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The "Glass of Milk" Subsidy Program and Malnutrition in Peru

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Abstract

Stifel and Alderman evaluate the Vaso de Leche (VL) feeding program in Peru. They pose the question that if a community-based multistage targeting scheme such as that of the VL program is progressive, is it possible that the program can achieve its nutritional objectives? The authors address this by linking VL public expenditure data with household survey data to assess the targeting, and then to model the determinants of nutritional outcomes of children to see if VL program interventions have an impact on nutrition. They confirm that the VL program is well targeted to poor households and to those with low nutritional status. While the bulk of the coverage of the poor is attributed to targeting of poor districts, the fact that the poor receive larger in-kind transfers is attributed to intradistrict targeting. But the impact of these food subsidies beyond their value as income transfers is limited by the degree to which the commodity transfers are inframarginal. The authors find that transfers of milk and milk substitutes from the VL program are inframarginal for approximately half of the households that receive them. So, it is not entirely surprising that they fail to find econometric evidence of the nutritional objectives of the VL program being achieved. In models of child standardized heights, the authors find no impact of the VL program expenditures on the nutritional outcomes of young children—the group to whom the program is targeted.

This paper—a product of Public Services, Development Research Group—is part of a larger effort in the group to understand the distribution of public services. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Hedy Sladovich, mail stop MC3-311, telephone 202-473-7698, fax 202-522-1154, email address hsladovich@worldbank.org. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at david.stifel@cornell.edu or halderman@worldbank.org. June 2003. (35 pages)

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Contents

1. Introduction

Governments often subsidize food in an effort to either augment the real incomes of constituents, or to improve the nutritional status of vulnerable groups, or both (Pinstrup-Andersen 1988). Criteria for evaluating such subsidy programs, however, differ for these two broad objectives. Evaluation of the former focuses primarily on the incidence of transfers among subpopulations, while the impact on growth (preferable) or on incremental food consumption are the standard forms of evaluating the latter. While income transfers do affect nutrition itself, the impact of food subsidies is greater than that of a cash transfer to the degree that the commodity subsidy is extramarginal (that is, the subsidy decreases prices at the margin) and to the degree that price decreases lead to net increases in nutrient demand after substitution. Moreover, nutritional impacts are enhanced when program designs encourage behaviors that target food toward children at risk.

Milk is often believed to be a commodity particularly well suited to meeting nutritional objectives. This view prevails despite the fact that such subsidies are seldom targeted towards poorer households or towards the youngest children within populations (Kennedy and Alderman 1987). Peru's program to provide milk and milk substitutes to low income households is an example of a transfer that is motivated by this belief. The program, called the *Vaso de Leche* (VL), uses community-based targeting, an approach that has proven progressive in other contexts (Conning and Kevane 2002, Alderman 2001, Galasso and Ravallion 2002). The question we thus address in this paper is: If targeting is propoor, is it possible that a program such as VL can achieve its nutritional objectives in a manner similar to the well documented impact of the Women Infant Children (WIC) program in the United States (Rush and others 1988)? Since randomized evaluations are often hard to implement in politically popular transfer programs, we approach this question by linking public expenditure data with household survey information to illustrate this approach to program impact assessment.

The next section depicts the details of the VL program. Section 3 describes the various data sources used in this evaluation, and is followed by a discussion of methodologies used to assess both the targeting efficiency of the program as well as its impact on the nutritional status of children. Section 5 presents the results.

2. Description of VL Program

Totaling $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 as a pilot in Lima in 1984, the program expanded nationally during the economic crises in the late 1980s amd early part of the 1990s. By 1998, the program had expanded to reach 44 percent of households with children aged 3 through 11 through earmarked monthly transfer to municipalities (Younger 2002). The 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. It is this committee, which has a fair degree of 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 program is not confined to the distribution of milk or even milk substitutes. In some case cereals or a combination of commodities are distributed in lieu of, or in addition to, milk products. Priority is given to households with children 6 years of age and under, as well as to households with pregnant or lactating women. Once these first-tier beneficiaries are attended to, second-tier beneficiaries (children aged 7 to 13, and people with tuberculosis) may participate. Within these categories, priority is based on need.

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 percent of households received only 46 percent of total transfers. However, she also found that, at the margin, food transfers were entirely spent on food and that if *and only if* household income was treated as endogenous, VL program participation increased standardized child growth by 0.7 standard deviations. 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 found 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 center 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 the household. 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]

[1] The PETS study also claimed leakage or dilution 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 so-called leakage differ from the leakage in the public expenditure allocation chain. As argued in

3. Description of Data Sources

This evaluation of the VL program benefits from a wealth of data sources available in Peru. The data used in this analysis come from four main sources: (1) information on the geographic allocation of VL expenditures; (2) national household living standard surveys; (3) national demographic and health surveys; and (4) the Public Expenditure Tracking Survey (PETS).

VL Expenditures

The *Vaso de Leche* (VL) Program has maintained monthly records of expenditures allocated to each administrative (department, province and district) region in Peru since 1994. We use this information, along with district population sizes from the 1993 census, to determine real annual total and per capita VL expenditures in each of the recipient districts for the years 1994 to 2000. It is worth noting that allocations made to the district VL committees do not translate fully into benefits to recipients. But, given the small-scale leakages at least to the committee level found in the PETS study, we are confident that they represent a reasonably accurate proxy for the value of benefits available to the district residents.

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 include information on participation in the VL program. 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 well-being (e.g., education, housing, health, economic activity, consumption and assets). The 1994 ENNIV includes information on VL participation by the household, while the 1997 data also includes 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.

Alderman and others (1995) an expectation of targeting all consumption of a good to one individual within a household unit is not easily reconciled with any standard household model.

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 program 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 is not collected, we use the asset data to construct household asset indices as measures of household wealth (Sahn and Stifel 2001). Child anthropometric measurements are recorded in the individual module.

Public Expenditure Tracking Survey

The PETS for the VL program 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. As such, 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 in some municipalities there are fewer than four committees, only 393 committees were interviewed, and 1,587 beneficiary households were interviewed. The household survey includes information on household demographics, assets, and details about participation in the VL program including values of transfers, types of products transferred and information on additional purchases.

4. Research Strategy

A. Program 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 program, but also what share of benefits accrue to different groups. This provides a fair description of both errors of exclusion and inclusion. We also take this a bit further using a technique to decompose the targeting efficiency into interdistrict and intradistrict components (Galasso and Ravallion forthcoming).

Table 1: Notation for Decomposition of Targeting Efficiency

	Poor	*Nonpoor*	*Total*	
VL Participant	$n_{v,p}$	$n_{v,-p}$	n_v	(Share in program)
Not VL Participant	$n_{-v,p}$	$n_{-v,-p}$	n_{-v}	(Share not in program)
Total	n_p (Share poor)	n_{-p} (Share not poor)	*1.0*	

To understand the targeting efficiency decomposition, we begin by categorizing the shares of households as recipients who are poor ($n_{v,p}$) or nonpoor ($n_{v,-p}$), and as nonrecipients who are poor ($n_{-v,p}$) or nonpoor ($n_{-v,-p}$), as illustrated in Table 1. Given this notation, we can define a targeting coefficient (T) as the difference between the share of the poor in the program ("coverage") and the share of the nonpoor in the program ("leakage"),

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

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

As Galasso and Ravallion (forthcoming) point out, the targeting coefficient is simply a measure of association related to the 2x2 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 program allocations $(H_0 : \phi = 0)$.

