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(**) Federico Tagliati: Banco de España, DG Economics, Statistics and Research, Calle Alcalá 48, 28014 Madrid, Spain. Email address: federico.tagliati@bde.es.

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Abstract

This paper shows how a theory-consistent demand system can be used to quantify recipient welfare under in-kind and cash transfers. Since welfare under an in-kind subsidy depends on the extent to which the transfer is extra-marginal, I compute the shadow prices at which a recipient would be as well off as with the in-kind transfer. Shadow prices are then used to compute the distribution of the willingness to pay for in-kind benefits among beneficiaries. As an application of this approach, I study the welfare effects of a governmental program which randomly transferred either a food basket or cash to poor households in rural Mexico. Results suggest that on average a recipient values the in-kind transfer at 80 percent of its face value. Despite the welfare loss, the in-kind transfer is more cost-efficient than cash. This is due to the fact that the food basket was significantly more expensive at the retail level than at the procurement level, which implies that a cash transfer of the same cost to the government could only buy a fraction of the food basket in recipient's local markets. Because the food basket is mainly formed of normal goods, I also find that the willingness to pay is larger among recipients at the top of the income distribution, suggesting a regressive effect of the in-kind transfer.

Keywords: in-kind transfers, cash transfers, demand system, welfare.

JEL classification: D61, H23, H43, I38, 022.

Resumen

Este artículo muestra cómo modelos de demanda pueden utilizarse para cuantificar los efectos de transferencias en especie y en efectivo sobre el bienestar de los beneficiarios. La metodología propuesta se basa en calcular los «precios virtuales» que garantizarían el mismo nivel de bienestar que una transferencia en especie y a partir de los cuales es posible construir la distribución de la propensión al pago por la transferencia entre los beneficiarios. Como ejemplo de dicha metodología, el artículo estudia un programa que transfirió, de manera aleatoria, transferencias en especie o en efectivo a hogares en pueblos rurales de México. Los resultados sugieren que la propensión al pago de los beneficiarios por la transferencia en especie es cercana al 80 % de su valor de mercado. A pesar de dicha distorsión, la transferencia en especie resulta más eficiente que una transferencia en efectivo de igual coste. Esto se debe a una diferencia significativa entre el coste al por mayor de la transferencia y su coste al por menor, lo cual sugiere que una transferencia en efectivo de igual coste solo sería suficiente para comprar una parte de la transferencia en especie. Además, el artículo muestra que transferencias en especie pueden tener efectos regresivos, ya que la propensión al pago resulta mayor entre hogares con rentas más elevadas.

Palabras clave: transferencias en especie, transferencias en efectivo, modelos de demanda, economía del bienestar.

Códigos JEL: D61, H23, H43, I38, 022.

1 Introduction

More than 1.5 billion people in the developing world are recipients of social protection programs whose benefits are delivered either in-kind or in-cash (Honorati et al., 2015). Yet few empirical tools exist which are able to quantify the welfare implications of one transfer scheme against another. Because in-kind transfers are not fungible, they are typically associated with potential welfare losses as compared to cash-equivalent transfers. Moreover, they usually have larger administrative costs as compared to cash (Hidrobo et al., 2014). Despite this criticism, in markets that are not well-integrated in-kind transfers might be more cost-efficient than cash. If the economies of scale from procuring goods in wholesale markets are large enough to compensate for the additional distribution costs, the recipient's welfare gains under a transfer in-kind might surprisingly be larger than under a cash transfer of the same cost.[1] Therefore, determining which policy generates the largest welfare gains at a given cost to the policy maker requires an empirical model which is able to quantify how much an in-kind transfer is actually worth to a recipient.

This paper proposes a novel approach to compute the welfare effects of in-kind transfers, and to assess their relative efficiency with respect to cash transfers. Welfare analysis in the presence of an in-kind subsidy is not straightforward for several reasons. First, recipients might substitute goods that they usually consume with the subsidized goods. Therefore, accounting for the substitution possibilities requires estimating a demand system for both subsidized and non-subsidized goods. Second, the welfare effects depend on whether the in-kind transfer is infra-marginal or extra-marginal for a given recipient. For recipients that would reduce their purchases one-to-one with the subsidized goods (i.e., if the in-kind transfer is infra-marginal), welfare would coincide with that of an equal-value cash transfer. Instead, an extra-marginal in-kind transfer increases recipient's consumption of the subsidized goods

[1] Margolies and Hoddinott (2015) compare the costs of two recent programs which delivered food or cash assistance to targeted households in Ecuador and Yemen. They found that, in Yemen, the cost of procuring a food basket worth US$ 49 at local market prices was approximately US$ 39. As a result, the per-transfer cost of food was lower than the per-transfer cost of cash, even when accounting for the larger logistic and distribution costs of the food aid. While this was not true for the program in Ecuador, large differences in the procurement and retail prices of food have been documented in Kenya (ACF, 2012) and in the Gaza Strip (Creti, 2011).

by more than a cash-equivalent transfer. However, this “distortionary effect” on the budget allocation of the recipient can not be directly ascribed to observed changes to income or prices within a demand system.

To overcome this issue, I use an estimated demand system to compute the virtual prices of the subsidized goods at which a consumer would be as well off as he would be with the in-kind transfer. Virtual prices are then used to construct a money metric utility measure.[2] Given variation in recipient’s income, demographic characteristics and in the relative prices, virtual prices can be computed at the individual level, which allows to construct the distribution of the welfare effects within the population of recipients.

As an application of the proposed approach, I study the *Programa de Apoyo Alimentario* (PAL), a governmental program providing monthly baskets of food to poor households in rural Mexico. The basket subsidized by the government includes both common staples within the Mexican diet (e.g., rice, beans) and other less frequently consumed foodstuffs (e.g., breakfast cereals, canned fish). As a result of transferring some commodities that beneficiaries do not usually consume - a choice which stems essentially from paternalistic motives - the transfer might thus imply large welfare losses among program beneficiaries.

There are several reasons which make the PAL program a particularly suitable setting to assess the efficiency of in-kind transfers relative to cash transfers. First, pre and post intervention surveys (among approximately $5,400$ households in 200 villages) collected extensive data about household consumption and expenditure for a large variety of food commodities, including those transferred in-kind. In addition, information about the prices of these commodities were obtained through surveys of local shops.

Second, the evaluation of the program relies on an experimental trial in which eligible villages were randomly assigned to an in-kind treatment arm, to a cash treatment arm, or to a control group. The experimental design of the program allows me to conduct powerful tests of the model’s validity. In particular, after estimating a quadratic almost ideal demand system (QUAIDS, Banks et al., 1997) on a sample

[2] Virtual prices were first developed by Neary and Roberts (1980) in the context of rationing constraints.

of baseline households only, I show that the model can replicate extremely well the observed changes in the consumption patterns of households receiving the cash transfer program.

Third, in the context of PAL there is a substantial difference in the costs of the two transfer schemes, which makes the determination of the most efficient transfer modality a non trivial exercise. The value of the cash transfer was set so to equalize the purchasing cost of the food basket in wholesale markets. However, price data reveal that the food basket was approximately 37 percent more expensive at the local level, which implies that the face value of the in-kind transfer was larger than the value of the cash transfer. In addition, the administrative costs of the two transfer modalities have been documented by previous evaluations of the PAL program (Ventura-Alfaro et al., 2011). Although, not surprisingly, these were larger for the in-kind subsidy, the total cost per-dollar of the in-kind transfer is lower than the total cost per-dollar of cash. Therefore, which policy generates the larger welfare gains at a given cost to the government depends on the size of the welfare loss of the transfer in-kind relative to the difference in the costs of the two transfer modalities.

Results suggest that the efficiency loss of the in-kind transfer was relatively large: on average, recipients valued the transfer at approximately 80 percent of its face value. However, for most recipients the magnitude of the welfare loss is not large enough to outweigh the difference in the face value of the in-kind versus the cash transfer. As a result, approximately 65 percent of targeted households would prefer the in-kind transfer to the cash transfer. The welfare analysis also suggests the existence of substantial heterogeneity in the welfare effects, which reflects both variation in the prices of the food basket across villages and different characteristics of the recipients. Another important result of this paper is the fact that the transfer in-kind is found to be regressive: the willingness to pay for the in-kind transfer is larger among households at the top of the income distribution. Intuitively, an in-kind transfer benefits proportionally more those recipients with higher consumption levels of the subsidized goods. Since estimated price elasticities for PAL commodities suggest that these are on average normal goods, the welfare gains of the in-kind subsidy are larger among relatively better-off recipients.

The estimated model of demand can also be used to study how household welfare changes under different assumptions about the general equilibrium effects of the program. In a recent paper, Cunha et al. (2018) provide evidence that the PAL program, by increasing the supply of the subsidized goods, caused a modest but significant reduction in the local prices of PAL goods. When I simulate a change in the price of the subsidized commodities which is in line with the estimated price effect in their paper, I find that consumer's welfare increases as compared to a scenario with constant prices. This is consistent with the fact that households pay lower prices for out-of-pocket purchases of the subsidized goods. However, price changes might imply redistribution from producers to consumers. Given the lack of data on the supply side of the market, this paper only provides a partial equilibrium analysis by quantifying the effects on consumer's welfare.

This paper is mainly related to a large literature studying the effects of in-kind versus cash transfer programs, to which it contributes in several ways. First, I develop a flexible procedure to quantify the welfare effects of an in-kind subsidy program. Other studies in the literature focused on the estimation of the cash-equivalent value of the well-known Food Stamp Program in the US by exploiting a cash-out policy of the program (Moffit, 1989; Whitmore, 2002).[3]From a methodological point of view, the closest study to this paper is Schwab (1985), who used virtual prices in order to compute the value of a housing benefit program. In his paper, Schwab (1985) provides an application in which only one good (housing) is subsidized in-kind. Moreover, he made the restrictive assumption that the demand of the non-subsidized goods is of the constant elasticity form, which allows to estimate the demand of housing only. My work generalizes this approach by using state of the art techniques in the estimation of demand systems in order to model the demand of multiple subsidized goods as well as the demand of non-subsidized goods. This is particularly important in many settings, such as the application presented here in which modeling the demand of food requires taking into account the substitutability between subsidized and non-subsidized foods.

[3]Moffit (1989) estimated a piecewise-linear constraint model, finding that the food stamps were equivalent to cash, mostly because the majority of beneficiaries were infra-marginal and partly because of potential trafficking of the vouchers. Whitmore (2002) developed a theoretical model which she used to estimate the distorting effect of the voucher. Her findings suggest that the beneficiaries valued the vouchers at approximately 80 percent of their face value.

Second, to my knowledge this is the first paper to structurally estimate the welfare effects of a food assistance programs in a developing country. The findings from the above mentioned studies which estimated the value of the Food Stamp program might not be generalized to developing countries since food stamps - which give recipients freedom on how to spend the voucher on many different foodstuffs - are less restrictive than many food assistance programs in developing countries, which typically entail the direct provision of food. Moreover, food represents a much larger fraction of the budget of the poor in developing countries than it is for the poor in developed countries. Finally, as food voucher programs are typically spent by recipients at the retail level, they can not be used by policy makers to take advantage of lower prices at the wholesale level. For all these reasons, the size and even the direction of the welfare effects of food transfer programs in the developing world might not be comparable to those of existing studies in the literature.

Third, I focus on the heterogeneity of the welfare effects across recipients, documenting a regressive effect of the in-kind transfer. This is a relevant result for the policy debate, as it suggests that food transfers might not be well-targeted, especially in a context in which most of the population is poor and take-up of the program is high.

One additional contribution of this paper is to study one channel that could justify the use of in-kind transfers over cash transfers, namely the existence of differences between the procurement and the retail prices of the subsidized commodities. This is of considerable importance as it has efficiency implications, but it has received relatively little attention in the literature. Among the other justifications for the provision of in-kind transfers instead of cash, the most cited reason is paternalism: a paternalistic donor usually wants to induce higher consumption of some merit goods, either because there are externalities from the consumption of these goods (Garfinkel, 1973) or because it believes that recipients might spend cash on non-desirable goods, such as alcohol or tobacco. In-kind transfers might also be used as a screening device to induce the non-poor to self-select out of a transfer scheme (Nichols and Zeckhauser, 1982; Blackorby and Donaldson, 1988; Gahvari and Mattos, 2007). Implicit in this argument is the idea that in-kind transfers are not as appealing to the rich as cash, either because of the low-quality of the in-kind bundle or because of stigma effects (Moffit, 1983). Other suggested reasons in favor of the provision of in-kind transfers point to lower adverse effects on labor supply, as compared to cash transfers (Fraker and Moffit, 1988; Hoynes and Schanzenbach, 2012); or to the possibility of lowering the price of some target good by increasing its supply, potentially achieving redistribution from producers to consumers (Coate et al., 1994; Cunha et al., 2018).[4]

In the context of the PAL program, the most rigorous evaluation has been conducted by Cunha (2014). The focus of his paper is to test the paternalistic justification of the program and, to this aim, he exploits the randomized design of the program to compare the consumption patterns and health outcomes of in-kind and cash recipients. While the reduced form estimates in Cunha (2014) provide evidence that the in-kind transfer shifted household budget composition towards the subsidized goods, quantifying the size of the implied welfare loss of the transfer requires the structural estimation of a model of demand. This paper addresses this gap and proposes a flexible tool to compute the differential effects of these two policies on the welfare of the recipients. It is worth noting that the main conclusions of the paper by Cunha (2014) are also instrumental to the analysis presented here. As the author does not find substantial differences in the health of cash and in-kind recipients - another dimension of interest to policy makers when choosing among different transfer modalities, this paper focuses only on the comparison of the welfare implications of these two policies.

The rest of the paper is organized as follows. Section 2 presents a theoretical framework for household choice under cash and in-kind transfers, and a formal definition of virtual prices in the context of an in-kind transfer program. Section 3 describes the PAL program and the data. Section 4 presents the demand system and discusses the estimation strategy. Section 5 describes the procedure used to quantify the welfare effects of a a transfer in-kind. Section 6 reports results from the estimation of the demand system, while Section 7 shows results from the welfare analysis. Section 8 concludes.

[4] See Currie and Gahvari (2008) for a review of the literature.

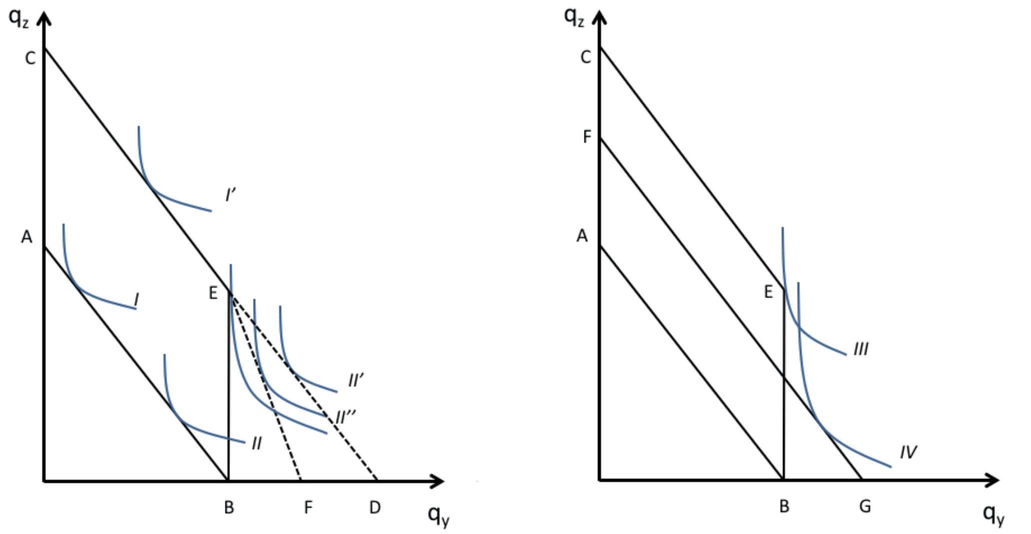
2 Theoretical framework

2.1 Choice under cash and in-kind transfers

Suppose that a consumer has preferences over two goods, y and z, whose prices are respectively p_y and p_z . A government can either provide an in-kind subsidy $\overline{q}_z$, for which it pays a procurement price $\bar{p}_z$, or provide an equal-cost cash transfer, $\bar{x} = \bar{p}_z\bar{q}_z$. Figure 1 shows the traditional theory of choice under cash and in-kind transfers in two different scenarios. In both cases, the pre-transfer budget set is given by AB.

In the first scenario, depicted in Figure 1a, the price paid by the consumer to buy good z coincides with the procurement price $\bar{p}_z$ paid by the government. In this case, the face value of the in-kind transfer is equal to the value of the cash transfer. The transfer in-kind shifts the budget set to CEB, if no resale is possible; or to CEF, if the resale price is lower than the market price. The budget set under the cash transfer is given by CD. The indifference curves in Figure 1a show the preferences of two types of consumers. Consumer I would move from I to I' under both transfers, consuming more of the subsidized good than what is provided in-kind by the government. In other words, the in-kind transfer is infra-marginal for consumer I. On the contrary, the in-kind transfer is clearly extra-marginal for consumer II: while the consumer would move to II' under a cash transfer, consuming less than $\overline{q}_z$, with an in-kind transfer he would move to the kink point E (if resale is not possible) or to II'' (if resale is possible but costly). This implies that a consumer always (weakly) prefers an equal-value cash transfer over an in-kind transfer.

