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THE IMPACT OF *PROGRESA* ON FOOD CONSUMPTION

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Abstract

As exemplified by the Millennium Declaration of the United Nations, the reduction of poverty and hunger are now seen as central objectives of international development. Yet the modalities for attaining these goals are contested. Further, while it might be assumed that interventions that alleviate poverty will automatically reduce hunger, a number of studies of the relationship between income and the acquisition of food suggest that this assumption may be incorrect.

This paper contributes to this debate through an analysis of a Mexican antipoverty program called PROGRESA (the Programa de Educación, Salud y Alimentación). PROGRESA provides cash transfers linked to children's enrollment and regular school attendance and to clinic attendance. By 2000, it reached approximately 2.6 million families, about 40 percent of all rural families and about one-ninth of all families in Mexico.

We use a longitudinal sample of approximately 24,000 households from 506 communities. A distinguishing characteristic of this sample was that communities were randomly selected for participation in PROGRESA, while the rest were introduced into the program at later phases. Exploiting this feature in our analysis, we find that households receiving PROGRESA benefits increased caloric acquisition compared to comparable households not receiving these benefits. By November 1999, beneficiary households in treatment localities obtained 7.1 percent more calories than did comparable households in control localities. Perhaps more significantly, we find that the impact is greatest on dietary quality as measured by the acquisition of calories from vegetable and animal products—a finding consistent with the view of respondents themselves that PROGRESA was enabling them to "eat better."

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1. Introduction

As exemplified by the Millennium Declaration of the United Nations—a resolution signed by 189 countries—the reduction of poverty and of hunger are now seen as the central objectives of international development (United Nations 2000). Together with 16 other Millennium Development Goals (MDGs), the global community has committed itself to halving by 2015 the proportion of the world's population that lives in poverty and suffers from hunger.

One might think that these goals are intertwined, i.e., that interventions that alleviate poverty automatically reduce hunger. However, the existing literature, as reviewed by Strauss and Thomas (1995) and Hoddinott, Skoufias, and Washburn (2000), suggests that this may not be the case. For example, estimates of income-calorie elasticities (measuring the responsiveness of caloric acquisition given changes in income) range from a high of 0.54 (Chernichovsky and Meesook 1984) to a low of 0.01 (Wolfe and Behrman 1983). Further, as Ravallion (1983) stresses, it is also important to consider where within a given distribution such changes occur.

This paper contributes to this debate, but using a significantly different methodology. Our analysis is based on the impact of an antipoverty program in Mexico called PROGRESA (the Programa de Educación, Salud y Alimentación). Started in 1997, PROGRESA is the centerpiece of Mexican efforts to fight rural poverty. It provides cash transfers linked to children's enrollment and regular school attendance and to clinic attendance. The program also includes in-kind health benefits; nutritional supplements for children up to age five, and pregnant and lactating women; and instructional meetings on health and nutrition issues. In contrast to earlier programs in Mexico, a unique feature of PROGRESA is the targeting of transfers to the mother of the family. By 2000, PROGRESA reached approximately 2.6 million families—about 40 percent of all rural families and about 11 percent of all Mexican families. The program operated in almost 50,000 localities, more than 2,000 municipalities, and in 31 states,

with a budget of approximately $777 million for 1999, equivalent to 0.2 percent of gross domestic product (GDP).[1]

We use a longitudinal sample of approximately 24,000 households from 506 communities located in the first states receiving PROGRESA benefits. Because it was not administratively feasible to provide benefits to all households simultaneously, and because of the importance of correctly assessing program impact, a distinguishing characteristic of this sample was that communities were randomly selected for participation in PROGRESA (treatment localities), while the rest were introduced into the program at later phases (control localities). We exploit this random allocation to explore whether PROGRESA improved the diet of poor rural Mexicans—a major objective of the program. As such, this evaluation provides insights into whether interventions designed to alleviate poverty also succeed in reducing hunger. Our core finding is that households receiving PROGRESA benefits increased caloric acquisition compared to comparable households not receiving these benefits. By November 1999, beneficiary households in treatment localities obtained 7.1 percent more calories than did comparable households in control localities. Perhaps more significantly, given recent work summarized by Ruel (2001) that stresses the importance of dietary quality in ensuring adequate intake of essential nutrients, we find that the impact is greatest on the acquisition of calories from vegetable and animal products—a finding consistent with the view of respondents themselves that PROGRESA was enabling them to "eat better."

2. Evaluation Issues

The fundamental problem in the evaluation of any social program is the fact that participating households cannot be simultaneously observed in the alternative state of no treatment. For a proper evaluation of program impact, it is necessary to observe a group of households that are similar to beneficiary households in every respect possible but do not benefit from the program. In the case of PROGRESA, evaluation was conceived

[1] For more details, see Gomez de Leon et al. 1999.

from the beginning as part of the design of the program. Therefore, from a set of rural communities in the same geographic region, localities were randomly selected for participation (treatment localities), while the rest were introduced in later phases (control localities). However, assuming that a randomized intervention is implemented as designed is a strong, and possibly highly misleading, assumption. Thus, a necessary precursor to our assessment of impact is to consider carefully evaluation design and implementation as well as actual program operations.

Evaluation Design

Our sample consists of longitudinal data collected from 24,000 households residing in 506 localities in seven states that were among the first to receive PROGRESA benefits: Guerrero, Hidalgo, Michoacán, Puebla, Querétero, San Luis Potosi, and Veracruz. Of the 506 communities, 320 were designated as treatment and 186 as control communities, implying that at the locality level, there was a 63 percent probability of a locality being assigned to treatment and a 37 percent chance of being assigned to the control group. In control localities, the incorporation of beneficiary households into PROGRESA was postponed until the year 2000.

The selection of beneficiaries was a three-stage process. Using national census data, poor communities with schooling and health infrastructure were identified. Within selected communities, PROGRESA conducted a census, the ENCASEH (*Encuesta de Características Socioeconómicas de los Hogares*), to determine which households, in both treatment and control localities, would be eligible for benefits. Last, the list of potential beneficiaries is presented to a community assembly for review and discussion and the list is changed according to established criteria for the selection of beneficiary families, a process described as "densification." On average in the evaluation sample, 78 percent of the households were classified as eligible for program benefits (Skoufias, Davis, and Behrman 1999).

A detailed investigation of whether the assignment of localities into treatment and controls based on equality of key characteristics, such as age, education, and income,

could not reject the null hypothesis that the means of these variables at the locality levels were equal, suggesting that randomization of localities into control and treatment groups was successfully implemented (Behrman and Todd 1999). However, Behrman and Todd detected some significant differences when the comparison of the means was conducted at the household level. While the magnitudes of these differences were often very small, this finding suggests that it would be prudent to extend our analysis beyond comparisons of means. Such control variables accounting for "observable" household heterogeneity may thus reduce the statistical bias associated with heterogeneity between households in treatment and control localities.

