

# The Impact of Food Price Increases on Poverty in Mexico

Juan Carlos Chávez Martín del Campo<sup>\*</sup>  
Héctor Juan Villarreal Páez<sup>\*\*</sup>

## Abstract

In Mexico, the recent upsurge in global food prices has more than proportionately affected the most marginalized sectors of the population. According to this study's results, it is possible to conclude that even though poverty is highly sensitive to food price increases, the substitution ability of households assists in cushioning the wealth loss of society's poorest segments. Different targeting mechanisms were analyzed to measure their efficiency in allocating public funds. In this case, food price subsidies were not the best mechanism studied. In contrast, utilizing the Oportunidades social welfare program platform increased targeting efficiency. However, it is important to remember that a large share of the Mexican population below the food poverty line does not receive any support from social programs. For the Mexican federal government, this represents a pressing challenge of expanding social welfare program coverage over the short and medium term.

**Key Words:** Food prices; poverty; public transfers; targeting; Mexico.

**JEL Classification:** D12, H53, I32, I38, Q11.

---

<sup>\*</sup>Centro de Estudios de las Finanzas Públicas, H. Cámara de Diputados; Escuela de Economía, Universidad de Guanajuato.

<sup>\*\*</sup>Centro de Estudios de las Finanzas Públicas, H. Cámara de Diputados; Escuela de Graduados en Administración Pública y Política Pública, ITESM.

# 1. Introduction

Since 2005, the international community has experienced considerable price increases in various agricultural products important for human consumption. For example, between January of 2005 and June of 2009, the international price of corn, a staple of the Mexican diet, rose 241%. Rice prices increased 670% and wheat 279.3% over the same period (World-Bank 2008a). In Mexico, the unitary value (or average price) of the imported food basket has increased significantly since 2006. By the end of March 2008, the unitary value of this basket had climbed 62% in relation to its 2005 level. The products whose price increases have most drastically impacted Mexico are corn, wheat, soy and powdered milk (Banxico 2008).

The price increase in foodstuffs has been propelled by several factors: rising energy and fertilizer costs, an escalation in biofuel demand, droughts in Australia and other countries, and even the increasing purchasing power of nations such as China and India (IFPRI 2008, FAO 2008, World-Bank 2008b). Two factors from the abovementioned list warrant special attention. The higher economic growth rates experienced by China and India have contributed to an expansion in the consumption of meat products in those countries. In turn, this has influenced the demand for feedstock. The other important factor is the rising demand for ethanol as biofuel. Given heightened desirability of utilizing corn for biofuel production, some farmers have substituted wheat and soy production to plant additional corn fields. The resulting lower wheat and soy production has led to a rise in the price of these two products.

The international reaction to these trends has been notable and national governments have implemented a series of policy methods to counteract the problem. From the demand side, Bangladesh, Bolivia, Ecuador, the European Union, India, Indonesia, Mexico, Morocco, the Republic of Korea, Russia, Turkey and the United States have relaxed import controls on a diverse array of primary goods (Banxico 2008). Azerbaijan, Benin, Cameroon, China, Ecuador, Egypt, Malaysia, Russia, Senegal and the Ukraine have implemented subsidies and price controls as well as eliminated taxes levied on consumable goods. These reactions have generated increased pressure on agricultural markets, which translates into higher food

prices (Banxico 2008, IFPRI 2008).

Despite growing concern among both public opinion and within government, there exists relatively little information regarding how food price increases will impact poverty in Mexico. This worry is well justified, as poor households in Mexico already dedicate nearly half of their expenditure to fulfilling dietary needs.

The present study has two fundamental objectives. First, it analyzes the effect of food price increases, particularly in grains, on poverty in Mexico. Second, it evaluates a series of fund allocation mechanisms implemented by the federal government that seek to combat food shortfalls experienced by the nation's poor. During the first semester of 2008, the Mexican federal government presented a series of action items to support family economic security. These items are founded on three principal axes (Sedesol 2008): 1) facilitate the provision of and access to the best world food prices for Mexican consumers; 2) Stimulate the production of food products and increase field productivity; 3) Protect the incomes of the poorest families. In this study, we focus on the last of the axes. In an effort to fulfill this third axis, the government has authorized an action to transfer 120 pesos MXN per month to those families participating in certain social programs such as Oportunidades, Diconsa Nutritional Support and Nutritional Support for Marginalized Areas.

The study is divided into sections. The second section presents a brief description of the poverty measures utilized as well as social methodology for poverty measurement. The third section describes the pattern of food consumption for poor families and the price structures they face. For this, a price index for poor families and the distributional characteristics of their consumed goods are estimated. The fourth section simulates the impact of a series of food price increases, particularly in grains, on poverty utilizing a demand system. The fifth section compares the current federal government transfer system implemented in reaction to these price increases to other fund allocation systems found within targeting theory. Section six enumerates the study conclusions. Methodology, descriptions of the data used, and tables and figures referenced in the body of this paper can be found in Appendices A, B, and C, respectively.

