure levels – as opposed to the number of participants – is also directed toward the poor, as indicated in Table 4. Over 60 per cent (and up to 76 per cent, depending on the year) of the value of all transfers is allocated to poor households.[6] Among households with young children, the average transfer to poor households is 72 per cent greater than the average transfer to non-poor households.

The VL programme also appears to be well targeted to the expected age group in the sense that leakage to households without any children of age six and under is relatively small. Further, despite substantive growth in total expenditures and in the number of participating families since 1994, the share of households without young children that received VL transfers only rose approximately 4 percentage points from 8 per cent in 1994 to 12 per cent in 2000. These figures admittedly over-estimate the degree of leakage, given that some of these households may have pregnant women and/or may have children who were recently in the age bracket.

We use the living standards measurement surveys (ENNIV) for 1994 and 1997 to get a better sense of how targeting of the poor changed over time. In

TABLE 4
POVERTY TARGETING PERFORMANCE OF VASO DE LECHE EXPENDITURES
VALUES OF TRANSFERS

Dataset and year	Per cent of transfers allocated to...		Difference	Average per capita transfer to...		Targeting coefficient
	Poor	Non-poor		Poor	Non-poor	
All transfers to households with children of age six and under						
ENNIV 1997	0.72	0.28	0.44	25.3	14.7	42.1
PETS 2002	0.74	0.26	0.48			
All transfers						
ENNIV 1997	0.63	0.37	0.25	23.2	12.2	45.2
PETS 2002	0.76	0.24	0.52			

particular, we estimate regressions of: (a) the district per capita VL transfers on the percentage of the district population that is poor; (b) the share of the district population participating in the VL programme on the percentage of the district population that is poor; and (c) the average value of per capita district VL transfers received by recipients on an indicator of the particular household's poverty status. Each of these models is estimated for both the 1994 and 1997 samples and the difference in the elasticity (marginal effect) estimates for the district (household) regressions tested. The results (Table 5) indicate that while the poor are targeted, with positive elasticities of per capita district transfers with respect to the district poverty rate, the degree of this expenditure targeting fell substantially between 1994 and 1997.

Nonetheless, the effect of the poverty rate of a district on the percentage of the district population participating increased over this period with the elasticities rising from 0.6 to 0.8. The effect of this increase in coverage appears to have offset the decline in targeting of district expenditure levels, to the extent that poor recipients received increasingly larger transfers than the non-poor on average in 1997 than they did in 1994.

Turning to nutrition-based targeting, the VL programme also is concentrated on households with low nutritional status of children. This finding is illustrated in Table 6, where coverage rates of all children under five years of age are presented by quintile of height-for-age z-scores (HAZ) for the three household surveys with information on both VL participation and anthropometric status of children. In addition, we show the percentage of the children in each of the quintiles who are stunted (that is, HAZ below – 2) to give a sense of leakage to non-malnourished children. In 1997, for example, 64 per cent of the children in the least well nourished quintile lived in households that received VL food transfers, while in the most nourished quintile, just over 30 per cent received them. Nonetheless, despite the fact that the primary stated objective of the VL programme is to reduce the levels

TABLE 5
CHANGES IN DISTRICT-LEVEL POVERTY TARGETING OF VASO DE LECHE TRANSFERS: 1994–97

Dependent variables	Elasticities				Marginal effects	
Year	Per capita district transfers	T stat	Share of district population participating	t stat	Average value of per capita transfers for recipients	t stat
1994	1.21	11.18**	0.577	5.99**	1.55	8.51**
1997	0.19	2.01*	0.815	9.81**	3.15	18.93**
Difference	− 1.02	− 7.15**	0.238	1.90+	1.60	6.46**

Independent variable for district level models is the district headcount ratio.
For the household model, the independent variable is an indicator of whether the household is poor or not.
** indicates significance at 99 per cent level of confidence, * at 95 per cent level of confidence, and + at 90 per cent level of confidence.