A series of household surveys, the ENCEL (*Encuesta de Evaluación de los Hogares),* were fielded in treatment and control localities in order to collect information for the evaluation of PROGRESA. The first of these took place in March 1998 before the initiation of benefits in May 1998. Unfortunately, design flaws in the consumption modules made this unusable. Further surveys were conducted after beneficiary households started receiving benefits, in October 1998 (ENCEL98O), June 1999 (ENCEL99J), and November 1999 (ENCEL99N). Core questions about the demographic composition of households and their socioeconomic status were asked in each round of the survey. These were accompanied by specific questionnaires that collected information critical to a thorough evaluation of program impact.[2]

Assessing Program Operation: Enrollment in PROGRESA

The next step is to determine whether all eligible households in treatment localities were indeed incorporated as prescribed by PROGRESA operational guidelines.[3]

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[2] The topics of these modules included collecting information about family background, assets brought to marriage, schooling indicators, health status and utilization, parental attitudes and aspirations toward children's schooling, consumption of food and nonfood items, the allocation of time of household members in various activities, and self-employment activities. These were supplemented by school and clinic surveys, community questionnaires, data on student achievement test scores, and other school and clinic administrative data.

[3] For a further discussion and evaluation of the operational aspects of PROGRESA, see Adato, Coady, and Ruel (2000).

For this purpose, we examined the record of payments sent out by PROGRESA headquarters in Mexico City since the start of the distribution of benefits in May 1998.

Of the 12,291 households in treatment localities eligible to receive benefits, 3,350, or 27 percent of the total eligible population, had not received any benefits by March 2000. The most likely explanation for this is that 2,872 households (or 85.7 percent of the eligible households not receiving any benefits) were never formally incorporated into the program. All of these "forgotten" households were households whose eligibility status was revised from ineligible to eligible as a result of the densification process described above. It is less clear why the remaining 478 households (14.3 percent of the omitted eligible households and 3.9 percent of the total eligible population in treatment areas) did not receive benefits despite being formally enrolled during the early months of 1998.

Consequently, we have two options available to identify the impact of PROGRESA on food consumption. First, we can compare potential beneficiaries in treatment areas to those in control areas. This would provide an estimate of the impact of PROGRESA inclusive of errors in the operational aspects of the program. By construction, however, the estimated impact would be biased downward, since the conditional mean of food consumption or caloric availability among eligible households in treatment areas would be calculated by including households that were never incorporated for reasons beyond their control. The other option is to examine whether PROGRESA has an impact *conditional* on households receiving monetary benefits.

At least two critical questions can be raised about this latter option. First, the receipt of benefits may result from household behavior or choices that may result in misleading inferences about the impact of program. Given that the majority of the omitted households were left out of the program for reasons beyond their control, this issue should not present a major concern. Second, the eligible households in the control group may not be the appropriate comparison group. The set of "true" beneficiaries seems to disproportionately exclude smaller, older households. For example, beneficiary households tend to be slightly larger, but considerably younger, than control households.

With the number of adults between 18 and 55 years old nearly equal, the main demographic difference between the groups is that beneficiary households have roughly 12 percent *more* children (up to age 18) and 13 percent *less* adults over age 55. Since beneficiary households are, on average, larger than eligible households, their total expenditures may be higher than the total expenditures of eligible households because of differences in households size and not because of PROGRESA. Along similar lines, comparisons of the value of food consumption per capita (consumption divided by family size) may lead to underestimates of the effects of PROGRESA when comparing simple averages. These differences in the samples of beneficiary and control groups suggest that a more credible evaluation of the impact of PROGRESA has to rely on regression methods that control for the household size and age and gender composition of beneficiary and control households instead of simple comparisons of (unconditional) means.