## 2. Poverty Measurement in Mexico

In Mexico, the General Law of Social Development indicates that the National Board of Social Development Policy Evaluation (CONEVAL for its Spanish acronym) will establish the guiding direction and criterion for defining, identifying and measuring poverty (CONEVAL 2006). This board is comprised of the head of the Secretary's Office of Social Development, one executive assistant and six academic experts.<sup>1</sup>

The board determined that the simplest and most transparent methodology was to establish monetary poverty lines, employing total net income per capita as the welfare indicator. This income considers monetary as well as non-monetary income. The board established three poverty lines: Nutritional, Capacity and Patrimony. The Nutritional poverty line refers to purchasing power to acquire a basic food basket<sup>2</sup>, Capacity poverty corresponds to those expenses necessary to cover nutritional, health and education requirements. The Patrimony poverty line represents the value of the Capacity poverty line plus the costs of housing and transportation considered necessary. These poverty lines were created both for rural communities (those with fewer than 2500 inhabitants) and for urban zones (communities with more than 2500 inhabitants).

### 2.1. Poverty Measurement

We allow  $(y_1, \dots, y_n)$  to be a vector of incomes observed for a population of  $n$  individuals. The poverty function  $\pi(y_i, z)$  informs how poor an individual who has income  $y_i$  is when the poverty line is  $z$ .

The poverty index most commonly utilized is the proportion of poor individuals

$$H = \frac{1}{n} \sum_{i=1}^n 1(y_i < z) \quad (1)$$

---

<sup>1</sup>For additional details about the organization CONEVAL and its objectives, see [www.coneval.gob.mx](http://www.coneval.gob.mx).

<sup>2</sup>As of August 2006, the nutritional poverty line in rural and urban areas was 598.7 pesos MXN and 809.87 pesos MXN, respectively.

Where the poverty function is simply

$$\pi(y_i, z) = 1(y_i < z) \quad (2)$$

In other words, the binary function is equal to one if the individual is poor and equal to zero if the individual is not poor.

Since the seminal work of Amartya Sen (1976), special emphasis has been placed on the intensity of poverty. To examine this, an undisputed apparatus was incorporated into the model. This action served as a taking off point for constructing poverty measurements that are more sensitive to income distributions below the poverty line.<sup>3</sup> In particular, Sen touts the importance of two specific axioms:

1) *Axiom of Monotonicity: ceteris paribus*, a decrease in an individual's income should increase the measured level of poverty.

2) *Axiom of Transfers: ceteris paribus*, the transfer of income from one poor individual to another with higher income should increase the measured level of poverty.

Foster, Greer and Thorbecke (1984) proposed a poverty measure that respects these two axioms under certain conditions:

$$P_\alpha = \frac{1}{n} \sum_{i=1}^n 1(y_i < z) \left( \frac{z - y_i}{z} \right)^\alpha \quad (3)$$

The parameters measure the relative importance that is given to poverty intensity: the larger  $\alpha$ , the larger the weight assigned to poor households with lower incomes. Additionally, this measure of poverty respects the Axiom of Monotonicity for  $\alpha > 0$  and the Axiom of Transfers for  $\alpha > 1$ . Family  $P_\alpha$  can be decomposed into subgroups. For example, national poverty can be broken into the sum of rural poverty and urban poverty.

---

<sup>3</sup>For a detailed revision of poverty measurement, see Zheng(1997) and Seidl(1998).

## 2.2. Equivalent Income and Poverty Measurement

Consider an agent who faces a vector of prices  $p_1$  and has income  $y$ . The agent's utility function is given as

$$v(p_1, y) \tag{4}$$

where  $p_0$  is a vector of reference prices. Similarly to King's (1983) construction, equivalent income is implicitly defined as:

$$v(p_0, y^e) = v(p_1, y) \tag{5}$$

Equivalent income represents the minimum income necessary to maintain the welfare level observed under level of prices  $p_1$ , assuming that the price structure that prevails is that of the reference vector  $p_0$ .

Utilizing the expenditure function, which represents the minimum expenditure necessary to reach a level of utility  $u$  given the price vector  $p$  for all goods and services consumed, equivalent income can also be expressed as:

$$y^e = e(p_0, v(p_1, y)) \tag{6}$$

In such, when prices change from  $p_0$  to  $p_1$  for a household with poverty  $P_\alpha$ , the poverty level is given by

$$P_\alpha = \frac{1}{n} \sum_{i=1}^n 1(y_i^e < z) \left( \frac{z - y_i^e}{z} \right)^\alpha \tag{7}$$

## 3. Characteristics of Consumption and Inflation

One characteristic frequently encountered in the consumption pattern of individuals is that the proportion of total expenditure allocated to food tends to diminish as income rises. For this reason, in order to evaluate the impact that a food price increase has on an impoverished population it is necessary to analyze how food consumption varies among households with different levels of income.

Consumption patterns can vary according to area of residence and income level. Table

1 presents the proportion of total expenditure allocated toward the purchase of food and is divided according to rural vs. urban area and for individuals situated above vs. below the Nutritional poverty line. On average, in rural areas, poverty stricken as well as not poverty stricken individuals direct a larger percentage of their expenditure toward the consumption of food, as compared to their urban counterparts. While the rural poor dedicate an average of 47.5% of their total expenditure on food consumption, urban poor dedicate just over 42%, which translates into a gap of approximately 5.5%. The percentage gap in expenditure between rural poor and the urban group that is not poverty stricken is approximately 8%.

Table 2 presents information related to the consumption specifically of grains, beans and root vegetables according to poverty designation and area of residence. As a proportion of total expenditure, corn is the most important grain consumed by both the rural and urban poor (6.4% and 5.3%, respectively). In rural areas, the other products in descending order of importance for poverty stricken households are: beans (3%), wheat (2.5%), root vegetables (0.7%) and rice (0.6%). The relative importance of these products shifts in the case of the urban poor. Corn consumption is followed by wheat (2.5%), beans (1.3%), root vegetables (0.6%) and rice (0.3%).