TABLE 6
PERCENTAGE OF CHILDREN UNDER FIVE IN VL PROGRAMME

	Quintiles of Height-for-Age Z-scores		
	ENNIV	DHS	ENNIV
Quintiles	1994	1996	1997
	Percentage in VL Programme		
1	42.8%	41.6%	64.0%
2	33.8%	33.2%	49.2%
3	28.4%	26.4%	41.8%
4	25.4%	21.7%	34.8%
5	20.0%	20.8%	30.5%
Total	30.1%	28.7%	44.1%
	Percentage who are stunted		
1	100.0%	100.0%	100.0%
2	39.1%	29.5%	19.0%
3	0.0%	0.0%	0.0%
4	0.0%	0.0%	0.0%
5	0.0%	0.0%	0.0%
Total	27.9%	26.0%	23.8%

Note: Domain is the set of children with HAZ scores.

of malnutrition in Peru, over a third of the intended beneficiaries in the most malnourished quintile were missed.

Although the nutrition targeting coefficients presented in Table 3 are positive and significant, they are considerably smaller than those found when using poverty as the targeting criterion. This follows from the degree of leakage being higher for malnutrition than for poverty (that is, a greater share of healthy children participate in the programme relative to the share of non-poor households benefiting from VL transfers). Nevertheless, coverage rates of all malnourished kids under the age of five exceed the percentage of non-malnourished benefiting from VL transfers – hence the positive targeting coefficient.

The low levels of coverage of malnourished children may reflect the intent of the programme to improve the nutritional status of children. It is possible that targeting of children based on *ex-ante* nutritional needs may have resulted in improved *ex-post* outcomes. However, if targeting based on *ex-ante* needs is persistently effective, and if the programme expands at a rate faster than that of the new malnourished population,[7] then as the nutritional status of participants improves over time a deterioration in the targeting coefficient should be observed. This appears not to be the case, as the coverage rates for malnourished children rose between 1994 and 1997, from 42.8 per cent to 64.0 per cent, respectively (Table 3).

Since the mechanism to target and distribute food under the VL programme is decentralised, it is useful to ascertain the degree to which this overall targeting reflects budget allocations to various districts and the degree to which it reflects within district prioritisation. Thus, we decompose the targeting coefficients based on both poverty and nutrition using the method in Galasso and Ravallion [*2003*]. We find that inter-district targeting dominates intra-district targeting (left columns of Table 7). In other words, the degree of overall targeting (coverage of individuals less leakage) attributable to the central government's choice of districts is greater than that attributable to choice of participants made within the districts by the municipalities and the mothers' committees. The inter-district contribution to overall targeting based on poverty status increased from 53 per cent in 1994, to over 70 per cent in 2000 when considering pro-poor targeting. Similarly, three-quarters of targeting towards malnourished children can be attributed to targeting of districts as opposed to malnourished children within districts.

Because the decompositions that appear in the first set of columns in Table 7 are defined over population shares (that is, share of poor in the programme versus share of non-poor in the programme), not values, we turn to our modified targeting coefficient defined over transfer values. When this targeting coefficient is decomposed (right-hand columns of Table 7), we find the opposite – that intra-district targeting dominates inter-district targeting. In

TABLE 7
DECOMPOSING TARGETING PERFORMANCE OF VL EXPENDITURES

	Participants		Value of transfer	
Dataset and year	Intra-district	Inter-district	Intra-district	Inter-district
Targeting based on poverty among households with children of age 6 and under...				
ENNIV 1994	46.7%	53.3%		
ENNIV 1997	42.2%	57.8%	67.1%	32.9%
Enaho 1998	40.2%	59.8%		
Enaho 1999	39.7%	60.3%		
Enaho 2000	21.6%	78.4%		
Targeting based on poverty among all households...				
ENNIV 1994	48.1%	51.9%		
ENNIV 1997	47.6%	52.4%	73.0%	27.0%
Enaho 1998	46.1%	53.9%		
Enaho 1999	44.6%	55.4%		
Enaho 2000	29.7%	70.3%		
Targeting based on child malnutrition				
ENNIV 1994	25.4%	74.6%		
DHS 1996	14.6%	85.4%		
ENNIV 1997	26.8%	73.2%		

1997, the only year for which we are able to evaluate this form of targeting, over two-thirds of targeting took place within the districts, and less than a third can be attributed to inter-district allocations. Poor households within districts received larger transfers in value terms (consistent with the last column in Table 2 and to the last set of columns in Table 5) relative to the shares of the poor within districts participating in the VL programme.[8]