Given the decentralized, community-based nature of targeting for the VL program, 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 interdistrict ("between") component and an intradistrict ("within") component. Galasso and Ravallion 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 intradistrict 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 nonpoor 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 place on this district is zero (the share of the nonpoor is zero, $n_{-p,d} = 0$) because intradistrict targeting is irrelevant to overall targeting. The targeting of the district itself is what matters. Conversely, if the entire population in a district is nonpoor, 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 and Ravallion targeting coefficient, however, is defined over the shares of households/individuals participating in the VL program, not over the shares of benefits accruing to the different groups. This follows from their assumption of equal transfer values to all recipients, an assumption in keeping with the program they were investigating. When we have differential transfer values for each of the recipient households, we need to redefine the targeting measure and how to decompose it. We thus develop an extension to the Galasso and Ravallion methodology, and apply it to the 1997 ENNIV data. 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 nonpoor 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 nonpoor,

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

The targeting differential, in turn, can be decomposed into inter- and intradistrict components. To see this, first note that the average transfers to the poor and nonpoor 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:

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

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

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 is the contribution of intradistrict targeting to the total targeting differential. The second component, the weighted averages of the district average transfers to the poor and to the nonpoor, represents the contribution of interdistrict targeting to the total differential.

Finally, the targeting differential is normalized by the average transfer to the poor. This gives us a "targeting coefficient" (T),

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

Thus for a program targeted perfectly to the poor, the targeting coefficient will take on a value of 1 since the average transfer value received by the nonpoor is zero (i.e., $\overline{VL}_{-p} = 0$). A program that distributes the benefits perfectly randomly will result in equal values going to the poor and nonpoor and a targeting coefficient equal to zero (i.e., $\overline{VL}_{-p} = \overline{VL}_p$). Finally, the targeting coefficient takes on a value of negative infinity when the program is targeted perfectly to the nonpoor (i.e., $\overline{VL}_p = 0$).

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 program. No information was collected from nonparticipating households. Further, the PETS data do not include household expenditures or incomes. Nonetheless, we can indicate the share of the total program 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 2001). 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.[2]

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 beneficiaries.

[2] See Sahn and Stifel (2001) 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.

C. *Modeling the Determinants of Nutritional Status*

After illustrating the targeting efficiency we then model child nutritional status using a framework derived from a household model in the tradition of Becker (1991). Assume that the household maximizes a quasi-concave utility function that takes as its arguments consumption of commodities and services, x, and the leisure, l, and health status, θ (of which a child's anthropometric measurement, h, is one dimension), of each household member. The household solves the following problem,

$$\max_{x,l,\theta} u(x,l,\theta;A,Z),$$

where A and Z respectively represent household and community characteristics, some of which are not observed. Allocation choices are conditional on the budget constraint:

$$px = w(T-l) + y,$$

where p is a vector of prices, w is a vector of household members' wages, T is a vector of the household members' maximum number of work hours, and y is household nonwage income.

The nutritional status of children, h, is determined by a biological health production technology:

$$h_i = h(I,A,Z,\mu_i),$$

where I is a vector of health inputs and μ_i represents the unobservable individual, family, and community characteristics that affect the child's nutritional outcomes. Household characteristics (e.g., demographics, educational levels, etc.), A, can have an impact on health by affecting household allocation decisions. Community characteristics, Z, such as access to clean water, can also have direct impacts on nutritional outcomes. Note that the input vector, I, includes consumption goods which contribute positively to household welfare both directly through x, and indirectly through h. This represents the simultaneous choice of consumption goods and health inputs.

Solving the household's optimization problem leads to reduced-form demand equations including those for consumption, nutrition inputs, and child nutrition. The nutrition functions for each child conditional on per capita expenditures (quasi-reduced form) can be represented as follows:

$$h_i = \widetilde{h}(x,A,Z,\varepsilon_i),$$

where ε_i is the child-specific random disturbance term, which as such is assumed to be uncorrelated with the other elements of the demand function. Since consumption, x, is a choice variable, it is unlikely that it is uncorrelated with the disturbance term, and instrumental variables approaches are typically employed. This is the model that we estimate, substituting an asset index for x as instruments, using the 1996 and 2000 DHS data.

The dependent variable is the standardized anthropometric height-for-age z-score (HAZ). HAZ is defined as $(h-h_r)/\sigma_r$ where h is the observed height of a child of a specified sex/age group, h_r is the median height in the reference population of children of that sex/age group, and σ_r is the standard deviation of height measurement for the reference population of that sex/age group. The standard reference population recommended by the World Health Organization is that of the United States National Center for Health Statistics. As several studies have indicated that less than 10 percent of the worldwide variance in height can be ascribed to genetic or racial differences (Martorell and Habicht 1986), this reference population is appropriate. Children with a HAZ score less than –2 are usually classified as stunted.

The set of predictors consists of characteristics of the child (e.g., age, gender, birth order), household demographic variables such as household size and age-sex composition, characteristics of the parents (e.g., educational attainment, and mother's age and height), access to public services (e.g., piped drinking water), and an urban dummy.

We seek not only to model the overall determinants of nutrition, but also to see if the VL program has an impact on nutrition. However, as households chose to participate, we have an issue of self selection if we include households' VL participation as an explanatory variable. If we use the VL allocation to the community in lieu of participation, we solve the issue of endogenous household choice, but only at the expense of introducing potential bias from endogenous program placement (Rosenzweig and Wolpin 1986). The bias, if any, can not even be signed with confidence since an estimated impact may be an overestimate (if programs are placed where the anticipated return is higher than average) or negative (if programs go to favored but more developed communities). We address this issue by taking advantage of the fact that we have two observations on the VL expenditures that correspond to different rounds of DHS surveys. Thus, we can use fixed effects estimations that control for the initial conditions in the communities. The general form of the models that we estimate is as follows:

$$h_{i,d,t} = \alpha + \phi x_{i,d,t} + \beta A_{i,d,t} + \lambda Z_{i,d,t} + \gamma VL_{d,t} + \sum_{d} \delta D_{d}, + \varepsilon_{i,d,t} ,$$

where i is the index for individual children, d is the indicator for the district in which the child resides, and t is the year (1996 or 2000). VL is the district level per capita VL expenditure, and D is the set of district dummies. We merge the district-level VL expenditure data with the DHS data for 1996 and 2000 to create a dataset with 19,053 observations on child heights upon which we estimate the model. The per capita VL district expenditure variable is the district average amount spend on in the two years prior to and including the survey (i.e., 1994–1996 for the 1996 DHS, and 1998–2000 for the 2000 DHS).

In assessing the effect of VL expenditures on child nutritional outcomes (HAZ), the parameter of interest is γ. Even using district fixed-effects, ordinary least squares (OLS) estimates of this model, however, can still be biased if there are unobserved factors (e.g., capabilities or poverty) that vary over time and are correlated with *VL*. We thus estimate the model using instrumental variables (IV) methods. The identifying instrument we use is the district-level Peruvian Social Fund (FONCODES) index of unmet basic needs, an composite of various measures – including access to schooling, electricity, water, sanitation, adequate housing, and measures of illiteracy – based on the 1993 census (Schady 2002). As we will see in the results, the FONCODES index is correlated with district-level VL expenditures, satisfying one condition for valid instruments. The other condition, that it is uncorrelated with the error term, is plausible given that the index was formulated based on the 1993 census, three years prior to the 1996 DHS survey, and thus is unlikely to be correlated with changes in unobserved factors.