It is important to remark that the extra-marginality of the in-kind transfer is defined over the counterfactual consumption of the subsidized good under an equal-value cash transfer, rather than over the pre-transfer consumption. Even though the household pre-transfer consumption of the subsidized good might be strictly lower than $\overline{z}$, if the income elasticity of the good is sufficiently large the consumer might consume a quantity $q_z \geq \overline{q}_z$ after receiving an equal-value cash transfer. As I will explain in Section 5, this distinction is important since it motivates the procedure that I use to compute the welfare effects of a transfer in-kind.



(a) $\bar{p}_z = p_z$ (b) $\bar{p}_z < p_z$

Figure 1: Choice under cash and in-kind transfers

In the second scenario, depicted in Figure 1b, the price paid by the consumer is larger than the procurement price paid by the government, i.e. $p_z > \bar{p}_z$. In such a case, the in-kind transfer is worth more at face value than the cash transfer, i.e. $\bar{x} < \bar{p}_z \bar{q}_z$. The in-kind transfer still shifts the budget constraint to CEB (assuming no reselling of the subsidized good), while the cash transfer shifts it to FG. As it is apparent from Figure 1b, in this case there is no dominant transfer: a consumer with indifference curves denoted with III is better off with the in-kind transfer, while consumer IV prefers the cash transfer over the in-kind subsidy.

2.2 Virtual price for the subsidized goods

In this section, I extend the two-goods economy presented above to an economy with multiple goods and show how virtual prices can be used to compute consumer's welfare under an in-kind transfer.[5] Let q_z be the vector of goods subsidized in-kind by a government and q_y be the vector of goods that the consumer can only buy in the market. Denote with p_y and p_z the vector of prices associated

[5]This section is largely based on Neary and Roberts (1980)'s and Deaton (1981)'s original works about the theory of choice under rationing. A similar framework also appears in Schwab (1985).

with y and z, respectively, and with x the pre-transfer income of the consumer. I assume that the consumer has a well-defined preference ordering over (q_y, q_z), which can be represented by a strictly quasi-concave, differentiable and increasing utility function $u(q_y, q_z)$.

Without an in-kind transfer scheme, the "unrestricted" optimization problem of the consumer amounts to minimize the expenditure on q_y and q_z for a given utility level u,

$$e(p_y, p_z, u) = \min_{q_y, q_z} \left\{ p_y q_y + p_z q_z : u(q_y, q_z) \geq u \right\}. \tag{1}$$

The solution to problem (1) gives the compensated "unrestricted" demands $q_y(p_y, p_z, u)$ and $q_z(p_y, p_z, u)$.

Consider now a transfer scheme in which the government subsidizes a fixed quantity $\bar{q}_z$. As discussed in Section 2.1, a consumer for which the subsidy is infra-marginal optimally consumes $\bar{q}_z$ and possibly complements the subsidy with additional purchases of good z in the market. Denoting with $\bar{u}$ the maximum utility attainable under an infra-marginal in-kind transfer, we must have $e(p_y, p_z, \bar{u}) = x + p_z \bar{q}_z$. In other words, the income necessary to reach the utility level $\bar{u}$ is equal to the pre-transfer income of the consumer plus the market value of the in-kind transfer.

A consumer for which the transfer is extra-marginal would instead consume $q_z = \bar{q}_z$ and allocate his income to buy q_y. In other words, the "restricted" expenditure minimization problem is given by

$$\widetilde{e}(p_y, \overline{q}_z, u) = \min_{q_y} \left\{ p_y q_y : u(q_y, \overline{q}_z) \geq u \right\}. \tag{2}$$

Let $\widetilde{q}_y = \widetilde{q}_y(p_y, \overline{q}_z, u)$ be the compensated "restricted" demand which solves (2) and let u^* be the highest utility attainable by this extra-marginal consumer. The virtual price p_z^* is defined as the price equalizing the solutions of problems (1) and (2). In other words, the virtual price p_z^* solves

$$\begin{aligned} \overline{q}_z &= q_z(p_y, p_z^*, u^*) \\ \widetilde{q}_y(p_y, \overline{q}_z, u^*) &= q_y(p_y, p_z^*, u^*). \end{aligned} \tag{3}$$

Given convexity and strict monotonicity of preferences, such a price always exists (Neary and Roberts, 1980). In addition, strict quasi-concavity of the utility function guarantees its uniqueness (Deaton, 1981). The virtual price can be used to find how the restricted and unrestricted expenditure functions are related. We can write

$$\begin{aligned} e(p_y, p_z^*, u^*) &= p_y q_y(p_y, p_z^*, u^*) + p_z^* q_z(p_y, p_z^*, u^*) \\ &= p_y \widetilde{q}_y(p_y, \overline{q}_z, u^*) + p_z^* \bar{q}_z \\ &= \widetilde{e}(p_y, \overline{q}_z, u^*) + p_z^* \bar{q}_z \end{aligned}$$

where, in the second line, I have used equations (3) and the last line follows from the definition of the constrained expenditure function in (2). In order to write the above expression in a more compact way, I define $x^* \equiv e(p_y, p_z^*, u^*)$ and use the fact that $\widetilde{e}(p_y, \overline{q}_z, u^*) = x$. This implies that

$$x^* = x + p_z^* \bar{q}_z. \tag{4}$$

Equation (4) has a nice interpretation. It says that the income necessary to reach the utility level u^* for an "unrestricted" consumer given the price vectors p_y and p_z^* is equal to its pre-transfer income plus the in-kind transfer valued at the virtual price p_z^*. The term $p_z^* \bar{q}_z$ can thus be interpreted as the "virtual value" of the in-kind transfer. Note that since the consumer would not have consumed $q_z = \bar{q}_z$ if he was given an equal-value cash transfer, the value that he attaches to the transfer is indeed lower than its market value, i.e. $p_z^* \bar{q}_z < p_z \bar{q}_z$.

In the application that I will present in Section 5, equations (3) and (4) are used to compute the virtual prices of the subsidized goods. These equations ensure that the utility attained by an unrestricted consumer given the price vectors p_y and p_z^* and income x^* is the same utility of a consumer receiving an extra-marginal in-kind transfer $\bar{q}_z$. As a result, the consumer's utility from receiving the in-kind transfer can be computed from an unrestricted indirect utility function evaluated at x^*, p_y and p_z^*.

3 The PAL program and the data

3.1 Description of the PAL program and experiment

The *Programa de Apoyo Alimentario* (PAL) is an in-kind social assistance program providing food baskets to poor households in rural villages of Mexico. Villages are considered eligible if they have a population of less than 2,500 inhabitants, are highly marginalized (according to the Census classification) and are not beneficiaries of the other two major Mexican welfare programs, Liconsa and Oportunidades.[6]Another necessary condition for eligibility requires the village to be accessible and close enough to a store managed by DICONSA, the governmental agency in charge of administering the program and responsible for the distribution and supply of the food baskets.[7]Within eligible villages, households scoring below a means-test poverty threshold were offered the program.

The PAL program started to be phased-in at the end of 2003. Concurrent with its nationwide implementation, 206 villages were randomly selected among the universe of eligible villages to participate in an experimental trial. Each village was randomly assigned into one of three treatment groups: (i) 103 villages received an in-kind transfer; (ii) 53 villages received a cash transfer; (iii) 50 villages were assigned to a control group that received nothing.

Villages in the in-kind treatment group received a monthly allotment of ten commodities, which are reported in Table 1. Along with goods that are very common in the Mexican diet (rice, beans, vegetable oil), the basket also includes several commodities that are consumed less frequently (pasta soup, cookies) or very rarely (cereals box, corn flour, lentils, canned fish, powdered milk). However, the fact that a large fraction of the PAL basket is constituted by goods that households do not usually consume might imply large welfare losses for recipients. To get a sense of the extent of the extra-marginality of the transfer, the first and second columns of

[6]Liconsa is a subsidized milk program. Oportunidades (previously known as PROGRESA) is a conditional cash transfer program. PAL villages were not included in Oportunidades because they did not have close enough health facilities and/or schools to comply with the conditional requirements of the program.

[7]Accessibility is defined as the village being within 2.5 km from a road. Similarly, a village is considered to be close to a DICONSA store if it within 2.5 km from it.

Table 1 show respectively the monthly allotment of each good and the percentage of households in the cash treatment arm whose post-transfer consumption is less than the subsidized quantity.[8] For five out of ten goods, more than 75 percent of cash recipients consumed less than the subsidized quantity.

The rationale for choosing such a basket was to improve the nutritional status of recipients by encouraging a more diversified diet. However, previous evaluations of the program have not found significant improvements in the health outcomes of in-kind and cash recipients (Cunha, 2014). This is important in that, in the absence of a health externality which could support the paternalistic motive, transferring a food basket instead of cash can be justified if the transfer in-kind is more cost-efficient.

Villages in the cash treatment arm received a monthly cash transfer of 150 pesos (approximately US$ 13), which corresponds to the government purchasing cost of the food basket in wholesale markets. However, because of a significant differential between the wholesale and retail prices of the subsidized commodities, the food basket was on average 37 percent more expensive when valued at local prices. The last two columns of Table 1 report the mean and standard deviation of the market value of each commodity in the food basket, computed using pre-program village-level median unit values. As one can see, the average face value of the in-kind transfer, about 205 pesos (US$ 18), is larger than the value of the cash transfer. It is also worth noting that there is substantial variability in the value of the basket, which reflects variation in the prices of PAL commodities across villages.

Compared to household's income, both transfers were sizable: the in-kind transfer represented, on average, 18 percent of household's baseline food expenditure and 11 percent of total expenditure. Similarly, the cash transfer represented 13 percent of household's baseline food expenditure and 8 percent of total expenditure.

[8] Assessing the extra-marginality of the in-kind transfer would require comparing the subsidy with the quantity consumed under a cash-equivalent transfer. However, as discussed below, the value of the cash transfer is lower than the face value of the in-kind transfer. Despite this, the comparison in Table 1, which is reported only for descriptive purposes, is more informative than comparing the subsidy with pre-transfer consumption.

Table 1: PAL food commodities

Commodity	Amount of the transfer (kg)	Percentage of cash recipients with consumption lower than the amount of the transfer	Baseline average value of the transfer (pesos)	Baseline SD of the value of the transfer (pesos)
Beans	2	0.08	20.85	3.64
Vegetable oil	1 (lt)	0.09	10.47	0.93
Rice	2	0.26	13.03	4.50
Pasta soup	1.2	0.55	16.23	2.21
Cookies	1	0.55	18.72	5.03
Canned fish	0.6	0.77	16.31	6.04
Corn flour	3	0.80	15.95	8.03
Lentils	1	0.87	10.80	6.20
Cereals box	0.2	0.89	7.37	3.26
Powdered milk	1.92	0.90	75.45	60.25
Total			205.2	64.03

Notes: Calculations in column 2 are based on self-reported post-program consumption for households in the cash treatment group. Calculations in columns 3 and 4 use the pre-program median unit value in a village and are based on 197 sample villages.

The transfers are not conditional on family size and, whenever possible, they are given to a woman (the household head or the spouse of the head).[9]

It is often stated that one of the main reasons for providing transfers in-kind is to achieve self-targeting of recipients (Nichols and Zeckhauser, 1982; Blackorby and Donaldson, 1988; Gahvari and Mattos, 2007) since governments might transfer inferior or low-quality goods, or because there might exist stigma effects attached to receiving subsidies in-kind (Moffit, 1983). In the context of PAL this seems of little concern since program take-up was as high as 87 and 93 percent for recipients of cash and in-kind transfers, respectively (see Appendix $A1$).

[9]Similar to Oportunidades and other social welfare programs, the transfer was put in the hand of women in order to improve their condition within the household. Attanasio and Lechene (2014) found that Oportunidades changed the budget allocation of the household as a result of increased women's empowerment. Here, I abstract from the within-household allocation of resources since the main objective of the paper is the estimation of welfare effects at the household level. However, when using the model to make out-of-sample predictions about the effect of a cash transfer, the change in the budget structure predicted by the model is extremely similar to the one observed in the actual data.

One additional characteristic of the program is the fact that transfers were originally intended to be conditional on the attendance of monthly classes (*platicas*) covering health, nutrition and hygiene related topics. In the experiment, all cash villages and a random half of the in-kind villages also received the classes. The remaining half of in-kind villages should have received a purely unconditional transfer, although in practice classes were taught also in those in-kind villages that should not have received them.[10] This is potentially problematic since the classes might impact the way households spend their budget or change their preferences towards certain types of goods. However, this seems of little concern for two main reasons. First, although the courses were meant to be a mandatory requirements for the receipt of the transfer, session attendance was not enforced (Skoufias et al., 2008). Self-reported data on session attendance indeed suggest that PAL recipients only participated in about a third of the sessions that they were supposed to attend (Appendix $A1$). Second, class exposure was significantly lower for the group of in-kind villages randomized out of receiving the classes. Previous evaluations of the program did not find evidence that exposure to the classes had any differential effect on food consumption (Cunha, 2014), a result which is consistent with the lack of enforcement of the conditionality requirement. For these reasons, I pool together all in-kind villages and abstract from the effects of class attendance.

3.2 Data, sample and descriptive statistics

In each experimental village, about 33 households were randomly selected to participate in a baseline survey (October 2003 to April 2004) and in an endline survey (October 2005 to December 2005). The PAL transfer began to be delivered after the completion of the baseline data collection. The household survey provides extensive information about consumption and expenditure of a large variety of food commodities, elicited through a seven days recall. In addition to the household survey, enumerators visited local shops in order to gather information about food commodity prices. As information about prices is central in the estimation of a

[10] One of the objectives of the experimental design was to study the effect of information and education classes over and above the effect of the in-kind transfer itself. Avitabile (2012) finds small improvement in the health behavior of women in the in-kind plus education group as compared to women in the in-kind group, but no effect for men.

demand system, I postpone the data description to section 4.2, where I discuss thoroughly the methodology adopted to construct commodity prices.

Of the 206 experimental villages, nine villages in which the program was not correctly implemented are excluded from the analysis. Two villages started to receive PAL transfers prior to the baseline survey; two villages refused to participate in the program; two villages were excluded from PAL for receiving Oportunidades; and two villages received the wrong treatment (one control village received in-kind benefits and one village received both cash and in-kind transfers). Finally, the construction of village-level commodity prices requires geographical imputation of missing prices at the municipality or state level. Since there is only one village from the state of Quintana Roo, it is infeasible to construct prices for many commodities in this village, and it is thus dropped from the analysis.

Within the remaining 197 sample villages, I do not use data from attrited households. The estimation sample is formed of $5,333$ households observed in both survey waves. Household attrition was low, being around 12 percent, but it was significantly higher in control localities than in treatment localities and induced some change in household composition (see Appendix *A*2). In the empirical analysis, I take this into account by controlling for household characteristics. The implicit assumption is that, conditional on demographic characteristics, attrition is random.

Table 2 shows some descriptive statistics for the sample of households, separately for each treatment group. The average household is formed of five members and has two children younger than twelve. Households are in general low-educated: 60 percent of the household heads have not finished primary school, and only 18 percent have a secondary school degree or higher. Around 14 percent of the sample is headed by a female and approximately 18 percent is formed by indigenous households. The statistics in Table 2 confirm that the sample is poor: per capita food expenditure is about 300 pesos per month (approximately US$ 27), while per capita total expenditure is 480 pesos per month (approximately US$ 44). Overall, almost 70 percent of the household budget is spent on food. The last two rows of the table report some descriptive statistics for the sample of villages. Villages are quite small, with a population of approximately 600 inhabitants.[11] The average

[11] Information on the village population has been taken from the 2005 Census.

value of the PAL basket, computed using pre-program village-level prices, is approximately 205 pesos. The last three columns of Table 2, showing the differences in the relevant variable between one treatment group and another, suggest that the sample is overall balanced across the three treatment arms in terms of household and village-level characteristics.

Table 2: Descriptive statistics by treatment group

	Control	In-Kind	Cash	(2)-(1)	(3)-(1)	(2)-(3)
	(1)	(2)	(3)	(4)	(5)	(6)
Household members	4.82	4.65	4.60	-0.17	-0.22	0.05
	(2.18)	(2.13)	(2.09)	(0.16)	(0.18)	(0.16)
Children 0 to 5	0.75	0.69	0.67	-0.06	-0.08	0.02
	(0.91)	(0.88)	(0.85)	(0.05)	(0.06)	(0.06)
Age of the head	44.59	45.15	45.47	0.56	0.88	-0.32
	(14.74)	(15.31)	(15.44)	(0.86)	(0.95)	(0.79)
Education of the head (years)	4.18	4.24	4.03	0.06	-0.15	0.22
	(3.65)	(3.66)	(3.56)	(0.23)	(0.26)	(0.23)
Head female	0.15	0.14	0.12	-0.02	-0.03*	0.02
	(0.36)	(0.34)	(0.33)	(0.02)	(0.02)	(0.01)
Indigenous household	0.22	0.18	0.14	-0.04	-0.08	0.03
	(0.41)	(0.38)	(0.35)	(0.07)	(0.07)	(0.05)
Per capita food expenditure	317.18	293.95	299.25	-23.23	-17.93	-5.30
	(220.99)	(197.80)	(246.71)	(18.28)	(19.38)	(15.33)
Per capita total expenditure	505.66	468.36	477.77	-37.30	-27.89	-9.41
	(375.52)	(339.54)	(361.83)	(32.19)	(34.21)	(27.00)
Budget share of food	0.67	0.68	0.67	0.01	-0.00	0.01
	(0.17)	(0.18)	(0.18)	(0.01)	(0.02)	(0.01)
Value of PAL food basket	202.39	206.16	209.42	3.77	7.02	-3.26
	(38.80)	(70.17)	(76.97)	(9.57)	(12.59)	(13.45)
Village population	690.67	579.91	562.99	-110.77	-127.69	16.92
	(575.06)	(512.61)	(500.94)	(97.53)	(109.93)	(89.26)
N	1268	2679	1386			

Notes: "Indigenous Household" is an indicator equal to one if at least one household member speaks an indigenous language. Food expenditure includes an estimation of the value of home-produced goods. Per capita food and total expenditures are expressed in pesos per month. The value of the PAL food basket is computed using pre-program median unit values in the village. Numbers in parentheses are standard errors, clustered at the village level, for the differences in columns (4) to (6) and standard deviations elsewhere. *, **, *** denote significance at the 10, 5, 1 percent level, respectively.