A plausible explanation for greater inter-district targeting in terms of population coverage and leakage, and greater intra-district targeting in terms of the value of transfers received by the poor, could be that the Mothers' Committees feel compelled to distribute at least some food to as many people as possible, but give larger transfers to the poor.[9] On the one hand, since relatively high percentages of the district populations participate (that is, receive at least some transfers), the choice of the district matters in terms of maximising coverage of the poor participating while minimising leakage (that is, non-poor participating). This manifests itself in the inter-district contribution to targeting dominating. On the other hand, among those that receive transfers, the average value of transfers to the poor is almost double of that to the non-poor. Thus, the intra-district allocation of food items among recipients matters to the degree of targeting of the poor – that is, intra-district targeting dominates inter-district targeting.

Correlates of Participation and Transfer Values

While the stated targeting criteria (Tier I and II beneficiaries) are clear, participation may actually reflect decisions made by the eligible households in addition to those of the distribution committees [*Duclos, 1995*]. As such, we now turn to estimates of the factors affecting the participation of households in the VL programme. Table 8 presents the determinants of the probability of receiving VL transfers using the 1997 ENNIV survey data.[10] The dependent variable in these probit models is an indicator for participation in the VL among all households in the sample. The explanatory variables include household demographics, characteristics of the household head, per capita consumption as a proxy for wealth, and department fixed-effects dummies. Three models are presented based on different forms in which household per capita consumption enters as an explanatory variable. In the first model, household wealth is controlled for in the form of dummies for the quintile of per capita consumption into which the household falls. In the second and third models, the log of per capita consumption is used, with reported consumption used in the former, and given its endogeneity, instrumented consumption[11] is used in the latter.

These three models are qualitatively and statistically the same, and confirm that VL transfers are targeted to young children and to poor households. For example, a household with an additional child of age six or under is 11 per

TABLE 8
DETERMINANTS OF THE PROBABILITY (PROBIT) OF RECEIVING VASO DE LECHE TRANSFERS, ENNIV 1997

	Model 1		Model 2		Model 3	
	Marginal Effect	z-stat	Marginal Effect	z-stat	Marginal Effect	z-stat
No. of children 0–6	0.117	11.88**	0.111	11.34**	0.110	10.85**
No. of children 7–15	0.031	4.14**	0.025	3.29**	0.024	3.05**
No. of women 16–25	− 0.008	− 0.67	− 0.006	− 0.53	− 0.008	− 0.63
No. of women 26–65	− 0.015	− 1.04	− 0.013	− 0.91	− 0.017	− 1.19
No. of men 16–25	− 0.021	− 1.84+	− 0.024	− 2.09*	− 0.026	− 2.29*
No. of men 26–65	− 0.030	− 1.96*	− 0.028	− 1.87+	− 0.031	− 2.07*
Spanish speaking head	− 0.106	− 4.37**	− 0.104	− 4.19**	− 0.102	− 4.12**
Male head	− 0.049	− 2.23*	− 0.050	− 2.25*	− 0.049	− 2.20*
Age of head	− 0.001	− 0.30	− 0.001	− 0.32	− 0.001	− 0.14
Age of head squared	0.0000	0.00	0.0000	− 0.02	0.0000	− 0.19
Log per capita consumption			− 0.177	− 10.00**		
Log per capita consumption (IV)					− 0.178	− 9.51**
2nd consumption quintile	− 0.003	− 0.16				
3rd consumption quintile	− 0.079	− 3.08**				
4th consumption quintile	− 0.137	− 5.77**				
5th consumption quintile	− 0.240	− 8.28**				
Department dummies omitted						
No. of observations	3,752		3,752		3,752	
Wald chi_2	970.52		973.90		961.17	
DF	45		42		42	
Pseudo-R_2	0.215		0.216		0.213	

cent more likely to benefit relative to the average household (which has just one such child). Since the questionnaire did not identify women who were pregnant, we cannot precisely identify the remaining Tier I target group.[12] As such, it is not surprising that, controlling for the number of children, the number of women in the household does not affect the probability of participation. With regard to the Tier II target group, an additional child between that ages of seven and 15 makes the household 3 per cent more likely to receive VL benefits than the average household.