Figure 1 presents the National Consumer Price Index (CPI), published by the Bank of Mexico, as well as an index of prices for individuals experiencing Nutritional poverty.<sup>4</sup> Since 2004, a gap has existed between the CPI and the index comprised of the poverty stricken. A similar pattern is observed in the case of the Food Consumer Price Index (Food CPI), which in the case of those below the Nutritional poverty line, tends to be larger than the general Food CPI from 2004 to the present (see figure 2). This indicates that the increment in prices registered in recent years has affected individuals that fall below the Nutritional poverty line more than proportionately.

Finally, the inflation rate of the basic food basket utilized to calculate the Nutritional poverty line is estimated for both rural and urban areas. While prior to 2004 inflation in general was larger than the inflation rate for the Nutritional poverty line, this tendency has

---

<sup>4</sup>The price index for poverty stricken individuals is constructed utilizing the same methodology as the INPC. During estimation, only the expenditure weights were modified. The weights used were based on consumption patterns of Nutritional poverty stricken individuals in the base year 2002.

since reversed. The inflation rate of the Nutritional poverty line has recently been one to two points greater than the general inflation level (see figure 3). For example, the CPI growth rate from 1998 to 2000 was approximately 27.2% and that of the rural and urban poverty lines 19%. However, for the period between August 2006 and April 2008, the CPI increased 8.26% and the poverty lines approximately 13%.

In conclusion, price movements, particularly of food, registered over the past four years have affected groups classified as experiencing Nutritional poverty with greater intensity than the rest of the population.

### 3.1. Distributional Characteristics

The distributional characteristic of a good is defined as the degree of association that exists between its consumption and the marginal value of a change in the income of an individual, where the marginal value depends on the poverty measurement utilized (Feldstein 1972, Diamond 1975, Besley and Kanbur 1988). For example, in the case of poverty measurement  $P_\alpha$ , a larger value of the  $\alpha$  coefficient, *ceteris paribus*, implies a larger effect on the poorest individuals of a change in income. In such, those goods whose relative consumption tends to concentrate in the lower tail of the income distribution realize a larger value distributional characteristic with respect to those goods whose consumption is concentrated in the upper tail. When the distributive aspect is not considered important, the relative weight assigned to individual consumption is the same in estimating the distributional characteristic.

Table 3 presents the distributional characteristic  $\delta^\alpha$  for the case of the poverty gap ( $\alpha = 1$ ) and for the poverty gap squared ( $\alpha = 2$ ). It is notable that expenditure in food preparation and processing occupies first place. Within this expenditure group, cornmeal, related to corn consumption, is the most important. Second comes beans; and in third place is consumption of sugars and honeys.

Within the grains group, rice is the most important expenditure, occupying the number four position both for the poverty gap and the poverty gap squared. For its part, corn

occupies eighth and seventh places, respectively, for  $\alpha = 1$  and  $\alpha = 2$ . This indicates that the consumption of corn tends to concentrate in relative terms among the extremely poor groups. Thus, it is not coincidence that the distributional characteristic of cornmeal tends to grow in tandem with  $\alpha$ , the coefficient that measures the importance that is given to poverty intensity. For its part, wheat occupies positions number 16 and 14, respectively, for  $\alpha = 1$  and  $\alpha = 2$ . Similarly to the case of corn, this indicates that the relative consumption of this product tends to increase along with the intensity of poverty.

## 4. Poverty Level Impacts

To calculate the real income reduction of families that is caused by the increase in food prices, the expenditure function is utilized:  $e(p, u)$ . The equivalent variation (EV) of the household, when prices change from  $p_0$  to  $p_1$  is given by:

$$EV = e(p_1, u_1) - e(p_0, u_1) \quad (8)$$

As is intuitive, the equivalent variation determines the quantity of money that, when paid to the consumer, provides the same level of utility after a change in prices that the consumer realized when facing the original price level.

Here it is supposed that only good  $i$  changes price. Utilizing Shepard's Motto, the derivative of the expenditure function with respect to  $p_i$  is the compensated demand function for good  $i$ . With the Taylor expansion the following expression is obtained:

$$EV \approx h_i(p_0, u_1)\Delta p_i + \frac{1}{2} \frac{\partial h_i(p_0, u_1)}{\partial p_i} (\Delta p_i)^2 \quad (9)$$

where  $h_i(p_0, u_1)$  is the Hicksian demand for good  $i$  and  $\Delta p_i$  is the price change undergone by good  $i$ . The first term in the Taylor expansion represents the necessary change in expenditure that makes it possible for the household to acquire the original consumption basket (the basket of goods prior to a price change). This would be an approximation of the first order

of the equivalent variation. The other terms in the Taylor expansion represent changes in demand behavior. These changes are referred to as the *behavior effect* throughout the rest of this study.

Table 4 shows the impact of a series of food price increases on poverty, using a first order approximation. The first column reports poverty levels observed in August 2006. The other columns demonstrate the price effect on poverty. For example, an increment of 15% in the price of food would translate into an increase in national poverty of 2.1%. This increase is not homogenous among rural and urban areas. Rather, urban areas realize a 1.7% poverty increase while poverty in rural areas rises more than 3%. The price elasticity of poverty remains relatively constant amidst different price changes, varying between 1.01 and 1.11.

