"More calories or more diversity? An econometric evaluation of the impact of the PROGRESA and PROCAMPO transfer programs on food security in rural Mexico"

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Abstract

This paper examines the PROGRESA and PROCAMPO cash transfer programs in Mexico and evaluates their impact on household food security and nutrition. These two programs differ in their gender targeting, with PROGRESA aimed at women and PROCAMPO generally at men, and program conditionality, with PROGRESA linked to development of human capital of children in the households and PROCAMPO linked to agricultural production. We try to answer the following questions. First, can a cash transfer program geared to agricultural production have the same impact on food security as a cash transfer program geared to consumption through purchases? Second, do eligibility requirements (gender of the recipient) and conditionality in the provision of cash transfers matter? Our results suggest that, contrary to conventional wisdom, men do not just drink away cash transfers and that monetary payments linked to a productive asset –land- can have as large or larger impact on food security as cash transfers not linked to a productive asset. We show that both programs boost total food consumption and caloric intake in similar proportions. However, PROCAMPO has a larger impact on meat and vegetables consumption and PROGRESA on the other food category. Furthermore, increased food security is achieved through different channels: PROGRESA through purchases while PROCAMPO through investment in home production. We also find that cash transfers linked to information on nutrition and health increase food diversity. PROCAMPO households that also receive PROGRESA, and the information that goes with it, are more likely to be eating a more varied diet than households that get PROCAMPO only. All this suggests that the choice of program design in terms of food security depends on objectives beyond total food consumption and caloric intake, such as consumption from specific food categories, food diversity, investment in agricultural production, and the degree of access to retail food markets.

1. INTRODUCTION

The objective of this paper is to analyze the impact on food security of two conditional cash transfer programs, PROGRESA and PROCAMPO, implemented in rural Mexico. Monetary transfer programs are still rare in developing countries, but in Latin America they are increasingly replacing traditional policy instruments for alleviating poverty, food insecurity, and for promoting rural development. In-kind social programs such as school meals and feeding programs for pregnant-lactating women, and other food assistance interventions such as food stamps, input subsidies, livestock protection, price supports, and exchange rate controls have been widely used in developing countries to provide increased resources for low-income households. However, some studies of food subsidization find these to be inefficient in helping the poor improve their nutritional status, and argue that most of the subsidization policies end up benefiting the richest households[1]. Some other studies favor targeted food programs instead of general food subsidies in order to promote effective redistribution of income to the poor[2]. In addition, growing evidence, as well as economic efficiency arguments, suggests that, a simple income transfer system can provide similar opportunities for the poor to attain nutritionally adequate diets and self-sufficiency, with less administrative complexity and less distortions in the economy[3].

PROGRESA and PROCAMPO are interesting examples of social protection interventions. First, they are cash transfer programs, which are still unusual in developing countries around the world. These transfers often represent a large fraction of average household total income. Thus, they provide an exceptional opportunity to examine the impact of giving people relatively large sums of money. Second, they are conditional cash transfers, representing a shift in how rural policy is carried out in Latin America. Conditional cash transfers are targeted interventions that stress beneficiary 'co-responsibility' and require specific behavior by the recipients. The two cash transfer programs we examine differ in their gender targeting, with PROGRESA aimed at women and PROCAMPO at producers who are usually men, and program conditionality, with PROGRESA linked to development of human capital of children in the households and PROCAMPO linked to agricultural production. Third, they represent two distinct forms of cash transfers that have been implemented in rural areas of a single country: Mexico.

The main questions this paper tries to answer are the following. First, does the conditionality in the provision of cash transfers and the gender of the recipient matter in terms of food security outcomes? Second, can a cash transfer program geared towards production (PROCAMPO) have the same impact on food security as an anti-poverty cash transfer program geared towards consumption and the build up of human capital (PROGRESA)? Third, what is the mechanism through which increased food security is achieved? Fourth, do these programs contribute to increase nutritional diversity?

[1] See, for example Williamson-Gray (1982), Alderman and von Braun (1984), Trairatvorakul (1984),
[2] Pinstrup-Andersen (1985), Mateus (1983)
[3] Case and Deaton (1998), Duflo (1999), Shan and Gerstle (2001), Dreze and Sen (1989), Coate (1989), Ardington and Lund (1994).

Based on the detailed analysis of the PROGRESA household survey data, our results show that both programs boost total food consumption, and caloric intake in similar proportions. Significant differences between the programs arise for broad food categories such as meat and vegetables. Increased food security is achieved, however, through different channels: PROGRESA through purchases while PROCAMPO through investment in home production. Furthermore, both programs increase food diversity but PROCAMPO recipients that also receive PROGRESA, and the information on nutrition and health that goes with it, are more likely to be eating a more varied diet than beneficiaries that receive PROCAMPO only. This implies that access to information has a positive effect on food diversity, and that education and training given to women is able to affect the way resources given to men in the same household are spent. All this suggests the relevance of conditionality and gender of the recipient in the design and implementation of programs.

This paper examines only one aspect of poverty: food insecurity, but is part of a larger effort to compare the PROGRESA and PROCAMPO interventions. In a companion paper (Davis et al, 2002) we examine how the design of these two rural cash transfer programs can influence other dimensions of household welfare as well as schooling, health, and productive investment. We find that while both interventions increase overall household welfare in similar proportions differences emerge on expenditures on non-food items; PROGRESA households spend more on schooling and child clothing and PROCAMPO recipients on adult clothing and health. PROGRESA also leads to higher school enrolment rates and health care usage than PROCAMPO. As expected, PROCAMPO leads to a significant increase in expenditure in agriculture; more surprising, however, is that PROGRESA also leads to a significant increase in investment, though in non-agricultural activities. Other papers, currently in progress, focus more specifically first on the impact of gender targeting within programs, and second, on the relevance of conditionality versus a counterfactual of non-conditionality.

The rest of the paper is outlined as follows. In Section 2 of the paper we provide a presentation of the literature on cash transfers and economic theory. In Section 3 more detail is provided on the two cash transfer programs under analysis. Section 4 presents our hypotheses about the differential program effects. In Section 5, we present the empirical approach, and the data are described in Section 6. The empirical results follow in Section 7, and we conclude in Section 8.

2. BACKGROUND

Standard micro-economic theory predicts that the marginal propensities to consume out of two different forms of cash will be identical for an *unconstrained individual*. That is, a peso should be a peso independently of the source of income and to whom the income accrues. This neo-classical model result rests on two assumptions. One, that all family income is pooled and subsequently allocated to maximize a single objective function (Becker's common preference model, 1964, 1981). Two, that the individual or household

is unconstrained in his/her choice[4]. As a consequence of these assumptions, the household's optimization problem does not distinguish from where or to whom different sources of income accrue.

This neoclassical view has been challenged by recent literature (see, for example, Alderman et al., 1995, Lundberg and Pollak, 1993, Bourguignon and Chiapori, 1992). One example of this literature is the collective model of household decision-making. This is based on the idea that there is heterogeneity of preferences of household members and/or bargaining among household members. Thus, household allocation of resources differs according to whom income accrues. Once the household is modeled in a non-unitary fashion by explicitly formulating household decisions as the outcome of the interaction between individual members with possibly different preferences and endowments, the result concerning the equality of marginal propensities to consume for different sources of income goes away.

Along these lines, there is evidence that women spend income differently from men. In particular, women are more likely to spend own-earned income on nutrition and children's health and education while men are more likely to allocate income under their control to tobacco and alcohol. See, for example, Hoddinot and Haddad (1995), Thomas (1997), and Duflo (2000).

The result that "one peso is one peso, regardless of the form of income" does not necessarily hold if individuals face different constraints or requirements on how they should spend the different sources of income. Conditional cash transfer programs provide cash payments if certain conditions are met – classic examples are school attendance or health care check-ups. Conditional cash transfers exert both a substitution and an income effect, while unconditional cash transfers only exert an income effect upon the household, since the household can allocate its resources (time and money) to any activity. Therefore, conditionality of the cash transfer programs, or program requirements and objectives, are likely to affect the way income is allocated across expenditure categories affecting both the level of expenditure and the expenditure share across categories.

For instance, Shan and Gerstle (2001) find differences in the allocation of child allowance and other sources of income in Romania. Another example that supports the idea that the form of income matters is the cash-out puzzle, i.e. the larger marginal propensity to consume food out of food coupons relative to cash income, noted in the studies of the Food Stamp Program in the US: Fraker (1990), Devaney and Moffit (1991), Breuning and Dasgupta (1999) among others[5].

[4] Alternatively, identical constraints for all sources of income.

[5] Not all the literature agrees on this result. Devaney and Franker (1986) find no significant difference between food stamps and other income in Puerto Rico. Edirisinghe (1987) reports that for the Sri Lanka food stamp program, there were treated like any other earned income. Butler et. al (1985) and Franker et al (1986) also suggest that food stamps are no more effective than a simple cash transfer in increasing nutrient consumption by low-income households

PROCAMPO and PROGRESA recipients are constrained in different ways. PROCAMPO requires farmers to continue to produce on the land registered in the program. PROGRESA payments are made contingent upon families visiting health clinics, attending public health lectures, and sending their children to school. Do the different conditions for the receipt of transfers lead to different outcomes in terms of food security? Can we expect that the income and substitution effect exerted by these two different conditional cash transfer programs to be different?

Another explanation given in the literature to reject the neo-classical model is the timing and frequency of different sources of income. Differences in the periodicity of income or perception about the permanent or temporary nature of the income may contribute to different patterns of expenditures[6]. PROCAMPO by law will give regular payments to eligible farmer for a period of fifteen years, while PROGRESA was initially conceived to provide payments to poor households for at least three consecutive years only. Differences in this periodicity might bring about differences in income allocation. Finally, outcomes might differ depending on whether the marginal choices of individuals are informed or uninformed regarding, for instance, the calorie implications. Therefore, the provision of nutrition information by the PROGRESA program can affect the marginal choices of individuals who get this transfer so that a peso of PROGRESA has a higher return in terms of nutrient intake than a peso of PROCAMPO.

All these factors: heterogeneity of preferences and intra-household bargaining power, different program conditionality, and differences in the timing and the provision of information might lead to differences between PROCAMPO and PROGRESA income. However, to the extent that we find differences, we will not be able to distinguish between the possible contributing factors.

3. CASH TRANSFERS IN MEXICO: PROCAMPO AND PROGRESA

PROCAMPO

PROCAMPO was implemented in Mexico in the winter 1994 agricultural season following the commencement of NAFTA. The program was designed as a 15-year transition to free trade and is expected to terminate in 2008. Eligibility, and therefore the maximum level of PROCAMPO transfer payments, vary across households and are based on household behavior during the pre-PROCAMPO period. PROCAMPO provides eligible agricultural producers with a fixed payment per hectare. This payment is decoupled from current land use and is the same across the whole country. The level of eligibility is dependent on the total hectares of nine key crops (corn, beans, rice, wheat, sorghum, barley, soybeans, cotton and cardamom) that were planted in the three agricultural years prior to and including August 1993. Eligibility was actually given to land parcels and those with usufruct over these land parcels, not particular farmers, and payment should go to whomever is planting the property, whether owner, renter or

[6] See for example, the discussion in Smallwood and Blayock (1985) and Senauer and Young (1986) who talk about the issue of timing of the receipt of food stamps. Also, Paxon (1992) shows that in Thailand, the propensity to save out of transitory income is higher than the propensity to save out of permanent income.

sharecropper. The eligibility roster was fixed prior to commencement of the program; no new properties have been added since 1994.

Theoretically, the farmer receiving payment for a particular property may change depending on who is using the land, though in practice most benefits accrue to the owner, either directly or through the rental price. Since there are potentially two agricultural seasons per year, PROCAMPO payments may be received up to twice a year, though in general only farmers with access to irrigation can take advantage of the second agricultural season. Payments correspond to the amount of land currently under production, which cannot exceed the amount of land registered in the eligibility roster.[7]

Farmers must prove that the parcel is currently under production, but monitoring of actual planting is haphazard, and many devices are employed to skirt this requirement. However, given that the program is based on past agricultural production and the requirement that farmers continue producing or participate in an official environmental management program, the intervention is closely and intentionally linked to agricultural production.