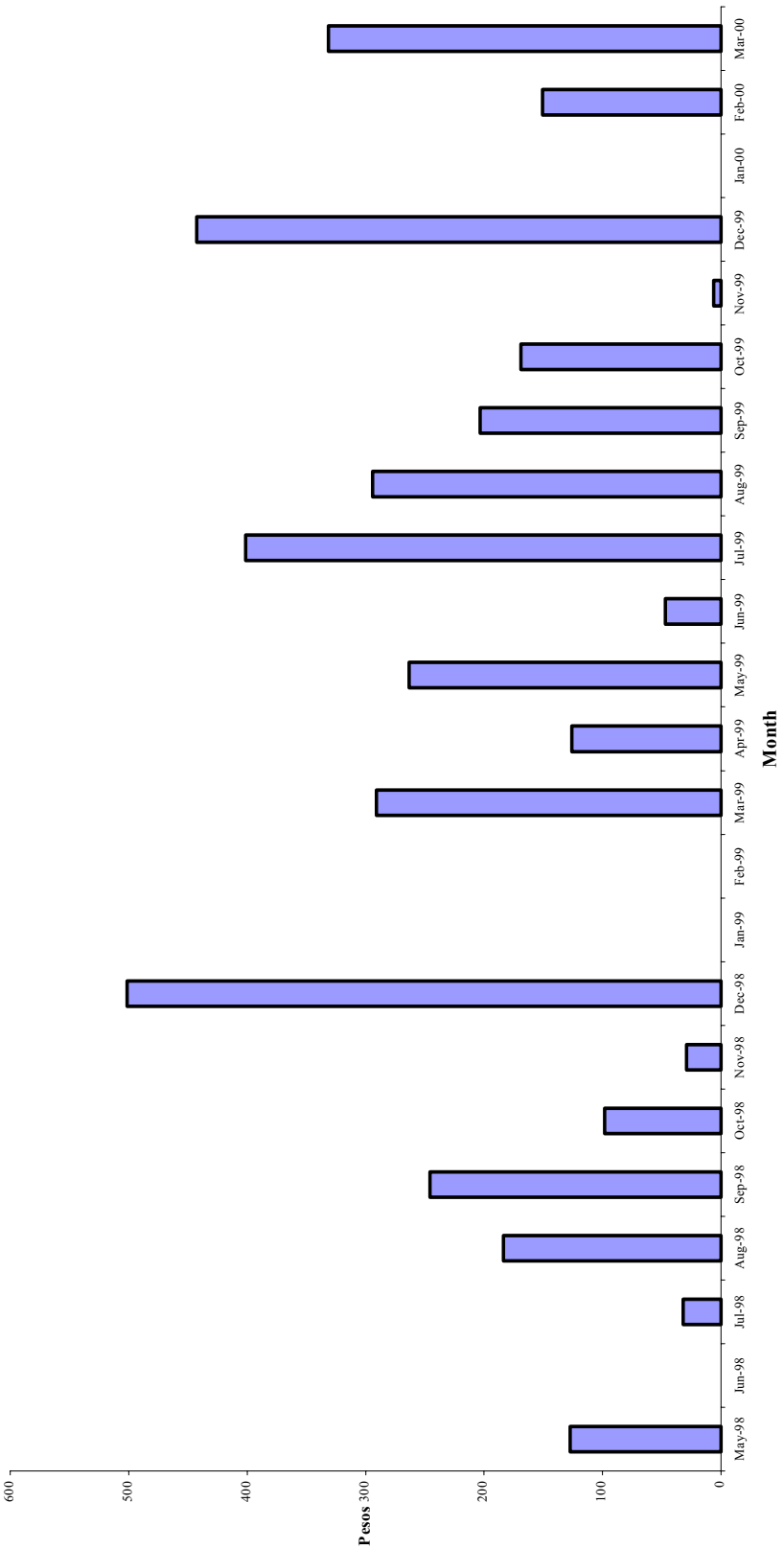
Operation of the Cash Transfer System

PROGRESA*'s* monetary transfers take three forms: scholarships tied to attendance of children at school (the *beca*); money for school supplies; and a cash transfer for food (the *alimento*). These transfers are given out in a lump sum every two months (PROGRESA 1997; Coady and Djebbari 1999). The monthly amount of the scholarships varies by age and sex of the child, ranging (in June 1998) from 65 pesos for a boy attending third grade to 240 pesos for a girl attending the third grade of secondary school. These payments were capped with the maximum scholarship set at 490 pesos per household per month January–June 1998, rising to 625 pesos per month July–December 1999. The *alimento* transfers were 95 pesos per month at the start of 1998, but were increased to 125 pesos per month in July 1999. Actual transfers to each household depend on the age and sex of children in the household, as well as their compliance with the requirements of PROGRESA. Coady and Djebbari (1999) estimate that for a family in extreme poverty, these monetary transfers should, in principle, average around 260 pesos per household.

Hoddinott, Skoufias, and Washburn (2000) determined that by November 1998 (corresponding to the ENCEL98O survey round), beneficiaries selected under the third phase of incorporation were beginning to receive the *alimento*, but had, in most cases, received only a single *beca* payment. An implication of this is that one should expect to observe a much smaller impact of PROGRESA when looking at the ENCEL98O data than when examining the ENCEL99J or ENCEL99N, simply because these transfers were of low value. Also the largest component of these cash transfers, the *beca*, is conditional on school attendance. Verification of attendance relies on a process by which households are sent relevant forms, these forms are completed, and ultimately returned to PROGRESA before the initiation of payment (Coady and Djebbari 1999). This process takes some time; further households do not receive school payments for the school holiday period (July–August). Consequently, one would expect there to be some "lumpiness" in the pattern of actual payments made to beneficiaries, a pattern that would be compounded by any delays that might creep into the payment process.

Given this background, it is not surprising that Figure 1 shows considerable variation in the average payment received per month. For example, a typical beneficiary received more than 500 pesos in December 1998, but nothing in January or February 1999. This variability in payments has an important implication for our analysis. Recall that the ENCEL surveys take place in November 1998, June 1999, and November 1999; thus, considerable time elapses between these large payments and the ENCEL surveys. It is widely documented that people generally forget purchases of consumer goods as the recall period is increased ("recall bias"), so it is possible that the ENCEL surveys are underestimating purchases of nonfood items (Deaton and Grosh 2000). As it is likely that beneficiaries are aware that payments will tend to be lumpy and irregular, it is plausible that they will smooth out purchases made out of these cash transfers rather than spending them as they are received. Consequently, payments received just prior to the ENCEL surveys are likely to be a noisy indicator of longer-run average payments.

Figure 1 Average cash transfers from PROGRESA, by month



Actual average payments, in total and by component, received over the 12-month period between November 1998 and October 1999, along with data on household consumption averaged across all three rounds, are reported in Table 1. The first monetary benefits associated with participation in PROGRESA start in May 1998, covering, in principle, the first two months of participation in the program (i.e., March and April 1998). However, given that there is no record of the date of incorporation of households into the program, and given the initial lags in payments that took place because of delays in the processing of the forms necessary for payment authorization, we base our calculation of the average monthly monetary benefits received by PROGRESA beneficiaries on the 12-month interval between November 1998 and October 1999.

Average monthly transfers are around 197 pesos (in November 1998 pesos) per beneficiary household per month. On average, households receive 99 pesos per month for the *alimento*, and 91 pesos for the *beca*. In households with school-age children, the average *beca* received rises slightly to 93 pesos. The *alimento* accounts for 67.4 percent of the transfers received by households headed by individuals 60 years or older, which is not surprising, given that such households tend to have fewer school-age children. One way of expressing these transfers as a percentage of income is to calculate the percentage of their average value to average expenditures made by poor households in control localities. This figure is 19.5 percent, with some variation by household demographic composition.

Table 1 shows that averaging across all survey rounds, total consumption in poor households receiving PROGRESA benefits is 151 pesos per month higher than in comparable households in control localities. The ratio between differences in consumption between poor households in control and treatment localities, and PROGRESA transfers is 77 percent. This ratio is 97.5 percent for households with preschoolers, 65.3 percent for households with school-age children, but only 41 percent for households headed by individuals age 60 or older. If older respondents (who tend to be less literate) have greater difficulty remembering past expenditures, then this recall

Table 1 PROGRESA transfers to beneficiary households from November 1998 to October 1999

	Beneficiary households						Poor households residing in control localities		
	Household size	**Total value of consumption (Food) [Nonfood]**	**Average monthly transfers received**	**Average monthly *alimento* transfer**	**Average monthly *beca* transfer**	**Average monthly school utilities transfer**	**Household size**	**Total expenditures (Food) [Nonfood]**	**Transfers as a percentage of nonbeneficiaries' expenditures**
All poor households	5.81	1,190 (947) [242]	197	99	91	8	5.47	1,039 (806) [233]	19.54
Households with preschoolers	6.58	1,289	202	101	93	8	6.41	1,092	18.7
Households with school-aged children	6.59	1,311	239	101	128	11	6.40	1,155	20.9
Households with heads aged 60 or older	4.35	936	138	93	41	3	4.23	880	16.5

Source: Calculations based on transfer data provided by PROGRESA averaged across the 12 months between November 1998 and October 1999 (deflated to November 1998 prices). Consumption and family size averaged across the three rounds of the ENCEL surveys in November 1998, June 1999, and November 1999.

problem might account for some of the divergence between transfers received and the difference in expenditures between these two groups of households. Although some of the divergence may be a result of households saving a fraction of the transfer, reducing labor supply, or the crowding out of private transfers by funds from PROGRESA, Teruel and Davis (2000) and Skoufias and Parker (2001) find little evidence to support these hypotheses.