Poorer households are more likely to benefit from VL transfers. Households in the poorest quintile are 25 per cent more likely to participate than are those in the richest quintile and 14 per cent more likely compared to

the fourth quintile. This difference is additional to any difference due to the greater number of children and other observed characteristics that correlate with poverty such as ethnicity and the gender of the household head. Using Spanish-speaking household heads as a proxy for non-indigenous households, we find no discrimination against indigenous households; indeed they are 10 per cent more likely to receive VL transfers than non-indigenous households with similar expenditures. Similarly, female-headed households are 5 per cent more likely to participate.

We now turn to an assessment of how the determinants of VL participation affect the amount of the actual transfers. We pursue this because of the possibility that the determinants of participation and the determinants of the transfer values conditional on participating may differ. Since the transfer values are censored at zero for non-participants, we estimate Tobit models with value of the per capita transfer in 1997 Soles as the endogenous variable.

These Tobit estimates (Table 9) suggest that, conditional on the number of children in the household poorer households receive more from the VL programme. The wealth (consumption) elasticity of the value of transfers estimated in model 2 is – 0.9. In the IV model (3) it is greater at – 3.8. In other words, once we control for the endogeneity of household consumption levels (as well as any errors in consumption measurement) in the estimation, we find that a 1 per cent decrease in consumption corresponds to a 3.8 per cent higher per capita value of food transferred under the VL programme. From another perspective, as illustrated in the first model, once we control for other factors that determine the level of VL transfers received by households, the average transfer value to households in the poorest 40 per cent of the population is 95 Soles larger than for households in the richest quintile. Again, indigenous households and female-headed households receive larger transfers.

In all three models, per capita transfer values increase with the number of children of age 6 and under. The negative quadratic indicates that these benefits diminish with the number of such Tier I children.[13] However, the second models appear to overestimate the size of this effect at over 45 Sole increase for an additional child (with the quadratic evaluated at the mean number of children, 1.07), while the IV estimate is 38 Soles. Given that the average per capita transfer among beneficiary households is 49 Soles, an additional young child for a household that already has one young child increases the per capita transfer to the household by over three-quarters. Further, while the estimates in the second model for kids between the age of 7 and 15 are positive and significant at about 22 Soles, the effect of the number of children in this age bracket is considerably smaller (15 Soles) for the IV model.

The PETS data also permit us to examine the relationship between wealth and the types of VL transfers. While we find that the mean transfer to

TABLE 9
DETERMINANTS OF THE VALUE OF VASO DE LECHE TRANSFERS (TOBIT) RECEIVED BY HOUSEHOLDS, ENNIV 1997

	Summary statistics		Model 1		Model 2		Model 3	
	Mean	S.D.	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
Per capita VL transfer value[a]	49.39	76.99						
No. of children 0–6	1.07	1.05	54.71	9.18**	54.62	9.15**	46.21	6.64**
No. of children 0–6 squared			− 7.79	− 4.98**	− 8.49	− 5.39**	− 7.82	− 4.89**
No. of children 7–15	1.37	1.28	25.49	5.03**	25.50	5.03**	17.95	3.02**
No. of children 7–15 squared			− 2.53	− 2.16*	− 3.04	− 2.58**	− 2.30	− 1.91+
No. of women 16–25	0.61	0.77	8.41	2.68**	9.46	3.03**	6.03	1.79+
No. of women 26–65	1.12	0.67	3.07	0.77	3.96	1.00	2.06	0.52
No. of men 16–25	0.58	0.85	− 3.55	− 1.21	− 4.14	− 1.41	− 8.15	− 2.52*
No. of men 26–65	1.05	0.65	− 0.870	− 0.20	0.025	0.01	− 1.542	− 0.36
Spanish speaking head	0.772	0.42	− 17.54	− 2.63**	− 15.66	− 2.33*	− 8.22	− 1.11
Male head	0.871	0.33	− 15.39	− 2.11	− 13.97	− 1.92	− 14.31	− 1.96*
Age of head	48	14	− 0.570	− 0.50	− 0.610	− 0.53	− 0.160	− 0.14
Age of head squared			0.0021	0.19	0.0022	0.20	− 0.0025	− 0.22
Log per capita consumption	7.72	0.66			− 48.52	− 9.60**		
Log per capita consumption (IV)							− 68.64	− 5.50**
2nd per capita consumption quintile	0.20	0.40	− 3.10	− 0.48				
3rd per capita consumption quintile	0.20	0.40	− 8.67	− 1.23				
4th per capita consumption quintile	0.20	0.40	− 29.16	− 3.62**				
5th per capita consumption quintile	0.20	0.40	− 94.45	− 8.97**				
Department dummies omitted								
Constant			− 116.4	− 3.29**	223.7	4.47**	379.2	3.88**
No. of observations	3,752		3,752		3,752		3,752	
Wald chi_2			804.39		790.75		723.18	
DF			45		42		42	
Pseudo R_2			0.051		0.050		0.459	