4 The Model of Demand

4.1 QUAIDS

Household demand is estimated using a quadratic almost ideal demand system (QUAIDS; Banks et al., 1997), which allows goods to be necessities at some income levels and luxuries at others. [12] The functional form of the QUAIDS is

$$w_i = \alpha_i + \sum_{j=1}^{N} \gamma_{ij} ln(p_j) + \beta_i ln\left(\frac{x}{a(p)}\right) + \frac{\lambda_i}{b(p)}\left(ln\left(\frac{x}{a(p)}\right)\right)^2 + u_i, \qquad (5)$$

$i = 1,...,N$, where w_i is the share of expenditure in commodity i; $log(p_j)$, for $j = 1,...,N$, is the natural logarithm of the price of commodity j; x is total expenditure; and u_i is an error term. The terms $a(p)$ and $b(p)$ are price indices[13] defined as

$$ln(a(p)) = \alpha_0 + \sum_k \alpha_k ln(p_k) + \frac{1}{2}\sum_j \sum_k \gamma_{jk} ln(p_j) ln(p_k)$$

$$b(p) = \prod_{i=1}^{N} p_i^{\beta_i}.$$

The demand system can accommodate the inclusion of demographic characteristics, which is done by assuming that the intercepts in each equation are linear functions of a vector of control variables d, including a constant, $\alpha_i = \alpha'_{di} d$.

Since the model gives a system of equations in which the commodity shares w_i sum up to one, the following adding-up restrictions must be imposed:

$$\sum_{i=1}^{N} \alpha_i = 1; \sum_{i=1}^{N} \beta_i = 0; \sum_{i=1}^{N} \gamma_{ij} = 0, j = 1,...,N; \sum_{i=1}^{N} \lambda_i = 0. \qquad (6)$$

[12]The QUAIDS generalizes the well-known almost ideal demand system (AIDS; Deaton and Muellbauer, 1980) by introducing quadratic effects in total expenditure.

[13]The term α_0 can be interpreted as the expenditure required for a minimal standard of living when prices are unity (Deaton and Muellbauer, 1980). Therefore, in the estimation I set it just below the minimum value of $ln(x)$.

Moreover, in order to be consistent with utility maximization, the following additional restrictions must hold:

homogeneity

$$\sum_{i=1}^{N} \gamma_{ij} = 0, i = 1, ..., N \tag{7}$$

symmetry

$$\gamma_{ij} = \gamma_{ji}. \tag{8}$$

Homogeneity requires that the demand functions are homogeneous of degree zero in prices, while symmetry requires that the cross price derivatives of the compensated demand functions are identical.

Banks et al. (1997) showed that the demand system in equation (5) can be derived from the following indirect utility

$$lnV = \left\{ \left[\frac{lnx - ln(a(p))}{b(p)} \right]^{-1} + \lambda(p) \right\}^{-1} \tag{9}$$

where $\lambda(p) = \sum_{i=1}^{N} \lambda_i ln(p_i)$. As I will discuss in Section 5, equation (9) is key for the computation of the welfare effects of the PAL program.

Elasticities Given the estimated parameters of the QUAIDS, income elasticities are computed from the following equations:

$$\eta_i = \frac{\mu_i}{w_i} + 1 = \frac{1}{w_i} \left(\beta_i + \frac{2\lambda_i}{b(p)} log \left(\frac{x}{a(p)} \right) \right) + 1, \tag{10}$$

where $\mu_i = \frac{\partial w_i}{\partial x}$. Uncompensated price elasticities are given by

$$\eta_{ij}^u = \frac{1}{w_i} \left(\gamma_{ij} - \mu_i \left(\alpha_j + \sum_k \gamma_{jk} logp_k \right) - \frac{\lambda_i \beta_j}{b(p)} \left(log \left(\frac{x}{a(p)} \right) \right)^2 \right) - \delta_{ij} \tag{11}$$

where δ_{ij} is the Kronecker delta. Compensated price elasticities are given by

$$\eta_{ij}^c = \eta_{ij}^u + \eta_i w_j. \tag{12}$$

4.2 Methodological issues

4.2.1 Separability between food and non food

In modeling household demand, I assume that household preferences are weakly separable between food and non-food consumption. Under separability, the demand of different food commodities depends only on the relative prices of food and on total food expenditure (instead of depending on total expenditure and on both food and other commodity prices).

This assumption is introduced for two main reasons. First, as noted in Section 3.2, food represents almost 70 percent of total household expenditure. Estimation of the welfare effects on the demand for food is therefore an economically meaningful exercise. Moreover, with food being such a large fraction of the household budget, although some substitutability between food and non-food might exist, it is likely to be relatively small. The second reason has to do with the lack of price measures for non-food commodities. The store surveys contains information about the prices of many food commodities, but not about the prices of other goods. The household survey collected information about non-food expenditure, but not about the quantities purchased. As a result, it is not possible to construct unit values (that is, the ratio between the expenditure and the quantity purchased) for non-food commodities. As information on prices is key in the estimation of a demand system, I impose separability and model the demand of food only. [14]

4.2.2 Variables construction: food groups, budget shares and prices

To model the demand for food I use information on self-reported consumption and expenditure for 57 food commodities, of which ten are provided in-kind by the PAL program (see Table 1). [15] Separately modeling the demand for all these goods

[14]Separability has been tested in different contexts and there is mixed evidence in the literature about its validity. Regarding separability between food and non-food, Moschini et al. (1994) find evidence in support of separability in the US, with results that are robust to several specifications for the demand system.

[15]I have excluded four goods (soy, goat/lamb meat, wheat tortilla, tomato paste) for which consumption is observed for less than 2% of households at baseline and one good (chocolate drink) because consumption data were collected only at follow-up but not at baseline.

would be practically and computationally unfeasible, especially for those goods that are consumed infrequently. For this reason, I aggregate food commodities into nine groups, four for PAL goods (PAL grains, PAL pulses, PAL vegetable oil, PAL meat and dairy) and five for other goods (fruit and vegetables, corn, wheat, meat and dairy, other foods).[16]

The chosen grouping is particularly detailed for grains. The motivation for this stems from two observations. First, a large fraction of the household budget is spent on grains (approximately 34 percent of total food expenditure). However, while some grains (e.g., corn, beans and rice) are basic staples in the Mexican diet, other types of grains (e.g., wheat) are typically luxury goods (Attanasio et al., 2013). Second, the large majority of goods subsidized in-kind by the PAL program is represented by grains. Since both cash and in-kind transfers might induce households to move from low to high quality grains by increasing household income (and, for an extra-marginal in-kind transfer, by implicitly changing the relative prices), it is important to model the substitutability between different types of grains in order to estimate household demand and welfare accurately.

For each food commodity included in the survey, households had to report the quantity consumed, the quantity purchased, the corresponding expenditure and, if applicable, the quantity consumed of home-produced goods in the last seven days.[17] Weekly quantities and expenditure are converted into monthly quantities and expenditure for consistency with the monthly delivery of PAL in-kind transfers.

The budget share of each food group is constructed by taking the ratio between the sum of the expenditures of the individual items in that food group and the total food expenditure. Expenditure includes an estimation of the value of home-produced goods, which is given as the product between the home-produced quantity and the median price of the good (constructed as reported below) within the village. Households mainly self-produce some varieties of vegetables and fruit and corn grains, while self-production of animal products is far less frequent (the only

[16]Table B1 in the Appendix reports the commodities included in each food group.

[17]Quantities are usually reported in kilos or liters. When other units of measurements have been reported (e.g. piece or packet), I have converted quantities in kilos or liters using conversion factors from the National Institute of Health (INSP). I thank Vincenzo Di Maro for providing me with INSP conversion factors.

notable exception being eggs). With respect to PAL goods, the basket is mainly represented by packaged commodities produced outside the villages. While less than 1 percent of the households in the sample self-produced rice and lentils, beans represent the only case for which self-production is relatively important, accounting for approximately 11 percent of the total expenditure in beans.

Table 3 reports the average budget shares of the different commodity groups, separately for each treatment arm.[18] Households spend approximately 20 percent of their budget on PAL goods, with the highest shares being the one for grains and pulses (approximately 14 percent of total food expenditure). Cereals (both PAL and non-PAL) and animal products together represent around half of total food expenditure, while fruit and vegetable constitute about 18 percent of the total food expenditure. Table 4 also shows that budget shares are overall balanced across households in the different treatment groups.

There are two price measures in the PAL data: unit values from the household survey (i.e., the ratio between the expenditure and the quantity purchased of a given good); and posted prices from a survey of local shops. While in general the use of store prices might mitigate potential measurement error and "quality effects" from using unit values (Deaton, 1988; Crawford et al., 2003; McKelvey, 2011), there are important differences in the quality of the baseline and endline store price data that should be taken into account.[19] First, prices were not collected in 12 percent of baseline villages. Second, in the baseline survey price data are available for a subset of 34 food commodities (out of the 57 included in the analysis). Third, even within villages where local shops were surveyed, the number of surveyed shops was higher in follow-up villages than in baseline villages.[20]

For these reasons, prices are constructed combining both data sources. Given the lower quality of the baseline price survey, pre-program prices are constructed as the median unit values within a village. If less than 10 percent of households

[18] Appendix *C* shows the average expenditure share of all the individual goods used in the analysis.

[19] Quality effects might arise if consumers react to variation in prices by adjusting both quantities and quality, in which case the observed variation in unit values would be lower than the actual variation in prices. This can lead to spurious correlation between the budget share and the unit value, resulting in exaggerated estimates of own-price elasticities.

[20] In the baseline, an average of 1.4 stores per village was surveyed, against an average of 1.9 stores per village at follow-up. More details about store price data are presented in Appendix *B*2.

Table 3: Baseline budget shares by treatment group

	Control	In-Kind	Cash	(2)-(1)	(3)-(1)	(2)-(3)
	(1)	(2)	(3)	(4)	(5)	(6)
PAL grains	6.20	6.42	6.16	0.22	-0.04	0.26
	(6.08)	(6.16)	(5.52)	(0.48)	(0.49)	(0.41)
PAL pulses	7.24	8.08	7.82	0.84	0.58	0.26
	(7.24)	(8.11)	(7.67)	(0.64)	(0.70)	(0.75)
PAL vegetable oil	4.52	4.84	5.09	0.32	0.57*	-0.25
	(3.73)	(3.72)	(4.08)	(0.27)	(0.31)	(0.25)
PAL meat and dairy	0.98	1.07	1.27	0.09	0.29	-0.20
	(2.68)	(3.06)	(4.25)	(0.14)	(0.23)	(0.22)
Fruit and vegetables	18.41	17.98	18.65	-0.43	0.24	-0.67
	(9.95)	(10.40)	(11.10)	(0.63)	(0.82)	(0.75)
Corn	16.83	16.52	16.93	-0.31	0.10	-0.41
	(12.84)	(13.69)	(13.42)	(1.16)	(1.26)	(1.17)
Wheat	3.66	3.33	3.26	-0.34	-0.41	0.07
	(4.80)	(4.86)	(4.23)	(0.32)	(0.36)	(0.28)
Meat and dairy	25.75	25.93	25.25	0.18	-0.50	0.68
	(14.79)	(15.22)	(15.30)	(1.31)	(1.45)	(1.29)
Other foods	16.40	15.82	15.58	-0.58	-0.82	0.24
	(10.45)	(9.48)	(9.86)	(0.57)	(0.60)	(0.48)
N	1268	2679	1386			

Notes: Budget shares are multiplied by 100. Numbers in parentheses are standard errors, clustered at the village level, for the differences in columns (4) to (6) and standard deviations elsewhere. *, **, *** denote significance at the 10, 5, 1 percent level, respectively.

in a village purchased a given good, I have taken the median unit value in the municipality (or, if less than 10 percent of households in the municipality purchased the good, the median unit value within the state). On the contrary, given the better quality of the follow-up price data, I have computed post-program prices as the median store prices in the village. Again, if village-level prices are missing for some good, I have taken the median prices within the municipality or state.[21]

The price index for a food group is constructed as the geometric mean of the commodity prices in that food group.[22]The first three columns of Table 4 report

[21]The details of the imputation process are presented in Appendix $B3$, which also discusses in more detail the construction of the variables used in the estimation.

[22]The weight for a commodity within a food group is given by the ratio between the state-level expenditure for that commodity and the state-level expenditure for the food group. I use state-level weights instead of village or municipality weights since weights would be zero or unit for a substantial fraction of villages and commodities. See Appendix $B3$ for further details.

the mean and standard deviation of the baseline price indices, separately for each treatment arm.[23] As one can see, there is considerable variation in the price indices, which reflects variation in local prices across localities. The last three columns of the table show that none of the price differences between one treatment group and another is statistically significant.

Table 4: Baseline food price indices by treatment group

	Control	In-Kind	Cash	(2)-(1)	(3)-(1)	(2)-(3)
	(1)	(2)	(3)	(4)	(5)	(6)
PAL grains	2.33	2.33	2.33	-0.00	-0.00	-0.00
	(0.12)	(0.11)	(0.09)	(0.02)	(0.02)	(0.02)
PAL pulses	2.36	2.32	2.32	-0.03	-0.04	0.01
	(0.15)	(0.20)	(0.18)	(0.03)	(0.03)	(0.03)
PAL vegetable oil	2.35	2.35	2.33	-0.00	-0.02	0.01
	(0.09)	(0.08)	(0.07)	(0.01)	(0.02)	(0.01)
PAL meat and dairy	3.39	3.38	3.40	-0.01	0.01	-0.02
	(0.17)	(0.17)	(0.16)	(0.03)	(0.03)	(0.03)
Fruit and vegetables	2.05	2.05	2.04	-0.00	-0.01	0.00
	(0.13)	(0.11)	(0.10)	(0.02)	(0.02)	(0.02)
Corn	1.41	1.41	1.38	0.00	-0.03	0.03
	(0.20)	(0.20)	(0.17)	(0.04)	(0.04)	(0.03)
Wheat	2.66	2.62	2.61	-0.04	-0.05	0.01
	(0.25)	(0.21)	(0.27)	(0.04)	(0.05)	(0.04)
Meat and dairy	3.29	3.29	3.29	0.00	-0.00	0.00
	(0.13)	(0.12)	(0.10)	(0.02)	(0.02)	(0.02)
Other foods	2.92	2.95	2.95	0.03	0.03	0.00
	(0.23)	(0.22)	(0.18)	(0.04)	(0.04)	(0.03)
N	1268	2679	1386			

Notes: Prices are reported in natural logarithms. The price of a food group is the geometric mean of the prices of the individual commodities within the food group. Weights are given by the state-level budget share of the commodity within the food group. Prices of the individual commodities are median unit values within a village. Numbers in parentheses are standard errors, clustered at the village level, for the differences in columns (4) to (6) and standard deviations elsewhere. *, **, *** denote significance at the 10, 5, 1 percent level, respectively.

[23] Appendix *C* shows the unit values for each commodity used in the analysis.

4.3 Estimation

The parameters of the demand system are estimated using the iterated linear least square estimator proposed by Blundell and Robin (1999) which relies on the observation that, conditional on the price indices $a(p)$ and $b(p)$, the budget shares are linear in explanatory variables and parameters. Therefore, starting from an initial guess for the price indices, estimates of the parameters can be used to update the price indices and reestimate the model until convergence is achieved.

Another attractive characteristics of this estimator is that it allows to correct for endogeneity by employing a control function approach. This relies on the assumption that the error terms in the budget share equations have an orthogonal decomposition (i.e., $u_i = \rho_i^{'} v_i + \varepsilon_i$) and on the existence of an instrument which is uncorrelated with ε_i. The correction for endogeneity is then implemented in two stages. In the first stage, the endogenous variables are regressed on exogenous variables and on the set of available instruments. In the second stage, the demand system, augmented with the residuals $\hat{v}_i$ from the first stage, is estimated using the iterative procedure described above.

Correcting for endogeneity is potentially important, since a number of studies show that total expenditure is often endogenous in the estimation of demand systems (Banks et al., 1997; Blundell and Robin, 1999). However, this relies on the existence of an instrument which is correlated with total expenditure but that can be excluded from the budget share equations. Standard instruments used in the literature are household income or wages, which are unfortunately not available in the PAL data. To overcome this issue, I use a wealth index constructed as the sum of 11 indicators of durable ownership (e.g., television, radio, refrigerator).

In the Appendix, I show that this instrument is strongly correlated with household's food expenditure. It is harder to prove that it should be excluded from the budget share equations, though. The motivation for this is in the same spirit of the two-stage budgeting hypothesis. Assuming that a household would first choose how much of his income is allocated to buy durable goods and then how much of his non-durables income is devoted to food consumption, under separability between durables and non-durables the wealth index should not impact food budget shares but through total expenditure.

Budget shares are allowed to depend on household demographic characteristics by including the following variables within the intercept of the demand system: the number of household members; the number of $0-5$ years old children; the age of the household head; the education of the household head; an indicator for the household being indigenous; an indicator for the head of the household being female; the total population in the village; and state and month of the survey indicators.