In the case of the poverty gap squared,  $\alpha = 2$ , the increase in poverty tends to grow more than proportionately along with the rise in prices. For example, while price elasticity for a 5% increase is approximately 0.8, a 30% price increase leads to a price elasticity around 1.8. This fact can be explicated through the relationship between food expenditures and income: the extremely poor are more intensely affected than the rest of the population when food prices rise.

Changes in relative prices can instigate modifications in family behavior. For example, households may partially or totally substitute some food products into or out of their diet. So as to incorporate changes in behavior, the Quadratic Almost Ideal Demand System<sup>5</sup> (QUAIDS) is estimated.

#### 4.1. Behavior and Poverty Effects

Table 5 presents the impacts on poverty utilizing the aforementioned demand system. Although the results are similar to those obtained with the linear model, the behavior effect tends to partially mitigate the impact of price changes on poverty. Throughout the diverse regional configurations considered (rural, urban and national), poverty tends to be slightly lower if family behavioral changes are permitted. It is important to note that said

---

<sup>5</sup>See Appendix A.

behavior effect tends to become more pronounced in poverty cases as larger price changes are implemented.

In the case of the poverty gap squared, differences between the linear approximation and the quadratic demand system tend to be much smaller. In particular, in urban zones the differences are null for all practical purposes. This can be explained in part by the relatively larger importance of food consumption among the poorest households, as well as the presence of consumption of self-cultivated food in rural households.

$\Delta_l^\alpha$  and  $\Delta_d^\alpha$  are, *ceteris paribus*, changes in poverty that occur as a result of price changes utilizing a first order approximation and a demand system, respectively, to estimate the equivalent variation. An indicator that measures the impact of the change in poverty stricken agents' behavior in reaction to a change in prices can be defined as:

$$s^\alpha = \frac{\Delta_l^\alpha}{\Delta_d^\alpha} = \frac{\sum_{i=1}^n 1(y_i - h_i \Delta p < z)(z - y_i + h_i \Delta p)^\alpha}{\sum_{i=1}^n 1(y_i - V E_i < z)(z - y_i + V E_i)^\alpha} \quad (10)$$

$s^\alpha$  measures the degree to which changes in the agent's behavior minimize the effect of price increases on poverty. The larger  $s^\alpha$ , the more the change in household demand assists in diminishing a price increase's effect on poverty.

Table 6 presents the estimations for  $s^\alpha$ ,  $\alpha \in \{0, 1, 2\}$ , for both rural and urban areas of Mexico, as well as estimations at the national level. In general, the behavior effect tends to diminish a grain price increase's impact on poverty. It is noteworthy that  $s^\alpha$  is greater for rural areas than in urban areas of the country. The only exception is the case in which  $\alpha = 0$  and prices are increased 5% and 10%. As can be inferred about the prevalence of poverty from table 6, the urban poor's ability to substitute tends to minimize the poverty impact of price increases less than 10%.

On the other hand, the gap between the rural and urban poor tends to be larger in the case of poverty intensity ( $\alpha = 2$ ). This indicates that extremely poverty stricken individuals in rural areas possess greater ability to substitute than their urban extremely poor counterparts. Issues related to the greater consumption of self-cultivated food products witnessed in rural areas could be one explanation for this occurrence.

## 5. Targeting

In the context of scarce resources, targeting becomes a fundamental tool. However, it is important to take into consideration the fact that if targeting is applied under a situation of asymmetric information, which is generally the case, the allocation process can become costly and inefficient.

Targeting can be broadly characterized into two separate veins. The first utilizes instruments such as subsidies and universal transfers that benefit the large majority of the population but probably do not concentrate resources toward the most vulnerable segments of society. The second vein channels resources directly to poor groups. Both types of targeting hold politically important implications in terms of the efficiency, efficacy and incentives generated.

### 5.1. Targeting Costs

Three factors are typically associated with the costs of the targeting process: program administration, incentives and political economy (Van de Walle 1998). In the realm of administrative costs, due to asymmetric information it becomes necessary to select mechanisms that permit potential program beneficiaries to be identified based on certain observable indicators associated with key variables, such as income. This allows resources to be directed to those most in need.

The second factor, incentives, is associated with behavioral changes that both the target and larger populations enact when a certain social program is implemented. For example, if the program authorizes a cash transfer to those individuals with incomes below the established poverty line it will incentivize those with incomes slightly above the poverty line to reduce their supply of labor so as to lower observed income to a point at which they too qualify for receipt of the cash transfer.

Finally, the third factor relates to the way in which different segments of the population express opinions regarding the channeling of public resources. In the case of education expenditure, for example, the middle class may favor increases in funding for secondary

education even though elementary education shortcomings play a larger part in improving the future economic situation of children from the most poverty stricken households.

## 5.2. Funding Allocation Options

In this study four resource allocation mechanisms are analyzed: perfect targeting, universal transfers, grain subsidies and transfers to the poor via the social program Oportunidades. The first compensates families for a food price increase utilizing family per capita income as the allocation criteria. The second mechanism transfers the same quantity of resources to the entire population. A subsidy implies intervening to artificially alter the market price for a specific good or group of goods to allow consumers to acquire them at a lower cost. Transfers to the poor assign the same quantity of resources to each individual whose income situates them below the poverty line. Finally, transfers via Oportunidades utilize this social program (and its already enrolled beneficiaries) as a platform to assign resources. For this exercise the same budget will be assumed for all allocation mechanisms. This budget is equal to the number of families enrolled in Oportunidades in 2006, multiplied by 120 pesos MXN per month. The number of families receiving support from Oportunidades in 2006 is estimated using the Mexican National Household Income and Expenditure Survey (ENIGH for its Spanish acronym). The 120 pesos represent the extra support recently approved by the Mexican federal government for families participating in Oportunidades and other social programs to face the difficulties caused by recent food price increases.