Although we pool the surveys, implicitly restricting the parameters of individual and household characteristics to be constant over time, we do allow the instrumenting equations to vary between periods. This is done in two ways; (1) with a time dummy included as a shifter, and (2) allowing all of the parameters to vary over time. We thus estimate seven variations of the model. First, we use OLS to estimate the basic nonfixed effects model, as well as the district fixed effects model. Then the basic model is re-estimated using time-varying IV. This model is then run with province-level (not district) dummy variables, since time-varying district dummies in the instrumenting equation would perfectly predict the district-level VL expenditure values. Finally, the basic model along with district- and province-level fixed effects models are estimated using IV methods in which a time dummy is included in the instrumenting equation.

5. Results

Targeting

We confirm that the VL program is reasonably well targeted to households in terms of their income status. This is done by comparing the coverage rates of households according to their per capita income levels[3] for five household surveys (Table 2). The percentage of households with children of age six and under (Tier I target group) that receive VL transfers declines sharply with the level of income. For example, coverage rates declined from 37 percent of the households in the two poorest quintiles to less than 8 percent in the richest in 1994. As the coverage for all households with children increased over time from 28 percent in 1994 to 48 percent in 2000, coverage in the two poorest quintiles rose from just over 37 percent to over 66 percent during this period. While there was a concurrent increase for the more well-off people in the population, the poorest 40 percent of the eligible households nonetheless received over three times as much as the richest 20 percent on average. A similar pattern is observed for all households, not just those with young children (Table 3).

[3] Household per capita consumption is used for the 1994 and 1997 ENNIV data.

Table 4 shows that the null hypothesis of no targeting is confidently rejected in the direction of targeting toward the poor (i.e., a positive targeting coefficient). Despite the increase of leaking to the well off as the program expanded, the targeting coefficient increased from 24 to 35. 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 relative magnitudes do not differ much. As such, the positive targeting coefficients are quite similar.

Table 2: Vaso de Leche Coverage Rates for Tier I Households

	Quintiles of per capita income[a]					*Transfers per capita (1997 Soles)*
	ENNIV	ENNIV	Enaho	Enaho	Enaho	ENNIV
	1994	1997	1998	1999	2000	
Quintiles	(percent)	(percent)	(percent)	(percent)	(percent)	1997
Poorest	39.3	60.5	65.5	59.4	68.2	26
2	37.0	52.4	61.5	50.0	66.9	30
3	34.3	44.6	48.2	39.4	49.4	19
4	20.1	30.7	36.0	29.3	37.3	22
Richest	7.8	15.8	20.2	15.8	15.2	7
Total	**27.7**	**40.8**	**46.3**	**38.8**	**47.5**	**21**

Note: Domain is the set of households with at least one child of age 6 and under.
a. Consumption for ENNIV 1994 and 1997.

Table 3: Percentage of All Households Benefiting from Vaso de Leche Transfers

	Quintiles of weighted per capita income[a]					*Transfers per capita (1997 Soles)*
	ENNIV	ENNIV	Enaho	Enaho	Enaho	ENNIV
	1994	1997	1998	1999	2000	
Quintiles	(percent)	(percent)	(percent)	(percent)	(percent)	1997
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**

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

The VL program 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 percent in 1994 to 12 percent in 2000. These figures admittedly overestimate 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.

Targeting of expenditure levels—as opposed to the number of participants—is also directed toward the poor, as indicated in Table 5. Over 60 percent (and up to 76 percent, depending on the year) of the value of all transfers is allocated to poor households.[4] Among households with young children, the average transfer to poor households is 54 Soles greater than the average transfer to nonpoor households.

Table 4: Targeting Performance of Vaso de Leche Expenditures

Data set / year	*Percent of "poor" in the program (coverage)*	*Percent of "nonpoor" in the program (leakage)*	*Targeting coefficient*	*Probability of untargeted*
Targeting based on poverty among households with kids of age 6 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

[4] Note that the poverty headcount ratio is 48 percent.

Table 5:. Poverty Targeting Performance of Vaso de Leche Expenditures–Values of Transfers

	Percent of transfers allocated to...			*Average per capita transfer to...*		
Data set and year	*Poor*	*Nonpoor*	*Difference*	*Poor*	*Nonpoor*	*Targeting coefficient*
All transfers to households with children of age 6 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			

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 particular, we estimate simple regressions of (a) the district per capita VL transfers on the percent of the district population that is poor; (b) the share of the district population participating in the VL program on the percent 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 were tested. The results (Table 6) 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 nonpoor on average in 1997 than they did in 1994.

Turning to nutrition-based targeting, the VL program also is concentrated on households with low nutritional status of children. This is illustrated in Table 7, 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 1997, for example, 64 percent of the children in the least well-nourished quintile lived in households that received VL food transfers, while just over 30 percent were in the most nourished quintile. Nonetheless, despite the fact that the primary stated objective of the VL program is to reduce the levels of malnutrition in Peru, over a third of the intended beneficiaries in the most malnourished quintile were missed.

Table 6: Changes in District-Level Poverty Targeting of Vaso de Leche Transfers, 1994–1997

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 **

Note: 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% level of confidence, * at 95% level of confidence, and + at 90% level of confidence.

Although the nutrition targeting coefficients presented in Table 4 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 (i.e., a greater share of healthy children participate in the program relative to the share of nonpoor households benefiting from VL transfers). Nevertheless, coverage rates of all malnourished kids under the age of five exceed the percentage of nonmalnourished benefiting from VL transfers – hence the positive targeting coefficient.

Moreover, it is possible that targeting of children based on *ex-ante* nutritional needs may have resulted in improved *ex-post* outcomes. In fact, this is the stated intent of the program – to improve the nutritional status of children. This could explain the low levels of coverage of malnourished children. However, if targeting based on *ex-ante* needs is persistently effective, 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 (Table 4).

Table 7: Percentage of Children Under Five in VL Program
(percent)

	Quintiles of height-for-age Z-scores		
Quintiles	ENNIV 1994	DHS 1996	ENNIV 1997
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**

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

Since the mechanism to target and distribute food under the VL program is decentralized, 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 prioritization. Nonparametric regressions (LOWESS) based on a census of first grade students in 1999 and VL expenditure data indicate that VL expenditure levels were targeted toward districts with higher levels of child malnutrition (Figure 1). Increases in VL expenditures between 1997 and 1999 are also slightly targeted to districts with higher levels of stunting (Figure 2).

To take this further, we decompose the targeting coefficients based on both poverty and nutrition using the method in Galasso and Ravallion (forthcoming). We find that interdistrict targeting dominates intradistrict targeting (left columns of Table 8). In other words, the degree of overall targeting (coverage of individuals less leakage) attributable to the central government's allocation to districts is greater than that attributable to allocations made within the districts by the municipalities and the mother's committees (*Club de Madres*). The interdistrict contribution to overall targeting based on poverty status increased from 53 percent in 1994, to over 70 percent in 2000 when considering propoor targeting. Similarly, some three-quarters of targeting towards malnourished children can be attributed to targeting of districts as opposed to malnourished children within districts.

We note, however, that the decompositions that appear in the first set of columns in Table 8 are defined over population shares (i.e., share of poor in the program versus share of nonpoor in the program), not values. When the targeting coefficient defined over transfer values is decomposed (right-hand columns of Table 8), we find the opposite – that intradistrict targeting dominates interdistrict targeting. In 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 interdistrict allocations. This follows from poor households within districts receiving larger transfers in value terms (consistent with the last columns in Tables 2 and 3, and to the last set of columns in Table 6) relative to the shares of the poor within districts participating in the VL program.