Every season after planting, farmers must go to one of the 700 CADER (Center for the Assistance of Rural Development) offices around the country with proof of planting to solicit their payment. Payments are in the form of checks distributed at the CADER offices and, in 1997, averaged US$329 per recipient and US$68 per hectare (Sadoulet et al, 2001). An additional benefit to farmers of participating in the program is that PROCAMPO qualification certificates can be used as collateral for borrowing from commercial banks and input retailers, although often at very high interest rates. PROCAMPO covers 95 percent of the cultivated area in Mexico that had been planted in corn, beans, sorghum and wheat. It covers on average 14 million hectares of land each year, reaching almost three million producers and providing payments in 1998 of US$919 million (SAGAR, 1998). PROCAMPO is particularly important in the ejido (land reform) sector where 84 percent of ejiditarios participated in PROCAMPO and received payments for, on average, 5.2 hectares (Cord and Wodon, 1999). Since PROCAMPO is distributed on a per hectare basis, larger farms have tended to get higher total transfers. SAGAR (1998) notes that households with less than 5 hectares make up 45 percent of recipients but receive only 10 percent of total transfer payments. However, PROCAMPO provides a uniform payment per hectare regardless of yield or if the output was sold on the market. PROCAMPO thus over compensates smallholders who may have had limited yields and reaches households who did not benefit from pre-NAFTA price supports because they had no marketed surplus (Martinez, 1999).

Current changes to the program include moving payments to prior to planting so that farmers are able to directly use the transfer for the purchase of inputs and thus avoid paying high interest rates. This enhances the value of PROCAMPO as a mechanism to overcome credit market failure and increases the likelihood the transfer will be used for agricultural investment. A plan currently under consideration would allow farmers with

[7] Fallow land does not merit payment.

an investment plan to move forward in time all future PROCAMPO payments into one large payment (PROCAMPO, 2001).

PROGRESA

PROGRESA was initiated in Mexico in 1997 as a mechanism for addressing extreme poverty in rural areas. Although a cash transfer program, a primary thrust of PROGRESA is to develop the human capital of poor households by improving education, health and nutrition outcomes. Households are required to visit health care clinics and send their children to school to receive payments. To help achieve these objectives, transfers are provided directly to mothers under the assumption they are more likely to use funds in a manner that will be beneficial to the development of their children. The gender targeting of the program is one of many mechanisms geared towards improving health and education outcomes.

Because PROGRESA targets poor households, criteria were developed for determining eligibility based on household well being. This selection of eligible households was done in three stages (see Skoufias, et al, 1999). First, potential recipient communities were identified as poor communities based on an index of marginality developed from the national population census. This marginality index was constructed using community data including the share of illiterate adults, access to water, drainage and electricity, number of occupants per room, dwellings with a dirt floor and population working in the primary sector. More marginal communities were considered potential target locations and were further evaluated based on location and existence of health and school facilities. After communities were identified, the second step was to select households for participation in PROGRESA based on data collected from a household census within the community. Scores were produced for each household using a statistical procedure, discriminate analysis, and households above a certain line were included as beneficiaries. After households were initially identified as potential participants, the third and last step was to present a list of these households to the community assemblies for review and discussion, though in practice these lists were rarely modified.

By the end of 1999, PROGRESA provided bimonthly transfers to approximately 2.6 million households or about 40 percent of all rural families and 11 percent of all Mexican families. The program operated in almost 50,000 communities, and had a budget of US$777 million or nearly 20 percent of the Mexican governments budget allocation for poverty alleviation (Skoufias and McClafferty, 2001). Average payments to beneficiary households in 1997 were substantial, representing 29 percent of average per capita income of beneficiaries (Teruel and Davis, 2000). Because PROGRESA links payment of transfers to school attendance and visits to health care facilities, it was expected and has been shown that the program had a significant impact on education attendance and health outcomes (Skoufias and McClafferty, 2001).

Households receiving PROGRESA are not permitted to receive other forms of anti-poverty or education subsidies, but this does not apply to PROCAMPO benefits. Thus PROGRESA and PROCAMPO transfers are provided to eligible rural households at the same time. A significant number of households are eligible to receive transfers from both sources.

4. OUR HYPOTHESES CONCERNING DIFFERENTIAL PROGRAM EFFECTS

In this section, we present some hypotheses about why we expect PROCAMPO and PROGRESA cash transfers to lead to different food security outcomes.
There are at least four explanations for rejecting the neo-classical model result that a peso is a peso regardless of the form of income.

A. GENDER

One of the most important differences between PROCAMPO and PROGRESA is that the former provides transferences to producers, who are 90 percent men, while PROGRESA is directly targeted to women.[8] There is evidence in the development literature that females spend income differently than men. In particular, women are more likely to spend own-earned income on nutrition, and children's health and education while men are more likely to divert income towards wasteful consumption, such as tobacco, and alcohol.

For instance, Duflo (2000) finds that pensions received by women in South Africa had a large impact on the anthropometrical status of girls. In contrast, no effect on the nutrition status of household children is found for pensions received by men. Thomas (1997) for Brazil shows that more income under the control of women leads to greater health- and nutrition-related expenditures. On the other hand, Hoddinot and Haddad (1995) indicate that in Cote d'Ivore expenditure on alcohol and tobacco are positively related to the share of income that goes to men. In addition, these gender differences in the allocation of income seem to be especially relevant among poor households (Kennedy and Peters, 1992), which is the case in our sample. Similar conclusions are drawn when the allocation of resources by female-headed households, as opposed to male-headed, is examined (Handa, 1994 and Kennedy and Peters, 1992).

Since the allocation of transfer income depends on the gender of the transfer recipient, we expect PROGRESA and PROCAMPO transfer payments to have a different impact on food security. The initial hypothesis is that PROGRESA will lead to a larger increase in food expenditure and caloric intake because it is directed to women.

B. INVESTMENT

Another key difference between PROGRESA and PROCAMPO is that the latter is linked to the use of a productive asset, agricultural land, while PROGRESA is not. PROCAMPO is conditioned on continued production, though the level is decoupled from current production choices. Hence, PROCAMPO is expected to have a positive effect on investment in agriculture. In addition, by linking transfers to productive assets, multiplier

[8] Males may be PROGRESA beneficiaries when no adult female is available. This occurs in approximately 1.5 percent of the households in this sample.

effects out of productive investment are expected. This is likely to be important if the household is credit constrained, as it is generally the case in poor, rural Mexico. Other studies of PROCAMPO have indeed found these multiplier effects (Sadoulet, de Janvry, and Davis, 2001). Another difference is that PROCAMPO payments can be used as a collateral against which to borrow money. Access to credit provides a channel to promote income-generating activities, which in turn is a way of providing stable household food intake.

On the other hand, PROGRESA is expected to have less of an impact on capital accumulation and investment (putting aside the very long term accumulation of human capital), since it is given to household members that do not typically own productive assets, in particular women, and because of the consumption-based or anti-poverty nature of the program. In a companion paper (Davis et al., 2002) we show that, as expected, PROCAMPO leads to a significant increase in investment in agriculture; more surprising, however, is that PROGRESA also leads to a significant increase in investment, though in non-agricultural activities.

If beneficiaries invest transfers and spend profits, the programs might not have a large current impact on consumption, but only after a few years. Note, however, that at the period of analysis, 1998, PROCAMPO had already been running for several years and it is likely that we are picking up the effect of past investments on current food security outcomes. Therefore, PROCAMPO may lead to similar results in the long-term as PROGRESA in the short-run, possibly because of a multiplying effect. PROGRESA also has a long-run dimension, which comes from the build up of human capital. The long run in this case is generational, and an evaluation of the long-run impact of PROGRESA is beyond the scope of this paper.

C. QUANTITY VERSUS QUALITY

There exists a debate in the development literature that turns around the extent to which nutrition responds to income. It was long claimed that economic growth and rising per capita income will bring along better nutrition and will eventually eliminate malnutrition among the poorest. Subramanian and Deaton (1996) find calorie elasticities around 0.3-0.5, which partially supports this view. Strauss (1984) finds an estimate as high as 0.9 for rural Sierra Leone, which would imply a great effectiveness of cash transfer policies on reducing malnourishment.

Some authors have questioned the claim and findings above. Wolfe and Berhman (1983), Behrman and Deolaikar (1987), Bouis and Haddad (1992), Bouis (1994) find that the calorie elasticity with respect to income is close to zero, even in populations with considerable malnutrition, so that increases in income would not result in substantial improvements in nutritional intakes. Also, Butler, Ohls and Posner (1985) using data from the Food Stamp Cashout Project find no significant increase in nutrient intake as income increases.

Behrman and Deolalikar (1987, 1989) present estimates for a poor Indian population that indicate that, although income elasticities of food expenditure are large, income elasticities of calorie intakes are much smaller. This finding suggests that individuals weigh food attributes other than calorie content when they make their food choices in response to income changes. That is, people substitute quality or diversity for quantity as income rises. The income elasticity of the average price paid per calorie has been used as a proxy for food quality. Estimates of this elasticity have been found to be positive and not trivially small even for very poor households [Williamson-Gray (1982), Berhman and Deolalikar (1987)]. Thus, if non-nutritive food characteristics –taste, appearance, status, and degree of processing- are favored highly at the margin, then income increases will not alleviate malnutrition nearly as much as the World Bank (1980) and others have claimed.

We are interested in learning whether PROGRESA and PROCAMPO cash transfers increase diversity. This quantity versus quality tradeoff might also be present among relatively food insecure households, like extremely poor rural households in Mexico. It is also of interest the direction towards which they increase diversity: towards more vegetables and meat, or towards more expensive but less nutritive products, such as processed foods.

Our initial hypothesis is that PROGRESA will increase diversity through program information and obtaining calories through purchases, while PROCAMPO might not increase diversity since calories are more likely to be obtained through home production. PROGRESA beneficiaries are required to attend lectures, *platicas,* where information and training on education and nutrition are given by a doctor or a nurse from the health clinic serving the community. It is widely recognized that poor nutritional status can be caused, not only by insufficient intake of calories, but also by a diet that is insufficiently diverse. The information and training given at the *platicas* might lead recipients to increase their vegetable and meat intake, improving their nutritional status, and anthropometric indicators (underweight, stunting, wasting, etc), and reducing, therefore, undernourishment. In addition, PROGRESA recipients are more likely to obtain calories through purchases. Since the market offers a wider range of food products than home production, PROGRESA might increase the likelihood of eating a more varied diet. However, access to and reliance on the market might increase diversity in an undesirable fashion. If households spent transfer income in non-nutritive products, such as cookies and sodas, the nutritional status of the household would not improve. In contrast, PROCAMPO money is more likely to be invested in home production, which consists basically of grains and cereals: the basis of rural, poor Mexican households' diet.

D. MECHANISMS FOR ACHIEVING HOUSEHOLD FOOD SECURITY

For policy purposes it is not only of interest whether cash transfer programs contribute to increased household food security, but also the mechanism through which this is achieved. The requirements of the program influence this mechanism and this should be taken into account when designing policies.

There are basically two mechanisms through which rural poor households in Mexico can reduce their food insecurity: purchases and home production. Households can either use the cash payments to acquire calories from the market, or can invest them in their land to increase own production and consumption. If PROCAMPO requires that farmers continue to use their agricultural land for crops or livestock it is more likely that the payments are invested in the land or in the creation of household assets, which would stimulate home food production and consumption. If no such requirement exists for PROGRESA payments, and if the *platicas* provide better access to the market through information, we can expect PROGRESA beneficiaries to increase their food security through purchases.

Table 1 summarizes the discussion above.

Table 1. Summary hypotheses about differential program effects

	PROGRESA	PROCAMPO	Program expected to have larger impact
A. Gender	Targeted at women: more likely to spend money on food.	Targeted at men: more likely to drink transfers away.	PROGRESA on food consumption and caloric intake
B. Investment	Not linked to productive asset. More emphasis on immediate consumption but non-agricultural investment observed.	Linked to productive asset. Potential multiplier effects from past investments in agriculture	Long-term effect of PROCAMPO similar to short-term of PROGRESA
C. Quantity versus quality	Large effect on diversity through: platicas and access to the market.	Small effect on diversity - high dependency on home production	PROGRESA on nutritional diversity
D. Mechanisms for achieving food security	Purchases from the market	Investment in home production	PROCAMPO on calories from home production

5. EVALUATING THE EFFECTS OF PROCAMPO AND PROGRESA: THE EMPIRICAL APPROACH

We are interested in analyzing the effect of PROGRESA and PROCAMPO transfers on the following food security indicators: food consumption in monetary terms, caloric availability, food diversity, and the mechanism of caloric intake. These measures are a function of transfer income, non-transfer income, prices, and preferences. Since our focus lies on comparing the effects of PROGRESA and PROCAMPO, and not the effects of non-transfer income on food security, we choose not to include a measure of non-transfer income, which is likely to be endogenous. Instead, we include a set of exogenous variables that would be used to explain non-transfer income.