The concept of compensated variation (CV) is utilized to evaluate the effects of these public policies. The compensated variation is equivalent to the transfer necessary to ensure that a household can obtain the same level of welfare at new prices that they realized before the price change. Formally, this is demonstrated by:

$$CV = e(p_1, u_0) - e(p_0, u_0) \tag{11}$$

In such, if an amount  $\tau$  is transferred to a household, the compensated variation will be

given by:

$$CV_\tau = e(p_1, u_0) - e(p_0, u_0) - \tau \quad (12)$$

$p_1^s$  is a price vector that includes the government authorized subsidy. In this case the compensated variation after government intervention in the market is given by:

$$CV_s = e(p_1^s, u_0) - e(p_0, u_0) \quad (13)$$

### 5.3. Targeting Efficiency

Two types of targeting errors should be defined: a) Type I Error (Exclusion): This occurs when a poor household does not receive the social program's benefits. b) Type II Error (Inclusion): This occurs when a household that is not poor receives benefits from the social program.

Here targeting efficiency is defined as the percentage of total transfers that poverty stricken individuals receive. In other words, the efficiency indicator tells us the number of cents that poor individuals receive for each peso that is transferred to the population.

Table 7 presents the proportions of type I and type II errors as well as the efficiency indicator for the four targeting mechanisms previously mentioned. The universal transfer and subsidy minimize type I errors but maximize type II errors, given that the entire population is subject to benefit from their application. The transfer via Oportunidades is accompanied by a 6.3% exclusion error (type I), while the inclusion error (type II) is 9.8%. In the case of perfect targeting, both errors are minimized.

In terms of mechanism efficiency, universal transfers prove the least efficient; only 11 cents of each transferred peso arrives in the hands of families experiencing Nutritional poverty. Subsidies follow universal transfers in inefficiency, with 16 cents per peso reaching the target. Oportunidades has an efficiency indicator of 34 cents. Perfect targeting, in which resources are channeled exclusively to families whose incomes currently do not meet their basic nutritional needs, is the most efficient mechanism.

## 5.4. Subsidies versus Transfers

A food subsidy, such as one enacted upon grain imports, transfers purchasing power to every family that consumes the good in question. The individual transfer gain is proportionate to the value of their total consumption of the subsidized good. On the other hand, a universal transfer authorizes the same level of resources to every member of the population, irrespective of income level. The relevant question, then, becomes defining which mechanism is more efficient in terms of targeting so as to direct resources toward the most needy populations.

Besley and Kanbur (1988) study marginal and inframarginal subsidies within a context in which the objective is to ameliorate poverty. The authors demonstrate that it is indeed possible to use a good's distributional characteristics to deduce which mechanism is the most appropriate:

**Proposition 1 (Besley y Kanbur, 1988)** *If the demand for good  $i$  is increasing in income, then for classes with poverty measure  $P_\alpha$ ,  $\alpha \geq 1$ , a universal transfer is preferable to a subsidy on good  $i$  if the poor population's average consumption of the good is less than its average consumption by the population in general.*

In this sense, those foodstuffs whose distributional characteristic  $\delta_i^1$  is larger than one are natural candidates to be subsidized. To the contrary, if  $\delta_i^1 < 1$ , a general transfer would be the better policy option. Intuitively, those goods whose consumption represents a large proportion of the poor population's food basket should be subsidized. If the good represents a relatively small proportion of the poverty stricken population's consumption, a universal transfer would be more efficient in terms of targeting.

Table 3 presents information on the distributional characteristics for the poverty gap by type of food product as they appear published by the ENIGH. The only food groups that register a distributional characteristic larger than one are beans and sugar. The expenditures related to food preparation and processing report the highest distributional characteristic, which indicates that expenditure on cornmeal occurs principally within the lowest income sectors. The majority of food groups have distributional characteristics less than one. This

leads to the conclusion that a general transfer at the margin would be a better allocation instrument than a subsidy.

If the government decided to implement subsidies on food products, which foods should receive priority to be subsidized if the objective was poverty reduction? In the case of the poverty gap, the distributional characteristic can be utilized to make comparisons between candidate goods:

**Proposition 2 (Besley y Kanbur, 1988)** *In the case of a poverty gap, the subsidy should be directed toward that good with the largest value distributional characteristic.*

For example, if the objective was to shrink the poverty gap and it was necessary to decide between assigning a peso to subsidize either beans or sugar, at the margin it would be more efficient to subsidize beans.

## 5.5. Experiment 1: Grain Price Increase

Table 8 presents the monthly compensated variation by family income group (divided into tenths along the income scale) for three price increase scenarios: 30%, 50% and 70% as well as for six counterfactual scenarios of allocation policy with a set budget.

The first scenario consists of non-intervention. Given a price impact of 30%, a family situated within the bottom ten percent of the income bracket should receive a transfer of 57.5 pesos MXN to achieve the same welfare level that they realized before the price increase. The interpretation for the other 9 income brackets and their price impacts can be devised in this same manner.