Figure 1: District Targeting of Vaso de Leche Expenditures Based on Stunting Rates in Peru, 1999

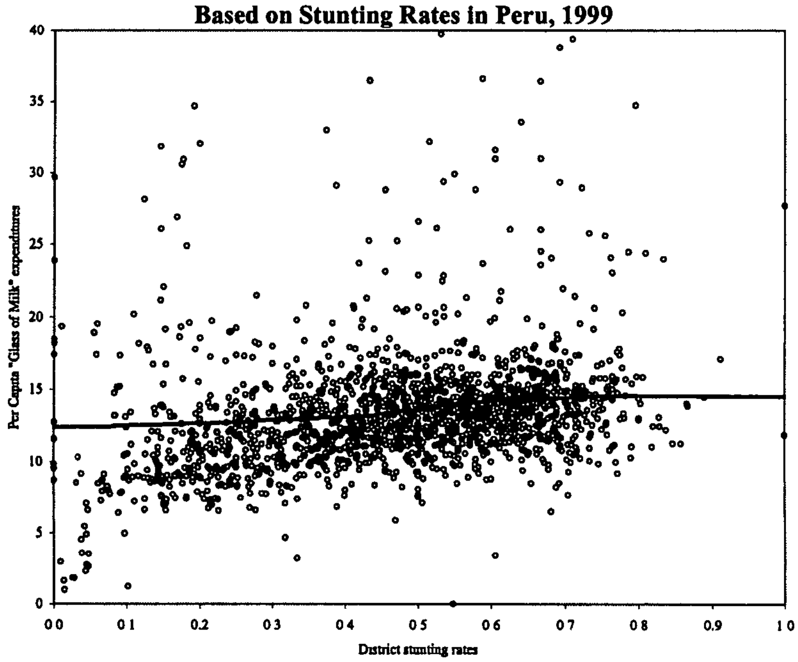

Figure 2: District Targeting of Changes in Vaso de Leche Expenditures Based on Stunting Rates in Peru, 1999

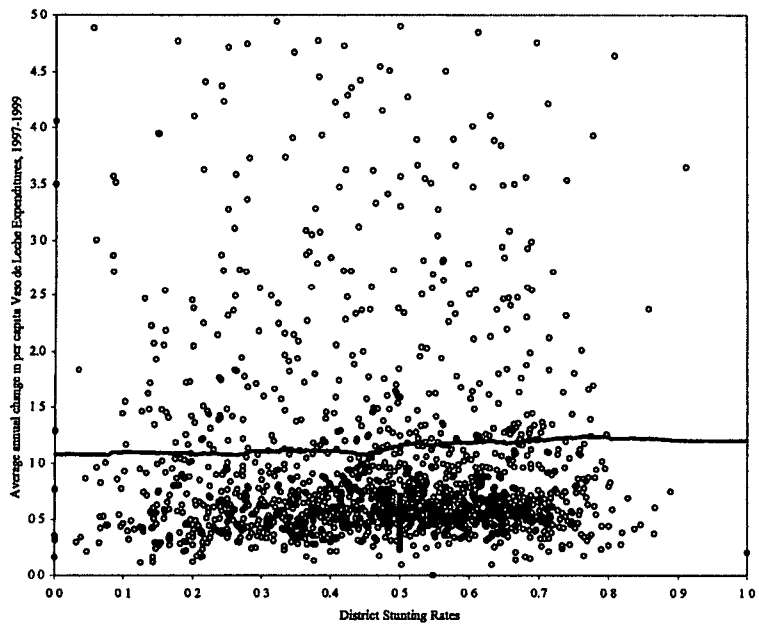

Table 8: Decomposing Targeting Performance of VL Expenditures
(percent)

	Participants		*Value of transfer*	
Data set and year	*Intradistrict*	*Interdistrict*	*Intradistrict*	*Interdistrict*
Targeting based on poverty among households with kids 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		

A plausible explanation for greater interdistrict targeting in terms of population coverage and leakage, and greater intradistrict targeting in terms of the value of transfers received by the poor, could be that the Mother's Committees feel compelled to distribute at least some food to as many people as possible, but give larger transfers to the poor.[5] On the one hand, since relatively high percentages of the district populations participate (i.e., receive at least some transfers), the choice of the district matters in terms of maximizing coverage of the poor participating while minimizing leakage (i.e., nonpoor participating). This manifests itself in the interdistrict 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 nonpoor. Thus the intradistrict allocation of food items among recipients matters to the degree of targeting of the poor – i.e., intradistrict targeting dominates interdistrict 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

[5] We thank Steve Younger for pointing this out.

distribution committees (Duclos 1995). As such, we now turn to estimates of the factors affecting the participation of households in the VL program. Table 9 presents the determinants of the probability of receiving VL transfers using the 1997 ENNIV survey data.[6] 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 district 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[7] 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 6 and under is 11 percent 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.[8] 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 7 and 15 makes the household three percent more likely to receive VL benefits than the average household.

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

[7] 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.

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

Table 9: 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. Kids 0–6	0.117	11.88	**	0.111	11.34	**	0.110	10.85	**
No. of kids 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 chi2	970.52			973.90			961.17		
DF	45			42			42		
Pseudo-R2	0.215			0.216			0.213		

Note: Instruments in IV models are education of head, employment status of head, dummy for own business/farm, head holds two jobs; jointly significant at 1 level (F(9,3752)=12.62).
** indicates significance at 99 level of confidence, * at 95 level of confidence, and + at 90 level of confidence.

Poorer households are more likely to benefit from VL transfers. Households in the poorest quintile are 25 percent more likely to participate than are those in the richest quintile and 14 percent 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 nonindigenous households, we find no discrimination against indigenous households; indeed they are 10 percent more likely to receive VL transfers than nonindigenous households with similar expenditures. Similarly, female-headed households are 5 percent 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 nonparticipants, we estimate Tobit models with value of the per capita transfer in 1997 Soles as the endogenous variable.

These Tobit estimates (Table 10) suggest that, conditional on the number of eligible beneficiaries, poorer households receive more from the VL program. The wealth (consumption) elasticity of the value of transfers estimated in model 2 (OLS) 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 one percent decrease in consumption corresponds to a 3.8 percent higher per capita value of food transferred under the VL program. 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 percent 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.[9] However, the OLS models appear to overestimate the size of this effect at an 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 IV estimates for kids between the age of 7 and 15 are positive and significant for the OLS estimates at about 22 Soles, the effect of the number of children in this age bracket is considerably smaller (15 Soles) for the IV model.

[9] 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.

Table 10. 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 kids 0-6	1.07	1.05	54.71	9.18 **	54.62	9.15 **	46.21	6.64 **
No. of kids 0-6 squared			-7.79	-4.98 **	-8.49	-5.39 **	-7.82	-4.89 **
No. of kids 7-15	1.37	1.28	25.49	5.03 **	25.50	5.03 **	17.95	3.02 **
No. of kids 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 ommitted>								
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 chi2			804.39		790.75		723.18	
DF			45		42		42	
Pseudo R2			0.051		0.050		0.459	

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.

a. Mean value conditional on receiving transfers.