These variables include measures of human capital and other household assets as well as regional dummies, which control for regional differences in the ability to generate income that are linked to infrastructure, public services, etc. A number of these variables, particularly age and gender of the head of household, whether the household is

indigenous, and education levels, may also reflect differences in preferences across households. However, distinguishing the effects of non-transfer income and preferences on food consumption and caloric intake is not the main concern of this study and the specification is therefore sufficient to meet our needs. Note that all these variables come from a 1997 baseline survey while the expenditure and transfer data come from the October 1998 ENCEL survey (see Section 6), in order to ensure the exogeneity of these variables.

Food consumption

We need to estimate the Engel curve for food expenditure. Many different functional forms have been used in the literature. Here, we consider the following linear model:

$$\textbf{(1)} \quad F_i = \beta_0 + \beta_1 PROGRESA_i + \beta_2 PROCAMPO_i + \beta_3 X_i + \varepsilon_i$$

where F_i is monthly per capita food consumption of household *i*, $PROGRESA_i$ and $PROCAMPO_i$ are monthly per capita payments from the two transfer programs, X_i is a vector of socio-economic characteristics of household *i*, including regional dummies, and a price index, and ε_i is the error term. An interaction term was initially added to all specifications in the analysis. However, since no evidence of significant non-linearities of transfers was found, the term was dropped from the final specification, except for the case of food diversity, in which the interaction term is significant. A detailed explanation can be found later in the text.

To determine if the impact of a PROGRESA peso is different from a PROCAMPO peso we test the following hypothesis: $Ho: \beta_1 = \beta_2$. A failure to reject this hypothesis would imply that the marginal propensity to consume food out of PROCAMPO is the same as the marginal propensity to consume food out of PROGRESA. However, this does not necessarily imply that the conditions and eligibility requirements in the provision of cash transfers do not matter. The mechanism through which increased consumption is achieved, which is mostly determined by the program conditionality and the gender of the recipient, is relevant. Even when the coefficients are equal, if PROCAMPO recipients invest payments and delay consumption, and PROGRESA recipients spend immediately, the conclusions and policy implications will be different than if the two types of recipients make the same marginal choices. On the other hand, a rejection would clearly indicate that eligibility requirements (gender of the recipient), or/and conditionality in the provision of cash transfer matter.

We use a linear specification because we are ultimately interested in comparing marginal propensities to consume out of two different forms of income. In a log-log specification the estimated coefficients are elasticities, which give information about the percentage increase in the dependent variable given a percentage unit increase in the transfer variable. These parameters are not directly comparable if the two sources of income under analysis differ in size, as in our case, where the average value of PROCAMPO payments is 14.6 pesos, and the average value of PROGRESA transfers is 41.2 pesos.

Marginal effects can be recovered from a double log model evaluating at the median[9] or average values of the variables, though the choice is somewhat arbitrary.[10]

The double log model seems to give a better fit for most data, so it is usually preferred when the focus is either on the impact evaluation of a single program or on the sensitiveness of consumption to total income. However, when the purpose is to compare the impact of two sources of income, the linear model is more appropriate. Case and Deaton (1996) and Duflo (2000) use a linear model to compare transfer and non-transfer income. A linear model is also used in the literature of food stamps when the objective is to compare the marginal propensity to consume out of food stamps and out of cash[11]. The main drawback of using a linear model is the underlying assumption of constant marginal propensity to consume out of cash transfers. However, this might not be such strong assumption since our sample is restricted to the poorest of the poor in rural Mexico, and hence, the variability of income within this population is relatively small[12].

To examine whether the design of the program leads to differences in the way income is allocated across food consumption categories, in both levels and shares, two additional sets of regressions are run. First, we examine the effect of the programs on household consumption on four food consumption categories: fruits and vegetables, grains and cereals, meat and other animal products, and other food. The expectation is that the programs will have a positive effect on all categories but that the effect might differ across program. The specification of the model is the same as in equation (1) with the dependent variable the consumption in each particular category. Second, we examine food consumption shares across the four consumption categories. While equation (1) considers the effect of the transfer programs on the level of consumption for the category, the share equations examine how the transfer programs affect income allocation over different foods.

Caloric intake

The link between increases in food expenditure and increased nutrient intake is not a direct one. Food may be purchased for many reasons -convenience, pleasing tastes, appearance, taste for variety, etc. So, if households display large marginal propensities to consume out of transfers, this does not necessarily imply that the transfers contribute to increase their nutritional status. Since caloric availability is the most common measure used to characterize nutritional status, it is the change in calories caused by transfer programs what we examine next. As for food consumption, we examine the impact of the transfers on total caloric availability and on calories derived from the main food groups. The specification we estimate is:

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[9] Breuning and Dasgupta (1999)

[10] Another difficult and rather arbitrary decision required when recovering marginal effects from elasticities involves whether to take the median/average over the whole sample, or just over the beneficiaries in the sample.

[11] For example, Fraker, Martini, and Ohls (1995) and Breuning and Dasgupta (1999)

[12] Semiparametric estimation of the program effects will be incorporated in the next version of the paper as a robustness check for our linear specification.

$$\textbf{(2)}\quad Cal_i = \beta_0 + \beta_1 PROGRESA_i + \beta_2 PROCAMPO_i + \beta_3 X_i + \varepsilon_i$$

where Cal_i is number of kilocalories consumed per person per day in household *i*. We are not only interested in whether transfer income contributes to increase the caloric intake of these poor households, but also in whether there are shifts across food groups, for instance from foods with high caloric content towards foods which are more expensive but not as nutritive. In order to examine these shifts we regress the equation above but replacing calories with calorie shares as the dependent variable.

Variety

The next stage of the analysis is to explore the possibility that food variety *per se* is valued so that people purchase increased food variety as their incomes increase even though that may not alter their caloric intake. We examine whether PROGRESA and PROCAMPO have resulted in beneficiary households consuming a more varied diet. No standard definition or measurement of optimal level of food diversity can be found in the literature, and food diversity can be quantified in a number of ways. One possibility depends only upon whether or not any of each food is consumed, or upon the number of commodities consumed within a broad commodity group. An alternative approach to measuring variety is through several diversity indices, which take into account not only whether or not each food is consumed, but also the relative magnitudes of each food consumed. We examine the impact of the PROGRESA and PROCAMPO transfer programs on the number of foods, as well as on the following diversity indices, two of which (Simpson and Shannon) have been widely used in many areas of economics and biology:

$$\textbf{(3)}\qquad \text{Simpson index}^{13} = 1 - \sum \Pi_i^2$$

$$\text{Shannon index} = -\sum_i \Pi_i \log(\Pi_i)$$

$$\text{ROD index} = 1 - \sum_i (\Pi_i - \omega_i)^2$$

where Π_i is the calorie share of food i (i=1, 2, ...36), ω_i is the average calorie share of good *i* consumed by the top decile of the distribution of per capita total income (measured as total consumption). If only one food was consumed, the first two indices would be zero. So, variety increases with the index value. The ROD (Revealed Optimal Diversity) index, which is of our own invention, would be one in the case of optimal diversity, which is assumed to be the average consumption basket of the top decile households. So, the closer the index is to one the more "optimally diverse" the diet will be. Equal shares of two different goods are weighted equally in these indices. However, one might want to weight processed foods, for instance, differently from the rest of foods. This is based on the view that increasing diversity towards more varied vegetables, meat

[13] This is simply the Hirschman-Herfindhal index of concentration.

and fish is better than expanding the consumption basket towards sodas, cookies, and alcohol.

The econometric specification in this case is the following:

(4) $Index_i = \beta_0 + \beta_1 PROGRESA_i + \beta_2 PROCAMPO_i + \beta_3 PROG\_DUM * PROCAMPO + \beta_4 X_i + \varepsilon_i$

where $PROG\_DUM$ is a dummy equal to one if the household is PROGRESA beneficiary. The interaction term gives us information about the impact of each additional peso of PROCAMPO for those households that are beneficiaries of the two programs. The need of this type of interaction is suggested by the fact that a large number of PROCAMPO households receive PROGRESA, and hence the information on health and nutrition that goes with it. Although this information is provided to female PROGRESA recipients (in general) and not male PROCAMPO recipients, it may have an effect on household expenditures of PROCAMPO transfers. While this interaction term is not significant, and hence dropped, when the dependent variable is food consumption or caloric intake it is relevant for food diversity.

To complete the diversity analysis we estimate a number of probit regressions. We want to look at whether PROGRESA has a different impact on the probability of consuming new foods not previously consumed than PROCAMPO. Regardless of the amount they might consume of each food, do PROCAMPO and PROGRESA make households more likely to eat a more varied diet, where variety in this particular case is understood as the number of foods within a broad category? The determinants of the probability of eating given foods are expected to include transfer and non-transfer income, preferences, prices, and household characteristics. As with the previous equations, non-transfer income and preferences are included in the estimation using asset and other household characteristics. The following equation is estimated:

(5) $P(C(j)_i) = \beta_0 + \beta_1 PROGRESA_i + \beta_2 PROCAMPO_i + \beta_3 X_i + \varepsilon_i$

where $P(C(j)_i)$ is the probability of consuming food *j* or group *j* of foods by household *i.*

Mechanism of caloric intake

Finally, we want to explore the mechanisms through which increased caloric intake is achieved. As pointed out earlier, there are basically two mechanisms: purchases through the market and investment in home production. The PROGRESA survey gives us information about how much households consume out of home production. Interest lies in estimating the effect of PROGRESA and PROCAMPO on caloric intake derived from home production. If this caloric intake was observed for everyone in the sample, we would proceed in the standard regression framework. Possibly, estimating a censored Tobit if this variable had a positive probability mass at zero. However, a potential sample selection problem arises because calories from home production are observed only for people who farm.

The econometric strategy used in this case is a Heckman selection model (Gronau 1974, Lewis 1974, Heckman 1976). The Heckman selection model differs in an important aspect from censored Tobit models, thus being preferable in our case. With censored models, the censoring rule is known for each individual in the population. In our case, and using Gronau's terminology, we do not know each individual's *reservation wage* that induces him/her either to farm or not to farm. However, the selection, or decision rule, is assumed to depend on a set of observable variables. We assume that the decision to farm, and hence the possibility to derive calories from home production, depends basically on ownership of land, cattle, and agricultural machinery. Failing to account for this selectivity would introduce bias in the coefficients estimated under standard regression techniques.

The Heckman selection model assumes that there exists an underlying regression relationship:

$$\textbf{(6)}\quad CHP_i = \beta_0 + \beta_1 PROGRESA_i + \beta_2 PROCAMPO_i + \beta_3 X_i + \varepsilon_i$$

The dependent variable is not always observed. Rather, the dependent variable is observed if:

$$\textbf{(7)}\quad \alpha Z_i + u_i > 0$$

where CHP_i is calories consumed from home production by household i, ε_i is normally distributed, with zero mean and variance equal to σ^2. u_i is $N(0,1)$, and $corr(\varepsilon_i, u_i) = \rho \neq 0$. Z_i is the set of variables that determines selection (it might include variables from the regression equation too). So the participation or selection equation includes a dummy for owning land, the number of pieces of land owned, number of animals for agricultural work (horses, oxen, and mules), and ownership of agricultural machinery (tractor, plumb, etc.). A test of $\rho = 0$ is performed to determine whether the use of Heckman estimation is appropriate. A rejection of this hypothesis will reject independence of both equations and will, therefore, support the choice of a selection model over standard OLS estimation.

Identification issues

Including transfer data in the regressions

An important issue to consider is the inclusion of data on the transfer payments in the regressions. Both PROCAMPO and PROGRESA cash transfers are reported in the surveys. Because of the experimental design, participation in PROGRESA can be considered random. However, the data suggest that a number of households receive a level of PROGRESA transfers that are less than that dictated by their eligibility. This difference could be the result of administrative mistakes or a household could choose not to complete all program requirements. Whatever the reason, the reported PROGRESA transfer amounts may be endogenous. To overcome this problem, instead of the reported transfer value of PROGRESA we use the intent to treat (ITT), which is the theoretical amount that should be paid to households that are entitled to participate in the program

(details of this procedure are presented in Appendix I) As such, ITT is a good predictor of actual receipts and is exogenous to the system (Bloom, 1984).