I have estimated the demand system on the full sample of baseline households imposing all restrictions from the theory. Standard errors are computed using a cluster-robust bootstrap estimator, which takes into account the correlation in the error terms at the village level. Data on follow-up households are not used in the estimation for two main reasons. First, the main objective of the paper is to show how a demand system can be used to conduct an ex-ante estimation of welfare effects from in-kind and cash transfers using only pre-program data. Second, using the endline data for the in-kind recipients in the estimation could result in estimation bias if the in-kind transfer is extra-marginal since the estimated parameters of the demand system would reflect the change in the consumption patterns induced by the transfer rather than genuine response of household demand to relative prices and expenditure. As I will discuss, the sample of follow-up households is instead used to test the validity of the model and to conduct the welfare analysis.

5 Estimating welfare effects

Given its consistency with consumer theory, the QUAIDS has been widely used to study the welfare implications of different policies affecting either income or prices.[24] This section shows how demand systems could also be used to quantify the welfare effects of policies providing subsidies in-kind.

This is a more complex task in that, instead of exogenously changing the price of a good or the income of a consumer, an in-kind transfer rather subsidizes a fixed bundle of goods. However, intuitively a transfer in-kind can be seen as implicitly

[24] Banks et al. (1997) study the welfare loss of introducing a tax reform increasing sales tax on clothing in the UK; Attanasio et al. (2013) used the QUAIDS to estimate the welfare loss of food price increases in Mexico.

changing both income and relative prices: the transfer increases the recipient budget but, if it is extra-marginal, it also makes the subsidized goods relatively more convenient. Therefore, as discussed in Section 2, a solution to this problem is to compute the virtual prices (and the virtual income) at which a consumer would be as well off as with the transfer in-kind.

In order to describe the procedure, it is useful to proceed by steps and to introduce some notation. Let J be the set of subsidized goods, and, for $j \in J$, let p_j , p_j^* and $\bar{q}_j$ be respectively the market price, the virtual price and the subsidized quantity of good j. Moreover, let $\left(\hat{a}, \hat{\beta}, \hat{\gamma}, \hat{\lambda}, \hat{\rho}\right)$ be the set of estimated parameters of the QUAIDS in equation (5).

1. From the estimated parameters of the demand system, compute the counterfactual demand of a consumer upon receiving a cash-equivalent transfer $\bar{x} = \sum_{j \in J} \bar{q}_j p_j$. This is simply done using equation (5) to compute the budget shares of all goods in the demand system, $\hat{w}_i$, for an income level equal to $x + \bar{x}$, and then converting shares into quantities, i.e. $\hat{q}_i = \frac{\hat{w}_i \cdot (x+\bar{x})}{p_i}$.

2. For each subsidized good $j \in J$, compare the predicted quantities $\hat{q}_j$ with the subsidize quantities $\bar{q}_j$. The transfer is infra-marginal if $\hat{q}_j \geq \bar{q}_j$ for all $j \in J$, and extra-marginal if $\hat{q}_j < \bar{q}_j$ for at least one $j \in J$. Let $K \subseteq J$ be the subset of extra-marginal goods.

3. For infra-marginal goods, the virtual price is trivially equal to the market price. For all extra-marginal goods $k \in K$, virtual prices are computed from the system of equations in (5) by fixing the quantity of the goods to the subsidy level

$$w_k = \frac{p_k^* \bar{q}_k}{x^*} = \hat{\alpha}_k + \sum_{i \notin K} \hat{\gamma}_{ki} log(p_i) + \sum_{l \in K} \hat{\gamma}_{kl} log(p_l^*) + \hat{\beta}_k log\left(\frac{x^*}{a(p^*)}\right) + \frac{\hat{\lambda}_k}{b(p^*)}\left(log\left(\frac{x^*}{a(p^*)}\right)\right)^2 + \hat{\rho}_k \widehat{v} \tag{13}$$

where $x^* = x + \sum_{j \in J} p_j^* \bar{q}_j$ is the sum of the pre-transfer income and of the "virtual value" of the in-kind subsidy.[25]

[25] Note that the price indices have been denoted with $a(p^*)$ and $b(p^*)$ to highlight the fact that some of the prices within the indices are virtual prices rather than market prices.

4. After finding the virtual prices, recompute the quantities consumed of all goods in the demand system using the virtual prices instead of the market prices and check that $\hat{q}_j \geq \bar{q}_j$ for all $j \in J$. This step is important because, even though a given subsidized good might not be extra-marginal under the cash-equivalent transfer in step 1, it might be extra-marginal under the new set of (virtual) prices. By construction, virtual prices are lower than market prices. Therefore, if the cross-price elasticity of the infra-marginal good with other extra-marginal goods is sufficiently large, the virtual reduction in prices might cause the demand of the (previously) infra-marginal good to fall below the subsidized quantity. When this occurs, repeat step 3 by simultaneously solving equation (13) for all the extra-marginal goods, and repeat the procedure until $\hat{q}_j \geq \bar{q}_j$ for all $j \in J$.

5. Steps 1 to 4 provide a solution for the virtual prices and for the post-transfer expenditure x^*. Using equation (9) the utility for an infra-marginal transfer is given by

$$lnV_k = \left\{ \left[\frac{ln(x+\bar{x}) - ln(a(p))}{b(p)} \right]^{-1} + \lambda(p) \right\}^{-1} \tag{14}$$

while the utility for an extra-marginal transfer is

$$lnV_k = \left\{ \left[\frac{ln(x^*) - ln(a(p^*))}{b(p^*)} \right]^{-1} + \lambda(p^*) \right\}^{-1}. \tag{15}$$

6. To find a money metric measure of utility, compute the income for which the household should be compensated in order to be as well off as with the in-kind transfer, given the vector of market prices p. In other words, find x_k such that

$$\left[\left(\frac{log(x_k) - log(a(p))}{b(p)} \right)^{-1} + \lambda(p) \right]^{-1} = lnV_k, \tag{16}$$

where lnV_k is given by (14) for an infra-marginal transfer and by (15) for an extra-marginal transfer.

In the PAL program application, I measure welfare by computing the equivalent variation, which is given by $EV = x_k - x$. This is a natural choice since the equivalent variation can be interpreted as measuring the recipient's willingness to pay for the in-kind transfer. Note that one nice feature of the above procedure is that, given variation in market prices, expenditure and demographic characteristics, virtual prices can be computed at the individual level. This allows to construct a distribution of the welfare effects among recipients and, therefore, to study how the willingness to pay varies with household characteristics.

It is important to emphasize that the analysis above assumes that goods transferred in-kind can not be sold. This is apparent when looking at equation (13) since the computation of the virtual price requires that the recipient consumes exactly as much of the subsidized goods as it is transferred in-kind. In the context of PAL, reselling was not officially prohibited but there is no clear evidence on whether it occurred or not. However, two observations are in order. First, since PAL villages are generally isolated, reselling goods outside the village might be quite costly. Second, the high take-up of the program suggests that most households within a village received the same food basket. If preferences for the subsidized goods are not too heterogenous, the extent of within-village reselling might be relatively limited. Despite these observations, if the no reselling assumption is violated, the welfare effects computed in steps 1-6 would represent lower bounds to the "true" welfare effects (see Figure 1*a*).

6 Results

6.1 Model parameters and specification

In this section, I report a selection of the estimated parameters, which I use to discuss two specific features of the chosen specification for the demand system: the endogeneity of food expenditure and the nonlinearity of the budget shares with respect to household expenditure. Appendix $C3$ shows the full set of estimated parameters.

In the first stage, $ln(x)$ and $[ln(x)]^2$ are regressed on the wealth index and on its square. The results are reported in Appendix $C2$. The F statistics for the null hypothesis that the coefficients of the instruments are jointly zero is above 140 in each equation, suggesting that the instruments are indeed strongly correlated with the logarithms of total food expenditure and its square. Following the control function approach, the demand system is augmented with the residuals from the first stage regressions. The coefficients associated with the first-stage residuals for $ln(x)$ and $[ln(x)]^2$ are denoted respectively with $\hat{p}_{i1}$ and $\hat{p}_{i2}$ ($i = 1,...,N$ being an index for the i-th equation of the demand system), and are reported in the second and third columns of Table 5. A t-test of the null hypothesis that the coefficients in each equation is zero can be interpreted as a test of exogeneity of food expenditure. As one can see, the coefficients are significantly different from zero in several equations. Moreover, joint tests of exogeneity of total food expenditure, performed by separately testing the null hypotheses that $\hat{p}_{i1} = 0$ for all i and $\hat{p}_{i2} = 0$ for all i, are strongly rejected (see last row of Table 5). Taken together, these results imply that it is important to take into account the endogeneity of food expenditure and, therefore, all the results reported correct for it.

Table 5 also reports the estimated coefficients on the square of food expenditure, $\hat{\lambda}_i$. For three out of nine food groups, the coefficient is statistically different from zero, suggesting the existence of nonlinearities. This becomes even more apparent if we look at Figure 2, which shows the Engel curves for each food group with prices and household demographic characteristics fixed to their sample means. Consistently with the results of Table 5, PAL grains, PAL meat and dairy, fruit and vegetables and corn exhibit a strong nonlinear response. For the remaining food groups (PAL pulses, PAL vegetable oil, wheat, meat and dairy and other foods), the relationship with total food expenditure is very close to linear.

Table 5: Estimated parameters of the QUAIDS

	$\hat{\lambda}_i$	$\hat{\rho}_{i1}$	$\hat{\rho}_{i2}$
PAL grains	0.009**	0.151***	-0.010***
	(0.004)	(0.051)	(0.004)
PAL pulses	-0.011	-0.018	0.005
	(0.008)	(0.112)	(0.008)
PAL vegetable oil	0.007	0.057	-0.004
	(0.004)	(0.057)	(0.004)
PAL meat and dairy	0.003	0.037	-0.003*
	(0.002)	(0.023)	(0.002)
Fruit and vegetables	0.023***	0.323***	-0.027***
	(0.008)	(0.100)	(0.007)
Corn	-0.035***	-0.298	0.025*
	(0.012)	(0.197)	(0.014)
Wheat	-0.001	-0.051	0.003
	(0.006)	(0.044)	(0.003)
Meat and dairy	0.013	0.100	-0.014
	(0.009)	(0.140)	(0.010)
Other foods	-0.007	-0.300*	0.025**
	(0.011)	(0.171)	(0.013)
Joint exogeneity test: χ^2		34.5	41.9

Notes: Estimation of the system of equation (5). Standard errors are reported in parentheses and are computed using a bootstrap estimator accounting for clustering at the village level. 500 replications of the bootstrap have been used. *, **, *** denote significance at the 10, 5, 1 percent level, respectively.

6.2 Elasticities

Table 6 reports income and own-price elasticities, which are computed from the estimated parameters of the demand system as described by equations (10)-(12). Prices, expenditure and other demographic characteristics are set at the sample mean. As can be seen in the first column, with the exception of PAL meat and dairy, the commodities transferred by the PAL program are necessities. As one would expect, fruit and vegetables and animal products are luxuries. Consistently

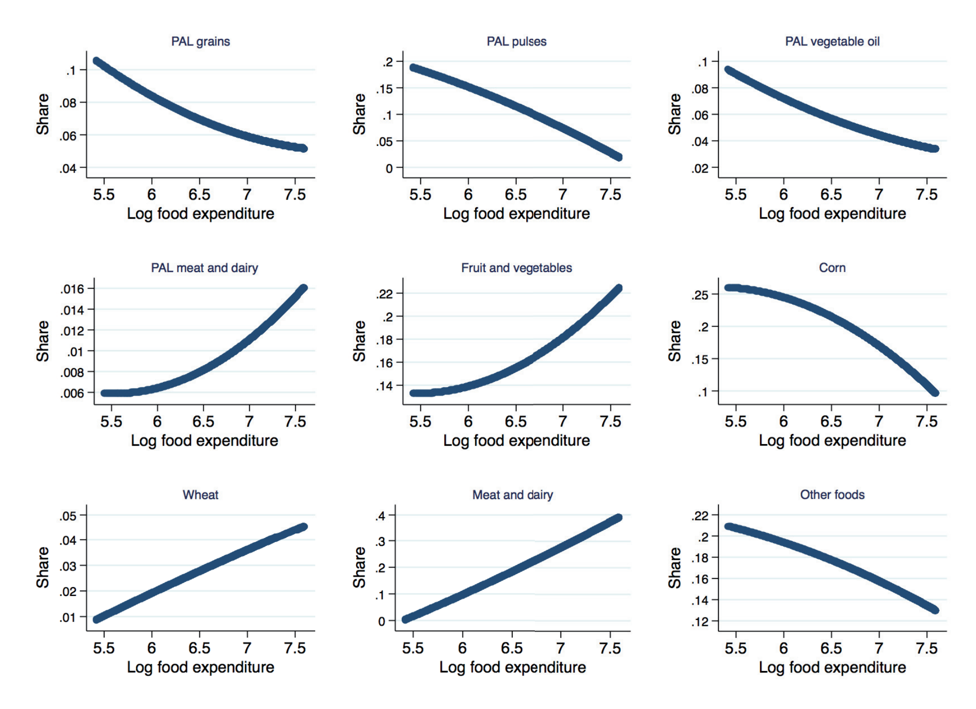


Figure 2: Engel curves

with what is found in other studies in Mexico (Attanasio et al., 2013), wheat cereals are luxuries, while corn cereals are strong necessities. Indeed, while corn cereals represent more than 40 percent of the average caloric intake among the poor in Mexico, wheat-based products constitute only 3 percent of it (Skoufias et al., 2009). Note that all the results obtained for the income elasticities of demand are consistent with the Engel curves plotted in Figure 2, where the budget shares of luxury (necessity) goods are increasing (decreasing) in household expenditure.

Turning to the analysis of the price elasticities, all compensated and uncompensated own-price elasticities have the expected sign. Meat and dairy, PAL pulses and PAL meat and dairy are the most price-elastic goods, while corn cereals and other foods are the least elastic. The full set of compensated and uncompensated cross-price elasticities is reported in Appendix *C*3. As expected, different types of cereals (i.e., PAL grains, corn and wheat) present some degree of substitutability between each others, even though the cross-price elasticities are often not statistically different from zero.

Table 6: Income and own-price elasticities

	Income elasticities	Uncompensated Own-price Elasticities	Compensated Own-price Elasticities
PAL grains	0.688***	-0.881**	-0.839**
	(0.104)	(0.300)	(0.299)
PAL pulses	-0.031	-1.300***	-1.303***
	(0.133)	(0.276)	(0.277)
PAL vegetable oil	0.503***	-0.924***	-0.901***
	(0.093)	(0.252)	(0.252)
PAL meat and dairy	1.652***	-1.163**	-1.147**
	(0.329)	(0.463)	(0.463)
Fruit and vegetables	1.331***	-0.916***	-0.684***
	(0.073)	(0.161)	(0.163)
Corn	0.450***	-0.339*	-0.258
	(0.117)	(0.204)	(0.195)
Wheat	1.484***	-0.903***	-0.852***
	(0.185)	(0.159)	(0.160)
Meat and dairy	1.747***	-1.272***	-0.834***
	(0.078)	(0.149)	(0.149)
Other foods	0.744***	-0.724***	-0.604***
	(0.080)	(0.103)	(0.101)

Notes: Elasticites are computed from equations (10)-(12), with prices expenditure and household demographic characteristics fixed at their sample mean. Standard errors are computed using the delta method. *, **, *** denote significance at the 10, 5, 1 percent level, respectively.

6.3 Model fit

In order to understand if the model is capable of reproducing the consumption patterns observed in the data, in this section I perform in-sample and out-of-sample tests of the model's validity. The QUAIDS is estimated on the sample of baseline households. As a first test, I first split the estimation sample into quintiles along the food expenditure distribution; then, for each quintile, I compare the average actual budget shares against the average predicted budget shares of each food group. Given estimates of the model's parameters, predicted budget shares are computed from equation (5). The standard errors for the difference between the actual and the predicted budget shares have been computed using a bootstrap clustered at the village level. Table 7 shows that the model is able to replicate extremely well the evolution of the household budget composition across the expenditure distribution. The differences between the observed and the predicted budget shares are small and almost never statistically significant.

It is also interesting to see how the composition of food expenditure changes with household income. While households in the first quintile spend about 40 percent of their budget in various types of cereals and grains (PAL grains, PAL pulses, corn and wheat), this is only equal to 28 percent of the budget for households in the top quintile. The budget share of PAL pulses in the top quintile is about half of the budget share for the bottom quintile, which is consistent with the fact that pulses are overall strong necessities and might even be inferior goods towards the top of the income distribution (see Table 6). Similarly, the budget share of meat almost doubles when moving from the lowest to the highest quintile. The budget share of fruit and vegetables is instead relatively flat, partly due to the fact that the very poor might be able to compensate the expenditure differential by increasing their consumption of home-produced goods.

The validity of the model is further tested within the following out-of-sample exercise, which exploits the experimental design of the PAL program. I first compute the experimental impact of the PAL cash transfer on the household budget structure, which is done in two ways: (i) as the average difference between the budget share of households in the cash treatment arm and the budget share of households in the control group, using only the endline sample (cross-sectional difference); and (ii) by subtracting from the cross-sectional difference the average pre-program difference between the budget shares of the cash and the budget shares of the control treatment groups (difference-in-difference). The experimental impacts, labelled respectively with "CSD" (cross-sectional difference) and "DID" (difference-in-difference), are reported in the second and third columns of Table 8. The next step is to use the estimated model to simulate the provision of a 150 pesos cash transfer and to compute the predicted impacts of this subsidy on the household budget composition. This is done on the control group endline sample, thus making the test completely out-of-sample. The predicted impacts, reported in the first column of Table 8, are computed as the average difference between the simulated budget share under the cash transfer and the actual budget share for the control group.