** indicates signficance at 99% level of confidence, * at 95% level of confidence, and + at 90% level of confidence.

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 households in the poorest national asset index quintile is 23 percent larger than to households in the richest quintile, the bulk of this comes in the form of milk products (Table 11). 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 product received in the other quintiles are between 52 and 100 percent of the mean value of milk product they receive. As such, milk product transfers are generally progressive in the values received by the beneficiaries, while transfers of nonmilk products are not.

Table 11: Values of Vaso de Leche Transfers to Beneficiaries

		Mean value (Soles)		*Shares of total transfer value*		
Asset index Quintiles	*Total transfer*	*Milk products*	*Other products*	*Total transfer (percent)*	*Milk products (percent)*	*Other products (percent)*
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: Public Expenditure Tracking Study, 2002.

As with the mean transfer level, milk transfers appear to be distributed progressively among the bulk of the recipients, unlike nonmilk transfers. While the poorest quintile receives 32 percent of all milk transfers, only 7 percent of other transfers make it to the poorest households. In fact, households in the third quintile receive over 45 percent 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 program leads to increases in benefits to current recipients. In other words, we implicitly assume that all changes would take place at the intensive margin. But 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 the extensive margin, and in particular how a program expansion might affect 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,

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

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

$$\frac{\delta E(VL_i)}{\delta G} = \underbrace{\left[\frac{\delta \Pr(VL_i > 0)}{\delta G} \cdot E(VL_i \mid VL_i > 0)\right]}_{\text{Extensive Margin}} + \underbrace{\left[\Pr(VL_i > 0) \cdot \frac{\delta E(VL_i \mid VL_i > 0)}{\delta G}\right]}_{\text{Intensive Margin}}.$$

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

$$\frac{\delta \Pr(VL_i > 0)}{\delta G} = \frac{1}{E(VL_i \mid VL_i > 0)} \left(\frac{\delta E(VL_i)}{\delta G} - \Pr(VL_i > 0) \cdot \frac{\delta E(VL_i \mid VL_i > 0)}{\delta G} \right).$$

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

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

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

$$\frac{\delta E(VL_i \mid VL_i > 0)}{\delta G}$$

is also be estimated using the ENNIV data by regressing per capita VL transfer values among recipient households on district level per capita VL expenditures, correcting for selection into the sample of recipients. Note that since this is estimated on a cross-section, an identifying assumption is that new and old recipients receive similar transfer values.

The estimates give the following,

$$\frac{\delta E(VL_t)}{\delta G} = \left[\frac{\delta \Pr(VL_t > 0)}{\delta G} \cdot E(VL_t \mid VL_t > 0)\right] + \left[\Pr(VL_t > 0) \cdot \frac{\delta E(VL_t \mid VL_t > 0)}{\delta G}\right].$$

$$\underbrace{0.0098 \qquad 49.39}_{\substack{\text{Extensive} \\ \text{Margin} \\ 0.482}} \qquad \underbrace{0.3054 \qquad 1.70}_{\substack{\text{Intensive} \\ \text{Margin} \\ 0.518}}$$

In other words, we find that roughly half (0.518) of an expansion in the VL program 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 one percent.

Inframarginality of Transfers

Further, the PETS data can give us a sense of how the in-kind VL transfers compare to equivalent cash transfers. In other words, we can get an indication of whether the quantities of milk provided to households by the program are equal to the marginal increases in the quantities of milk consumed by those households. If so the transfers are considered to be extramarginal, and are expected to have a larger impact on milk consumption than an inframarginal program might have. This follows from the general equivalence of inframarginal transfers and cash transfers of the same value. Extramarginal transfers have a price effect as well.[10]

We find that nearly half of all the recipients consume additional amounts of the products distributed to them through the VL program (Table 12). For example, for the 80 percent of the recipients who receive milk and milk substitutes from the VL program, 49 percent purchase additional milk and milk substitutes. For 30 percent of the households that receive milk/dairy products, the program is inframarginal for 43 percent of them with respect to these particular products. While only 3 percent of those households that receive milk substitutes (53 percent of recipient households) purchase additional milk substitutes, most of these households also purchase milk/dairy products. In other words, for half of these households, the VL program is inframarginal over the more broadly defined category of milk and milk substitutes (hence the 49 percent figure above), but not for milk substitutes alone.

[10] The transfer is extra-marginal if *ex-post* consumption (what we observe) is exactly equal to the transfer – i.e., the recipient would consume less of the product if the transfer was in the form of cash (he/she is consuming at the kink in the budget constraint). Alternatively, if she purchases additional amounts of the product, then the transfer is infra-marginal.

Table 12: Inframarginality of Vaso de Leche Transfers

	Share of beneficiary households					
	Total	*Poorest*	*2nd*	*3rd*	*4th*	*Richest*
That receive...						
Milk/dairy products	**29.4**	18.4	20.1	23.0	32.9	41.3
Milk substitutes	**53.3**	74.8	48.8	43.2	51.5	48.7
Milk and milk substitutes	**79.5**	89.6	67.3	63.9	81.7	85.4
Other products	**58.3**	22.3	58.7	62.6	62.9	74.9
That purchase additional...*						
Milk/dairy products	**42.5**	20.7	14.6	30.4	52.1	52.6
Milk substitutes	**2.6**	2.2	3.0	4.1	1.5	3.0
Milk and milk substitutes	**48.6**	36.1	38.9	36.4	57.2	58.7
Other products	**26.5**	9.7	19.7	15.0	26.6	37.1

*Share of beneficiary households that receive the product.

These results suggest that, assuming cash transfers are less costly and more efficiently distributed than food transfers, cash transfers may be a superior means of increasing the consumption of milk and milk substitutes for half of the recipient households. However, we find that the milk and milk substitutes are inframarginal for 36 percent of the poorest quintile compared to 59 percent of the richest quintile.

Thus, although we find that the VL program is reasonably well targeted to the expected beneficiary groups, to the poor, and to the malnourished, it is unclear *ex ante* what effect the program has had on reducing child malnutrition. We now turn to an econometric analysis in an effort to shed light on this.

Impact of VL Transfers on Nutritional Outcomes

In this section we assess the impact of the VL food transfer program on nutrition by examining how the transfers affect child nutritional outcomes. We do this by estimating quasi-reduced form models with standardized height-for-age z-scores (HAZ) of children under five years of age as the dependent variable. The summary statistics of the variables used in the model appear in Table 13.

These quasi-reduced form models are conditioned on the asset index as a proxy for the potentially endogenous household expenditures. In all of the models, the parameter estimates are positive and statistically significant at the 99 percent level of confidence, indicating that household wealth has a positive impact on child nutritional status. The magnitude of the parameter estimates, however, are sensitive to the identifying assumptions made in the estimation of the asset index (see Sahn and Stifel 2001).