3. Assessing the Impact of PROGRESA on Food Consumption

A Descriptive Assessment

Thinking about your household, what has changed since you began receiving assistance from PROGRESA*?*
"We eat better" (48 percent of beneficiary households);
"We eat more" (19 percent of beneficiary households).
Source: Household survey data: November 1998

We now examine the impact of PROGRESA on food consumption. Recall that a key objective of the program is to improve the health and nutritional status of individuals residing in poor households. Access to food plays an important role in meeting these needs. However, "access to food" is a broad term. Households do not solely value food quantity. Dietary *quality,* as exemplified by a varied diet, is also important. Such concerns are clearly in the minds of PROGRESA beneficiaries in our sample, as the responses above to the question about PROGRESA's impact illustrate.

We begin by exploring whether PROGRESA has led to an increase in the physical consumption of food. To do so, we constructed a measure of caloric availability

at the household level in calories per person per day.[4] There are a number of reasons why one should be careful in interpreting these data. First, these are rough estimates of calories "available to be consumed," rather than actual consumption. Second, there can be considerable heterogeneity with broad food categories such as "chicken" or "rice," and such heterogeneity may be correlated with household characteristics. For example, 100 grams of boneless chicken has more calories than 100 grams of chicken wings. Third, households may consume food outside the household, and such consumption is not reflected in these data. Fourth, there is some evidence in the data to suggest that reported caloric availability falls dramatically in large (more than 10 person) households, suggesting that for these (few) households, measurement error may be a matter of considerable concern.

Mindful of all these caveats, Table 2 reports mean values of caloric availability in poor households in treatment and control localities as well as at the 25th, 50th (median), and 75th percentiles. They are further disaggregated by food group: grains, fruit and vegetables, animal products, and other foods.

Beginning with the November 1998 survey round, there are several noteworthy features. The first is the monotony of the diets of these poor Mexican households, with calories from grains accounting for about 75 percent of caloric availability. Second, there is a statistically significant difference in the unconditional means across these poor households, but the magnitude of the difference is small. However, as we move from

[4] ENCEL98O, ENCEL99J, and ENCEL99N contained a set of questions of the following form: "In the last seven days, how much have you consumed of the following foods?" This was asked with reference to 35 different foods. Converting these data into calories involved the following steps. First, different units of measurement were converted into a common measure for each food item. Next, volumes were converted to weights using M. Chavas, *Tablas de Valor Nutrivo* (Mexico 1999). The acquisition of each food item, now expressed in kilograms, was multiplied by the percentage weight of the food deemed edible and these edible kilograms of food were converted to kilocalories (kcal). Both calculations were based on the *Tablas de Valor Nutritivo*. These 35 food variables and their aggregate, expressing kcal per family per week, were then converted to daily amounts and divided by household size to get kcal per person per day. This measure of household size excludes members not regularly eating in the home and includes nonhousehold members that eat there. (We experimented with various measures of "adult equivalent units," but such adjustments do not substantively affect the results presented here).

Table 2 Household caloric availability per month per day: Poor beneficiary and control households

	Beneficiary 25%	Control 25%	Percent difference	Beneficiary median	Control median	Percent difference	Beneficiary 75%	Control 75%	Percent difference	Beneficiary mean	Control mean	Percent difference
All food												
November 1998	1,450.0	1,432.8	1.2%	1,957.6	1,930.3	1.4%	2,699.8	2,682.6	0.6%	2,160.6	2,144.2	0.8%
June 1999	1,547.5	1,513.9	2.2%	2,136.4	2,054.2	4.0%	2,925.4	2,828.3	3.4%	2,302.9	2,245.9	2.5%
November 1999	1,494.8	1,387.8	7.7%	1,940.0	1,799.4	7.8%	2,569.4	2,389.9	7.5%	2,109.5	1,978.6	6.6%
Cereals and grains												
November 1998	1,006.9	994.3	1.3%	1,421.4	1,397.1	1.7%	2,076.7	2,038.2	1.9%	1,622.2	1,597.4	1.6%
June 1999	1,067.2	1,064.0	0.3%	1,550.2	1,495.5	3.7%	2,291.1	2,214.8	3.4%	1,735.8	1,700.9	2.0%
November 1999	1,005.9	943.3	6.6%	1,348.2	1,250.1	7.9%	1,836.5	1,690.1	8.7%	1,510.5	1,395.8	8.2%
Fruits and vegetables												
November 1998	17.3	14.4	20.6%	36.1	3.0	9.6%	64.5	62.4	3.4%	46.9	45.2	3.7%
June 1999	20.1	13.4	50.0%	38.1	29.8	27.9%	64.5	54.3	18.7%	48.0	39.6	21.2%
November 1999	24.6	17.9	37.6%	44.5	36.3	22.7%	75.7	63.9	18.5%	55.5	46.7	18.7%
Meat and animal products												
November 1998	33.1	30.9	7.0%	77.3	74.0	4.5%	162.1	161.6	0.4%	125.9	123.7	1.8%
June 1999	39.6	31.0	27.5%	81.4	66.8	21.8%	169.6	147.9	14.7%	129.2	113.4	14.0%
November 1999	49.7	36.9	34.7%	94.8	79.0	20.0%	176.5	166.3	6.1%	137.5	127.4	7.9%
Other food												
November 1998	230.0	224.7	2.4%	326.3	336.5	-3.0%	446.5	471.9	-5.4%	365.5	377.8	-3.3%
June 1999	243.0	238.9	1.7%	344.8	339.6	1.5%	469.7	497.5	-5.6%	389.9	392.1	-0.5%
November 1999	269.7	254.3	6.1%	363.5	359.4	1.1%	487.7	534.4	-8.7%	406.0	408.7	-0.7%

Source: ENCEL98O, ENCEL99J, and ENCEL99N household surveys. Sample does not include 212 observations reporting that no food was consumed within the home or 10 percent of consumption records with caloric availability per person per day less than or equal to 875 kcal or greater than or equal to 4,700 kcal.

November 1998 to June 1999, and then to November 1999, the magnitude of these differences increases. By November 1999, households receiving PROGRESA benefits have, at the mean, 7.8 percent more calories available per person per day than do comparable households in control localities. Particularly striking are the increases in calories consumed from vegetables and fruits and meat and animal products. Proportionately, the largest impacts are found for fruits, vegetables, and meat and animal products for the poorest beneficiary households, as measured by households at the 25th percentile.