As can be observed, the compensated variation is increasing in income. This explains the larger absolute quantities destined to the consumption of grains as we move up the income distribution.

The compensated variation that appears in table 8 for different intervention schemes can be interpreted as the transfer that would be necessary in order to leave families at the same level of welfare after the mechanism is implemented as they enjoyed before the price increase ( $CV_T$  in the case of a transfer and  $CV_S$  in the case of a subsidy). For example,

in the case of the universal transfer with a 30% impact on prices, it would be necessary to transfer an average of 39.8 pesos to the lowest tenth of the income distribution after the universal transfer to leave the households at their original welfare level. This implies that the universal transfer is approximately equivalent to assigning 17 pesos to every family within the population. Perfect targeting in this case consisted of transferring an amount identical to the compensated variation, utilizing family per capita income as the allocation criteria.

Table 9 presents the allocation-income proportion for each tenth of the income distribution. For example, in the case of a subsidy, the allocation to the household with income  $y$  would be given by:

$$\frac{CV - CV_s}{y} \quad (14)$$

While in the case of an income transfer the allocation as a proportion of income would be:

$$\frac{CV - CV_\tau}{y} \quad (15)$$

If the effect of a price increase on grains is evaluated in terms of relative family income, the impact is clearly regressive. While the compensated variation prior to a 30% price change in grains represents approximately 13.5% of average income for the lowest tenth of the income distribution, the compensated variation relative to income tends to drastically diminish beginning with the second to lowest tenth of the distribution. The compensated variation passes from 2.7% for that segment to 0.4% of average income for households located in the highest tenth of the income distribution. This pattern repeats itself in other price increase scenarios.

On the side of resource allocation, while perfect targeting and transfers to the poor fundamentally benefit the lowest income groups, the universal transfer and subsidies dilute public resources among the entire population. Transfers via Oportunidades are the most efficient in terms of targeting in relation to subsidies and universal transfers. However, they are less efficient than the transfer to Nutritional poverty stricken individuals and perfect targeting.

Table 12 presents poverty scenarios for the proportion of poor individuals, the poverty gap and the poverty gap squared, each for rural areas, urban areas and at the national level, given a 30% increase in grain prices. The proportion of poverty stricken individuals increases one percentage point, from 13.7% to 14.7%.

A universal transfer lowers poverty 0.3%, while a subsidy effects only a 0.1% change. A transfer via Oportunidades has the largest impact among these three, decreasing poverty by 0.5%.

The poverty gap registers a small increase after the price change, rising from 0.042 to 0.046. The universal transfer and the subsidy are practically inconsequential in affecting the poverty gap, while a transfer via Oportunidades brings the poverty gap back to its original level. Similar results are obtained for poverty intensity measurement as for the poverty gap squared, which changes from 0.024 to 0.026. The universal transfer as well as the subsidy both slightly shrink the poverty gap squared. The transfer via Oportunidades returns poverty intensity to the level observed prior to the price change.

## 5.6. Experiment II: Food Price Increase

Tables 10 and 11 present an analysis analogous to that realized for the case of grain prices. This time, however, the general impacts of food price increases of 15%, 20% and 25% are considered.<sup>6</sup> The results are similar to those found with the grain experiment. What varies is the order of magnitude of the impacts on various segments of the income distribution. For example, a 15% increase in food prices, *ceteris paribus*, translates into an income reduction of 32% for the bottom tenth of the distribution and a 2.3% reduction for the top tenth. On the other hand (see table 13), poverty in rural areas increases from 24.5% to 27.1% and from 7.5% to 9.1% in urban areas, raising the national poverty rate from 13.8% to 15.7%.

In analyzing the effects of different resource allocation policy options, perfect targeting and transfers to households experiencing Nutritional poverty have the largest poverty reduc-

---

<sup>6</sup>Between August 2006 and June 2008, food prices in Mexico increased 14.9% and grain prices 22%.

ing effects for the various levels of  $\alpha$  considered. The effects of transfers via Oportunidades dominate those of universal transfers and subsidies, which is consistent with the results found in the case of grains.

Although transfers via Oportunidades are a more efficient targeting mechanism at the national level than subsidies and universal transfers, their effectiveness varies according to geographic location. For example, while poverty decreases more than 1% in rural areas utilizing the Oportunidades platform, poverty remains practically unaltered in urban areas. This is attributed principally to the fact that the majority of Oportunidades households are rurally located. While 36% of rural households received support from Oportunidades in 2006, only 3.5% of urban households did.

## 6. Conclusions

Food price increases have affected large segments of the Mexican population. However, the impact has been proportionately larger among the population's most marginalized sectors. Given the fundamental composition of lower income households' consumption, a larger proportion of income is destined toward purchasing food.

On the other hand, it is observed that the consumer price indices can underestimate the effect of the increase of prices on the sector of households situated under the Nutritional poverty line. This is reflected in the price index estimation for this group. One possible explanation is extended by the fact that poor individuals allocate a larger proportion of their expenditure toward foodstuffs, which have been subject to higher inflation rates than other products utilized by the Bank of Mexico in estimating the consumer price index (CPI).

Given the studies realized in this paper, it is possible to conclude that poverty is sensitive to food price increases. A 15% price increase, *ceteris paribus*, translates into approximately a 2% increase in Nutritional poverty. It is also important to point out that these price changes increase poverty intensity significantly, which is consistent with the fact that a food price increase affects lower income groups more than proportionally. Regardless, the behavior effect that operates through households' substitution capacity assists in minimizing

the impact of price increases. This is particularly true for the rural poor.