Table 13: Means of Variables in HAZ Models DHS, 1996 & 2000

Variables	*Mean*	*Std. Dev*
HAZ	–1.11	1.34
Per Capita VL District Expenditures	31.90	7.63
Asset Index	–0.10	0.90
Male dummy	0.50	0.50
Multiple birth dummy	0.01	0.11
Birth order -- 2nd Child	0.22	0.42
Birth order -- 3rd Child	0.16	0.37
Birth order -- 4th Child	0.10	0.30
Birth order -- 5th Child	0.07	0.25
Birth order -- 6th+ Child	0.14	0.35
Age 0-6 months	0.10	0.30
Age 7-12 months	0.10	0.31
Age 13-18 months	0.10	0.30
Age 25-35 months	0.19	0.39
Age 36-59 months	0.41	0.49
Share HH members age 0-5	0.30	0.13
Share HH girls age 6-15	0.10	0.12
Share HH boys age 6-15	0.10	0.12
Share HH women 16-25	0.10	0.12
Share HH women 26-65	0.16	0.11
Share HH men 16-25	0.07	0.11
Share HH men 26-65	0.17	0.10
Number of HH members	6.38	2.56
Head is male	0.88	0.32
Head is indigenous	0.12	0.33
Mother's age	29.24	6.77
Mother's height (cm)	150.33	5.67
Mother's educ - primary	0.36	0.48
Mother's educ - secondary	0.39	0.49
Mother's educ - post sec.	0.16	0.37
Father's educ - primary	0.30	0.46
Father's educ - secondary	0.44	0.50
Father's educ - post sec.	0.20	0.40
House floor dirt dummy	0.51	0.50
Piped drinking water dummy	0.55	0.50
Flush toilet dummy	0.40	0.49
Urban dummy	0.68	0.47
Number of observations	19,053	

The effect of VL expenditures is insignificant in the basic OLS model (Table 14, model 1). Moreover, it is negative in the IV models without district fixed effects (3 and 5).

Although this effect is statistically significant in model 5, and almost significant in model 3, the parameter estimates are substantively small. When district fixed effects are included (2 and 6), the program effect becomes negligible and statistically insignificant. The result is similar when province-level fixed effects models are estimated (4 and 7). Thus, we find no evidence that expenditures on the VL program have a direct positive impact on the nutritional outcomes of young children—the group to whom the program is directed—using either the preferred approach (controlling for the initial conditions in communities with district fixed effects), or other models.

In both sets of IV models, the identifying instrument (FONCODES index of unmet needs) is significantly correlated with per capita VL district expenditures. Although the first-stage parameter estimate for the FONCODES index is negative for 1996 in the basic IV models (3 and 5), it is positive and strongly significant in the fixed effects models. While this confirms that the instrument is valid in terms of its correlation with VL expenditures, it also implies that marginal program targeting is propoor (Lanjouw and Ravallion 1999). In other words, the positive parameter estimates for the instruments suggests that the incidence of inframarginal VL spending benefits those districts with higher FONCODES indices (i.e., the poor benefit more from marginal increases in program spending that may not be distributed homogeneously across all districts).

The remaining characteristics of the model are similar across estimation methods. With regard to characteristics of the child, we find first that the gender variable is negative, implying that boys have worse nutrition, holding household characteristics constant.11 Second, as expected, children who are from multiple births show significant reduced linear growth. This effect of being a twin (or triplet) results in stunted growth that is approximately 0.45 standard deviations below the average. Third, the increasingly negative and significant effects associated with the birth order dummy variables indicate that as the birth order increases, children have lower height-for-age z-scores. This may be due to parity effects, however, these dummies may be picking up intrahousehold effects, whereby there is less investment in younger siblings. Fourth, we find a pattern, as illustrated by the dummy variables for the age of the child, where stunting worsens as the child gets older up to the age of the left-out category. This is attributable to the cumulative effect of periods of nutritional and health stress leading to a continued deterioration in growth relative to age and gender standardized norms, though there are some signs of catch-up or leveling off after the weaning age (24 months).[12]

[11] We note that this differs from Ruggeri Laderchi's (2001) finding of no statistical effect using the 1997 ENNIV data.

[12] Sahn and Stifel (2002) find that when errors in the measurement technique are not accounted for, the post weaning-period catch up tends to be underestimated.

Table 14: Quasi-Reduced Form Models of HAZ (Age 0-159 Months)
Peru DHS 1996 & 2000

	OLS				*Time varying IV equation*			
			Fixed effects				*Fixed effects*	
	Basic Model (1)		*District (2)*		*Basic Model (3)*		*Province (4)*	
HAZ	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Per Capita VL District Expenditures	0.0001	0.05	–0.0010	–0.42	–0.0060	–1.64	–0.0007	–0.28
Asset Index	0.302	8.08 **	0.156	4.46 **	0.291	7.53 **	0.158	4.46 **
Male dummy	–0.083	–4.25 **	–0.075	–3.97 **	–0.082	–4.22 **	–0.080	–4.23 **
Multiple birth dummy	–0.431	–4.26 **	–0.468	–4.95 **	–0.440	–4.35 **	–0.469	–5.01 **
Birth order -- 2nd Child	–0.069	–2.06 *	–0.062	–1.87 +	–0.068	–2.05 *	–0.067	–2.02 *
Birth order -- 3rd Child	–0.160	–4.00 **	–0.140	–3.53 **	–0.161	–4.01 **	–0.151	–3.83 **
Birth order -- 4th Child	–0.267	–5.42 **	–0.252	–5.21 **	–0.270	–5.47 **	–0.263	–5.50 **
Birth order -- 5th Child	–0.376	–5.89 **	–0.330	–5.36 **	–0.378	–5.91 **	–0.348	–5.63 **
Birth order -- 6th+ Child	–0.425	–6.61 **	–0.358	–5.72 **	–0.430	–6.69 **	–0.371	–5.95 **
Age 0-6 months	1.160	25.13 **	1.137	24.43 **	1.160	25.16 **	1.142	24.77 **
Age 7-12 months	0.667	14.14 **	0.642	13.81 **	0.668	14.15 **	0.647	14.02 **
Age 13-18 months	0.153	3.35 **	0.142	3.20 **	0.152	3.34 **	0.148	3.31 **
Age 25-35 months	0.286	7.02 **	0.266	6.77 **	0.286	7.03 **	0.271	6.94 **
Age 36-59 months	0.053	1.50	0.044	1.27	0.052	1.48	0.045	1.33
Share HH members age 0-5	–0.540	–2.48 *	–0.542	–2.48 *	–0.544	–2.50 *	–0.535	–2.49 *
Share HH girls age 6-15	–0.198	–0.90	–0.177	–0.80	–0.191	–0.87	–0.150	–0.69
Share HH boys age 6-15	–0.268	–1.18	–0.264	–1.17	–0.273	–1.20	–0.249	–1.12
Share HH women 16-25	0.031	0.12	0.024	0.10	0.025	0.10	0.043	0.18
Share HH women 26-65	0.144	0.58	0.228	0.95	0.127	0.52	0.245	1.03
Share HH men 16-25	0.300	1.29	0.317	1.36	0.301	1.30	0.315	1.38