Modeling Impact in a Multivariate Framework

Recall that Behrman and Todd (1999) find that at the locality level, there are no significant differences between treatment and control communities across a range of characteristics that include age, education, access to health care, and income. However, when these tests are performed on household-level data, they find many more rejections of the null hypothesis of no differences across control and treatment localities than would be expected by chance. Also recall our finding that a significant proportion of households who were enrolled in treatment communities received no monetary transfers. For these reasons, we now turn to a parametric analysis of the impact of PROGRESA on caloric acquisition.

We begin by specifying a linear regression of the form,

$$\ln PCCA(i,v) = \alpha \cdot \tilde{X}(i) + \beta \cdot T(i) + \gamma \cdot E(i) + \delta \cdot (E \cdot T) + \eta(i,v) \ , \qquad (1)$$

where *PCCA* denotes caloric availability in household *i* in village *v*, α, β, and γ are fixed parameters, $\tilde{X}$ is a vector of household characteristics, and η is an error term summarizing the influence random disturbances. The elements of the vector $\tilde{X}$ are specified to be as follows: household demographic characteristics (the logarithm of household size, proportions of children 0–2, 3–5; boys 6–7, 8–12, 13–18; girls 6–7, 8–12, 13–18; women 19–54; men 55 and older; women 55 and older); characteristics of the

head (education, age, occupation, ethnicity, marital status, gender). We also include dummy variables for each of the localities in the sample (see below). The variables contained in $\widetilde{X}$ allow us to condition out the impact of these confounding factors on the impact of PROGRESA. Note that we exclude log per capita expenditures from this specification but include it in results reported in Section 4. We are left with three variables and their associated parameter estimates, specifically,

T = 1 if household resides in a treatment community;
T = 0 if resides in a control community;
E = 1 if household is eligible for PROGRESA benefits;
E = 0 if not eligible or otherwise;
$T \cdot E$ = 1 if household resides in a treatment community ($T = 1$) and is eligible for PROGRESA benefits (i.e., $E = 1$);
$T \cdot E$ = 0 otherwise.

With this specification, for a household eligible for PROGRESA and residing in a treatment locality, the expected value of ln*PCCA* is given by

$$E(\ln PCCA \mid E = 1, T = 1) = \boldsymbol{\alpha}\, \widetilde{X} + \beta T + \gamma E + \delta (E \cdot T) . \qquad (2)$$

Similarly, for a household eligible for PROGRESA but located in a control locality, the expected value of ln*PCCA* is given by

$$E(\ln PCCA \mid E = 1, T = 0) = \alpha\, \widetilde{X} + \gamma E . \qquad (3)$$

The expected value of ln*PCCA* for a household not eligible for PROGRESA and residing in a treatment locality is

$$E(\ln PCCA \mid E = 0, T = 1) = \alpha\, \widetilde{X} + \beta T . \qquad (4)$$

Finally, the expected value of ln*PCCA* for a household not eligible for PROGRESA and residing in a control locality is

$$E(\ln PCCA \mid E = 0,\ T = 0) = \alpha \widetilde{X} \ . \tag{5}$$

The impact of PROGRESA on eligible households can be written as

$$E(\ln PCCA \mid E = 1,\ T = 1) - E(\ln PCCA \mid E = 1,\ T = 0) \ , \tag{6}$$

i.e., the difference in the conditional expectation of ln*PCCA* between PROGRESA-eligible households in treatment localities and PROGRESA-eligible households in control localities)

$$\begin{aligned} E(\ln PCCA \mid E = 1, T = 1) - E(\ln PCCA \mid E = 1,\ T = 0) &= \alpha \widetilde{X} + \beta T + \gamma E + \delta(E \cdot T) - [\alpha \widetilde{X} + \gamma E] \\ &= \beta T + \delta(E \cdot T) \ . \end{aligned} \tag{7}$$

We also need to consider the nature of the disturbance term. In order to capture the role of regional differences in characteristics, the error term for each household is decomposed as

$$\eta(i,v) = \mu(v) + \varepsilon(i,v) \ . \tag{8}$$

Variation arising from regional differences that are common for all households in the same community is denoted by $\mu(v)$, while variation arising from other random shocks is denoted by $\varepsilon(i,v)$. For our purposes, a region or community is specified at both the state and municipality level. In our sample, there are seven states and 191 different municipalities. Assuming that $\varepsilon(i,v)$ is independently and identically distributed across households and communities with mean 0, and variance σ_ε^2, the appropriate estimator is determined by the treatment of the state or municipality-specific

component $\mu(v)$. Hausman tests consistently reject the random effects estimator in favor of the state or municipality fixed effects estimator; hence, only the latter is reported here (Hausman 1978).

The Impact of PROGRESA on Caloric Availability

As previously discussed, administrative errors resulted in significant differences in the list of eligible households in treatment areas and the list of beneficiary households (i.e., eligible households that ended up receiving monetary benefits). To check the sensitivity of our econometric estimates regarding the impact of PROGRESA on consumption, we used two different definitions of the binary variable E for households in treatment localities. In the first specification (specification A) in the treatment localities where PROGRESA operates, $E = 1$ for the households that received non-zero monetary benefits between May and October 1999 and $E = 0$ for the households that did not receive any monetary benefits (note that some nonreceiving households may have been eligible but never received any benefits). In the second specification (specification B) in the treatment localities, $E = 1$ for all eligible/poor households irrespective of whether they received any monetary benefits and $E = 0$ for households classified as noneligible (nonpoor). In the control localities, for both specifications, the binary variable $E = 1$ for eligible (poor) households and $E = 0$ for noneligible households.

Table 3 reports the parameter estimates for β, γ, and δ for specification A using fixed effects specifications for five outcomes: the log of total calories available per capita and the logs of calories available from cereals, vegetables, animal products, and other foods.[5] The magnitude of these impacts is higher for the acquisition of fruits and vegetables, and to a lesser extent animal products, than for grains and miscellaneous food

[5] We have also estimated these equations including the median locality-level prices of tomatoes, onions, potatoes, oranges, leafy vegetables, tortillas, corn, rice, beans, chicken, milk, and eggs, but found that the parameter estimates and their standard errors were practically identical to those obtained excluding the locality level food prices. Therefore, we focus on the estimates obtained using municipality fixed effects (that allow for food and nonfood prices to differ across municipalities and excluding locality-level food prices (that allow food prices to differ by locality within municipalities).