Table 7: Actual and predicted budget shares by food expenditure quintiles

	1st quintile			2nd quintile			3rd quintile			4th quintile			5th quintile		
	(1)	(2)	(1)-(2)	(1)	(2)	(1)-(2)	(1)	(2)	(1)-(2)	(1)	(2)	(1)-(2)	(1)	(2)	(1)-(2)
	Pred.	Actual		Pred.	Actual		Pred.	Actual		Pred.	Actual		Pred.	Actual	
PAL grains	7.27	7.47	-0.20	6.80	6.58	0.22	6.43	6.18	0.26	5.97	5.86	0.10	5.24	5.40	-0.16
	(0.38)	(0.34)	(0.20)	(0.26)	(0.25)	(0.20)	(0.24)	(0.21)	(0.20)	(0.23)	(0.23)	(0.19)	(0.25)	(0.21)	(0.19)
PAL pulses	10.92	11.61	-0.69**	8.92	8.63	0.30	7.86	7.40	0.46	6.69	6.38	0.31	4.91	5.05	-0.14
	(0.64)	(0.62)	(0.35)	(0.53)	(0.41)	(0.40)	(0.51)	(0.34)	(0.43)	(0.49)	(0.23)	(0.43)	(0.54)	(0.23)	(0.47)
PAL vegetable oil	6.97	7.36	-0.39**	5.48	5.13	0.34**	4.76	4.58	0.18	4.11	3.93	0.18	3.02	3.14	-0.12
	(0.32)	(0.29)	(0.19)	(0.19)	(0.14)	(0.17)	(0.18)	(0.12)	(0.18)	(0.18)	(0.10)	(0.18)	(0.20)	(0.11)	(0.18)
PAL meat and dairy	0.89	0.84	0.05	1.10	1.14	-0.04	1.15	1.14	0.00	1.19	1.14	0.05	1.24	1.24	0.00
	(0.10)	(0.11)	(0.07)	(0.09)	(0.15)	(0.09)	(0.09)	(0.11)	(0.10)	(0.09)	(0.11)	(0.09)	(0.12)	(0.12)	(0.08)
Fruit and vegetables	17.39	17.18	0.21	18.34	18.29	0.04	18.44	18.29	0.15	18.64	19.03	-0.38	18.57	18.52	0.05
	(0.56)	(0.54)	(0.27)	(0.38)	(0.40)	(0.33)	(0.40)	(0.43)	(0.39)	(0.41)	(0.39)	(0.37)	(0.52)	(0.47)	(0.45)
Corn	20.32	20.63	-0.32	17.84	17.47	0.36	16.69	17.42	-0.73	15.31	14.88	0.43	13.20	13.10	0.10
	(1.07)	(1.24)	(0.42)	(0.63)	(0.63)	(0.52)	(0.62)	(0.66)	(0.55)	(0.63)	(0.49)	(0.61)	(0.78)	(0.49)	(0.68)
Wheat	2.36	2.07	0.29	2.92	2.91	0.01	3.32	3.53	-0.21	3.80	3.96	-0.15	4.45	4.49	-0.03
	(0.36)	(0.23)	(0.22)	(0.16)	(0.16)	(0.14)	(0.18)	(0.16)	(0.17)	(0.18)	(0.16)	(0.16)	(0.25)	(0.20)	(0.19)
Meat and dairy	17.13	16.13	0.99	23.23	23.87	-0.63	26.09	26.10	-0.01	28.88	29.89	-1.01	32.67	32.59	0.08
	(0.92)	(0.95)	(0.80)	(0.95)	(0.66)	(0.85)	(1.05)	(0.73)	(0.89)	(1.07)	(0.56)	(0.96)	(1.28)	(0.68)	(0.99)
Other foods	16.75	16.71	0.04	15.38	15.98	-0.60**	15.26	15.37	-0.11	15.41	14.94	0.47	16.70	16.47	0.23
	(0.48)	(0.44)	(0.28)	(0.35)	(0.32)	(0.29)	(0.35)	(0.36)	(0.35)	(0.34)	(0.29)	(0.31)	(0.56)	(0.43)	(0.37)

Notes: Predicted budget shares are computed from equation (5). Standard errors are reported in parentheses and are computed using a bootstrap clustered at the village level. 500 replications of the bootstrap have been used. *, **, *** denote significance at the 10, 5, 1 percent level, respectively.

Table 8: Predicted and experimental impacts of the PAL cash transfer on the household budget

	Predicted impact (1)	Experimental impacts CSD (2)	Experimental impacts DID (3)	Differences (2)-(1)	Differences (3)-(1)
PAL grains	0.05	-0.15	-0.03	-0.20	-0.08
	(0.68)	(0.56)	(0.37)	(0.57)	(0.69)
PAL pulses	-1.07	-0.64	-1.24	0.43	-0.17
	(1.01)	(0.66)	(0.53)	(0.66)	(1.08)
PAL vegetable oil	-0.54	-0.30	-0.93	0.23	-0.39
	(0.42)	(0.27)	(0.32)	(0.27)	(0.48)
PAL meat and dairy	0.50	0.50	0.16	-0.00	-0.35
	(0.32)	(0.20)	(0.22)	(0.20)	(0.38)
Fruit and vegetables	1.53	1.69	1.27	0.16	-0.26
	(1.19)	(1.06)	(0.92)	(1.05)	(1.14)
Corn	-0.50	-0.88	-0.81	-0.38	-0.31
	(1.27)	(1.22)	(1.02)	(1.22)	(1.35)
Wheat	0.32	0.21	0.67	-0.11	0.35
	(0.40)	(0.41)	(0.28)	(0.42)	(0.44)
Meat and dairy	1.01	1.68	2.11	0.67	1.10
	(1.48)	(1.60)	(1.27)	(1.58)	(1.73)
Other foods	-1.31	-2.12	-1.20	-0.81	0.11
	(1.09)	(0.67)	(0.67)	(0.66)	(1.05)

Notes: Predicted impacts are computed from model (5). CSD=cross-sectional difference; DID=difference-in-difference. Standard errors are reported in parentheses and are computed using a bootstrap clustered at the village level. 500 replications of the bootstrap have been used. *, **, *** denote significance at the 10, 5, 1 percent level, respectively.

The experimental impacts suggest that the cash transfer had a limited effect on the household budget structure. As compared to the control group, households in the cash treatment arm have on average larger budget shares for luxuries (PAL meat, meat and dairy, fruit and vegetables, wheat) although the magnitude of such differences is small. Overall, both the direction and the size of the predicted impacts are very similar to those of the actual impacts. The fourth and fifth columns of

Table 8 show the differences between the actual and the predicted impacts, with standard errors computed using a bootstrap clustered at the village level. None of the differences is statistically significant, although the precision of the estimates of the experimental and of the actual impacts is rather low.

7 Welfare analysis

In this section, I compute the welfare effect of the PAL program following the procedure described in Section 5. The simulation exercise is performed on the sample of households in the control group in the post-intervention period. I contrast two simulation scenarios. In the first scenario, I assume that local prices are not affected by the provision of the in-kind transfer. As a result, recipient's willingness to pay reflects exclusively the value that a recipient attaches to the food basket. In the second scenario, I incorporate in the welfare analysis the effect that the PAL program had on local prices, as estimated by Cunha et al. (2018).

7.1 Welfare effects under constant prices

The first step of the welfare analysis requires estimating household demand under a cash-equivalent transfer which, given variation across villages in the prices of the subsidized goods, varies at the locality level. Comparing the predicted and the subsidized quantities for each subsidized good reveals that the transfer in-kind is extra-marginal for almost every recipient. Therefore, in order to quantify the welfare effects of the in-kind transfer, it is necessary to compute the virtual prices of the extra-marginal goods by solving the system of equations (13).[26]

Figure 3 plots the distribution of the equivalent variation, EV, reported in pesos. The dashed line represents the median, while the solid line indicates the mean. In order to contrast the welfare of households receiving the in-kind subsidy with that of households receiving the cash transfer, I have indicated with the dash-dotted line the value of the cash transfer, which was fixed for each household and equal to 150 pesos. Clearly, the equivalent variation of a 150 pesos cash transfer is trivially equal to 150 pesos.

[26] For some values of the estimated parameters and of the data, a solution to this system might not exist. However, in this context, virtual prices can be obtained for 96 percent of the sample.

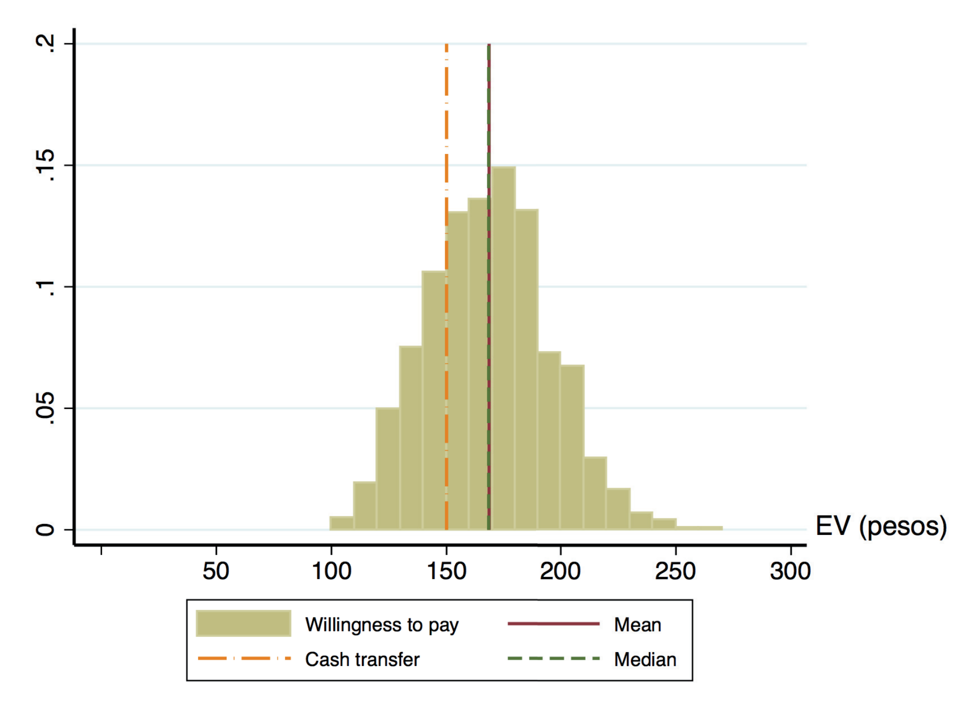


Figure 3: Distribution of the willingness to pay for the in-kind transfer

Both the mean and median willingness to pay are approximately equal to 168 pesos. This implies that, on average, households valued more the in-kind transfer than a 150 pesos cash transfer. For approximately 25 percent of the households, the equivalent variation is lower than 150 pesos and, therefore, these households would be better off receiving the in-kind transfer instead of the cash transfer. However, it should be noted that the welfare loss of the in-kind subsidy is not negligible. The market value of the PAL food basket, computed using follow-up store prices, was approximately 210 pesos. This implies that about 42 pesos of the total value of the transfer are extra-marginal. In other words, recipients valued the in-kind transfer at approximately 80 percent of its face value. Therefore, a significant fraction of the efficiency gains that could have been achieved with the in-kind transfer are lost as a result of the choice of transferring commodities which are extra-marginal for most recipients.

7.2 Welfare effects under PAL price changes

In a recent paper, Cunha et al. (2018) studied the effect of PAL on local prices by exploiting the experimental design of the program. They find that in villages receiving the in-kind transfer subsidized commodity prices were on average 3.7 percent lower than in villages in the control group, a result which is consistent with the increased supply of these goods. On the other hand, the injection of money in villages in the cash treatment arm was not large enough to determine a significant increase in food prices. In order to account for the "price effect" of the program, in this section I use the estimated model of the demand to simulate a 3.7 percent reduction in the prices of PAL goods and study how recipient welfare changes in this scenario. It is worth noting that the prices of other foodstuffs which are substitutes or complements with the subsidized goods could also change as a result of changes in the demand of these goods. Because Cunha et al. (2018) do not find any change in non-PAL prices, I assume that these are constant in the simulation.

In principle, a reduction in the prices has two opposite effects on household welfare as compared to the scenario with constant prices. On one hand, lower prices of the subsidized goods would mechanically decrease the face value of the food basket. On the other hand, recipients pay lower prices for out-of-pocket purchases of the subsidized good. The results in Figure 4 suggest that the latter effect is predominant. The median willingness to pay for the in-kind subsidy is approximately 187 pesos, while the mean is 189 pesos. This represents a 12 percent increase in household welfare with respect to the scenario with constant prices.

It should be noted that the change in the prices of PAL goods might imply very different welfare effects for producers and consumers of PAL goods. While the reduction in prices translates into additional welfare gains for consumers, producers might incur in a welfare loss as a result of lower profits. Studying the effect of the PAL program on the supply side of the market would require information on food production, as the negative effects of the reduction in prices would be borne by producers of the PAL goods (or of close substitutes of PAL goods). As this

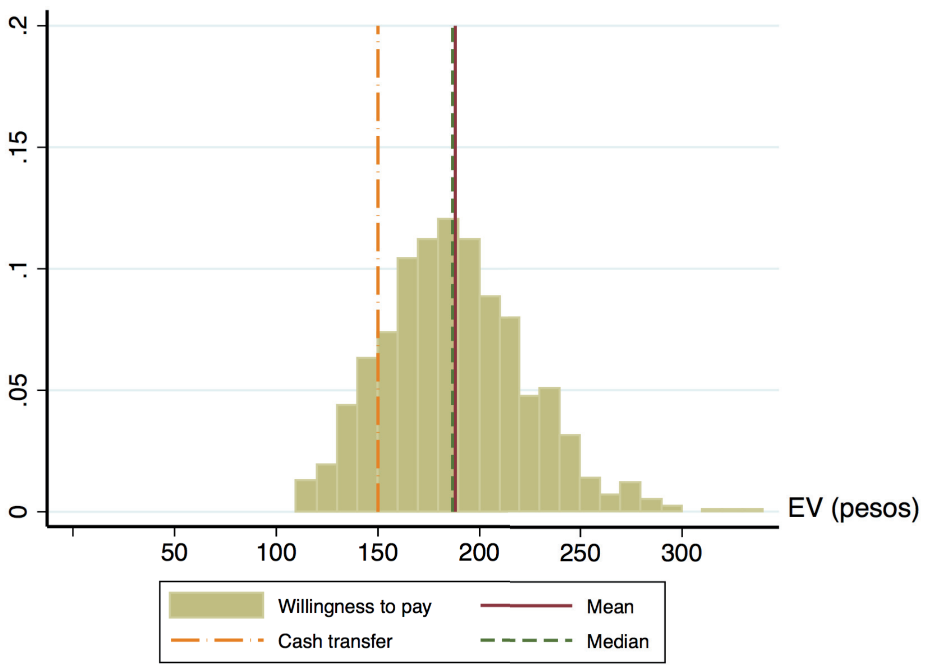


Figure 4: Distribution of the willingness to pay for the in-kind transfer under a change in PAL prices

information is not available in the data, I do not address this issue in the present paper. [27]However, two observations are in order. First, most of the goods transferred in-kind are packaged commodities produced outside the villages. Second, while food production is not observed, the household survey reveals some information about consumption from self-production. For the three commodities that might be produced locally (i.e., rice, beans, lentils), the only one for which self-production is meaningful is represented by beans: while 10 percent of baseline households consumed beans from self-production, less than 1 percent of households consumed self-produced rice or lentils. These two observations suggest that PAL recipients might be, on average, net consumers of the transferred goods and therefore the welfare losses among recipients might be relatively small.

[27]Cunha et al. (2014) present some evidence about the effect of the program on total profits from agricultural production but, as the authors admit, "the quality of the data on agricultural production is not ideal". While there seems to be a larger increase in producer's profits under a cash transfer, the difference with respect to in-kind transfers is not statistically significant.

7.3 Heterogeneity

The welfare effects in Figures 3 and 4 exhibit substantial variation. Hence, it is interesting to study which households received the largest benefits from the in-kind transfer. The main objective of this section is to study how the welfare effects vary across the income distribution. To do so, I run local polynomial regressions of the willingness to pay against household total monthly expenditure (i.e., the sum of food and non-food expenditure), which is used as a proxy for the unobserved household income. Results are presented in Figure 5, which shows the willingness to pay computed from both the simulation with constant prices and the simulation with non-constant PAL prices.