a. Mean value conditional on receiving transfers; **indicates significance at 99 per cent level of confidence, *at 95 per cent level of confidence, and + at 90 per cent level of confidence.
Note: Instruments in IV models are education of head, employment status of head, dummy for own business/farm, head holds two jobs, frequency of payments.

households in the poorest national asset index quintile is 23 per cent larger than to households in the richest quintile, the bulk of this comes in the form of milk products (Table 10). For example, the mean value of milk product transfers to the poorest quintile is 135 Soles, and 18 for milk substitutes and other products. Conversely, the mean values of other products received in the other quintiles are between 52 and 100 per cent of the mean value of milk products they receive. As such, milk product transfers are generally progressive in the values received by the beneficiaries, while transfers of non-milk products are not.

As with the mean transfer level, milk transfers appear to be distributed progressively among the bulk of the recipients, unlike non-milk transfers. While the poorest quintile receives 32 per cent of all milk transfers, only 7 per cent of other transfers make it to the poorest households. In fact, households in the third quintile receive over 45 per cent of all of these other transfers.

Marginal Targeting

Our discussion of targeting thus far has concentrated on average participation rates. The assumption implicit in this analysis has been that an expansion of the VL programme leads to increases in benefits to current recipients [*Younger, 2003*]. In other words, we implicitly assume that all changes would take place at the intensive margin and that there is no difference between the marginal and the average benefit [*Lanjouw and Ravallion, 1999*]. But, in fact, two forms of expansion can take place: (1) current recipients can receive larger transfers (intensive margin); and (2) participation rates can increase (extensive margin).

To elaborate on how we might identify the effects at both the intensive and the extensive margins, and how a programme expansion might affect

TABLE 10
VALUES OF VASO DE LECHE TRANSFERS TO BENEFICIARIES

Asset index	Mean value (Soles)			Shares of total transfer value		
Quintiles	Total transfer	Milk products	Other products	Total transfer	Milk products	Other products
Poorest	152.6	135.1	17.5	23.1%	32.3%	7.2%
2	121.0	71.6	49.4	34.4%	32.1%	38.3%
3	141.4	70.7	70.6	33.2%	26.3%	45.3%
4	157.2	103.3	53.9	8.3%	8.6%	7.8%
Richest	123.7	55.4	68.3	1.0%	0.7%	1.5%
Total	136.7	86.6	50.1	100.0%	100.0%	100.0%

Source: PETS 2002

participation rates, first note that the expected value of the VL transfer to household *i* is equal to the product of the probability of participating and the expected value of the transfer conditional upon participation:

$$E(VL_i) = \Pr(VL_i > 0) \cdot E(VL_i | VL_i > 0).$$

Taking the derivative of this expression with respect to the change in the per capita VL grants made to the community (G) and applying the chain rule, gives us the following decomposition:

$$\frac{\partial E(VL_i)}{\partial G} = \underbrace{\left[\frac{\partial \Pr(VL_i > 0)}{\partial G} \cdot E(VL_i | VL_i > 0)\right]}_{\text{Extensive margin}} + \underbrace{\left[\Pr(VL_i > 0) \cdot \frac{\partial E(VL_i | VL_i > 0)}{\partial G}\right]}_{\text{Intensive margin}}$$

An object of interest is the change in the probability of participation with a change in the grant to the community. Rearranging terms gives us:

$$\frac{\partial \Pr(VL_i > 0)}{\partial G} = \frac{1}{E(VL_i | VL_i > 0)} \left(\frac{\partial E(VL_i)}{\partial G} - \Pr(VL_i > 0) \cdot \frac{\partial E(VL_i | VL_i > 0)}{\partial G}\right)$$