The data on the PROCAMPO transfer is more problematic. Like PROGRESA, transfers received from PROCAMPO may be less than that dictated by household eligibility. Furthermore, PROCAMPO began in 1994, before the survey used here was conducted. More importantly, PROCAMPO is not a randomized program, so bias may be introduced into the estimation by the fact that households choose to participate (selection bias) or by the design of the program (program placement bias). This suggests that even if an ITT predictor could be created there is still a possibility that PROCAMPO transfers are endogenous. Since PROCAMPO eligibility is based on land use the main concern is that the OLS estimator of PROCAMPO might be picking up the true program effect combined with a land effect, and therefore be biased upwards.

However, we are confident that we are able to identify the two effects separately by adequately controlling for all relevant characteristics in the regression. In particular, by controlling for the size of the different types of land: irrigated land, rainfed land, forestry land and pasture land. In our sample, about 90 percent of the households that report owning or using land grows staples (the crops that entitled eligibility). However, 53 percent of these households did not report receiving PROCAMPO payments in October, 1998. Furthermore, about 10 percent of PROCAMPO recipients do not grow staples because the program allowed different uses of land, as well as authorized environmental programs. Hence, as shown in Table 2 there is not a one to one relationship between growing staples or owning land, and being beneficiary of PROCAMPO. Identification of the program effect is coming from all those households that are similar in all relevant characteristics to PROCAMPO recipients (and in particular, have the same type of land), but that do not get the cash transfer. There might be a fraction of households out of these 53 percent that, despite being eligible, decided not to participate. This would introduce self-selection bias in the estimation, though our intuition and previous work on PROCAMPO (Sadoulet, de Janvry, and Davis, 2001) says that this group is likely to be very small among these poor households.

Table 2. Relationship between PROCAMPO, land and staple land

Share of households	*Grow Staples*	*Do not grow staples*	*Total*
PROCAMPO	25.5	3	28.5
Non PROCAMPO	28.1	43.4	71.5
Total	54.6	46.6	

Index of correlation	*PROCAMPO*	*Land ownership*	*Growing staples*
PROCAMPO	1		
Land ownership	.46	1	
Growing staples	.45	.88	1

We have performed a number of *t* tests on the equality of means of the size of the different types of land within the following two groups: PROCAMPO beneficiaries and non-PROCAMPO beneficiaries but otherwise eligible. We would need a more refined matching strategy to identify the non-PROCAMPO beneficiaries but otherwise eligible, but as a first approximation we define this group as those households that are growing staples in 1998, yet are not PROCAMPO recipients. We fail to reject that the means of irrigated land, forestry land, and pasture land are the same within these two groups. However, we reject that the means are equal for the case of rainfed land. Although rather simple, these tests are suggestive evidence that there exists a comparison group for PROCAMPO beneficiaries, and that identification of the PROCAMPO program effect is feasible with OLS estimation.

Another concern is that those who choose to participate in either program may be different in immeasurable ways from those who do not, thus causing the disturbance term in the model to be correlated with the regressors. For PROGRESA, the random nature of the program, the use of ITT as the transfer predictor, and the fact that the take-up ratio is close to one take care of this potential problem. For PROCAMPO, this concern remains. Econometric techniques are only able to account for observable differences between PROCAMPO and non-PROCAMPO households.

Finally, given the nature of PROCAMPO, there might exist some concern that we will be identifying a NAFTA effect rather than the true program effect. However, PROCAMPO actually over compensated small landowners and reached households who did not benefit from pre-NAFTA price supports because they had no marketed surplus. Households in our sample are the poorest of the poor in Mexico, and their agricultural production is basically subsistence, so NAFTA likely had a minimal impact on them, and PROCAMPO represented an overcompensation.

Instrumental variables approach

An alternative strategy to deal with the potential endogeneity of PROCAMPO (i.e. to the concern that PROCAMPO and non-PROCAMPO recipients are different in some systematic way that our regression controls are unable to account for) is to use an instrumental variables approach. The difficulty in this approach is identifying valid instruments that adequately predict PROCAMPO transfers and that are uncorrelated with the error term in the main regression. The standard strategy would be to instrument the program by the program eligibility criteria. However, this is not feasible in our case given that land, which entitled eligibility to the program, is a direct determinant of food security outcomes. The choice of instruments and the test of their validity represented a major effort in this research effort.

Instruments used in the analysis can be classified into three categories. The first category incorporates the idea that randomization of the PROGRESA program may help to identify the PROCAMPO program effect. Some of the variables used in the selection of eligible communities for PROGRESA are exogenous but correlated with being a PROCAMPO beneficiary (partly because a high percentage of PROGRESA recipients get PROCAMPO as well), and thus can be used as instruments for PROCAMPO.

Communities selected into PROGRESA were chosen on the basis of a marginality index. After selecting the subset of localities with the highest marginality index to participate in the evaluation, each locality is randomly assigned to be a member of either the treatment or control group. The marginality index was created using the method of principal components based on seven variables at the community level (see Skoufias et al, 1999 for detailed explanation). Some of them work as valid instruments for PROCAMPO: share of population working in the primary sector, share of dwellings with dirt floor, share of dwellings without drainage system, share of dwellings without water, and average number of occupants per room.

The second set of instruments also contains community level variables: the non-self cluster mean of PROCAMPO transfers, and the non-self cluster mean of irrigated land. Although not very common, non-self cluster means are proper instruments, in the sense that, by definition, are uncorrelated with the error term (and hence program outcomes), and are highly correlated with the instrumented variable (Alderman and Garcia, 1994; Handa, 1996). Finally, the third category includes individual level variables: number of animals for agricultural work (oxen, mules), and a dummy for ownership of agricultural machinery (tractor, plump, etc). The rationale for using these variables as instruments is that they are highly correlated with PROCAMPO, since recipients are farmers, but are not necessarily determinants of living standards or food security indicators. Ownership of animals and agricultural machinery is common among both poor and richer rural households in Mexico.

A reduced set of instruments from these three categories is selected for each of the regressions performed. In each case instruments pass the test of overidentifying restrictions.

In the analysis that follows we take the following steps. First, the model is estimated by OLS using actual PROCAMPO transfer data as specified in the above equations. Second, an instrumental variable approach is used. Third, a test suggested by Hausman (1978, 1983) is used to determine if PROCAMPO transfers are exogenous. In the estimation of probit models, the Smith-Blundell test (1986) of exogeneity is performed instead. In general, the hypothesis of exogeneity cannot be rejected suggesting that the standard regression model is appropriate. However, given the rejection of this hypothesis in some cases we present results for both the standard model and instrumental variable model as well as the results of the test of exogeneity and focus on the appropriate model in the discussion.

Clustering

Finally, Berhman and Todd, 1999 suggest that the means of key characteristics such as age, education and income at the locality level are statistically equal in control and treatment localities. However, they detect some significant differences when the comparison of the means was conducted at the household level. Heterogeneity between households in treatment and control localities is accounted for including control variables in the regression. In addition, all estimated standard errors are obtained using clustering

by locality[14]. We are thus assuming that observations are independent across clusters (localities), but not necessarily across households within localities.

6. THE DATA

Data collected for the evaluation of PROGRESA are structured as follows. A first source of data is the census (ENCASEH) conducted in 1997 in all communities selected for participation in PROGRESA and which formed the basis for the selection of beneficiary households. Since it covered all PROGRESA communities, including those households surveyed for the PROGRESA evaluation, the census serves as a baseline survey for this study.[15] Second, as part of an evaluation based on an experimental design, 506 PROGRESA communities were selected and randomly allocated into treatment and control groups. Only households in the treatment communities received PROGRESA. The random assignment of localities allows for a more rigorous evaluation of PROGRESA and ensures that there is only a limited probability that differences between treatment and control groups are due to unobserved factors (see Behrman and Todd, 1999). As part of this evaluation, a follow-up survey (ENCEL98O) was conducted in these selected communities in October 1998.[16] Thus, this study is based on data from the 1997 ENCASEH and 1998 ENCEL98O surveys.

The ENCEL surveys collected data on all households in the 506 communities, both treatment and control, numbering over 24,000 households in total. We focus our attention on families originally classified as poor. Initially, PROGRESA classified as eligible about 52 percent of households. Afterward, due to perceived bias against certain kinds of poor households (especially elderly with no children), criteria of eligibility were revised and the program was extended to cover 78 percent of households. This expansion is known as "densification". Because of the revision of the criteria of eligibility, households included in the second phase have different characteristics. As these households were declared eligible later, most of them started receiving cash transfers some time after the initial households, so that the impact of PROGRESA on their consumption could be different. Hence, we restrict our analysis to the "pre-densification" poor. After dropping some observations considered as outliers (see footnote 19) our sample consists of 9841 households.

[14] Except for the probit model with instrumented variables.
[15] A baseline household survey (ENCEL98M) was carried out in both the treatment and control communities in March, 1998, prior to the initiation of PROGRESA payments in May, 1998. The first ENCEL did not collect demographic, labor use, and asset information available in ENCASEH, and instead focused on household consumption. We thus use ENCASEH as the source for control variables.
[16] Additional ENCEL surveys were conducted in March and October 1999, and in 2000. Results from the evaluation of PROGRESA show that the main impact of Progresa in terms of schooling, health, and consumption is found after the initial 6 months of the program (October 1998). After that, the impact does not get bigger, and in fact in some cases, is reduced. Thus we only use the first round, and not subsequent rounds--we expect no difference in terms of results. Furthermore, PROCAMPO households in ENCEL October 1998 have been in the program for 4 years. It is safe to assume that the long term benefits (multiplier effect) of PROCAMPO are fully realized by this time.

Table 3 presents allocation of households across the four categories of households in the sample. The sample can be divided as follows: Group 1: PROGRESA recipients only (44.2 percent), Group 2: PROCAMPO recipients only (9.4 percent), Group 3: PROGRESA and PROCAMPO recipients (19.1 percent of all households), and Group 4: non-recipients (27.3 percent). Households in groups 2 and 4 are considered poor by PROGRESA but located in the control communities. Overall, 63.3 percent of the sample receives PROGRESA, 28.5 percent receive PROCAMPO and 72.7 percent receive at least one type of transfer.

Table 3. Allocation of households to program categories

Number of obs=9841 (in percent)	**PROGRESA**	**Non-PROGRESA**	Total
PROCAMPO	19.1	9.4	28.5
Non-PROCAMPO	44.2	27.3	71.5
Total	63.3	36.7	100

Table 4 summarizes the data on cash transfers, household characteristics, and regional differences that are used in the analysis. In the first column, data from the entire sample is presented while the remaining columns report the results for the four household categories. It is expected that PROGRESA (categories 1 and 3) and non-PROGRESA (categories 2 and 4) households have similar characteristics, as treatment and control communities were chosen randomly. PROCAMPO participation is not randomly assigned in the survey so some differences between PROCAMPO (categories 2 and 3) and non-PROCAMPO (categories 1 and 4) are expected to emerge. PROGRESA transfers are on average between three and four times greater than PROCAMPO transfers. For PROGRESA recipients, the transfer represents about 23 percent of total monthly expenditure while for PROCAMPO recipients the transfer represents less than 10 percent of total expenditure. For households who receive both types of transfers, the combination provides on average 33 percent of total expenditure. Both of these programs represent significant contributions to household income.

The PROCAMPO households, split into categories 2 and 3, appear to have different characteristics as compared to categories 1 and 4. PROCAMPO households depend more on agricultural and livestock production for their livelihood; they have much larger land and livestock holdings, and they participate less in non-agricultural wage labor. On average PROCAMPO households are larger than non-PROCAMPO households and are further along in the life cycle, with older household heads. PROCAMPO households also have a higher share of speakers of an indigenous language. All four categories have similar levels of infrastructure such as electricity and pipe water, as well as dirt floors in their dwellings.

These results indicate that there are some differences between the PROCAMPO households and other households while PROGRESA households seem to be similar to non-participant households. While this should not be surprising given the sampling framework, it suggests care must be taken in evaluating the effects of PROCAMPO. It must also be kept in mind that these PROCAMPO households are unlikely to be representative of PROCAMPO households nationwide, but instead poorer than average given the nature of the PROGRESA sample.