Table 3 Dependent variable: Log of total calories available per person per day controlling for household characteristics and municipality fixed effects, excluding the log of per capita consumption as a regressor

Log calories	Survey round	Regressor	Coefficient	t-value	p-value
Total	November 1998	Treatment locality (T)	-0.029	-2.61	0.01
		Eligible/poor household (E)	-0.025	-2.39	0.02
		Beneficiary household (T · E)	0.043	3.51	0.00
	June 1999	Treatment locality (T)	0.016	1.39	0.17
		Eligible/poor household (E)	-0.016	-1.52	0.13
		Beneficiary household (T · E)	0.027	2.11	0.04
	November 1999	Treatment locality (T)	0.025	2.56	0.01
		Eligible/poor household (E)	-0.029	-3.22	0.00
		Beneficiary household (T · E)	0.046	4.29	0.00
From grains	November 1998	Treatment locality (T)	-0.024	-1.71	0.09
		Eligible/poor household (E)	-0.001	-0.06	0.95
		Beneficiary household (T · E)	0.035	2.25	0.02
	June 1999	Treatment locality (T)	0.027	1.73	0.08
		Eligible/poor household (E)	0.001	0.05	0.96
		Beneficiary household (T · E)	0.010	0.59	0.56
	November 1999	Treatment locality (T)	0.036	2.84	0.01
		Eligible/poor household (E)	-0.014	-1.25	0.21
		Beneficiary household (T · E)	0.036	2.60	0.01
From vegetables	November 1998	Treatment locality (T)	-0.073	-2.80	0.01
		Eligible/poor household (E)	-0.172	-7.12	0.00
		Beneficiary household (T · E)	0.161	5.63	0.00
	June 1999	Treatment locality (T)	0.004	0.16	0.88
		Eligible/poor household (E)	-0.132	-5.76	0.00
		Beneficiary household (T · E)	0.217	8.01	0.00
	November 1999	Treatment locality (T)	0.034	1.47	0.14
		Eligible/poor household (E)	-0.129	-6.04	0.00
		Beneficiary household (T · E)	0.170	6.67	0.00
From animal products	November 1998	Treatment locality (T)	-0.110	-3.9	0.00
		Eligible/poor household (E)	-0.172	-6.7	0.00
		Beneficiary household (T · E)	0.160	5.2	0.00
	June 1999	Treatment locality (T)	-0.071	-2.4	0.02
		Eligible/poor household (E)	-0.166	-6.0	0.00
		Beneficiary household (T · E)	0.215	6.6	0.00
	November 1999	Treatment locality (T)	0.043	1.7	0.09
		Eligible/poor household (E)	-0.112	-4.8	0.00
		Beneficiary household (T · E)	0.109	4.0	0.00
From other foods	November 1998	Treatment locality (T)	-0.031	-1.9	0.05
		Eligible/poor household (E)	-0.059	-4.0	0.00
		Beneficiary household (T · E)	0.038	2.2	0.03
	June 1999	Treatment locality (T)	-0.021	-1.2	0.22
		Eligible/poor household (E)	-0.047	-3.1	0.00
		Beneficiary household (T · E)	0.036	2.0	0.05
	November 1999	Treatment locality (T)	-0.021	-1.5	0.13
		Eligible/poor household (E)	-0.052	-4.2	0.00
		Beneficiary household (T · E)	0.050	3.4	0.00

Notes: Estimates are based on data from the November 1998, June 1999, and November 1999 ENCEL surveys. Sample excludes 221 households reporting that no food was consumed within the home, and 7,165 households with caloric availability per person per day less than 875 kcal or greater than 4,768 kcal.

items. Comparing *nonpoor* households, we also find that those nonpoor households residing in localities where PROGRESA is providing benefits also appear to exhibit increased levels of caloric acquisition.

The impact on poor households is obtained by calculating the value of $[\beta T + \delta(E \cdot T)]$. This is reported in Table 4 along with its t-statistic for the two different representations of E. The conditional impact of PROGRESA on poor households, reported in Table 4, are generally smaller than the unconditional impacts reported in Table 2. Further, there is little evidence of much of a statistically significant impact on caloric availability as of November 1998. Given that PROGRESA had begun only limited operations at the time of this survey, such a result is not surprising. By contrast, the estimates for June and November 1999 are increasing in magnitude and significant at the 95 percent confidence level. For example, specification A indicates that in June 1999, households receiving PROGRESA benefits in treatment localities obtained 4.3 percent more calories than did comparable households in control localities. In November 1999, under the same specification, this effect is even higher. Households receiving PROGRESA benefits in treatment localities obtained 7.1 percent more calories than did comparable households in control localities. The impact is greatest on the acquisition of calories from vegetable and animal products—a finding consistent with the view of respondents that PROGRESA was enabling them to "eat better."

Under specification A, which focuses on the impact of PROGRESA on beneficiary households (i.e., households that received some monetary benefits), the estimated effect of PROGRESA is larger than that using specification B. However, when we include beneficiary households that did not in fact receive any transfers, we continue to obtain significant, albeit lower, effects.

The Impact of PROGRESA on Caloric Availability With Controls for Household Expenditures

By excluding the logarithm of household consumption ($\ln PCE$) as an explanatory variable, the estimates reported above represent the total impact of all PROGRESA

Table 4 Impact of PROGESA on log caloric acquisition controlling for household characteristics and municipality fixed effects, excluding the log of per capita consumption as a regressor

	November 1998				June 1999				November 1999			
	(A)		(B)		(A)		(B)		(A)		(B)	
	Impact	t-value	Impact	t-value	Impact	t-value	Impact	t-value	Impact	t-value	Impact	t-value
Log total calories	0.014	1.71	0.009	1.18	0.043	5.23	0.035	4.34	0.071	10.18	0.063	9.52
Log calories from grains	0.011	1.05	0.004	0.43	0.037	3.37	0.030	2.79	0.071	7.97	0.065	7.50
Log calories from vegetables	0.088	4.65	0.063	3.47	0.221	12.57	0.188	10.87	0.204	12.28	0.176	10.98
Log calories from animal products	0.050	2.46	0.020	1.02	0.144	6.86	0.115	5.61	0.152	8.48	0.144	8.33
Log calories from other foods	0.007	0.64	0.016	1.44	0.016	1.34	0.010	0.83	0.030	3.09	0.024	2.56

Notes: Estimates are based on data from the November 1998, June 1999, and November 1999 ENCEL surveys. Sample excludes 221 households reporting that no food was consumed within the home, and 7,165 households with caloric availability per person per day less than 875 kcal or greater than 4,768 kcal. Columns (A) contain impact estimates based on eligible households that received monetary benefits. Columns (B) contain impact estimates based on all eligible households without any reference as to whether the household received any benefits (see text for details).

components on caloric availability. However, it is of interest to separate out the impact of cash transfers from other program interventions. As noted in the introduction, one of the stated objectives of PROGRESA is to promote community participation and support for the actions of PROGRESA, so that educational and health services benefit all families in the localities where the program operates. Thus, as part of the program, in the localities where PROGRESA operates, there are a series of regular lectures *(platicas)* where information and training on health and nutrition are given by a doctor and/or nurse from the health clinic serving the community.