Share HH men 26-65	0.433	1.84 +	0.449	1.89 +	0.440	1.87 +	0.464	2.00 *
Number of HH members	–0.030	–6.16 **	–0.025	–4.97 **	–0.030	–6.03 **	–0.025	–5.13 **
Head is male	–0.115	–2.99 **	–0.090	–2.35 *	–0.117	–3.05 **	–0.090	–2.37 *
Head is indigenous	–0.213	–4.36 **	–0.256	–4.63 **	–0.203	–4.11 **	–0.250	–4.81 **
Mother's age	0.062	3.69 **	0.055	3.30 **	0.063	3.74 **	0.056	3.43 **
Mother's age squared	–0.001	–2.60 **	–0.001	–2.41 *	–0.001	–2.63 **	–0.001	–2.47 *
Mother's height (cm)	0.054	22.79 **	0.051	22.54 **	0.054	22.79 **	0.052	22.98 **
Mother's educ - primary	0.018	0.35	–0.024	–0.49	0.024	0.47	–0.017	–0.36
Mother's educ - secondary	0.077	1.27	0.011	0.20	0.086	1.41	0.025	0.45
Mother's educ – post sec.	0.130	1.91 +	0.105	1.63	0.136	2.01 *	0.120	1.90 +
Father's educ - primary	–0.029	–0.61	0.005	0.11	–0.029	–0.62	0.007	0.14
Father's educ - secondary	0.112	2.47 *	0.112	2.50 *	0.111	2.46 *	0.114	2.55 *
Father's educ - post sec.	0.084	1.64	0.127	2.50 *	0.083	1.62	0.129	2.54 *
House floor dirt dummy	–0.029	–1.02	–0.064	–2.15 *	–0.033	–1.15	–0.063	–2.20 *
Piped drinking water dummy	–0.155	–4.34 **	–0.046	–1.24	–0.154	–4.31 **	–0.039	–1.09
Flush toilet dummy	0.031	0.75	0.055	1.36	0.046	1.06	0.050	1.25
Urban dummy	0.075	1.83 +	Fixed effect		0.064	1.55	Fixed effect	
Constant	–10.122	–20.01 **	dummies omitted		–9.933	–19.57 **	dummies omitted	
FONCODES index (t=0) in IV equation					–0.098	–8.13 **	0.218	48.17 **
FONCODES index (t=1) in IV equation					0.239	11.95 **	0.100	13.69 **
FONCODES index in IV equation								
Number of observations	19,053		19,053		19,053		19,053	
R^2	0.300		0.356		0.301		0.342	

Note: Instrument in IV models is district-level FONCODES index. All models were also estimated without household demographic variables. The remaining estimates were not statistically, nor substantively affected.

** indicates significance at 99 level of confidence, ** at 95 level of confidence, and + at 90 level of confidence.

Table 14: (Continued)

HAZ	*Time dummy in IV equation*								
				Fixed effects					
	Basic Model (5)			*District (6)*			*Province (7)*		
	Coeff.	*t-stat*		*Coeff.*	*t-stat*		*Coeff.*	*t-stat*	
Per Capita VL District Expenditures	–0.0073	–1.97	*	–0.0005	–0.21		–0.0003	–0.12	
Asset Index	0.288	7.55	**	0.157	4.47	**	0.159	4.50	**
Male dummy	–0.082	–4.22	**	–0.075	–3.98	**	–0.080	–4.22	**
Multiple birth dummy	–0.442	–4.39	**	–0.468	–4.95	**	–0.469	–5.00	**
Birth order -- 2nd Child	–0.068	–2.04	*	–0.062	–1.87	+	–0.067	–2.02	*
Birth order -- 3rd Child	–0.161	–4.01	**	–0.140	–3.53	**	–0.151	–3.82	**
Birth order -- 4th Child	–0.270	–5.48	**	–0.252	–5.21	**	–0.263	–5.49	**
Birth order -- 5th Child	–0.379	–5.92	**	–0.330	–5.36	**	–0.348	–5.63	**
Birth order -- 6th+ Child	–0.431	–6.71	**	–0.357	–5.71	**	–0.371	–5.94	**
Age 0-6 months	1.160	25.15	**	1.137	24.43	**	1.142	24.77	**
Age 7-12 months	0.668	14.15	**	0.642	13.81	**	0.647	14.03	**
Age 13-18 months	0.152	3.34	**	0.142	3.20	**	0.148	3.31	**
Age 25-35 months	0.286	7.03	**	0.266	6.77	**	0.271	6.94	**
Age 36-59 months	0.052	1.47		0.044	1.27		0.045	1.33	
Share HH members age 0-5	–0.544	–2.51	*	–0.540	–2.47	*	–0.533	–2.48	*
Share HH girls age 6-15	–0.190	–0.86		–0.177	–0.80		–0.150	–0.69	
Share HH boys age 6-15	–0.274	–1.20		–0.263	–1.17		–0.248	–1.12	
Share HH women 16-25	0.024	0.10		0.025	0.10		0.043	0.18	
Share HH women 26-65	0.124	0.50		0.228	0.96		0.245	1.03	
Share HH men 16-25	0.301	1.30		0.318	1.37		0.316	1.38	
Share HH men 26-65	0.441	1.88	+	0.449	1.90	+	0.464	2.00	*
Number of HH members	–0.030	–6.02	**	–0.025	–4.97	**	–0.025	–5.12	**
Head is male	–0.117	–3.06	**	–0.090	–2.34	*	–0.090	–2.36	*
Head is indigenous	–0.201	–4.06	**	–0.256	–4.62	**	–0.250	–4.80	**
Mother's age	0.063	3.75	**	0.055	3.30	**	0.056	3.43	**
Mother's age squared	–0.001	–2.64	**	–0.001	–2.41	*	–0.001	–2.47	*
Mother's height (cm)	0.054	22.79	**	0.051	22.54	**	0.052	22.98	**
Mother's educ - primary	0.026	0.50		–0.024	–0.50		–0.017	–0.36	
Mother's educ - secondary	0.087	1.44		0.011	0.19		0.025	0.44	
Mother's educ - post sec.	0.137	2.03	*	0.104	1.61		0.120	1.89	+
Father's educ - primary	–0.029	–0.62		0.005	0.11		0.007	0.15	
Father's educ - secondary	0.111	2.46	*	0.112	2.51	*	0.114	2.56	*
Father's educ - post sec.	0.083	1.61		0.127	2.51	*	0.129	2.55	*
House floor dirt dummy	–0.034	–1.18		–0.064	–2.14	*	–0.063	–2.19	*
Piped drinking water dummy	–0.154	–4.31	**	–0.046	–1.25		–0.039	–1.10	
Flush toilet dummy	0.049	1.14		0.055	1.35		0.050	1.25	
Urban dummy	0.062	1.50		Fixed effect			Fixed effect		
Constant	–9.892	–19.39	**	dummies omitted			dummies omitted		
FONCODES index (t=0) in IV equation									
FONCODES index (t=1) in IV equation									
FONCODES index in IV equation	–0.018	–1.85	+	0.149	2.40	*	0.241	44.09	**
Number of observations	19,053			19,053			19,053		
R^2	0.301			0.356			0.341		

Note: Instrument in IV models is district-level FONCODES index.
** indicates significance at 99 level of confidence, ** at 95 level of confidence, and + at 90 level of confidence.

Turning to the household demographic variables, we find that larger households have a negative and significant effect on child linear growth. This could follow from competition for household resources at a given level of wealth. The positive and significant effect of the share of men between the ages of 26 and 65 suggests that their contribution to income earnings outweighs their competition for resources. On the other hand, the large negative and significant effect of the share of members under the age of six likely implies competition for child nurturing resources.

Children living in male-headed households are found to suffer relative to those in female-headed households. Recall that we control for household wealth, and as such this effect could reflect preferences of male household heads for consumption items that are not health/nutrition related. Children living in indigenous (non-Spanish-speaking) households are also found to be disadvantaged.

We also consider the effects of a mother's characteristics on nutritional outcomes. The increasing age of the mother contributes to better nutritional outcomes, although the negative quadratic indicates diminishing positive effects of increase maternal age.13 Since we have controlled for birth order, it is likely that this age effect largely represents experience in household production activities (e.g., child nurturing). A mother's height also contributes positively and significantly to increased heights of her children ceteris paribus either through her genetic contribution or its expression in health or both.