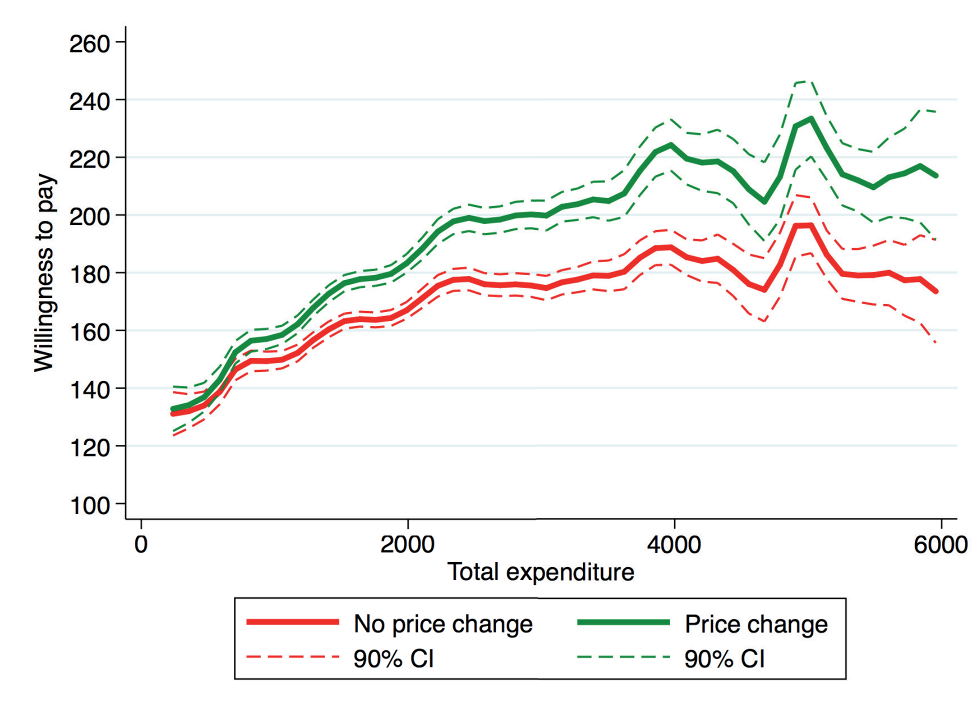


Figure 5: Willingness to pay across the total expenditure distribution

The welfare effects of the in-kind transfer are clearly increasing across the total expenditure distribution. This suggests a regressive effect of the in-kind transfer. The estimated income elasticities in Table 6 suggest that PAL goods are, on average, normal goods. Because for households at the top of the income distribution the consumption levels of the subsidized goods are on average larger than those of households at the bottom, welfare gains are larger among relatively better-off recipients. Note that, when price changes are taken into account, the regressivity of the in-kind transfer becomes even more pronounced. This is not surprising since lower PAL prices benefit proportionally more those recipients with higher consumption levels for those goods.

One possible concern of this analysis is the fact that relatively richer households are larger, or they live in villages where prices for the subsidized goods are higher. In order to shed more light on these results, I estimate the following regression in which I control for other household demographic characteristics

$$EV_{hv} = \alpha_0 + \alpha_1 e_{hv} + \alpha_2 vbasket_v + \theta' z_{hv} + \varepsilon_{hv}. \quad (17)$$

EV_{hv} denotes the equivalent variation for household h in village v; e_{hv} is the total expenditure; $vbasket_v$ is the market value of the in-kind transfer in village v; and z_{hv} are household and village characteristics including the number of household members, the age and education of the head, the total population in the village and indicators for the head of the household being female and for the household being indigenous.

The results of the regression are reported in Table 9. In the first column the equivalent variation is computed from the simulation with constant prices, while the second refer to the simulation accounting for the price change. As one would expect, households living in villages in which the value of the basket is higher are also those with a larger willingness to pay. Moreover, even when controlling for the value of the basket and demographic characteristics, the coefficient on total expenditure is positive and significantly different from zero, which suggests that indeed relatively richer households have a larger willingness to pay for the in-kind transfer. The magnitude of the estimated coefficient is larger when accounting for the change in the prices, which is consistent with the results in Figure 5. Not surprisingly, the number of household members is positively correlated with the value of the in-kind transfer, suggesting that for larger households the extra-marginality of the transfer in-kind is lower.[28]

[28]The age of the household head seems to be negatively correlated with the value of the in-kind transfer, which might reflect different dietary habits in older households. Inspections of the data reveal that older households have lower budget shares for PAL grains as compared to younger households. This descriptive evidence is consistent with the fact that these types of households have a lower valuation of the in-kind transfer.

Table 9: Heterogeneity of welfare effects

	Constant prices	Price change
Total expenditure	0.006***	0.010***
	(0.001)	(0.002)
Value PAL basket	0.559***	0.585***
	(0.063)	(0.068)
Number household members	0.852	2.615***
	(0.517)	(0.635)
Age head	-0.501***	-0.506***
	(0.058)	(0.067)
Education head	-0.020	-0.201
	(0.247)	(0.303)
Indigenous household	-4.989*	-5.430*
	(2.799)	(3.031)
Female head	2.109	0.830
	(1.728)	(2.042)
Village population	-0.002	-0.002
	(0.004)	(0.004)
Constant	60.362***	55.819***
	(13.377)	(14.485)
N	1028	1029

Notes: OLS estimates of equation (17). The dependent variable is the equivalent variation, computed as described in Section 5. Standard errors are clustered at the village level. *, **, *** denote significance at the 10, 5, 1 percent level, respectively.

The regressive effect of the transfer in-kind is an important result. Policy makers are often concerned about providing well-targeted transfers. In this respect, it is often claimed that despite potential efficiency losses as compared to cash transfers, in-kind transfers might achieve self-targeting of recipients by providing goods that are not appealing to the rich (Nichols and Zeckhauser, 1982; Blackorby and Donaldson, 1988; Gahvari and Mattos, 2007). However, self-targeting of recipients might not be easily achieved in small rural villages in which the income inequality is not very high and the existence of large stigma effects is unlikely, such as those targeted by PAL. In this case, policy makers should take into account that the efficiency loss of transferring goods in-kind are potentially larger for the most vulnerable households.

7.4 Discussion and cost-efficiency

The results in the previous section suggest that the estimated welfare effects for in-kind recipients were larger than for cash recipients. Although the in-kind transfer is valued on average at 80 percent of its face value, the efficiency loss of the transfer in-kind is not large enough to compensate for the wedge in the values of the two transfer schemes. However, in order to determine which policy is more cost-efficient, the administrative costs of the two transfer modalities must be taken into account. Estimating such costs is often difficult since distribution, personnel, warehousing and other operational costs might vary not only across regions and over time but also with the scale of the program. In this section, I provide a discussion of such costs by referring to Ventura-Alfaro et al. (2011) which, to my knowledge, represents the most careful study of the operational costs of PAL.

Excluding costs which are sustained only at the outset of the program and that are common to both transfer modalities (such as the costs of design and evaluation of the program and the costs of identification and incorporation of beneficiaries), Ventura-Alfaro et al. (2011) estimate that in 2004 the total administrative costs of the transfer in-kind correspond to approximately 22 percent of the purchasing cost of the food basket (approximately 33 pesos per transfer). Instead, the administrative costs of the cash transfer correspond to about 12 percent of the value of the transfer.[29]

If we assume that a policy maker would like to evaluate the welfare gains generated by the two policies at a given cost, we can fix this cost to the total procurement cost of the food basket (i.e., 183 pesos) and compare the average willingness to pay

[29] Calculations in Ventura-Alfaro et al. (2011) are based on consultation of the program registries and follow the procedure of Caldes et al. (2006). The costs of worker salaries by program activity were imputed from the self-reported time that a worker devoted to a given activity multiplied by the worker's salary. The warehousing costs include both the cost of the central and of the rural warehouses. The estimation of the costs of renting establishments and of worker salaries was conducted separately for the in-kind and cash transfers since each modality operated independently. I thank Carmelita Ventura-Alfaro for several clarifications about the estimation of the program's administrative costs.

for the in-kind transfer against a cash transfer of 160 pesos (since the administrative costs of a 183 pesos cash transfer would be roughly 23 pesos). Ignoring for simplicity the general equilibrium effects that these policies might have on local prices, Figure 3 suggests that approximately 62 percent of beneficiaries would prefer to receive the basket of food instead of a 160 pesos cash transfer.

8 Conclusions

This paper shows how demand systems can be a useful tool to study the welfare effects of in-kind and cash transfer programs. By building on the theory of virtual prices developed by Neary and Roberts (1980), the methodology discussed in the paper allows to conduct welfare analysis using standard demand models derived from linear budget constraints even in non-standard consumer's problems in which budget sets are nonlinear, as it is the case under the provision of an in-kind transfer. Since this procedure requires the estimation of a demand system using only information on pre-program prices and expenditure, it could be a useful tool for policy makers to conduct ex-ante evaluations of the welfare effects of different transfer policies and of their relative cost-efficiency.

As an application of this approach, the paper studies an experimental trial in rural Mexico in which participating villages were randomly assigned to receive either a basket of food or a cash transfer of approximately the same cost to the policy maker. Results suggest that the welfare of in-kind recipients, as measured by their willingness to pay for the food basket, was on average larger than the welfare of cash recipients. This (perhaps surprising) result can be explained from two observations. First, because the prices of the subsidized commodities in recipient villages were significantly larger than the wholesale prices paid by the government, the face value of the food basket to a recipient was approximately 37 percent larger than the purchasing cost of the basket to the government. Second, although the analysis reveals that there were efficiency losses associated with transferring a food basket that was extra-marginal to most recipients, the welfare loss was not large enough to compensate for the larger costs of cash.

Because the procedure discussed in the paper allows to compute not only the average welfare effects but also their distribution among recipients, another result of the paper suggest that the PAL in-kind transfer was regressive. Since the commodities in the food basket are normal goods for most recipients, welfare losses are larger at the bottom of the income distribution. This is an important result in the context of the policy debate since the use of transfers in-kind over cash transfers is often justified as a mean to achieve self-targeting of recipients. In the context of the rural villages studied in the PAL program in which program take-up is as high as 90 percent, self-targeting of recipients is unlikely to occur given that most of the population is poor and stigma effects are presumably small. In such a case, extra-marginal transfers in-kind might not be well-targeted as the efficiency losses are relatively larger among the most vulnerable households.

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Appendix A: PAL take-up and attrition

Appendix $A1$ discusses the program take-up and the conditionality requirement (education component). Appendix $A2$ presents some statistics about attrition.

Appendix $A1$: Program take-up and the education component

Section 3 briefly discussed that PAL benefits were originally intended to be conditional on the attendance of monthly classes covering topics in hygiene, nutrition and health. All villages in the cash treatment group and a random half of villages in the in-kind treatment arm were randomly selected to receive this additional "education component" of the program. In practice, however, the randomization was confounded and classes were taught also in in-kind villages that were supposedly randomized-out of the education component. This section documents the extent of contamination and the the take-up of the program.

All households were asked if they received any transfer from the PAL program, the periodicity of the delivery and the number of benefits they received. Moreover, conditional on having received at least one transfer, households were asked about their attendance to classes, the total number of classes attended and the topics covered among four possibilities: health, nutrition, hygiene, other topics.[30]

The first column of Table A1 shows that the percentage of households receiving at least one transfer was very high in all three treatment arms (CE=cash plus education; KE=in-kind plus education; K=in-kind without education). However, as reported in the last two rows of the table, program take-up was significantly higher for the in-kind sample than for the cash sample. Take-up among households receiving the cash treatment is around 87%, while it is above 92% for households in in-kind villages. Moreover, in-kind households also received significantly more transfers (column 2). The variability in the number of transfers received is due to the different timing of implementation of the program, with full coverage of eligible villages that was achieved after one year since the start of the program.

[30] One additional category refers to classes about the organization of the PAL program. However, since attendance to this type of classes was a mandatory requirements for all experimental villages, irrespective of whether they were randomized-in or out of the education component, I exclude them from the computation of class attendance.

The next columns show the extent of contamination of the educational component. Column 3 reports the percentage of households attending at least one class while column 4 reports the average number of classes attended (irrespective of the topic). A few comments are in order. First, 70% of households in the "in-kind without education" group attended at least one class, suggesting that the treatment was indeed confounded. Second, the program rules envisaged compulsory attendance to monthly classes. However, the average number of sessions attended (about four in all treatment groups) was significantly lower than the average number of benefits received by program recipients. This suggests that the conditionality requirement was not enforced.

Table A1: Program take-up and contamination

	At least one transfer	Number of transfers	At least one class	Number of classes
Cash+Education (CE)	0.869	12.210	0.729	4.467
	(0.020)	(0.431)	(0.045)	(0.432)
Kind+Education (KE)	0.953	13.564	0.850	4.929
	(0.011)	(0.373)	(0.026)	(0.321)
Kind (K)	0.924	13.181	0.710	4.203
	(0.015)	(0.274)	(0.040)	(0.430)
H0: CE = KE, p-value	0.000	0.019	0.021	0.392
H0: CE = K, p-value	0.027	0.059	0.750	0.665
H0: KE = K, p-value	0.120	0.409	0.004	0.178

Notes: Data are from the household survey and are self-reported. Standard errors are reported in parenthesis and are clustered at the village level.

Appendix $A2$: Attrition

Table A2 shows the attrition rates at the household and at the individual level, separately for each treatment group. While household attrition was close to 15 percent in the control group, it was significantly lower for households in the three treatment groups (approximately equal to 10 percent). There are no statistically significant differences in the attrition rates of the three treatment groups (as reported at the bottom of Table A2, where I test for differential attrition between one treatment group and another).

Attrition also caused some change in household composition. In Table A3 I report the means of demographic characteristics of the household among attriters and non-attriters. Non-attrited households are larger, the household head is on average two years older and it is less likely that the household is headed by a woman. Other variables, such as an indicator for the household being indigenous, the number of younger children and the total food expenditure (net of self-production), do not present statistically significant differences.

Table A2: Attrition rates by treatment group

	Households	Individuals
Cash+Education (CE)	-0.039**	-0.029
	(0.019)	(0.018)
Kind+Education (KE)	-0.047**	-0.045**
	(0.018)	(0.016)
Kind (K)	-0.044**	-0.042**
	(0.021)	(0.021)
Control	0.146***	0.199***
	(0.015)	(0.013)
N	6625	30362
H0: CE=K, p value	0.813	0.531
H0: CE=KE, p value	0.598	0.288
H0: K=KE, p value	0.843	0.850

Notes: The table shows attrition rates at the household (column 1) and at the individual level (column 2) by treatment groups (CE=cash plus education; KE=in-kind plus education; K=in-kind without education). Standard errors are reported in parentheses and are clustered at the village level. *, **, *** denote significance at the 10, 5, 1 percent level, respectively.

Table A3: Means of selected demographic characteristics for attriters and non-attriters

	Non attriters	Attriters	Difference	*N*
Number of household members	4.656	4.137	-0.519***	6691
	(2.159)	(2.037)	(0.120)	
Number of children 0-5 years old	0.709	0.723	0.014	6691
	(0.893)	(0.890)	(0.039)	
Age of the household head	45.207	42.901	-2.307**	6667
	(15.488)	(16.482)	(0.772)	
Indigenous household	0.180	0.232	0.051	6691
	(0.385)	(0.422)	(0.052)	
Female head	0.140	0.202	0.062**	6691
	(0.347)	(0.402)	(0.020)	
Food expenditure	943.035	924.217	-18.818	6691
	(647.519)	(654.832)	(50.201)	

Notes: Columns 1 and 2 show the mean and standard deviations (in parentheses) of demographic household characteristics for attriters and non-attriters. Column 3 reports the mean difference between the two groups and, in parentheses, the corresponding standard errors, clustered at the village level. "Indigenous household" is a dummy equal to one if any member of the household speaks an indigenous language. Food expenditure does not include the value of self-production. *, **, *** denote significance at the 10, 5, 1 percent level, respectively.

Appendix B: Sample and variables construction

Appendix $B1$: Sample construction

The original sample includes $6,707$ baseline and $6,063$ follow-up households in 208 villages. Two villages were excluded from the program because of violence in the community, which could have risked enumerators' safety. As discussed in the paper, I have further excluded nine villages for various reasons: two localities were excluded because households started to receive PAL prior to the baseline survey; two villages refused to participate in the PAL program; two localities were dropped because all households in these villages received Oportunidades; two localities received the wrong treatment (one control village received in-kind transfers and one village received both cash and in-kind transfers). Finally, as documented in Section 4.2 and in Appendix $B2$, the construction of commodity prices requires geographical imputation of missing prices at the municipality or state level. Since in the sample there is only one village from the state of Quintana Roo, it is infeasible to construct prices for this village, and it is thus dropped from the analysis.

Within the remaining 197 sample villages, I have further excluded households with incomplete surveys or in which the household head could not be identified. Among follow-up households, about 200 of them were classified as "split-off", i.e. they were formed by separation from an original baseline household.[31] Whenever possible, both the "original" household and the "split-off" household were surveyed at follow-up. Since the survey of the latter had many missing modules, I have dropped the split-off households from the sample, while I do keep the corresponding "original" households. I have also dropped attrited households and surveys with incomplete food module. Few households were excluded because they had inconsistent or non existing information on the household roaster. I have also excluded households with null food expenditure at baseline or at follow-up. The final estimation sample includes $5,333$ households observed in both waves.

[31] While information on the reason for separation is not reported, inspection of the data reveals that the most common case consists of adult children leaving the parental household to live independently.

Appendix *B*2: Store price survey

Out of the 197 sample villages, store prices were collected in 173 baseline villages and in 192 follow-up villages. A maximum of three stores in each village was surveyed.[32] At baseline, in 65 percent of villages one store was surveyed; in 25 percent of villages two stores were surveyed; and in 10 percent of villages three stores were surveyed. At follow-up, in 33 percent of villages one store was surveyed; in 48 percent of villages two stores were surveyed; and in 19 percent of villages three stores were surveyed. On average, 1.4 and 1.9 stores were surveyed at baseline and at follow-up, respectively.

The follow-up survey collected prices for all the 57 goods included in the analysis, while the baseline survey only collected prices of 34 goods. Even for surveyed stores, there are considerable missing values: the baseline survey lacks information on 22 percent of total village-good observations; the follow-up survey lacks information on 20 percent of total village-good observations.