Table 5 reports regression coefficient estimates with ln*PCE* as an additional explanatory variable using specification A. It is important to note that the interpretation of impact has to be revised appropriately when *PCE* is included as an additional explanatory variable in the regression. In this case, $[\beta T + \delta(E \cdot T)]$ is the change in the conditional mean of ln*PCCA* after accounting for the potential increases in ln*PCCA* brought about by the cash transfers received from participating in PROGRESA. Assuming there are no potential biases from correlated measurement errors between *PCE* and *PCCA*, then $[\beta T + \delta(E \cdot T)]$ provides an estimate of the impact of participation in the health and nutrition-related lectures on *PCCA*.

Based on the coefficient estimates in Table 5, Table 6 contains estimates of PROGRESA's impact. There are four important findings. First, although participation in PROGRESA raises the amount of calories acquired from grains and "other foods," this would appear to be due to PROGRESA's income effect. Once we control for log per capita expenditures, there is no additional effect of PROGRESA on the acquisition of calories from these sources.

Second, participation in PROGRESA does have an impact on the acquisition of calories from fruits, vegetables, and animal products after controlling for its income effect. Consistent with our description of the operations of PROGRESA, this is only observed in the two 1999 survey rounds. It is also consistent with the fact that during the *platicas*, beneficiaries are encouraged to eat a more diverse diet, including more fruits,

Table 5 Dependent variable: Log of total calories available per person per day controlling for household characteristics and municipality fixed effects, including the log of per capita consumption as a regressor

Log calories	Survey round	Regressor	Coefficient	t-value	p-value
Total	November 1998	Treatment locality (T)	0.001	0.07	0.94
		Eligible/poor household (E)	0.018	1.85	0.07
		Beneficiary household (T · E)	0.012	1.09	0.28
		Log consumption p.c.	0.296	60.10	0.00
	June 1999	Treatment locality (T)	0.025	2.35	0.02
		Eligible/poor household (E)	0.020	2.00	0.05
		Beneficiary household (T · E)	-0.002	-0.15	0.88
		Log consumption p.c.	0.285	58.92	0.00
	November 1999	Treatment locality (T)	0.030	3.49	0.00
		Eligible/poor household (E)	0.014	1.81	0.07
		Beneficiary household (T · E)	0.013	1.34	0.18
		Log consumption p.c.	0.349	73.76	0.00
From grains	November 1998	Treatment locality (T)	0.002	0.12	0.91
		Eligible/poor household (E)	0.036	2.80	0.01
		Beneficiary household (T · E)	0.009	0.57	0.57
		Log consumption p.c.	0.259	39.00	0.00
	June 1999	Treatment locality (T)	0.035	2.33	0.02
		Eligible/poor household (E)	0.033	2.40	0.02
		Beneficiary household (T · E)	-0.016	-0.96	0.34
		Log consumption p.c.	0.254	38.05	0.00
	November 1999	Treatment locality (T)	0.040	3.36	0.00
		Eligible/poor household (E)	0.023	2.10	0.04
		Beneficiary household (T · E)	0.007	0.54	0.59
		Log consumption p.c.	0.300	46.27	0.00
From vegetables	November 1998	Treatment locality (T)	0.000	-0.01	0.99
		Eligible/poor household (E)	-0.071	-3.18	0.00
		Beneficiary household (T · E)	0.088	3.33	0.00
		Log consumption p.c.	0.700	59.94	0.00
	June 1999	Treatment locality (T)	0.025	1.07	0.29
		Eligible/poor household (E)	-0.059	-2.75	0.01
		Beneficiary household (T · E)	0.157	6.25	0.00
		Log consumption p.c.	0.574	54.90	0.00
	November 1999	Treatment locality (T)	0.045	2.14	0.03
		Eligible/poor household (E)	-0.033	-1.70	0.09
		Beneficiary household (T · E)	0.096	4.20	0.00
		Log consumption p.c.	0.796	69.14	0.00
From animal products	November 1998	Treatment locality (T)	0.011	1.22	0.22
		Eligible/poor household (E)	-0.074	-3.08	0.00
		Beneficiary household (T · E)	0.088	3.13	0.00
		Log consumption p.c.	0.731	57.26	0.00
	June 1999	Treatment locality (T)	-0.053	-1.92	0.06
		Eligible/poor household (E)	-0.081	-3.17	0.00
		Beneficiary household (T · E)	0.153	5.04	0.00
		Log consumption p.c.	0.657	51.05	0.00
	November 1999	Treatment locality (T)	0.050	2.23	0.03
		Eligible/poor household (E)	-0.006	-0.31	0.76
		Beneficiary household (T · E)	0.032	1.30	0.20
		Log consumption p.c.	0.876	69.16	0.00
From other foods	November 1998	Treatment locality (T)	-0.008	-0.51	0.61
		Eligible/poor household (E)	-0.027	-1.89	0.06
		Beneficiary household (T · E)	0.015	0.89	0.38
		Log consumption p.c.	0.223	29.75	0.00
	June 1999	Treatment locality (T)	-0.013	-0.82	0.41
		Eligible/poor household (E)	-0.016	-1.08	0.28
		Beneficiary household (T · E)	0.012	0.70	0.49
		Log consumption p.c.	0.246	33.65	0.00
	November 1999	Treatment locality (T)	-0.017	-1.31	0.19
		Eligible/poor household (E)	-0.020	-1.66	0.10
		Beneficiary household (T · E)	0.025	1.79	0.07
		Log consumption p.c.	0.263	37.11	0.00

Table 6 Impact of PROGESA on log caloric acquisition controlling for household characteristics and municipality fixed effects, including the log of per capita consumption as a regressor

	November 1998				June 1999				November 1999			
	(A)		(B)		(A)		(B)		(A)		(B)	
	Impact	t-value	Impact	t-value	Impact	t-value	Impact	t-value	Impact	t-value	Impact	t-value
Log total calories	0.013	1.76	0.009	1.32	0.024	3.11	0.015	1.98	0.043	6.95	0.038	6.36
Log calories from grains	0.010	1.03	0.004	0.48	0.019	1.83	0.012	1.14	0.047	5.55	0.042	5.15
Log calories from vegetables	0.087	5.04	0.066	3.92	0.182	11.16	0.148	9.17	0.141	9.44	0.118	8.17
Log calories from animal products	0.051	2.71	0.024	1.36	0.099	5.05	0.067	3.50	0.082	5.11	0.078	5.02
Log calories from other foods	0.007	0.63	0.016	1.54	-0.001	-0.09	-0.008	-0.70	0.008	0.91	0.004	0.43