A common assumption that we make here is that an increase in transfers from the committees is equal to the grant (that is, that there is no change in the leakage when there is a change in the size of grant):

$$\frac{\partial E(VL_i)}{\partial G} = 1$$

The expected value of transfers for recipients ($E(VL_i | VL_i > 0)$) and the probability of participation ($P_r(VL_i > 0)$) are estimated using the 1997 ENNIV data. The change in the expected transfer for participants for a change in the grant:

$$\frac{\partial E(VL_i | VL_i > 0)}{\partial G}$$

is also be estimated using the ENNIV data by regressing per capita VL transfer values among recipient households on district level per capita VL allocation from the centre, correcting for selection into the sample of recipients. This calculation tacitly assumes that the allocation from the centre is taken as exogenous by the Mothers' Committees. Note that since this equation is estimated on a cross-section, an identifying assumption is that

new and old recipients receive similar transfer values. While this is a standard assumption, it challenges the results of our targeting efficiency decomposition analysis. Mothers' committees could very well take advantage of programme expansions to distribute transfers to new households who might be non-poor. But in keeping with the results in the previous section, these transfer values could be smaller than for current beneficiaries.[14] However, this is an empirical question that cannot be addressed with the currently available data. Thus we cautiously proceed by assuming that equal transfer values.

The estimates give the following with bootstrapped standard errors in parentheses:

$$\frac{\partial E(VL_i)}{\partial G} = \underbrace{\left[\frac{\partial \Pr(VL_i>0)}{\partial G}\cdot E(VL_i|VL_i>0)\right]}_{\substack{0.0098 \quad 49.39 \\ (0.0037) \quad (2.78) \\ \text{Extensive margin} \\ 0.482 \\ (0.178)}} + \underbrace{\left[\Pr(VL_i>0)\cdot\frac{\partial E(VL_i|VL_i>0)}{\partial G}\right]}_{\substack{0.3054 \quad 1.70 \\ (0.0081) \quad (0.58) \\ \text{Intensive margin} \\ 0.518 \\ (0.178)}}.$$

In other words, we find that roughly half (0.518) of an expansion in the VL programme grants benefits existing participants, and the other half (0.482) benefits new participants. Further, for a one Sole increase in per capita VL grants, we estimate that the probability of participation increases by 1 per cent.

If the VL programme were saturated among the poor, then expansion at the extensive margin would involve new beneficiaries who are necessarily non-poor. But as illustrated in Table 3, over half of the poor households in Peru participated in the programme in 2000. As such, whether expansion of the programme at the extensive margin proves to be pro-poor depends on how the expansion affects the targeting coefficient. Since the targeting coefficients in Table 3 increase over time, we can conclude that the expansions at the extensive margin have been pro-poor.

VI. CONCLUSION

This article evaluates the *Vaso de Leche* (VL) feeding programme in Peru in order to illustrate an evaluation methodology based on targeting criteria for a decentralised transfer programme. We confirm that the VL programme is reasonably well targeted to poor households and to households with low nutritional status. Despite official targeting criteria primarily based not on household income status, rather on the presence of young children and pregnant and lactating women in the household, approximately 50 per cent of

the poor received VL benefits, while less than 20 per cent of the non-poor were beneficiaries. Further, in Probit estimates we find that households in the poorest quintile of the population are 24 per cent more likely than households in the richest quintile to receive VL transfers. In terms of the values of transfers, over 60 per cent (possibly up to 75 per cent) of the allocated VL budget goes to the poor. Tobit models of the determinants of household transfer values also indicate that the poor benefit more, as a 1 per cent decrease in the income level of a household corresponds to a 4 per cent increase in the value of the VL transfer, *ceteris paribus*.

When using the Galasso-Ravallion targeting coefficient, we find that the degree of overall targeting of poor *individuals* attributable to the central government's choice of districts is greater than that attributable to choice of participants within districts made by the municipalities and the mothers' committees. However, when we use our modified targeting coefficient in which targeting is defined on the *values* of allocations, the opposite is the case. Over two-thirds of targeting takes place within the local communities, while less than a third can be attributed to inter-district allocations. This finding helps to explain our econometric results (Table 5) that increased coverage of individuals in poor districts and reduced expenditure targeting at to the district level, can exist concurrently with poor recipient receiving increasingly larger transfers than the non-poor. The community-based decision makers appear to be targeting the poor in terms of the values of the transfers.