Prices were generally reported for fixed quantities (e.g., 200 grams of pasta soup). When unconventional units were used (e.g., piece of white bread), I have converted them into kilograms (or liters, for liquids) using the conversion factors from the INSP.

Appendix *B*3: Variables construction

Budget shares Data are from household's seven days recall. For each good in the analysis, households had to report the quantity consumed, the quantity purchased, the corresponding expenditure and, if applicable, the quantity self-produced in the last 7 days. Quantities are usually reported in kilos or liters. When other units of measurements have been reported (e.g. piece or packet), I have converted quantities in kilos or liters using conversion factors from the INSP. Expenditure is reported in Mexican pesos. I have converted weekly quantities and expenditure into monthly quantities and expenditure, using a conversion factor equal to 4.3.

Expenditure is equal to the reported expenditure plus the value of self production. The value of self-production for a given commodity has been imputed as the

[32] I considered a store to have been surveyed if the price of at least one commodity was collected.

product between the quantity self-produced and the median village-level price of that commodity. To construct the expenditure for a food group I have summed the expenditure of all individual commodities in that group. The budget share for the group is computed as the ratio between the budget share of the food group and the total food expenditure (see below).

Total expenditure Total expenditure is the sum of the expenditure on all the 57 commodities considered in the analysis.[33] As described above, the expenditure for a commodity includes the value of self-production; of course, this additional value is also included in the total food expenditure.

Baseline Prices for individual commodities Baseline prices are constructed from unit values. A unit value is obtained taking the ratio between the expenditure for a commodity and the quantity consumed of the commodity. In order to avoid that the estimated parameters are affected by implausible outliers, baseline prices are equal to the median unit value in a village if at least 10 percent of unit values are non-missing. If less than 10 percent of observations are non-missing, I have imputed the price using the median unit value in the municipality or (if less than 10 percent of observations at the municipality level are non-missing) the median unit value in the state. Table *B*2 shows, for each commodity included in the analysis, the imputation process, i.e. the percentage of villages in which the price was equal to the median within the village (columns 2 and 6), or the median within the municipality (columns 3 and 7), or the median within the state (columns 4 and 8).

Follow-up prices for individual commodities Follow-up prices are constructed from surveys of local shops (see Appendix *B*2). The price of a given commodity is equal to the median store price within the village. If the price of a commodity was missing within a village, I have imputed it using the median price within the municipality or the median within the state. Table *B*3 shows, for each commodity included in the analysis, the imputation process, i.e. the percentage of villages in which the price was equal to the median within the village (columns 2 and 6), or the

[33] The list of these goods is reported in Table *B*1.

median within the municipality (columns 3 and 7), or the median within the state (columns 4 and 8). Local store prices were not collected for 5 out of 196 follow-up villages. I have not imputed a price for these villages and consider them as missing in the analysis.

Some goods in the store survey present some differences with respect to the household food consumption survey. First, because of an error in translating the questionnaire, the price of crackers ("galletas saladas") was collected instead of the price of biscuits ("galletas"). I have used the median unit value (constructed as detailed above) instead of the store price for this commodity. Second, in the consumption module two pairs of goods (beef and pork; sardines and tuna) were asked about jointly while they were disaggregated in the price survey. I have used the aggregated category and taken the median of any food price within the pair.

Prices of food groups The price of a food group (e.g., fruit and vegetables; corn; etc.) was constructed as the geometric mean of the prices of the individual commodities in that food group. Let P_J be the price for food group J. Let p_k, $k = 1, ..., K$ be the price of the k-th individual commodity in food group J. The price index for food group J is $ln(P_J) = \sum_{k=1}^{K} w_k ln(p_k)$, where w_k is the weight of the k-th commodity. The weight for commodity k is constructed taking the state-level budget share of good k within food group J. In other words, for each commodity in a given food group, I divide the total expenditure in the state for that commodity by the total expenditure in the state for that food category. Because the in-kind transfer might affect the weights by shifting the expenditure towards certain goods, follow-up state-level weights are constructed separately for the group of villages in the in-kind treatment arm and for the other villages.

Demographics Demographics included in the estimation of the demand system are: the number of household members, the number of children 0 to 5 years old, the age of the household head, the education level (in years) of the household head, an indicator for the household head being female, an indicator for the household being indigenous. All variables are self-explanatory except the last one. I have defined a household to be indigenous if at least one household member reported to speak an indigenous language.

Village population The total population in the village is taken from the 2005 Census compiled by the INEGI (the national institute of statistics).

Wealth index The wealth index is the sum of eleven self-reported indicators about ownership of the following durables: radio, television, video-player, phone, computer, fridge, washing machine, gas heating, boiler, motorcycle, car.

Table B1: Food groups

Group	Group name	Food commodities	Number of goods
1	PAL grains	rice, corn flour, pasta soup, cookies, cereals box	5
2	PAL pulses	beans, lentils	2
3	PAL vegetable oil	vegetable oil	1
4	PAL meat and dairy	canned fish, powdered milk	2
5	Fruit and vegetables	tomato, onion, potato, carrot, greens, pumpkin, chayote, nopales, chile, guayaba, mandarin, papaya, orange, banana, apple, lemon, watermelon	17
6	Corn	corn tortilla, corn grain	2
7	Wheat	white bread, sweet bread, loaf of bread, wheat flour, oats	5
8	Meat and dairy	chicken, beef/pork, fish, eggs, milk, yogurt, cheese, lard, cold cuts	9
9	Other foods	snacks, soft drink, alcohol, coffee, sugar, mixed fry, chocolate, sweets, mayonnaise, fruit juice, consome, powdered soft drink, atole, canned chile	14

Table B2: Imputation of baseline prices

	Good		Price equal to median unit value in the village (% of villages)	Price equal to median unit value in the municipality (% of villages)	Price equal to median unit value in the state (% of villages)		Good		Price equal to median unit value in the village (% of villages)	Price equal to median unit value in the municipality (% of villages)	Price equal to median unit value in the state (% of villages)
		(1)	(2)	(3)	(4)			(5)	(6)	(7)	(8)
1	Tomatoes		0.995	0.005	0.000	30	Lentils	PAL	0.289	0.041	0.670
2	Onions		0.990	0.010	0.000	31	Oats		0.431	0.071	0.497
3	Potatoes		0.954	0.030	0.015	32	Chicken		0.904	0.030	0.066
4	Carrots		0.528	0.076	0.396	33	Pork/beef meat		0.868	0.056	0.076
5	Lettuce and greens		0.472	0.030	0.497	34	Fish		0.371	0.076	0.553
6	Pumpkin		0.518	0.091	0.391	35	Canned fish	PAL	0.680	0.096	0.223
7	Chayote		0.629	0.086	0.284	36	Eggs		0.985	0.005	0.010
8	Nopales		0.112	0.015	0.873	37	Milk		0.848	0.056	0.096
9	Chili peppers		0.838	0.086	0.076	38	Yogurt		0.330	0.051	0.619
10	Guayaba		0.102	0.005	0.893	39	Cheese		0.741	0.056	0.203
11	Mandarin		0.294	0.041	0.665	40	Lard		0.411	0.015	0.574
12	Papaya		0.168	0.030	0.802	41	Processed meats		0.462	0.076	0.462
13	Oranges		0.497	0.102	0.401	42	Powdered milk	PAL	0.152	0.036	0.812
14	Banana		0.802	0.056	0.142	43	Snacks		0.086	0.000	0.914
15	Apples		0.548	0.056	0.396	44	Soft drink		0.944	0.041	0.015
16	Lemons		0.335	0.051	0.614	45	Alcohol		0.168	0.020	0.812
17	Watermelon		0.076	0.005	0.919	46	Coffee		0.975	0.000	0.025
18	Corn tortilla		0.650	0.056	0.294	47	Sugar		1.000	0.000	0.000
19	Corn grain		0.756	0.102	0.142	48	Vegetable oil	PAL	0.995	0.000	0.005
20	Corn flour	PAL	0.386	0.076	0.538	49	Mixed fries		0.203	0.015	0.782
21	White bread		0.660	0.076	0.264	50	Chocolate		0.112	0.000	0.888
22	Sweet bread		0.949	0.030	0.020	51	Sweets		0.543	0.066	0.391
23	Loaf of bread		0.218	0.036	0.746	52	Mayonnaise		0.508	0.041	0.452
24	Wheat flour		0.102	0.000	0.898	53	Fruit juice		0.091	0.020	0.888
25	Pasta soup	PAL	1.000	0.000	0.000	54	Consome		0.619	0.071	0.310
26	Rice	PAL	1.000	0.000	0.000	55	Powdered soft drink		0.797	0.066	0.137
27	Cookies	PAL	0.964	0.015	0.020	56	Atole		0.066	0.005	0.929
28	Cereals box	PAL	0.122	0.036	0.843	57	Canned chili		0.680	0.081	0.239
29	Beans	PAL	0.964	0.010	0.025						

Notes: The table shows, for each commodity included in the analysis, the percentage of villages in which the price was equal to the median unit value within the village (columns 2 and 6), or the median unit value within the municipality (columns 3 and 7), or the median unit value within the state (columns 4 and 8). Columns 1 and 5 reports the goods in the PAL subsidy.

Table B3: Imputation of follow-up prices

	Good	(1)	Price equal to median store price in the village (% of villages) (2)	Price equal to median store price in the municipality (% of villages) (3)	Price equal to median store price in the state (% of villages) (4)		Good	(5)	Price equal to median store price in the village (% of villages) (6)	Price equal to median store price in the municipality (% of villages) (7)	Price equal to median store price in the state (% of villages) (8)
1	Tomatoes		0.917	0.052	0.031	30	Lentils	PAL	0.734	0.115	0.151
2	Onions		0.932	0.036	0.031	31	Oats		0.870	0.063	0.068
3	Potatoes		0.906	0.052	0.042	32	Chicken		0.776	0.141	0.083
4	Carrots		0.766	0.135	0.099	33	Pork/beef meat		0.776	0.125	0.099
5	Lettuce and greens		0.661	0.193	0.146	34	Fish		0.583	0.208	0.208
6	Pumpkin		0.661	0.172	0.167	35	Canned fish	PAL	0.990	0.005	0.005
7	Chayote		0.740	0.156	0.104	36	Eggs		0.969	0.021	0.010
8	Nopales		0.354	0.219	0.427	37	Milk		0.849	0.068	0.083
9	Chili peppers		0.839	0.094	0.068	38	Yogurt		0.818	0.094	0.089
10	Guayaba		0.432	0.240	0.328	39	Cheese		0.792	0.104	0.104
11	Mandarin		0.578	0.245	0.177	40	Lard		0.646	0.177	0.177
12	Papaya		0.531	0.234	0.234	41	Processed meats		0.724	0.135	0.141
13	Oranges		0.594	0.203	0.203	42	Powdered milk	PAL	0.464	0.219	0.318
14	Banana		0.807	0.135	0.057	43	Snacks		0.755	0.120	0.125
15	Apples		0.760	0.161	0.078	44	Soft drink		0.917	0.026	0.057
16	Lemons		0.708	0.182	0.109	45	Alcohol		0.328	0.219	0.453
17	Watermelon		0.484	0.234	0.281	46	Coffee		0.943	0.021	0.036
18	Corn tortilla		0.760	0.120	0.120	47	Sugar		0.979	0.021	0.000
19	Corn grain		0.792	0.104	0.104	48	Vegetable oil	PAL	0.990	0.000	0.010
20	Corn flour	PAL	0.818	0.104	0.078	49	Mixed fries		0.891	0.057	0.052
21	White bread		0.682	0.167	0.151	50	Chocolate		0.792	0.104	0.104
22	Sweet bread		0.781	0.120	0.099	51	Sweets		0.948	0.016	0.036
23	Loaf of bread		0.760	0.125	0.115	52	Mayonnaise		0.901	0.063	0.036
24	Wheat flour		0.818	0.083	0.099	53	Fruit juice		0.880	0.089	0.031
25	Pasta soup	PAL	1.000	0.000	0.000	54	Consome		0.953	0.036	0.010
26	Rice	PAL	0.995	0.005	0.000	55	Powdered soft drink		0.943	0.047	0.010
27	Cookies	PAL	0.875	0.063	0.063	56	Atole		0.844	0.089	0.068
28	Cereals box	PAL	0.745	0.156	0.099	57	Canned chili		0.964	0.026	0.010
29	Beans	PAL	0.964	0.016	0.021						

Notes: The table shows, for each commodity included in the analysis, the percentage of villages in which the price was equal to the median store price within the village (columns 2 and 6), or the median store price within the municipality (columns 3 and 7), or the median store price within the state (columns 4 and 8). Columns 1 and 5 reports the goods in the PAL subsidy. For cookies (good 27) median unit values were used instead of median store prices.

Appendix C: Additional Results

Appendix $C1$: Additional summary statistics

Table C1 and Table C2 report respectively the average baseline budget share and the average baseline price of each commodity used in the analysis. Prices are constructed as the median unit value in the village.

Table C1: Mean and standard deviation of baseline budget shares

	Good		Mean	SD		Good		Mean	SD
1	Tomatoes		0.040	0.035	30	Lentils	PAL	0.003	0.010
2	Onions		0.022	0.021	31	Oats		0.004	0.013
3	Potatoes		0.013	0.021	32	Chicken		0.085	0.088
4	Carrots		0.003	0.009	33	Pork/beef meat		0.040	0.068
5	Lettuce and greens		0.005	0.017	34	Fish		0.025	0.068
6	Pumpkin		0.008	0.023	35	Canned fish	PAL	0.010	0.023
7	Chayote		0.010	0.024	36	Eggs		0.037	0.042
8	Nopales		0.003	0.012	37	Milk		0.041	0.075
9	Chili peppers		0.014	0.026	38	Yogurt		0.006	0.022
10	Guayaba		0.004	0.020	39	Cheese		0.019	0.035
11	Mandarin		0.009	0.026	40	Lard		0.006	0.021
12	Papaya		0.004	0.016	41	Processed meats		0.005	0.018
13	Oranges		0.019	0.039	42	Powdered milk	PAL	0.022	0.060
14	Banana		0.016	0.028	43	Snacks		0.001	0.009
15	Apples		0.008	0.022	44	Soft drink		0.030	0.051
16	Lemons		0.009	0.017	45	Alcohol		0.008	0.044
17	Watermelon		0.001	0.010	46	Coffee		0.043	0.063
18	Corn tortilla		0.071	0.109	47	Sugar		0.053	0.046
19	Corn grain		0.081	0.120	48	Vegetable oil	PAL	0.043	0.036
20	Corn flour	PAL	0.012	0.037	49	Mixed fries		0.003	0.011
21	White bread		0.008	0.022	50	Chocolate		0.003	0.014
22	Sweet bread		0.020	0.038	51	Sweets		0.003	0.012
23	Loaf of bread		0.003	0.013	52	Mayonnaise		0.004	0.012
24	Wheat flour		0.001	0.009	53	Fruit juice		0.002	0.012
25	Pasta soup	PAL	0.016	0.019	54	Consome		0.003	0.010
26	Rice	PAL	0.020	0.023	55	Powdered soft drink		0.005	0.016
27	Cookies	PAL	0.018	0.034	56	Atole		0.001	0.006
28	Cereals box	PAL	0.005	0.019	57	Canned chili		0.003	0.009
29	Beans	PAL	0.065	0.069					

Notes: Calculations include the value of home-produced goods, which has been estimated as the product between the quantity home-produced and the median unit value

Table C2: Mean and standard deviation of baseline prices

	Good		Mean	SD		Good		Mean	SD
1	Tomatoes		9.32	2.22	30	Lentils	PAL	9.81	1.60
2	Onions		9.10	1.38	31	Oats		12.63	3.63
3	Potatoes		9.76	2.00	32	Chicken		24.90	5.49
4	Carrots		8.45	1.96	33	Pork/beef meat		39.67	10.74
5	Lettuce and greens		12.44	3.81	34	Fish		28.66	8.77
6	Pumpkin		8.24	2.45	35	Canned fish	PAL	30.77	8.83
7	Chayote		7.85	2.37	36	Eggs		13.89	2.25
8	Nopales		10.42	1.62	37	Milk		54.51	18.91
9	Chili peppers		16.15	6.33	38	Yogurt		25.80	6.73
10	Guayaba		9.61	1.69	39	Cheese		40.82	9.55
11	Mandarin		5.95	1.34	40	Lard		14.37	3.97
12	Papaya		7.24	1.47	41	Processed meats		38.80	8.41
13	Oranges		3.49	1.91	42	Powdered milk	PAL	36.16	7.62
14	Banana		5.47	1.19	43	Snacks		45.19	13.94
15	Apples		13.25	2.74	44	Soft drink		7.04	1.34
16	Lemons		6.33	1.67	45	Alcohol		18.27	5.77
17	Watermelon		5.42	0.94	46	Coffee		103.16	76.22
18	Corn tortilla		6.55	1.08	47	Sugar		7.26	0.52
19	Corn grain		2.70	1.09	48	Vegetable oil	PAL	11.27	1.27
20	Corn flour	PAL	5.21	1.20	49	Mixed fries		66.91	18.19
21	White bread		14.27	3.81	50	Chocolate		43.72	9.84
22	Sweet bread		17.29	7.54	51	Sweets		84.63	32.22
23	Loaf of bread		21.03	7.78	52	Mayonnaise		52.92	13.28
24	Wheat flour		5.44	0.63	53	Fruit juice		13.18	2.49
25	Pasta soup	PAL	14.28	1.93	54	Consome		140.41	40.18
26	Rice	PAL	6.82	1.73	55	Powdered soft drink		172.28	76.44
27	Cookies	PAL	19.15	5.23	56	Atole		60.61	11.83
28	Cereals box	PAL	38.34	7.95	57	Canned chili		25.94	6.94
29	Beans	PAL	10.33	1.75					

Notes: The baseline price is obtained taking the median unit value in a village (or, if this is missing for more than 10 percent of households in a village, the median unit value in the municipality or in the state). The unit value is constructed from self-reported household consumption data and is the ratio between the expenditure for a commodity and the quantity purchased.