When devising social programs to combat Nutritional poverty, targeting mechanisms for public resources becomes a fundamental topic. In comparing different resource allocation mechanisms in terms of their targeting efficiency, it is possible to extract a series of public policy implications. First, food subsidies are not the best option within the realm of those mechanisms analyzed. In fact, universal transfers tend to beat effectiveness of food subsidies. Secondly, utilization of the Oportunidades platform to channel resources to the Nutritional poverty stricken population, while not close to perfect targeting, does represent an improvement in terms of targeting when compared to the other two aforementioned mechanisms.

It remains to be pointed out that during this analysis, the administrative costs of transfer mechanisms were not taken into consideration. However, the transfer via Oportunidades represents a clear advantage over other mechanisms, as the 120 transferred pesos to benefiting families virtually represent the marginal cost of the allocation mechanism. In utilizing Oportunidades and other already established social programs to identify potential recipients for the recently authorized additional 120 pesos per month, the Mexican federal government saves the administrative costs that would otherwise be required to target this funding. Even so, the utilization of social programs as a platform to overcome the country's nutritional shortfalls presents several challenges. Certainly an important percentage of the households that fall below the Nutritional poverty line are not currently incorporated into the social program network. Thus, one of the fundamental challenges for the federal government will be to expand this social welfare net in the short and medium term.

For future research, it is worth enumerating that one limitation of this study is the lack of incorporation of the supply side within the simulations. While an increase in food prices generally implies a decrease in household purchasing power, this argument can not be generalized to include the case of farmers and ranchers. This holds particularly true in the case of cultivation and production for internal household consumption. In this sense, an increment in food prices does not necessarily imply an increase in poverty (Aksoy and

Izik-Dikmelik 2008).

## References

- AKSOY, M., AND A. IZIK-DIKMELIK (2008): “Are low prices pro-por? net food buyers and sellers in low ncome countries,” Policy Research Working Paper Series 4642, The World Bank.
- BANKS, J., R. BLUNDELL, AND A. LEWBEL (1997): “Quadratic Engel Curves and Consumer Demand,” *Review of Economics and Statistics*, 79(4), 527–539.
- BANXICO (2008): “Informe sobre la inflación: Enero-Marzo 2008,” <http://www.banxico.org>.
- BESLEY, T., AND R. KANBUR (1988): “Food Subsidies and Poverty Alleviation,” *The Economic Journal*, 98, 701–719.
- CONEVAL (2006): “Nota técnica sobre la aplicación de la metodología del comité técnico para la medición de la pobreza 2000-2005,” .
- DIAMOND, P. (1975): “A Many-Person Ramsey Tax Rule,” *Journal of Public Economics*, 4(4), 335–342.
- FAO (2008): “High Level Conference on World Food Security: the Challenges of Climate Change and Bioenergy,” <http://www.fao.org/foodclimate>.
- FELDSTEIN, M. (1972): “Distributional Equity and the Optimal Structure of Public Prices,” *American Economic Review*, 62(1), 32–36.
- FOSTER, J., J. GREER, AND E. THORBECKE (1984): “A Class of Decomposable Poverty Measures,” *Econometrica*, 52(3), 761–66.
- IFPRI (2008): “High Food Prices: The What, Who, and How of Proposed Policy Actions,” <http://www.ifpri.org/pubs/if/foodpricespolicyaction.pdf>.

- KING, M. (1983): “Welfare analysis of tax reforms using household data,” *Journal of Public Economics*, (21), 183–214.
- SEDESOL (2008): “Acciones en apoyo de la economía familiar,” <http://www.presidencia.gob.mx/infografias/economiafamiliar/index.html>.
- SEIDL, C. (1998): “Poverty Measurement: A Survey,” in *Welfare and Efficiency in Public Economics*, ed. by D. Boss, M. Rose, and C. Seidl. Springer-Verlag.
- SEN, A. K. (1976): “Poverty: An Ordinal Approach to Measurement,” *Econometrica*, 44(2), 219–31.
- SHONKWILER, J., AND S. YEN (1999): “Two-Step Estimation of a Censored System of Equations,” *American Journal of Agricultural Economics*, 81(4), 972–982.
- VAN DE WALLE, D. (1998): “Targeting Revisited,” *The World Bank Research Observer*, 13(2), 231–248.
- WORLD-BANK (2008a): “Commodity Price Data,” <http://econ.worldbank.org>.
- (2008b): “Food Price Crisis,” <http://www.worldbank.org/html/extdr/foodprices>.
- ZHENG, B. (1997): “Aggregate Poverty Measures,” *Journal of Economic Surveys*, 11(2), 123–62.

# Appendix A: Methodology

## Distributional Characteristic

The distributional characteristic for good  $i$  is defined as:

$$\delta_i = [E(\frac{\partial\pi(y,z)}{\partial y})E(x_i)]^{-1}cov(x_i, \frac{\partial\pi(y,z)}{\partial y}) + 1 \quad (16)$$

which is equivalent to:

$$\delta_i = \frac{E(x_i \frac{\partial\pi(y,z)}{\partial y})}{E(\frac{\partial\pi(y,z)}{\partial y})E(x_i)} \quad (17)$$

For example, in the case of a family with poverty level  $P_\alpha$ :

$$\delta_i^\alpha = \frac{\int_0^z (\frac{z-y}{z})^{\alpha-1} x_i(q,y)dF}{P_{\alpha-1} \int x_i(q,y)dF} \quad (18)$$

In other words, the distributional characteristic depends on the consumption of poor households relative to total consumption.