Table 4. Mean characteristics of household groups

	ALL	PG	PC	Both	None
Number of households	9841	4353	923	1880	2685
Fraction of total	100	44.23	9.38	19.1	27.28
Transfers per month 1998 (1997 pesos per adult equivalent)					
PROGRESA	26.35	41.24	0	42.45	0
PROCAMPO	3.72	0	14.59	12.3	0
Household characteristics (1997)					
Household size	1.69	1.63	1.8	1.79	1.66
Age of household age	42.19	40.94	46.03	44.65	41.16
Head is male	0.92	0.91	0.94	0.94	0.91
Head speaks indigenous language	0.42	0.39	0.5	0.47	0.4
Share of kids 3-4 years old	9.51	10.22	7.23	8.09	10.14
Share of kids 4-9 years old	7.19	7.5	6.28	6.32	7.62
Share of kids 10-13 years old	19.58	19.45	19.72	19.83	19.58
Share of males 11-14 years old	5.59	4.93	6.92	7.01	5.21
Share of females 11-14 years old	5.2	4.7	6.42	5.87	5.14
Share of males 15-19 years old	4.2	3.99	5.17	4.91	3.7
Share of females 15-19 years old	4.5	4.35	4.88	4.91	4.32
Share of males 20-34 years old	9.89	10.99	6.81	7.82	10.61
Share of females 20-34 years old	10.78	11.22	8.98	9.14	11.83
Share of males 35-59 years old	8.31	7.6	10.07	9.65	7.9
Share of females 35-59 years old	8	7.5	9.46	9.15	7.52
Share of males 60+ years old	3.58	3.64	4.18	4.01	2.96
Share of females 60+ years old	3.49	3.67	3.76	3.23	3.28
Males with no education (share)	19.27	20.09	17.64	17.68	19.62
Females with no education (share)	21.92	22.25	20.65	20.09	23.13
Litterated males	19.86	19.24	21.13	21.64	19.17
Litterated females	17.55	17.22	18.1	18.21	17.42
Males with primary education	8.84	8.79	9.43	9.55	8.23
Females with primary education	8.52	8.35	9.06	8.72	8.47
Males with secondary education	1.73	1.78	1.52	1.87	1.62
Females with secondary education	1.53	1.5	1.71	1.52	1.54
Males with high education	0.22	0.26	0.16	0.18	0.18
Females with high education	0.15	0.19	0.09	0.08	0.15
Density of non agricultural wages in community	16.15	17.01	16.65	13.59	16.36
Density of agricultural wages in community	2.87	3.03	2.44	1.78	3.5
House has dirt floor	0.74	0.74	0.73	0.72	0.76
House has interna pipes	0.04	0.04	0.03	0.06	0.03
House has electricity	0.6	0.57	0.65	0.62	0.61
Hectares of irrigated land	0.05	0.04	0.12	0.06	0.03
Hectares of non irrigated land	1.61	1.1	3.26	2.72	1.09
Hectares of pasture land	0.12	0.11	0.17	0.2	0.07
Hectares of forestry land	0.02	0.02	0.03	0.05	0.02
Cows owned	0.61	0.43	1.16	1	0.46
Pigs owned	1.03	0.84	1.78	1.25	0.91
Price index	10.39	10.49	9.98	10.44	10.33
Percentage of households in group living in:					
Region 3-Sierra Negra-Zongolica-Mazateca	12.34	11.56	14.19	10.9	13.98
Region 4- Sierra Norte-Otomi Tepehua	18.39	20.45	12.89	12.13	21.32
Region 5- Sierra Gorda	42.92	41.28	45.61	45.16	43.09
Region 6- Montana (Guerrero)	10.12	11.3	8.78	12.66	6.9
Region 12- Huasteca (San Luis Potosi)	1.11	0.8	1.41	1.17	1.45
Region 27- Tierra Caliente (Michoacan)	12.78	13.21	13.65	11.7	12.52
Region 28- Altiplano (San Luis Potosi)	2.35	1.4	3.47	6.28	0.75

7. RESULTS

Food consumption and consumption shares

In this section we analyze the impact of PROCAMPO and PROGRESA on the monetary value of food consumption. Food consumption represents the most important expenditure category, making up around 80 percent of total household expenditure. Households report the monetary value of food consumption and the quantities of the individual food items used during the seven-day period preceding the interview. The price of food used is obtained by dividing monetary value of food consumption by the quantity of each food item used. Food not purchased directly by the household (i.e. home-produced food) is valued at the average community price per kilo for that food item that was paid by the survey households reporting its purchase and use. The total money value of food used at home is obtained by summing the money values of the individual food items. All expenditure measures discussed in this paper are expressed in constant (1997) pesos and in per adult-male equivalent persons.[17]

Table 5 reports mean values of per capita per month consumption in pesos and consumption shares of the main food categories for all households and our four beneficiary types. The main food categories are: vegetables and fruits; grains and cereals; meat and other animal products (dairy products are included in this category); and other food[18].

Table 5. Mean values of Food consumption (per person, per month in pesos) and consumption shares

	ALL		PROGRESA		PROCAMPO		BOTH		NONE	
	Level	Share	Level	Share	Level	Share	Level	Share	Level	Share
Total food	136.3		142.7		125.2		134.8		130.9	
Vegetables	21.5	15.4	22.5	15.6	20.2	14.7	21.7	15.7	20.1	15.0
Grains and Cereals	65.9	51.0	68.3	50.4	60.7	52.9	64.2	49.9	65.0	52.2
Meat and animal products	25.6	16.5	27.5	17.0	23.5	15.5	26.6	17.6	22.5	15.1
Other food	22.9	17.1	24.0	17.1	20.3	16.9	22.0	16.8	22.6	17.6

There are significant differences in the unconditional means across PROGRESA and PROCAMPO households. These households are not comparable in terms of total wealth and other characteristics, so only some of these differences are due to program effects. The mean value of food consumption for PROGRESA recipients is 143 pesos per person per month as compared to 125 pesos for PROCAMPO beneficiaries, a difference of 14 percent. It is noteworthy that grains and cereals account for more than half of all food consumption. Although PROGRESA households spend more in every category, cereals and grains account for a smaller share of food consumption. Recipients of both programs

[17] Household size in adult-male equivalent persons is actual household size adjusted for the age and sex of the household members. The adjustment procedure weights each household member by the nutritional requirements of an adult male age 23-50. This measure of household size is further adjusted to account for household members not eating at home, and guests.

[18] The Other Food group includes: oil, sugar, coffee, cookies, soda, and alcohol.

are relatively similar to PROGRESA recipients, but they consume a smaller share of grains. Households that received no transfers are relatively closer to PROCAMPO recipients.

The problem with the approach of simply comparing averages between groups is that participants and non-participants differ with regard to not only participation status but in other variables as well. To minimize this problem, multiple regression methods have been used to control for the effects of the other key factors in analyzing program effects on food security. As explained in the previous section, the use of multiple regression analysis does not totally avoid possible self-selection problems in the analysis caused by participants being systematically different from non-participants. Only variables that can be measured are controlled for in the regression framework, and thus the possibility of the program variable picking up unobserved differences remains.

Table 6 presents the results of the regression on total food consumption and for each individual food consumption category.

Table 6. Food consumption (OLS and IV regressions)

Exogeneity Test

	All Food	Vegetables	Grains	Meat	Other food
p- Hausman test	0.47	0.56	0.90	**0.02**	**0.07**

OLS

	All Food	Vegetables	Grains	Meat	Other Food
PROGRESA	0.307***	0.064***	0.117**	0.085***	0.037***
	(3.54)	(4.26)	(2.06)	(3.19)	(3.04)
PROCAMPO	0.332***	0.071***	0.145***	0.117*	0.019
	(3.20)	(2.69)	(3.95)	(1.87)	(0.77)
R-squared	0.25	0.11	0.13	0.12	0.12
Prob>Ftest PROG=PROC	0.85	0.81	0.60	0.69	0.48

IV

	All Food	Vegetables	Grains	Meat	Other food
PROGRESA	0.321***	0.065***	0.126**	0.087***	0.039***
	(3.66)	(4.30)	(2.17)	(3.16)	(3.14)
PROCAMPO	0.683	0.142	0.119	0.652**	-0.223
	(1.29)	(1.12)	(0.49)	(2.54)	(1.59)
R-squared	0.25	0.10	0.13	0.10	0.11
Prob>F-test PROG=PROC	0.50	0.55	0.98	0.03	0.06
p-OVID test	0.39	0.46	0.30	0.72	0.71

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%;*** significant at 1%

Both OLS estimates (using actual PROCAMPO transfer values) and IV estimates are presented. A test of overidentifying restrictions, as well as a Hausman exogeneity test, is shown. For each regression, Table 6 also includes results of the test of the hypothesis that the PROCAMPO and PROGRESA coefficients are equal. Only the estimates corresponding to the transfer variables are presented in this table, with the full results

provided in Appendix II. The discussion is based on the OLS results as long as the Hausman exogeneity test fails to reject that PROCAMPO is exogenous. Otherwise, IV estimates are discussed. Estimates that apply in each case are presented in a bold font.

The estimate of the marginal propensity to consume food out of PROGRESA is 0.31, and the corresponding estimate for PROCAMPO is 0.33. Both of these estimates are different from zero at one percent significance level, but they are not significantly different from each other. These estimates imply that, on average, when Mexican households receive an additional peso whether in the form of PROGRESA or PROCAMPO benefits, they increase their total expenditures on food by slightly more than 30 cents. However, as pointed out earlier, this does not necessarily mean that a peso is a peso always, regardless of the form of income. It will make a difference in terms of conclusions and policy implications whether this increase in brought about through immediate consumption, or through investment and delayed consumption.

The by food categories results indicate divergences from the neoclassical model. The Hausman exogeneity test fails to reject the null hypothesis of exogeneity of PROCAMPO for the grains and vegetables categories, so the appropriate estimates are the OLS coefficients. In the other two cases, we should look at the IV estimates. The marginal propensity to consume vegetables and fruits out of the two cash transfers is small, though significantly different from zero. Transfer increases have a larger impact on grain consumption, with a peso increase in either PROCAMPO or PROGRESA triggering an increase in the consumption of grains between 0.1 and 0.15 pesos. We don't observe significant differences between the two programs in these two cases either. On the other hand, tests of difference between PROCAMPO and PROGRESA coefficients indicate that the null hypothesis that they are equal can be rejected for meat (3 percent significance level), and other food (7 percent). The most noteworthy difference emerges when we evaluate the impact on meat consumption. An additional peso of PROCAMPO would increase meat consumption by 0.6 pesos, while a peso of PROGRESA would generate an increase of less than 0.1.

We next examine the influence of transfers on the allocation of income across food consumption categories. Table 7 summarizes the regression results on the food consumption shares.

The results indicate that PROGRESA recipients shift income towards vegetable and meat consumption, and away of grains and other food. This is a pattern displayed by most rural households in developing countries as income increases. PROCAMPO has no significant impact on the vegetable or grains share but it shifts a large fraction of income from the other food category towards meat and other animal products. In addition, this consumption shift is significantly different from the PROGRESA one. This result supports the view that a transferred peso doesn't bring about the same outcome regardless of the program.

Table 7. Food consumption shares (OLS and IV regressions)

Exogeneity Test

	Vegetables	Grains	Meat	Other Food
p-Hausman test	0.60	0.54	**0.00**	**0.00**

OLS

	Vegetables	Grains	Meat	Other Food
PROGRESA	0.014***	-0.031***	0.023***	-0.007
	(2.77)	(2.91)	(3.21)	(1.23)
PROCAMPO	0.008	-0.021	0.040***	-0.026***
	(0.84)	(1.06)	(2.68)	(3.23)
R-squared	0.07	0.15	0.14	0.13
Prob>F-test PROG=PROC	0.49	0.65	0.31	0.03

IV

	Vegetables	Grains	Meat	Other Food
PROGRESA	0.015***	-0.030***	0.023***	-0.008
	(2.78)	(2.79)	(3.08)	(1.42)
PROCAMPO	0.060	-0.084	0.259***	-0.215***
	(1.04)	(0.73)	(2.92)	(2.86)
R-squared	0.06	0.14	0.10	0.08
Prob>F-test PROG=PROC	0.43	0.64	0.01	0.01
p-OVID test	0.37	0.46	0.99	0.39

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%;*** significant at 1%

Caloric availability and calorie shares

Table 8 reports mean values of calorie consumption and calorie share by food categories for all households and for the four recipient types[19].