Appendix $C2$: First stage regressions

Table $C3$ shows the results of the first stage regressions for the logarithms of total food expenditure and its square. Estimation is performed by OLS. The instruments are a wealth index, computed as the sum of 11 indicators measuring ownership of durables, and its square. The regression also includes all the demographic characteristics of the household used to estimate the demand system and the logarithms of the prices of the food groups (estimated coefficients for the prices are not shown). The bottom of the table shows the F statistics from testing the joint significance of the set of instruments, separately for each equation, and the corresponding p-values.

Table C3: First stage regression results

	$ln(x)$	$[ln(x)]^2$
Wealth index	0.087***	1.072***
	(0.014)	(0.162)
Wealth index squared	-0.000	0.013
	(0.002)	(0.021)
Number household members	0.106***	1.462***
	(0.005)	(0.061)
Number children 0-5	-0.064***	-0.878***
	(0.011)	(0.145)
Age head	-0.001	-0.008
	(0.001)	(0.008)
Education head	0.010***	0.136***
	(0.003)	(0.034)
Indigenous household	-0.073*	-1.010**
	(0.042)	(0.350)
Female head	-0.090***	-1.115***
	(0.024)	(0.308)
Village population	-0.000	-0.000
	(0.000)	(0.000)
Guerrero	-0.007	-0.008
	(0.123)	(0.846)
Oaxaca	0.078	1.009*
	(0.071)	(0.561)
Tabasco	-0.172**	-2.342***
	(0.082)	(0.532)
Veracruz	-0.113	-1.520***
	(0.072)	(0.460)
Month survey February	0.002	-0.027
	(0.061)	(0.601)
Month survey March	0.042	0.617*
	(0.046)	(0.369)
Month survey April	0.005	0.069
	(0.065)	(0.453)
Month survey October	0.167**	2.386***
	(0.070)	(0.420)
Month survey November	0.080*	1.130***
	(0.046)	(0.319)
Month survey December	0.043	0.607
	(0.066)	(0.412)
Constant	3.006**	-6.414
	(0.905)	(5.523)
Log prices	YES	YES
F test	143.4	197.1
p-value	0.000	0.000
N	5333	5333

Notes: The asset index is constructed as the sum of eleven indicators measuring household ownership of durables. "Indigenous household" is an indicator equal to one if at least one household member speaks an indigenous language. Standard errors are reported in parentheses and are clustered at the village level. *, **, *** denote significance at the 10, 5, 1 percent level, respectively.

Appendix $C3$: Parameter estimates and elasticities

Table C4 shows the estimated parameters of the QUAIDS. The demand system includes the following demographics characteristics of the household: the number of household members; the number of children 0-5 years old children; the age of the household head; the education of the household head (in years); an indicator for the household being indigenous (which is defined by the presence of at least one household member speaking an indigenous language); an indicator for the head of the household being female; the total population in the village; indicators for the state and month of the survey. The terms v_1 and v_2, reported at the bottom of the table, indicate the residuals from the first stage regression of, respectively, $ln(x)$ and $[ln(x)]^2$ on the set of instruments (see Appendix $C3$). Standard errors have been computed using a bootstrap estimator which accounts for the clustering of the errors at the village level.

Tables C5 and C6 reports the full set of estimated Marshallian and Hicksian price elasticities, respectively. Price elasticities have been computed using equations (10) and (12) from the paper. Given the estimated standard errors for the model parameters, which account for clustering at the village level, standard errors for the elasticities have been computed using the delta method.

Table C4: Estimated parameters of the QUAIDS

	PAL grains	PAL pulses	PAL veg. oil	PAL meat and dairy	Fruit and vegetables	Corn	Wheat	Meat and dairy	Other foods
$ln(p_{pg})$	0.004	-0.012	0.013	-0.001	-0.011	-0.017*	0.012**	-0.012	0.025***
	(0.018)	(0.012)	(0.010)	(0.007)	(0.015)	(0.009)	(0.006)	(0.016)	(0.009)
$ln(p_{pp})$	-0.012	-0.040*	-0.004	0.012**	0.046***	-0.035***	0.008	0.060***	-0.036**
	(0.012)	(0.023)	(0.008)	(0.006)	(0.017)	(0.013)	(0.008)	(0.019)	(0.018)
$ln(p_{pv})$	0.013	-0.004	0.001	-0.003	0.006	-0.007	0.007	-0.009	-0.003
	(0.010)	(0.008)	(0.012)	(0.005)	(0.009)	(0.006)	(0.004)	(0.011)	(0.006)
$ln(p_{pm})$	-0.001	0.012**	-0.003	-0.002	-0.007	0.000	0.001	-0.006	0.007
	(0.007)	(0.006)	(0.005)	(0.005)	(0.008)	(0.004)	(0.002)	(0.008)	(0.005)
$ln(p_{fv})$	-0.011	0.046***	0.006	-0.007	0.022	0.007	-0.028***	-0.029	-0.005
	(0.015)	(0.017)	(0.009)	(0.008)	(0.028)	(0.015)	(0.009)	(0.022)	(0.016)
$ln(p_{co})$	-0.017*	-0.035***	-0.007	0.000	0.007	0.094***	-0.005	0.022	-0.058***
	(0.009)	(0.013)	(0.006)	(0.004)	(0.015)	(0.033)	(0.006)	(0.024)	(0.013)
$ln(p_{wh})$	0.012**	0.008	0.007	0.001	-0.028***	-0.005	0.003	0.004	-0.002
	(0.006)	(0.008)	(0.004)	(0.002)	(0.009)	(0.006)	(0.005)	(0.011)	(0.006)
$ln(p_{me})$	-0.012	0.060***	-0.009	-0.006	-0.029	0.022	0.004	-0.066*	0.036*
	(0.016)	(0.019)	(0.011)	(0.008)	(0.022)	(0.024)	(0.011)	(0.039)	(0.018)
$ln(p_{of})$	0.025***	-0.036**	-0.003	0.007	-0.005	-0.058***	-0.002	0.036*	0.036**
	(0.009)	(0.018)	(0.006)	(0.005)	(0.016)	(0.013)	(0.006)	(0.018)	(0.016)
$ln(x)$	-0.043***	-0.056***	-0.041***	-0.001	-0.004	-0.005	0.018	0.154***	-0.022
	(0.012)	(0.021)	(0.011)	(0.006)	(0.022)	(0.035)	(0.017)	(0.028)	(0.029)
$[ln(x)]^2$	0.009**	-0.011	0.007	0.003	0.023***	-0.035***	-0.001	0.013	-0.007
	(0.004)	(0.008)	(0.004)	(0.002)	(0.008)	(0.012)	(0.006)	(0.009)	(0.011)
N. hh members	0.003**	0.016***	0.002**	-0.002***	-0.013***	0.021***	-0.002**	-0.032***	0.007***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.004)	(0.001)	(0.005)	(0.002)
N. children 0-5	0.000	-0.004*	-0.002***	0.004***	0.002	-0.017***	0.001	0.025***	-0.008***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.003)	(0.004)	(0.001)	(0.005)	(0.002)
Age head	-0.000***	-0.000	-0.000	-0.000***	0.000	0.000	0.000**	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education head	-0.001*	-0.001***	-0.000**	0.000	0.001**	-0.002	0.001***	0.002*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Indigenous hh	-0.006	0.001	-0.012***	-0.001	0.023***	0.008	-0.010***	-0.004	0.002
	(0.005)	(0.009)	(0.003)	(0.002)	(0.008)	(0.015)	(0.003)	(0.013)	(0.008)
Female head	0.004	-0.012***	-0.002	0.002	0.009*	-0.017**	0.007***	0.020**	-0.012**
	(0.003)	(0.004)	(0.002)	(0.002)	(0.005)	(0.008)	(0.002)	(0.009)	(0.005)

Village pop.	-0.000	-0.000	-0.000	0.000	-0.000	-0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Guerrero	-0.008	-0.043***	-0.007	0.000	0.003	-0.025	0.022***	0.044	0.013
	(0.009)	(0.016)	(0.008)	(0.003)	(0.016)	(0.038)	(0.006)	(0.031)	(0.015)
Oaxaca	-0.007	-0.024	0.000	-0.007**	0.038***	-0.002	0.017***	-0.017	0.001
	(0.007)	(0.017)	(0.004)	(0.003)	(0.013)	(0.022)	(0.006)	(0.023)	(0.012)
Tabasco	0.023***	-0.053***	0.004	0.008**	0.008	-0.103***	0.007	0.102***	0.004
	(0.008)	(0.015)	(0.004)	(0.004)	(0.012)	(0.021)	(0.005)	(0.021)	(0.012)
Veracruz	0.006	-0.037***	0.007*	0.001	0.008	-0.062***	0.011***	0.061***	0.005
	(0.006)	(0.013)	(0.004)	(0.003)	(0.011)	(0.018)	(0.003)	(0.018)	(0.009)
Survey Feb.	0.012	0.024**	0.004	0.002	-0.003	-0.020	0.001	-0.011	-0.008
	(0.014)	(0.011)	(0.004)	(0.005)	(0.010)	(0.030)	(0.005)	(0.027)	(0.015)
Survey Mar.	-0.005	-0.003	-0.002	0.002	-0.016**	0.000	-0.002	0.011	0.016**
	(0.005)	(0.008)	(0.003)	(0.003)	(0.007)	(0.013)	(0.003)	(0.015)	(0.007)
Survey Apr.	-0.012*	0.001	0.005	0.003	0.001	0.015	-0.003	-0.010	0.001
	(0.007)	(0.015)	(0.004)	(0.003)	(0.009)	(0.027)	(0.004)	(0.020)	(0.009)
Survey Oct.	0.002	-0.002	0.003	0.009***	0.016	0.007	-0.002	-0.054***	0.021**
	(0.006)	(0.013)	(0.004)	(0.003)	(0.010)	(0.017)	(0.004)	(0.019)	(0.010)
Survey Nov.	0.005	-0.008	-0.004	0.008***	0.013**	-0.007	-0.004	-0.017	0.016***
	(0.004)	(0.006)	(0.003)	(0.003)	(0.006)	(0.013)	(0.003)	(0.016)	(0.006)
Survey Dec.	-0.003	-0.000	-0.005	0.006*	0.031***	-0.015	0.008*	-0.021	-0.000
	(0.006)	(0.007)	(0.003)	(0.003)	(0.010)	(0.016)	(0.004)	(0.018)	(0.008)
Constant	0.081***	0.099***	0.099***	0.011	0.217***	0.330***	-0.021	0.128**	0.057
	(0.024)	(0.038)	(0.017)	(0.012)	(0.040)	(0.062)	(0.018)	(0.063)	(0.036)
v_1	0.151***	-0.018	0.057	0.037	0.323***	-0.298	-0.051	0.100	-0.300*
	(0.051)	(0.112)	(0.057)	(0.023)	(0.100)	(0.197)	(0.044)	(0.140)	(0.171)
v_2	-0.010***	0.005	-0.004	-0.003*	-0.027***	0.025*	0.003	-0.014	0.025**
	(0.004)	(0.008)	(0.004)	(0.002)	(0.007)	(0.014)	(0.003)	(0.010)	(0.013)

Notes: Homogeneity and symmetry have been imposed throughout. $ln(p_i)$ is the natural logarithm of the price of food group i; pg=PAL grains, pp=PAL pulses, pv=PAL vegetable oil, pm=PAL meat and dairy, fv=fruit and vegetables, co=corn, wh=wheat, me=meat and dairy, of=other foods. "Indigenous hh" is an indicator equal to one if at least one household member speaks an indigenous language. Standard errors are reported in parantheses and are computed using a bootstrap estimator accounting for clustering at the village level. 500 replications of the bootstrap have been used. *, **, *** denote significance at the 10, 5, 1 percent level, respectively. The sample includes 5333 baseline households.

Table C5: Uncompensated price elasticities

	PG	PP	PV	PM	FV	CO	WH	ME	OF
PG	-0.881**	-0.120	0.254	-0.023	-0.146	-0.206	0.197**	-0.259	0.495***
	(0.300)	(0.199)	(0.167)	(0.118)	(0.240)	(0.158)	(0.098)	(0.261)	(0.147)
PP	-0.044	-1.300***	0.045	0.146**	0.685***	-0.153	0.112	0.758***	-0.218
	(0.146)	(0.276)	(0.093)	(0.069)	(0.207)	(0.155)	(0.095)	(0.220)	(0.213)
PV	0.341	0.037	-0.924***	-0.071	0.193	-0.028	0.152*	-0.239	0.036
	(0.221)	(0.168)	(0.252)	(0.115)	(0.199)	(0.137)	(0.091)	(0.249)	(0.132)
PM	-0.194	1.073*	-0.381	-1.163**	-0.802	-0.132	0.053	-0.650	0.546
	(0.705)	(0.555)	(0.529)	(0.463)	(0.828)	(0.410)	(0.241)	(0.756)	(0.498)
FV	-0.089	0.213**	0.013	-0.043	-0.916***	-0.044	-0.169**	-0.203	-0.092
	(0.085)	(0.097)	(0.053)	(0.047)	(0.161)	(0.091)	(0.052)	(0.131)	(0.096)
CO	-0.054	-0.110	-0.005	0.005	0.110	-0.339*	-0.017	0.175	-0.215**
	(0.052)	(0.071)	(0.034)	(0.023)	(0.084)	(0.204)	(0.033)	(0.135)	(0.073)
WH	0.303*	0.149	0.162	0.017	-0.896**	-0.277	-0.903***	0.134	-0.174
	(0.177)	(0.230)	(0.123)	(0.071)	(0.275)	(0.182)	(0.159)	(0.327)	(0.183)
ME	-0.126**	0.103	-0.102**	-0.027	-0.214**	-0.108	0.009	-1.272***	-0.011
	(0.061)	(0.073)	(0.045)	(0.030)	(0.086)	(0.097)	(0.042)	(0.149)	(0.076)
OF	0.181***	-0.176	-0.001	0.043	0.003	-0.292***	-0.011	0.234**	-0.724***
	(0.055)	(0.109)	(0.036)	(0.031)	(0.103)	(0.086)	(0.037)	(0.116)	(0.103)

Notes: Uncompensated price elasticities are computed at the midpoint of the sample. Standard errors are computed using the delta method. *, **, *** denote significance at the 10, 5, 1 percent level, respectively. PG=PAL grains; PP=PAL pulses; PV=PAL vegetable oil; PM=PAL meat and dairy; FV=fruit and vegetables; CO=corn; WH=wheat; ME=meat and dairy; OF=other foods.

Table C6: Compensated price elasticities

	PG	PP	PV	PM	FV	CO	WH	ME	OF
PG	-0.839**	-0.063	0.285*	-0.016	-0.026	-0.082	0.221**	-0.086	0.606***
	(0.299)	(0.201)	(0.168)	(0.117)	(0.244)	(0.156)	(0.098)	(0.256)	(0.144)
PP	-0.046	-1.303***	0.044	0.146**	0.679***	-0.159	0.111	0.750***	-0.223
	(0.146)	(0.277)	(0.094)	(0.069)	(0.205)	(0.150)	(0.095)	(0.214)	(0.213)
PV	0.371*	0.078	-0.901***	-0.066	0.281	0.063	0.169*	-0.113	0.117
	(0.221)	(0.170)	(0.252)	(0.115)	(0.199)	(0.136)	(0.092)	(0.246)	(0.128)
PM	-0.095	1.210**	-0.305	-1.147**	-0.515	0.165	0.109	-0.237	0.814*
	(0.705)	(0.561)	(0.530)	(0.463)	(0.831)	(0.404)	(0.242)	(0.736)	(0.494)
FV	-0.009	0.323**	0.075	-0.030	-0.684***	0.195**	-0.124**	0.130	0.123
	(0.084)	(0.099)	(0.053)	(0.047)	(0.163)	(0.091)	(0.052)	(0.129)	(0.095)
CO	-0.027	-0.073	0.016	0.009	0.189**	-0.258	-0.002	0.288**	-0.142*
	(0.051)	(0.070)	(0.034)	(0.023)	(0.086)	(0.195)	(0.033)	(0.138)	(0.073)
WH	0.392**	0.272	0.231*	0.032	-0.637**	-0.010	-0.852***	0.506	0.066
	(0.176)	(0.237)	(0.124)	(0.071)	(0.277)	(0.176)	(0.160)	(0.314)	(0.177)
ME	-0.021	0.248***	-0.021	-0.009	0.091	0.207**	0.068	-0.834***	0.271***
	(0.061)	(0.075)	(0.045)	(0.029)	(0.090)	(0.097)	(0.042)	(0.149)	(0.074)
OF	0.225***	-0.114	0.034	0.050	0.133	-0.158*	0.014	0.420***	-0.604***
	(0.055)	(0.109)	(0.037)	(0.031)	(0.102)	(0.082)	(0.037)	(0.115)	(0.101)

Notes: Compensated price elasticities are computed at the midpoint of the sample. Standard errors are computed using the delta method. *, **, *** denote significance at the 10, 5, 1 percent level, respectively. PG=PAL grains; PP=PAL pulses; PV=PAL vegetable oil; PM=PAL meat and dairy; FV=fruit and vegetables; CO=corn; WH=wheat; ME=meat and dairy; OF=other foods.

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