Next we consider the effect of the education of mothers and fathers on the linear growth of their children. In all of the models, we find a positive and significant effect of father's secondary education. In the fixed effects models, we also find positive and significant effects of father's post secondary education. Mother's secondary education has a positive and significant effect on the nutritional outcomes of her children in the basic models and the province-level fixed effects models. In none of the cases does primary education alone (36 percent of mothers and 30 percent of fathers) have an impact on nutritional outcomes.

Finally, in terms of the covariates that capture the child's proximate sanitary environment, we find that dirt floors in the household have negative effects on child growth (fixed-effects models). We also find in the basic models that drinking water piped into the household has a surprising negative effect on nutritional outcomes of children, though this is not true of the availability of flush toilets where we find no effects. These results, however, are not consistent with other studies both for the general literature as well as for Peru (Alderman, Hentschel, and Sabates 2003.).

[13] The effect becomes negative at 63 years of age, well beyond the age of any mother in the sample of women between the ages of 15 and 49.

6. Conclusion

This paper evaluates the *Vaso de Leche* (VL) feeding program in Peru. In doing so, we ask that if a community-based multi-stage targeting scheme such as that of the VL program is progressive, is it possible that the program can achieve its nutritional objectives? This is done by linking public expenditure data with household survey data to assess the targeting, and then to model the determinants of nutritional outcomes of children to see if VL program interventions have an impact on nutrition.

We confirm that the VL program is reasonably well targeted to poor households and to households with low nutritional status. Despite official targeting criteria based not on income status, rather on the presence of young children and pregnant and lactating women in the household, approximately 50 percent of the poor received VL benefits, while less than 20 percent of the non-poor were beneficiaries. Further, in Probit estimates we find that households in the poorest quintile of the population are 24 percent more likely than households in the richest quintile to receive VL transfers. In terms of the values of transfers, over 60 percent (possibly up to 75 percent) 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 one percent decrease in the income level of a household corresponds to a four percent increase in the value of the VL transfer, *ceteris paribus*. While this targeting is progressive, especially for one which is commodity based, it is less so than other programs including the interministerial fund, FONCOMUN (Fondo de Compensacion Municipal). At this time a cash transfer program is being piloted in Peru.

The impact of food subsidies beyond their value as income transfers, however, is limited by the degree to which the commodity transfers are infra-marginal. Using the 2002 Public Expenditure Tracking Survey, we find that transfers of milk and milk substitutes from the VL program are infra-marginal for approximately half of the households that receive them. Thus, it is not entirely surprising that we fail to find econometric evidence of the nutritional objectives of the VL program being achieved. In the models of child standardized heights, we use VL expenditures to the community instead of household participation as an explanatory variable, solving the issue of endogenous household choice. When we account for endogenous program placement with fixed effects and instrumental variables models, we find no impact of the VL program expenditures on the nutritional outcomes of young children – the group to whom the program is targeted.

Thus, despite being reasonably well targeted to the intended beneficiaries as well as to the poor and malnourished, the VL program falls short of its primary objective to improve the nutritional status of young children

References

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Alderman, Harold. 2001. Multi-tier Targeting of Social Assistance: Role of Inter-governmental Transfers. *World Bank Economic Review* 15(1): 33–53.

Alderman, H., P. A. Chiappori, L. Haddad, J. Hoddinott, R. Kanbur. 1995. "Unitary Versus Collective Models of the Household: Time to Shift the Burden of Proof?" *World Bank Research Observer* 10(1): 1-20..

Alderman, Harold, Jesko Hentschel, and Ricardo Sabates. 2003. "With the help of one's neighbors: externalities in the production of nutrition in Peru." *Social Science and Medicine* 56 (10): 2019-31.

Conning, Jonathan, and Michael Kevane. 2002. "Community-Based Targeting Mechanisms for Social Safety Nets: A Critical Review." *World Development* 30(3): 375-94.

Duclos, Jean-Yves. 1995. Modeling the Take-up of State Support. *Journal of Public Economics* 58: 391–415.

Filmer, Deon and Lant Pritchett. 2001. "Estimating Wealth Effects without Expenditure Data — or Tears: An Application of Educational Enrollment in States of India." *Demography* 38(1): 115–32.

Galasso, Emanuela, and Martin Ravallion. 2002. "Decentralized Targeting of an Anti-Poverty Program." *Journal of Public Economics*, forthcoming.

Hammer, Jeffrey. 1998. "Health Outcomes Across Wealth Groups in Brazil and India." Development Research Group, World Bank, Washington, D.C. Processed.

Instituto Apoyo and the World Bank. 2002. "Central Government Transfers to Municipalities in Peru: A Detailed Look at the Vaso de Leche Program." Lima, Peru. Processed.

Lanjouw, Peter, and Martin Ravallion. 1999. "Benefit Incidence, Public Spending Reforms, and the Timing of Program Capture." *World Bank Economic Review* 13(2): 257–73.

Kennedy, Eileen, and Alderman, Harold. "Comparative Analyses of Nutritional Effectiveness of Food Subsidies and Other Food-Related Interventions." International Food Policy Research Institute and WHO-UNICEF, March 1987.

Martorell, R., and J. Habicht. 1986. "Growth in Early Childhood in Developing Countries." In F. Falkner and J. Tanner, eds., *Human growth: A comprehensive treatise*, Vol. 3. New York: Plenum Press.

Pinstrup-Andersen, Per, ed. 1988. *Consumer-Oriented Food Subsidies: Costs, Benefits, and Policy Options for Developing Countries*. Baltimore, Md.: Johns Hopkins University Press.

Rosenzweig, Mark, and Kenneth Wolpin. 1986. Evaluation of the Effects of Optimally Distributed Programs: Child Health and Family Planning Initiatives. *American Economic Review* 76: 470–82.

Ruggeri Laderchi, Caterina. 2001. "Killing Two Birds with the Same Stone? The Effectiveness of Food Transfers on Nutrition and Monetary Policy." Paper presented at the 2001 Latin American Economic Association Conference, Montevideo, Uruguay.

Rush, D., J. Leighton, N. L. Sloan, J. M. Alvir, D. G. Horvitz, W. B. Seaver, G. C. Garbowski, S. S. Johnson, R. A. Kulka, and J. W. Devore. 1988. The National WIC Evaluation: Evaluation of the Special Supplemental Food Program for Women, Infants, and Children. VI. Study of infants and children. *American Journal of Clinical Nutrition* 48: 484–511.

Sahn, David, and David Stifel. 2001. "Exploring Alternative Measures of Welfare in the Absence of Expenditure Data." Cornell Food and Nutrition Policy Program Working Paper No. 97. Ithaca, NY.

Sahn, David, and David Stifel. 2002. "Parental Preferences for Nutrition of Boys and Girls: Evidence from Africa." *Journal of Development Studies* 39: 21–45.

Schady, Norbert R. 2002. "Picking the Poor: Indicators for Geographic Targeting in Peru." *The Review of Income and Wealth* 48 (3, September): 417–33.

World Bank and Inter-American Development Bank. 2002. Peru: Restoring Fiscal Discipline for Poverty Reduction. Public Expenditure Review. Report 24286-PE. Washington, D.C.

Younger, Stephen. 2002. "Public Social Sector Expenditures and Poverty in Peru." In Morrison, Christian, ed., *Education and Health Expenditure, and Development: The Cases of Indonesia and Peru.* Paris: OECD Development Centre.

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