When considering marginal targeting and how a programme expansion can take place at both the intensive and extensive margin, we find that roughly half of an expansion benefits existing participants (intensive margin), while the other half benefits new participants (extensive margin). As the programme is not yet saturated among the poor (in which case new beneficiaries would necessarily be non-poor) expansion at the extensive margin in the VL proves to be pro-poor in the sense that it increases the targeting coefficient.

Finally, as the decentralisation of government services grows in developing countries, the scope for community based targeting is increasing which increases the complexity of analysis of programme distribution and impact. The approach employed in this article can assist practitioners in understanding the choices to be made in designing the delivery of such services.

NOTES

1 The PETS study also claimed leakage in the sense that children did not always receive the milk that is obtained by the household. However, not only is this a difficult topic to quantify, the welfare interpretations of this diversion differ from the leakage in the public expenditure allocation chain.

2 Wodon and Yitzhaki [*2002*] also take advantage of this distinction in decomposing the Gini income elasticity, which itself is a measure of programme targeting (that is, showing the impact of a programme on income inequality as measured by the Gini coefficient). Our emphasis, however, is on not only the 'targeting' and the 'allocation' components, but also on the decentralised nature of the VL programme. Ravallion [*2000*] develops a method of monitoring targeting with decentralised allocations, but does so when the incidence of the benefits is unobserved at the local level. Here we have data in which the benefit incidence is observed.

3 See Sahn and Stifel [*2003*] for a detailed discussion of the factor analysis methodology, and for an evaluation of this type of asset index. Hammer [*1998*] and Filmer and Pritchett [*2001*] have employed a similar methodology.

4 Household per capita consumption is used for the 1994 and 1997 ENNIV data.

5 Note that since $\phi_t \tilde{N}(0, \frac{1}{N_t})$, and since the 1994 and 2000 samples were independently drawn, the t-statistic for H_0: $\phi_{2000}-\phi_{1994}$ is $\frac{\phi_{2000}-\phi_{1994}}{\sqrt{\frac{1}{N_{2000}}+\frac{1}{N_{1994}}}}$.

6 Note that the poverty headcount ratio is 49 per cent in 1997. For the PETS data, the poverty line is determined endogenously to yield a headcount ratio of 48 per cent [*Younger, 2002*]. As noted in Section III, household consumption (ENNIV) and wealth (PETS) capture different dimensions of household welfare. As such, rank orderings of households are not expected to be similar using these two measures [*Sahn and Stifel, 2003*]. This is especially the case since some of the public good assets in the wealth index are more prevalent in urban areas. However, it is not clear *a priori* which is a better metric of household welfare.

7 Note that during the period 1995–2000, VL allocations grew at an annual rate of 7 per cent in real terms, while the population grew at a rate of approximately 1.7 per cent.

8 Test statistics for the full 1997 sample for the null hypothesis that inter- and intra-district targeting are the same (that is, H_0: intra = 0.5), are $t = -16.78$ for population-share targeting, and $t = 20.53$ for the transfer-value targeting. The standard errors for these test statistics were bootstrapped.

9 We thank Steve Younger for pointing this out.

10 Ruggeri Laderchi [*2001*] estimates similar probits for participation in any feeding programme, not just Vaso de Leche. Her results are qualitatively similar to those presented here.

11 The instruments used in Model 3 are education of the household head, employment status of the head, an indicator of ownership of a business or farm, and an indicator for the head holding two jobs.

12 Lactating women are not missed since they obviously live in a household with a young child.

13 Note that the maximum is attained at 7.0 for model 1, 6.4 for model 2, and 5.9 for model 3. These are all greater than the maximum number of children under seven in a household (five) in the sample.

14 We thank an anonymous referee for highlighting this issue, which deserves empirical investigation with an appropriate dataset. Given our decomposition, if marginal entrants did indeed receive smaller allocations (thus leading to a smaller conditional average), then this would imply that the change in the probability of participation would be higher that reported here since the size of the extensive would remain unchanged.

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