Table 8. Mean values of Caloric availability (per person, per day in pesos) and calorie shares

	ALL		PROGRESA		PROCAMPO		BOTH		NONE	
	Level	Share	Level	Share	Level	Share	Level	Share	Level	Share
Total food	2126.4		2156.2		2095.7		2139.7		2079.4	
Vegetable	42.7	2.1	45.0	2.2	37.8	1.9	45.4	2.3	38.8	2.0
Grains and Cereals	1622.6	74.6	1633.7	74.0	1637.5	76.9	1640.0	75.1	1587.1	74.5
Meat and animal products	116.0	5.7	120.2	5.9	108.5	5.4	123.7	6.0	106.5	5.4
Other food	345.2	17.5	357.4	17.9	311.9	15.9	330.6	16.7	347.0	18.1

We constructed measures of caloric availability per capita following Hoddinot et al (2000). We use the caloric/food conversion factors in *Las Tablas de Valor Nutritivo* for

[19] We have excluded households reporting that no food was consumed, or households with caloric availability per person per day less than or equal to 875 kcal or greater or equal to 5000 kcal. We have also excluded households who reported having a party or that consumed more than 2000 kcal of oil or lard per day.

Mexico (Chavas, 1999). We estimate caloric availability based on household averages, as this is how the data were reported.[20]

The average nutrient intake for the households in our sample is 2126 Kcal per person per day with the median household receiving 1895 Kcal. The minimum dietary energy supply for Mexico is set at 1890 Kcal per person per day, and any intake below 1680 Kcal is considered undernourishment. Therefore, we estimate that about 40 percent of our sample is malnourished. PROGRESA recipients have, at the mean, 2.8 percent more calories available per person per day than do households receiving PROCAMPO only. The difference is particularly big for vegetable calories. PROGRESA households consume, on average, 19 percent more calories from vegetables and 11 percent more calories from meat and animal products than PROCAMPO recipients. Those receiving both programs do not consume more calories on average than households receiving PROGRESA only. This is, most likely, due to non-randomness of the samples, or to put in other words, to the fact that households receiving both programs are poorer than those receiving PROGRESA only. The econometric analysis that follows will allow us to control for wealth and other household characteristics, so we will be able to identify program effects.

Grains provide cheap calories and so they weigh heavier in the calorie share (74 percent) than in the consumption share (51 percent). At the other extreme, vegetable calories are the most expensive, they account for 2 percent of total caloric availability and 15 percent of the food budget. The grain share of calories for PROCAMPO households is nearly 4 percent higher than the corresponding share for PROGRESA recipients. However, calories from vegetables and meat account for a much smaller fraction of caloric availability in PROCAMPO households. These differences might be connected to these households' dependence on home production and to various market imperfections, such as transaction costs and credit constraints.

Table 9 summarizes the results for the estimation of total calories as well as calories derived from each of the food categories.

[20] This might be misleading if the distribution of inputs among the individuals in the household is not uniform. In this case, average household nutrient demand relations would not very useful to predict what happens to nutrient intakes for a given member in the household if household income increases

Table 9. Caloric availability (OLS and IV regressions)

Exogeneity Test

	All Food	Vegetables	Grains	Meat	Other food
p-Hausman test	0.84	**0.05**	0.66	**0.09**	**0.00**

OLS

	All Food	Vegetables	Grains	Meat	Other Food
PROGRESA	1.054*	0.114***	0.521	0.178**	0.241**
	(1.89)	(4.83)	(0.98)	(2.31)	(2.17)
PROCAMPO	2.802*	0.125**	1.688	0.498*	0.491
	(1.62)	(2.38)	(1.25)	(1.70)	(1.50)
R-squared	0.12	0.13	0.07	0.17	0.30
Prob>F-test PROG=PROC	0.33	0.85	0.42	0.30	0.46

IV

	All Food	Vegetables	Grains	Meat	Other food
PROGRESA	1.064*	0.120***	0.535	0.196**	0.224**
	(1.91)	(4.91)	(1.01)	(2.45)	(2.03)
PROCAMPO	4.033	0.597**	4.143	2.281*	-3.380**
	(0.63)	(2.31)	(0.70)	(1.72)	(2.23)
R-squared	0.12	0.12	0.07	0.14	0.26
Prob>F-test PROG=PROC	0.64	0.07	0.54	0.10	0.02
p-OVID test	0.30	0.72	0.33	0.41	0.55

Robust t statistics in parentheses

* significant at 10%; ** significant at 5%;*** significant at 1%

A transferred peso of PROGRESA per month would lead to a unit increase in total calories per person per day in the household. The same increase in PROCAMPO would increase total caloric availability by 2.8 calories. These coefficients are significant at the 10 percent level, and no significant difference between the programs is found. Hence, true program effects are the same for both types of beneficiaries and observed differences between them are due to random sampling error.

As in food consumption, statistical differences between the programs emerge when we explore the impact on the individual food categories. The most noteworthy result is the significantly larger impact of PROCAMPO on calories derived from meat and other animal products. PROCAMPO is also associated with higher consumption of vegetable calories. This result, together with the result in Table 6 that the marginal effects of PROCAMPO and PROGRESA on vegetable expenditure are the same, suggest that PROGRESA recipients are paying more for each additional calorie from vegetables. The F-test also rejects the null hypothesis of equality of the two coefficients for the other food category. PROCAMPO actually has a large and negative impact on calories acquired from these foods, while PROGRESA leads to more calorie consumption out of them. Again, results tend to reject the one peso is one peso hypothesis.

How does the sensitivity of caloric availability compare to the response of food expenditure with respect to transfer increases? This question becomes relevant when we

are interested in exploring whether these households display a taste for variety or whether there exists the so-called tradeoff between quality and quantity. Table A3 in Appendix II presents food consumption and calorie elasticities with respect to the two transfer programs. They are the estimated coefficients of a double log model. The calorie elasticity with respect to PROGRESA transfers is half as large as the corresponding food expenditure elasticity. In the case of PROCAMPO the size of the calorie elasticity is 70 percent the size of the food elasticity, indicating that PROGRESA recipients are more likely to substitute quality for quantity. It is interesting to observe this pattern even among relatively poor and food insecure households. This lends some support to the view that transfer increases would not contribute to increase nutrient intake as much as food expenditure because households value aspects other than caloric content when doing their marginal choices.

Food elasticities are not found to be larger than calorie elasticities for the individual food groups. This implies that there is no significant quantity-quality substitution within groups, but rather across food groups. The exception might be found in the meat category for PROCAMPO households.

Table 10 presents estimates of the regressions on calorie shares.

Table 10. Calorie shares (OLS and IV regressions)

Exogeneity Test

	Vegetables	Grains	Meat	Other food
p-Hausman test	**0.09**	0.16	0.14	**0.00**

OLS

	Vegetables	Grains	Meat	Other Food
PROGRESA	0.004***	-0.010	0.005	0.000
	(3.79)	(1.46)	(1.49)	(0.06)
PROCAMPO	0.004**	-0.014	0.011	-0.001
	(2.09)	(1.19)	(1.44)	(0.08)
R-squared	0.09	0.16	0.17	0.12
Prob>F-test PROG=PROC	0.74	0.78	0.52	0.91

IV

	Vegetables	Grains	Meat	Other food
PROGRESA	0.005***	-0.010	0.006*	-0.001
	(3.80)	(1.40)	(1.66)	(0.12)
PROCAMPO	0.031**	0.083	0.086	-0.234***
	(2.33)	(1.08)	(1.47)	(2.61)
R-squared	0.07	0.15	0.15	0.05
Prob>F-test PROG=PROC	0.05	0.22	0.17	0.01
p-OVID test	0.86	0.43	0.23	0.16

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%;*** significant at 1%

This table suggests that both programs contribute to increase the weight of vegetables and meat in total caloric intake, reducing the share of grains and other food. PROCAMPO has

a statistically significant effect and statistically different from PROGRESA in increasing the vegetable share and in reducing the other food share.

Diversity Analysis

Earlier in the section we saw that PROCAMPO and PROGRESA increase the value of food consumption. Now we focus on the possibility that this change comes about because of the consumption of new foods not previously consumed. Do PROGRESA and PROCAMPO make recipients more likely to be consuming a more varied diet? Table 11 displays the probability of not eating certain foods or food groups by program status.

Table 11. Percentage of households not consuming

	ALL	PROG	PROC	BOTH	NONE
Fruits and vegetables	20	18	27	19	23
Meat and fish	50	48	53	43	58
Dairy products	14	12	19	11	18
Processed food	19	17	23	17	22
Tortillas	10	9	11	9	10
Chicken	60	58	61	54	67
Rice	37	37	38	34	40
Beans	3	3	4	3	3

Note: Fruits and vegetables do not include tomatoes and onions. Dairy products includes milk, eggs, and cheese. Processed foods includes: white bread, sweet bread, loaf bread, noodles, crakers, breakfast cereals, cookies, coffee, and soda.

The table displays the main deficiencies in the diet of the poorest in Mexico. About half of the households did not consume any meat or fish during the week previous to the interview, 20 percent did not have any vegetables or fruits excluding tomatoes and onions, and 14 percent of the families did not consume any dairy products. The table shows that tortillas and beans constitute the base of the diet for these poor Mexican households. Before controlling for wealth and other household characteristics, PROGRESA households are more likely to be eating fruits and vegetables, dairy products, meat and fish, and also processed foods. The econometric analysis that follows allows us to disentangle program effects from other observable differences across recipient types. As explained in section 5, we estimate a probit model, with a binary dependent variable equal to one if the household is consuming a positive amount of a given food. Results for four probit (and four IV-probit) regressions are presented in Table 12. The results suggest that PROGRESA increases the likelihood of eating vegetables and fruits, while PROCAMPO has no statistically significant effect on this category. On the other hand, PROCAMPO has a large impact on the probability of eating meat and fish, and this is statistically different from the effect of PROGRESA transfers.

We do not find any evidence that supports that either program has a larger impact on the probability of eating more dairy products and processed foods. All this suggests that the two programs are contributing to increase variety, understood in this case as the likelihood of eating more foods not previously consumed. Since it is widely recognized that poor nutritional status can be caused, not only by insufficient intake of calories, but

also by a diet that is insufficiently diverse, the observed shift can be considered beneficial.

Table 12. Probability of eating

Exogeneity Test

	Veggies	Meat & Fish	Dairy products	Processed Foods
Smith-Blundell test	0.35	**0.00**	0.36	0.73

PROBIT

	Veggies	Meat & Fish	Dairy Products	Processed Foods
PROGRESA	0.003***	0.004***	0.003**	0.003***
	(3.48)	(4.60)	(2.32)	(2.97)
PROCAMPO	-0.000	0.005**	0.003	0.002
	(0.17)	(2.31)	(1.54)	(1.11)
Prob>chi2-test PROG=PROC	0.03	0.52	0.69	0.69

IV-PROBITS

	Veggies	Meat & Fish	Dairy products	Processed Foods
PROGRESA	0.003***	0.004***	0.003***	0.003***
	(5.47)	(6.95)	(4.27)	(4.29)
PROCAMPO	0.006	0.030***	0.010	-0.000
	(0.89)	(4.81)	(1.34)	(0.07)
Prob>chi2-test PROG=PROC	0.67	0.00	0.31	0.67

Note: Veggies includes all vegetables except tomatoes and onions. Dairy products includes milk, eggs and cheese. Processed foods includes: white bread, sweet bread, loaf bread, noodles, crakers, breakfast cereals, cookies, coffee, and soda.
Absolute value of z statistics in parentheses
* significant at 10%; ** significant at 5%;*** significant at 1%

In Table 13 mean values of the total number of foods consumed and the number within different food categories are presented, as are the mean values of several diversity indices. As pointed out in Section 5, the number of foods consumed is the most conventional measure of food diversity even though other diversity measures such as the Simpson, Shannon, and ROD indices might be more appropriate because they take into account not only whether or not each food is consumed, but also the relative magnitudes of each food consumed**.** On average, households consume a third of the total number of food categories available, and they consume higher variety of grains and cereals than of animal products and vegetables. PROGRESA recipients seem to be eating a more varied diet. We next explore whether these differences are due to program effects or to other differences between the two types of recipients.