Notes: Estimates are based on data from the November 1998, June 1999, and November 1999 ENCEL surveys. Sample excludes 221 households reporting that no food was consumed within the home, and 7,165 households with caloric availability per person per day less than 875 kcal or greater than 4,768 kcal. Columns (A) contain impact estimates based on eligible households that received monetary benefits. Columns (B) contain impact estimates based on all eligible households without any reference as to whether the household received any benefits (see text for details).

vegetables, and milk and other animal products. Note that this impact is observed after controlling for other confounding factors, including price changes, household characteristics, and fixed, municipality-level characteristics. However, the numerical estimate of the *platica* effect appears high. Consider the case of calories from vegetables observed in the November 1999 survey. Excluding the log per capita consumption, the estimated effect of program participation is 20.4 percent (see Table 4). Including the log of consumption per capita effect—which should account for PROGRESA's income effect—yields an estimated effect of 14.1 percent (Table 6). This suggests that 69 percent (i.e., 14.1/20.4) of the increase in calories from vegetables is due to the *platica* effect, while the remaining effect is due to the increased income. However, the estimated elasticity of vegetable calories with respect to income changes (0.789 in Table 5), combined with the size of the benefits received by participating in PROGRESA, suggests that the estimated *platica* effect is too high.

Third, inferences regarding PROGRESA's impact appear to be insensitive to the specification used for the binary variable *E*. As in Table 4, the estimated impact of PROGRESA is higher when focusing on beneficiary households (specification A) in comparison to the estimated impact on eligible households (specification B).

Fourth, in Table 5, the coefficient on being in a treatment locality, but in a nonbeneficiary household, is positive and significant for the acquisition of calories from fruits and vegetables in the June and November 1999 survey rounds, as well as for animal products in November 1999. (Although the coefficient is negative in June 1999, it is poorly measured.) As these regressions control for price differences at the municipality level, household characteristics and fixed, municipality-level characteristics, this suggests that the information provided at these *platicas* may be spilling over to nonbeneficiaries.

Finally, we examined the impact on households with preschool children. A further component of PROGRESA benefits is the *papilla* nutritional supplement that is distributed to households with pregnant and lactating women, children between the ages of four months and two years, and children between the ages of two and five years if any signs of malnutrition are detected. (These supplements also are given to non-

PROGRESA households under similar circumstances; if this occurs in control communities in the evaluation sample, it biases downward the estimated impact of PROGRESA, because both treatment and control children receive this part of the treatment.) Mothers visit the clinic at least once a month (more if they are pregnant or have small children) to pick up six packets of supplements per child per month with each packet containing five doses, enough for one dose per day. The supplements constitute 20 percent of caloric requirements and 100 percent of all necessary micronutrients.

A possible concern is that the provision of the *papilla* may cause households to divert expenditures on food to other items, thus undercutting efforts to increase caloric availability in these households. If the *papilla* is truly "crowding out" household acquisition of calories, we would expect to see lower measures of impact for households with preschool children. The results presented in Table 7 (panel A) suggest that such concerns are unfounded; the impact of participation in PROGRESA on caloric acquisition is, if anything, slightly higher for these households.

Panel B in Table 7 reports the *platica* effect on households with preschoolers. Again, there is evidence that these *platicas* are having an impact on caloric acquisition from vegetables, fruits, and animal products, even after controlling for PROGRESA's impact via higher household incomes. This finding is particularly significant, given evidence that in Mexico, poor quality diets inhibit the physical growth of children under 30 months (Allen et al. 1991).

4. Conclusion

In this paper, we have examined the impact of PROGRESA on household food consumption. Our empirical strategy was motivated by the need to be conscious of the survey design with which we worked, the actual manner in which PROGRESA operated in the field, and the need to be conscious of carefully specifying the functional form relationship between caloric acquisition and incomes. Controlling for differences in household and municipality characteristics, as well as differences in prices among

Table 7 Impact of PROGRESA on log caloric acquisition of households with preschool (age 0-5) children, controlling for household characteristics and municipality fixed effects

	November 1998			June 1999			November 1999		
	Impact	t-value	p-value	Impact	t-value	p-value	Impact	t-value	p-value
A. Excluding the log of per capita consumption as a regressor									
Log total calories	0.027	2.53	0.01	0.044	3.93	0.00	0.082	8.60	0.00
Log calories from grains	0.018	1.36	0.18	0.033	2.29	0.02	0.075	6.17	0.00
Log calories from vegetables	0.120	4.77	0.00	0.256	10.71	0.00	0.244	10.88	0.00
Log calories from animal products	0.072	2.67	0.01	0.157	5.40	0.00	0.184	7.58	0.00
Log calories from other foods	0.028	1.89	0.06	0.039	2.56	0.01	0.044	3.45	0.00
B. Including the log of per capita consumption as a regressor									
Log total calories	0.019	1.90	0.06	0.020	1.91	0.06	0.040	4.73	0.00
Log calories from grains	0.011	0.85	0.40	0.011	0.80	0.43	0.038	3.27	0.00
Log calories from vegetables	0.102	4.39	0.00	0.210	9.44	0.00	-0.155	7.65	0.00
Log calories from animal products	0.058	2.29	0.02	0.105	3.86	0.00	0.085	3.92	0.00
Log calories from other foods	0.023	1.55	0.12	0.018	1.18	0.24	0.014	1.13	0.26

Notes: Estimates are based on data from the November 1998, June 1999, and November 1999 ENCEL surveys. Sample excludes 221 households reporting that no food was consumed within the home, and 7,165 households with caloric availability per person per day less than 875 kcal or greater than 4,768 kcal.

municipalities, we find that there is no evidence of a statistically significant impact on caloric availability as of November 1998. Given that PROGRESA had begun only limited operations at the time of this survey, such a result is not surprising. However, there is evidence of a significant impact in June and November 1999. For example, in November 1999, households receiving PROGRESA benefits in treatment localities obtained 7.1 percent more calories than did comparable households in control localities. The impact is greatest on the acquisition of calories from vegetable and animal products.

Although participation in PROGRESA raises the amount of calories acquired from grains and "other foods," this would appear to be due to PROGRESA's income effect. The estimates in Table 6 suggest that participation in PROGRESA does have an impact on the acquisition of calories from fruits, vegetables, and animal products, even after controlling for its income effect. Consistent with our description of the operations of PROGRESA, this is only observed in the two 1999 survey rounds. It is also consistent with the fact that during a regular series of lectures, called *platicas,* beneficiaries are encouraged to eat a more diverse diet, including more fruits, vegetables, milk, and other animal products. There is some evidence that information conveyed during these *platicas* spills over and positively affects the behavior of nonbeneficiaries in treatment localities. Further, it is observed in households with preschool children. This latter finding is particularly significant, given that in Mexico, poor quality diets inhibit the physical growth of children under 30 months. More generally, these results suggest that efforts to reduce poverty in the developing world will also reduce hunger.

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