Table 13. Diversity Analysis (mean values)

	ALL	PROG	PROC	BOTH	NONE
Number of foods (max=36)	12.7	12.9	12.3	13.4	12.1
Number of vegetables (max=10)	3.7	3.8	3.5	4.0	3.5
Number of grains and cereals (max=11)	4.3	4.4	4.2	4.5	4.2
Number of meats and animal products (max=9)	2.0	2.0	1.9	2.2	1.8
Number of other foods (max=6)	2.7	2.7	2.7	2.7	2.6
Number of processed foods (max=8)	1.6	1.6	1.5	1.7	1.4
Simpson Index	0.7	0.7	0.6	0.6	0.6
Shannon Index	1.5	1.5	1.4	1.5	1.5
ROD Index	0.9	0.9	0.8	0.9	0.9

Note: ROD stands for Revealed Optimal Diversity

Table 14 presents the results of regression of the number of food and three diversity indices on PROCAMPO, PROGRESA, the interaction term and our usual control variables.

Table 14. Diversity Analysis (OLS and IV regressions)

Exogeneity test

	Number of foods	Simpson Index	Shannon Index	ROD Index
p-Hausman test	0.16	0.84	0.36	**0.07**

OLS

	Number of foods	Simpson Index	Shannon Index	ROD Index
PROGRESA	0.011***	0.018**	0.072***	0.012**
	(4.16)	(2.27)	(3.19)	(2.11)
PROCAMPO	0.010**	0.006	0.063	-0.006
	(2.41)	(0.36)	(1.28)	(0.49)
PR*PG	0.016**	0.037	0.119*	0.035**
	(2.11)	(1.57)	(1.76)	(2.17)
R-squared	0.19	0.19	0.21	0.07
Prob>F-test PROG=PROC	0.94	0.57	0.87	0.17

IV

	Number of foods	Simpson index	Shannon index	ROD index
PROGRESA	0.010***	0.014*	0.061**	0.007
	(3.09)	(1.67)	(2.43)	(1.05)
PROCAMPO	0.033	-0.034	0.126	0.022
	(0.67)	(0.23)	(0.28)	(0.23)
PC*PG	0.046	0.119	0.365	0.147*
	(1.05)	(0.98)	(1.00)	(1.90)
R-squared	0.18	0.19	0.21	0.05
Prob>F-test PROG=PROC	0.63	0.74	0.88	0.87
p-overid	0.64	0.44	0.66	0.42

ROD stands for Revealed Optimal Diversity. All indices have been multiplied by 100.
Robust t statistics in parentheses.
* significant at 10%; ** significant at 5%;*** significant at 1%.

The results indicate that PROGRESA has a positive and significant effect on variety, measured as the total number of foods consumed and three food diversity indices. PROCAMPO is only significant for the regression of number of foods, while the

interaction term of a dummy for PROGRESA times PROCAMPO transfers is usually significant. Thus, even the poorest of the poor households in Mexico substitute diversity for quantity as their transfer income increases.

The rejection of the hypothesis that the coefficient of the interaction term is equal to zero implies that an additional peso of PROCAMPO has a different impact on diversity depending on whether its recipients receive PROGRESA as well or not. The fact that PROCAMPO cash transfers have a larger impact for both program recipients than for PROCAMPO beneficiaries only, suggests that the information on health and nutrition provided in the *platicas* to female PROGRESA recipients affects, not only the allocation of money controlled by women, but also the way PROCAMPO money, given primarily to men, is spent. One peso of PROCAMPO linked to education increase nutritional diversity more than a peso of PROCAMPO without education. Previous empirical evidence has pointed out that a more diverse diet is associated with higher income. We find that provision of information or education might amplify the effect of transferred money. However, access to information does not bring about differences in the impact of PROCAMPO cash transfers on caloric intake and food consumption, as implied by the non-significance of the interaction term in the consumption and calorie regressions. Therefore, information given to women is likely to have only a limited impact on expenditure decisions of money given to men. However, the results that education is a channel through which increased food diversity is achieved and that information given to women spills over the household and affects the allocation of money controlled by men have very important implications with regards provision of education and gender power balance within the household.

The results related to the total number of foods consumed are noteworthy: a peso of PROGRESA increases diversity by the same amount as a peso of PROCAMPO when PROCAMPO is received alone. On the other hand, a peso of PROCAMPO in households that are recipients of the two programs has a bigger impact than a peso of PROGRESA.

Calories from home production

Finally, we are interested in examining the mechanism through which PROGRESA and PROCAMPO contribute to increased food security, whether it is through home production or through purchases. The following table presents mean values of the shares of calories consumed from home production. On average, 30 percent of all calories consumed come from home produced food. PROCAMPO households are very dependent on home production, in particular for grains. Over 52 percent of all grain calories they consume come from home produced grains. Though not shown in the table, it is noteworthy that most of home production consists of grains, followed by vegetables.

Table 15. Caloric availability from Home Production (shares out of total calories)

PERCENTAGE	ALL	PROG	PROC	BOTH	NONE
Total food	30	27	42	40	25
Vegetables	15	14	16	16	15
Grains and Cereals	39	35	52	51	31
Meat and animal products	10	10	12	12	9
Other food	0	0	0	0	0

Table 16 presents the results of the Heckman selection model estimated for calories from home production. As mentioned in Section 4 we considered that a Heckman selection model was the best strategy to deal with the fact that not all households consume out of home production. The choice to home produce depends basically on ownership of land, cattle, and agriculture machinery. The regression equation includes, as usual, PROCAMPO, PROGRESA, and the demographic controls. The selection equation, on the other hand, includes a dummy for owning land, the number of pieces of land, number of animals for agricultural work (oxen, horses, mules), and agricultural machinery (plumb, tractors, etc.).

Table 16. Calories from Home Production

Heckman selection model

	Level	Share
PROGRESA	0.552*	-0.022
	(1.78)	(1.55)
PROCAMPO	2.859**	0.008
	(3.75)	(0.21)
Prob>chi2 PROG=PROC	0.00	0.44
rho	-0.249**	-0.945**
	(5.25)	(77.65)
p-LR test rho=0	0.00	0.00

Absolute value of z statistics in parentheses
* significant at 10%; ** significant at 5%,*** significant at 1%

The test of independence of the regression and the selection equations is rejected both for the level and for the share models. Therefore, the use of Heckman selection model is appropriate in this case.

Compared to the table for total calories, there are noticeable differences. The coefficient of PROCAMPO is approximately of the same magnitude, while the coefficient of PROGRESA is half as large as the one in the regression for total calories. Furthermore, we strongly reject the hypothesis that the impact of the two programs is the same. These results suggest that PROCAMPO is increasing food security essentially from calories achieved through home production. PROGRESA recipients are not as dependent on home production, and obtain their caloric intake both from purchases from the market and from home production in equal proportions. The condition of continued agriculture production that PROCAMPO payments require makes a difference in the way transfer beneficiaries

spend their money. The possibility of using PROCAMPO as a collateral against which to borrow money might also be making recipients more likely to invest payments in home production, and hence to derive their consumption from this source. No such requirement or possibility for borrowing money makes PROGRESA have a much smaller impact. The observed patterns are very likely to be the result of the relaxation of credit constraints. However, we are not able to tell whether PROCAMPO recipients are allocating financial resources in the most efficient manner; that is, toward the highest return activity in the absence of conditions. Higher reliance of PROCAMPO recipients on own production can also be the result of high transaction costs, lower access to markets, risk aversion or simply higher preference for home produced food.

8. CONCLUSIONS

PROCAMPO and PROGRESA are two cash transfer programs implemented in rural Mexico, with distinct requirements, eligibility criteria, and objectives. While PROGRESA is essentially an anti-poverty program, targeted at women, with the objective of enhancing the development of human capital of children, the explicit objective of PROCAMPO was not to alleviate poverty, but to compensate farmers for the removal of price supports.

This paper examines one aspect of poverty, food insecurity, and explores whether the conditionality and eligibility criteria (gender of the recipient) of these two different cash transfer programs may result in different impacts on food consumption, caloric intake, and nutritional diversity. While both the conditionality of the program and the gender of the recipient may matter in the provision of cash transfers, unfortunately we are unable to differentiate statistically between each of these contributing factors in accounting for our outcomes.

Several conclusions may be drawn from our analysis.

First, both programs boost consumption and caloric intake in similar proportions, despite differences in conditionality and gender of beneficiary. This suggests that a cash transfer program linked to utilization of a productive asset, in this case land, can have as large or larger an impact on food security as an anti-poverty program fostering the purchase of food. This result also suggests that men do not drink away all the money they receive. Conventional wisdom dictates that women should be targeted as the recipients of transfers since women are more likely to spend money on food, education and health. We do not find systematic evidence that PROGRESA, targeted at women, has a higher impact on food security outcomes than PROCAMPO, targeted at farmers, who are mostly men.

Second, by categories of food consumption, differences do emerge. PROCAMPO has a larger impact on meat and other animal products consumption, and on calories derived from fruits and vegetables, while PROGRESA is associated with higher consumption of the other food category.

Third, we find that beneficiaries of both programs prefer variety or diversity and thus shift from foods with high caloric content towards foods with other qualities, reflected by the fact that food expenditure elasticities are higher than calorie elasticities. Most of this substitution takes the form of increased food variety towards more meat and vegetables. Thus, even though households substitute quantity for quality, nutritional status does not appear to suffer.

Fourth, we observe a spill over effect of information inside the household. Both programs have a positive effect on food diversity. However, those PROCAMPO households that also receive PROGRESA, and the information that goes with it, are more likely to be eating a more varied diet than households that get PROCAMPO only. Thus, the *platicas,* where information on nutrition and education is provided to PROGRESA female recipients, represent an important channel through which increased food diversity is achieved. This result has important ramifications for the design of nutrition interventions: information on nutrition and health linked to transfers amplifies the impact of cash on food diversity, and information given to females affects the allocation of income controlled by men, in the form of PROCAMPO transfers.

Fifth, the results indicate that PROCAMPO recipients obtain almost the entire increase of their caloric intake from food consumed out of home production, while PROGRESA recipients are likely to increase food security equally from the market and from home production. This result also has important policy design ramifications; access to retail markets should be an important determinant of the type of nutrition intervention. In the face of high transaction costs and limited access to retail markets, a PROCAMPO-type intervention may be more effective then a PROGRESA- type intervention.

The results thus suggest that the choice of program design depends on objectives beyond total food consumption and caloric intake, such as consumption from specific food categories, food diversity, the relative importance of investment in productive capacity, and the degree of access to retail food markets.

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APPENDIX I. CREATING THE TRANSFER VARIABLES

PROGRESA Intent to Treat

PROGRESA is paid to all poor households in treatment communities. ITT is composed of a monthly contribution for every child enrolled in school, plus a fixed monthly payment. This part of the transfer is subject to a cap of 695 pesos per month. In addition, a contribution for school materials is granted once a year. Assuming no delayed enrollment, PROGRESA benefits begin at third grade, roughly at age 8. In principle, these benefits should stop at age 15, at the third year of secondary school, but the PROGRESA age-cap is 18, so the benefits granted to the third grade of secondary school are attributed to all the children aged 15 to 18. Benefits vary by age and gender of the child, from 60 to 225 pesos per month. In addition, 115 pesos per month are paid to all beneficiaries as the fixed payment. The yearly contribution for school materials amounts to 135 pesos for primary school and to 170 pesos for secondary. PROGRESA ITT is thus calculated according to the following equation:

ITT (November 1997 pesos) = min{695, [*(m8+f8)*60 * (m9+f9)*70 + (m10+f10)*90 + (m11+f11)*120 + (m12+m13)*175 + (f12+f13)*185 + (m14+m15)*185 + (f14+f15)*205 + (m16+m17+m18)*195 + (f16+f17+f18)*225 + 115*]} + (m8+m8+m10+m11+f8+f9+f10+f11)*(135/12) + (m12+m13+m14+m15+m16+m17+m18+f12+f13+f14+f15+f16+f17+f18)*(170/12)

where m*i* is a dummy for the presence of a male child aged *i*, enrolled in school, and f*i* is the equivalent for a female.

APPENDIX II: COMPLETED REGRESSION RESULTS AND ELASTICITIES

VARIABLES

VARIABLE NAME	DESCRIPTION
progpcIT	PROGRESA
procpc8o	PROCAMPO
lhhsiz97	household size
jefage97	age head
jefeM97	head is male
jefind97	head speaks ind language
shr_kid02_97	share kids 0-2
shr_kid34_97	share kids 3-4
shr_kd510_97	share kids 5-10
shr_m1114_97	share males 11-14
shr_f1114_97	share females 11-14
shr_m1519_97	share males 15-19
shr_f1519_97	share females 15-19
shr_m2034_97	share males 20-34
shr_f2034_97	share females 20-34
shr_f3559_97	share females 35-59
shr_m60p_97	share males 60+
shr_f60p_97	share females 60+
shr_ed_nonem	males no education
shr_ed_nonef	females no education
shr_ed_littm	litterated males
shr_ed_littf	litterated females
shr_ed_primm	males primary education
shr_ed_primf	females primary education
shr_ed_secum	males secondary education
shr_ed_secuf	females secondary education
shr_ed_highm	males high education
shr_ed_highf	females high education
shr_agwg97	density agr wages
shr_nagw97	density non-agr wages
drtpis97	house has dirt floor
aguav97	house has pipes
elect97	house has electricity
s_irln97	irrigated land
s_niln97	rainfed land
s_ganl97	pasture land
s_frsl97	forestry land
n_vaca97	cows owned
n_pigs97	pigs owned
pr_index	price index
f98oepc	food consumption per person
tot_cdm	calories per day per person

Table A1. Total food consumption

Regression with robust standard errors — Number of obs = 9406; F(45, 502) = 33.90; Prob > F = 0.0000; R-squared = 0.2524; Number of clusters (numloc) = 503; Root MSE = 73.869

f98oepc	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
progpcIT	.3065557	.0866099	3.54	0.000	.1363932	.4767183
procpc8o	.3322365	.1038721	3.20	0.001	.128159	.5363141
_Iregion_4	.1172433	5.614662	0.02	0.983	-10.91389	11.14837
_Iregion_5	-7.960368	4.57925	-1.74	0.083	-16.95722	1.036487
_Iregion_6	-23.73451	6.671936	-3.56	0.000	-36.84287	-10.62615
_Iregion_12	5.429278	6.823527	0.80	0.427	-7.976911	18.83547
_Iregion_27	3.282443	4.356012	0.75	0.451	-5.275816	11.8407
_Iregion_28	-13.44071	7.243939	-1.86	0.064	-27.67288	.7914611
lhhsiz97	-63.80777	4.046001	-15.77	0.000	-71.75696	-55.85859
jefage97	.1185542	.115041	1.03	0.303	-.1074669	.3445753
jefeM97	2.878877	4.535829	0.63	0.526	-6.03267	11.79042
jefind97	-13.46037	3.054045	-4.41	0.000	-19.46065	-7.460086
shr_kid02_97	105.1629	18.04692	5.83	0.000	69.7061	140.6197
shr_kid34_97	59.11029	17.23308	3.43	0.001	25.25245	92.96813
shr_kd510_97	27.27682	15.96487	1.71	0.088	-4.089375	58.64302
shr_m1114_97	-30.26344	15.54104	-1.95	0.052	-60.79694	.2700575
shr_f1114_97	7.869719	18.96749	0.41	0.678	-29.39572	45.13516
shr_m1519_97	-22.71413	13.52905	-1.68	0.094	-49.29466	3.866394
shr_f1519_97	36.88523	20.1542	1.83	0.068	-2.711751	76.48221
shr_m2034_97	-20.7207	11.31199	-1.83	0.068	-42.94537	1.50397
shr_f2034_97	54.59172	19.71783	2.77	0.006	15.85209	93.33135
shr_f3559_97	57.04617	23.6009	2.42	0.016	10.67746	103.4149
shr_m60p_97	9.606027	14.88266	0.65	0.519	-19.63395	38.846
shr_f60p_97	43.15223	22.56089	1.91	0.056	-1.173161	87.47762
shr_ed_littm	15.38527	9.510803	1.62	0.106	-3.300609	34.07116
shr_ed_primm	5.721231	9.916117	0.58	0.564	-13.76097	25.20343
shr_ed_secum	-7.50654	14.07631	-0.53	0.594	-35.16228	20.1492
shr_ed_highm	65.94397	44.02878	1.50	0.135	-20.55941	152.4474
shr_ed_nonef	-6.056945	7.825213	-0.77	0.439	-21.43115	9.317257
shr_ed_littf	-16.77416	8.013987	-2.09	0.037	-32.51924	-1.029071
shr_ed_primf	-22.60027	10.7922	-2.09	0.037	-43.80372	-1.396817
shr_ed_secuf	5.384365	26.08493	0.21	0.837	-45.86471	56.63344
shr_ed_highf	-6.163658	45.44513	-0.14	0.892	-95.44973	83.12242
s_irln97pc	5.370812	4.100586	1.31	0.191	-2.685612	13.42724
s_niln97pc	.8156323	2.112118	0.39	0.700	-3.334047	4.965312
s_ganl97pc	-5.931139	3.937978	-1.51	0.133	-13.66809	1.80581
s_frsl97pc	5.026661	6.231472	0.81	0.420	-7.216316	17.26964
drtpis97	-9.973737	2.107024	-4.73	0.000	-14.11341	-5.834065
aguav97	-1.767052	3.805813	-0.46	0.643	-9.244336	5.710231
elect97	-8.127812	2.668796	-3.05	0.002	-13.3712	-2.884427
n_vacapc	6.375223	2.190271	2.91	0.004	2.071996	10.67845
n_pigspc	.0358571	3.074194	0.01	0.991	-6.004013	6.075728
shr_agwg97	-6.286586	7.876842	-0.80	0.425	-21.76222	9.18905
shr_nagw97	-5.977367	10.66891	-0.56	0.576	-26.93859	14.98385
pr_index	3.159292	.5502242	5.74	0.000	2.078266	4.240318
_cons	191.3931	16.87891	11.34	0.000	158.2311	224.5551

Table A2. Total caloric availability

```
Regression with robust standard errors                Number of obs =    9404
                                                      F( 45,   502) =   17.13
                                                      Prob > F      =  0.0000
                                                      R-squared     =  0.1237
Number of clusters (numloc) = 503                     Root MSE      =  859.53

------------------------------------------------------------------------------
             |               Robust
     tot_cdm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    progpcIT |   1.054204   .5568677     1.89   0.059    -.0398748    2.148282
    procpc8o |   2.801995   1.729827     1.62   0.106    -.5965965    6.200587
  _Iregion_4 |  -6.069609    73.7319    -0.08   0.934    -150.9307    138.7915
  _Iregion_5 |  -93.11085   70.34146    -1.32   0.186    -231.3108    45.08907
  _Iregion_6 |  -511.4193   79.60186    -6.42   0.000    -667.8131   -355.0255
 _Iregion_12 |    91.5003   123.3537     0.74   0.459    -150.8529    333.8535
 _Iregion_27 |  -301.2274    68.5995    -4.39   0.000    -436.0049   -166.4499
 _Iregion_28 |  -246.1252   130.2568    -1.89   0.059    -502.0409    9.790427
    lhhsiz97 |  -401.4573   38.75563   -10.36   0.000    -477.6005    -325.314
    jefage97 |   .8476921   1.119802     0.76   0.449    -1.352383    3.047767
     jefeM97 |   55.07448   42.89301     1.28   0.200    -29.19744    139.3464
    jefind97 |  -179.5419   41.43744    -4.33   0.000    -260.9541   -98.12975
shr_kid02_97 |  -453.7173   182.4905    -2.49   0.013    -812.2565   -95.17802
shr_kid34_97 |  -645.0174   183.6654    -3.51   0.000    -1005.865   -284.1698
shr_kd510_97 |  -404.3113   166.0732    -2.43   0.015    -730.5955   -78.02712
shr_m1114_97 |  -164.1687   185.8092    -0.88   0.377    -529.2282    200.8909
shr_f1114_97 |  -372.0392   219.3684    -1.70   0.091    -803.0325    58.95414
shr_m1519_97 |   180.2201   157.5146     1.14   0.253    -129.2489    489.6892
shr_f1519_97 |   110.7342    235.357     0.47   0.638    -351.6719    573.1404
shr_m2034_97 |   37.44589   136.3993     0.27   0.784    -230.5379    305.4297
shr_f2034_97 |   56.61235   226.2019     0.25   0.802    -387.8066    501.0313
shr_f3559_97 |   113.7329    217.965     0.52   0.602    -314.5032    541.9689
 shr_m60p_97 |  -97.83624   134.1072    -0.73   0.466    -361.3168    165.6443
 shr_f60p_97 |  -281.6584   212.6752    -1.32   0.186    -699.5016    136.1847
shr_ed_littm |   85.07994   78.18344     1.09   0.277    -68.52711     238.687
shr_ed_primm |  -118.4172   119.7575    -0.99   0.323    -353.7048    116.8704
shr_ed_secum |  -542.7852   188.4952    -2.88   0.004    -913.1219   -172.4486
shr_ed_highm |  -493.0342   340.3945    -1.45   0.148    -1161.808    175.7391
shr_ed_nonef |  -3.017337    73.5358    -0.04   0.967    -147.4932    141.4585
shr_ed_littf |  -135.5773   88.76586    -1.53   0.127    -309.9757    38.82101
shr_ed_primf |  -230.6094   125.1394    -1.84   0.066    -476.4708    15.25199
shr_ed_secuf |  -498.1408    205.792    -2.42   0.016    -902.4605    -93.8211
shr_ed_highf |  -274.3636   496.0908    -0.55   0.580    -1249.034    700.3064
  s_irln97pc |   127.8798   68.43611     1.87   0.062    -6.576634    262.3363
  s_niln97pc |  -3.388935   17.71674    -0.19   0.848    -38.19703    31.41916
  s_ganl97pc |  -79.24024   46.47348    -1.71   0.089    -170.5467    12.06624
  s_frsl97pc |   93.25521   122.2443     0.76   0.446    -146.9182    333.4287
    drtpis97 |  -62.10234    29.4282    -2.11   0.035    -119.9199    -4.28474
     aguav97 |   89.25619    53.0356     1.68   0.093    -14.94289    193.4553
       _cons |   3349.844   195.3478    17.15   0.000     2966.044    3733.64
```

While the most important focus of this analysis is on the effects of PROCAMPO and PROGRESA on food security, it is also interesting to examine the estimated impacts of the other variables in the regression equations. In Appendix II we summarize the general regression results using as illustration the results for food consumption and total calories. The regression coefficients of the other variables in the model also provide considerable insight into the dynamics of the household consumption decisions and address issues of intra-household resource allocation. The demographic variables provide interesting information in and of themselves. Household size leads to a reduction in both per capita

food consumption and caloric intake. We find that the presence of children in the household increase food expenditure but decreases calorie consumption per adult equivalent units. The magnitude of this effect is particularly large for children under the age of five years old. A bit surprising is the fact that the share of adult men in different age categories and primary female education is negatively associated with food consumption. The presence of a dirt floor, a clear sign of asset poverty, is associated with lower food consumption and caloric intake. Ownership of livestock and land is in general associated with higher food consumption and caloric intake. As showed in the tables, there is regional variation, with some regions (Sierra Gorda, Montaña, Altiplano) having lower consumption than others (Sierra Norte-Otomí-Tepehua and Tierra Caliente).

Table A3. Food and calorie elasticities

Food consumption

	All Food	Vegetables	Grains	Meat	Other Food
PROGRESA	0.021***	0.046***	0.013**	0.056***	0.015**
	(4.23)	(4.80)	(2.12)	(4.86)	(2.29)
PROCAMPO	0.019***	0.039***	0.011*	0.052***	0.013*
	(3.59)	(4.18)	(1.72)	(4.36)	(1.79)
R-squared	0.34	0.25	0.16	0.30	0.31
Prob>F-test PROG=PROC	0.76	0.53	0.75	0.83	0.81

Caloric availability

	All Food	Vegetables	Grains	Meat	Other Food
PROGRESA	0.011**	0.064***	0.010*	0.060***	0.023***
	(2.45)	(5.17)	(1.79)	(3.83)	(2.62)
PROCAMPO	0.013***	0.045***	0.015**	0.049***	0.015
	(2.60)	(3.80)	(2.39)	(3.10)	(1.59)
R-squared	0.14	0.20	0.10	0.22	0.17
Prob>F-test PROG=PROC	0.84	0.24	0.61	0.61	0.56

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%;*** significant at 1%