In the case of the poverty gap, the distributional characteristic is given by:

$$\delta_i^1 = \frac{\bar{x}_i^p}{\bar{x}_i} \quad (19)$$

where

$$\begin{aligned} \bar{x}_i^p &= \int_0^z x_i dF / F(z) \\ \bar{x}_i &= \int x_i dF \end{aligned}$$

In this case, the distributional characteristic is equal to the proportion of average consumption of the poor with respect to average consumption of the entire population.

The distributional characteristic when the poverty measure utilized is the poverty gap squared is:

$$\delta_i^2 = \frac{z\bar{x}_i^p - H^{-1} \int_0^z x_i(q,y)y dF}{[z - \bar{y}^p]\bar{x}_i} \quad (20)$$

where  $\bar{y}^p$  is average income among the poor.

## Quadratic Almost Ideal Demand System (QUAIDS)

The Quadratic Almost Ideal Demand System (QUAIDS) (Banks, Blundell, and Lewbel 1997) is defined from the indirect utility function,  $V$ :

$$\ln V = \left\{ \left[ \frac{\ln m - \ln a(\mathbf{p})}{b(\mathbf{p})} \right]^{-1} + \lambda(\mathbf{p}) \right\} \quad (21)$$

where:

$$\begin{aligned} \ln a(\mathbf{p}) &= \alpha_0 + \sum_{i=1}^n \ln p_i + \frac{1}{2} \sum_{i=1}^n \sum_{j=1}^n \gamma_{ij} \ln p_i \ln p_j \\ b(\mathbf{p}) &= \prod_{i=1}^n p_i^{\beta_i} \\ \lambda(\mathbf{p}) &= \sum_{i=1}^n \lambda_i \ln p_i \\ \sum_{i=1}^n \lambda_i &= 0 \end{aligned}$$

and  $m$  is expenditure.

From equation 21 the following demand equations are derived:

$$w_i = \alpha_i + \sum_{j=1}^n \gamma_{ij} \ln p_j + \beta_j \ln \frac{m_i}{a(\mathbf{p})} + \frac{\lambda_i}{b(\mathbf{p})} \left\{ \ln \frac{m_i}{a(p)} \right\}^2 \quad i = 1, \dots, n \quad (22)$$

For the econometric estimation of the system of equations a non-linear SUR was utilized.

It is defined that  $\bar{V} = \ln V(\mathbf{p}_1, m_i)$ . In such, the equivalent variation when prices change from  $\mathbf{p}_0$  to  $\mathbf{p}_1$  is given by:

$$\begin{aligned} EV &= m_i - e(\mathbf{p}_0, \exp(\bar{V}_i)) \\ &= m - a(\mathbf{p}_0) \exp \left( \frac{b(\mathbf{p}_0) \ln \bar{V}}{1 - \lambda(\mathbf{p}_0) \ln \bar{V}} \right) \end{aligned}$$

## Appendix B: Database Construction

The database utilized in this study was generated from the 2006 Mexican National Household Income and Expenditure Survey (ENIGH for its Spanish acronym). The ENIGH is conducted by the National Institute for Geography, Statistics and Information (INEGI, again for its Spanish acronym).

The survey allows for geographic location divisions of the information into areas with fewer than 2,500 inhabitants and areas with more than 2,500 inhabitants. Observations belonging to the first group are designated rural and those that fall into the second group are categorized as urban. The sample size for the year 2006 is 20,875 households, of which 13,294 are urban households and 7,851 are rural households. The poverty estimations are based on total net household income per capita so as to identify the population subgroup that is impoverished. The poverty designation is defined by the methodology developed by the National Evaluation Board of Social Development Policy (CONEVAL for its Spanish acronym).

To estimate equivalent income, first the total net household income was obtained using the methodology set forth by the Technical Committee for Poverty Measurement. Total net income is calculated by aggregating monetary and non-monetary income. Monetary income is comprised of paid salaries, income from co-operatives, income earned by individual owned businesses, income from societal organizations, income from property rental and government transfers. Non-monetary income is comprised of the value of products self-produced for internal household consumption, payments in kind and the estimated value of rent of the household's living quarters. Finally income from gifts is eliminated from the calculation and the total remaining income is divided by the size of the household to obtain the total net household income per capita. The equivalent variation is subtracted from total net household income per capita to obtain equivalent income.

Consumption decisions, which are made within the family unit, are reflected in monetary expenditure and internal consumption of self-produced goods. Given that payment in kind and gifts were already excluded from the income calculation due to their being exoge-

nous to household decisions, total current expenditure was not utilized during the estimation of the demand system. Out of the total group of consumed products on which the ENIGH gathered data, five categories were constructed:

1. Meats, Dairy and Eggs
2. Grains, Beans and Root Vegetables
3. Fruits, Vegetables and Pod Vegetables
4. Other Food Products
5. All other non-food consumable goods

Prices for each category were constructed through the Fisher Index. Base values were an average, weighted by the expansion factor for conversion to the national level for each product. The actual prices were reported by the ENIGH.

For those families that did not consume any quantity within a category and whose price could not be constructed, theoretical values were imputed according to the household's socio-demographic variables. This procedure was conducted with linear regression techniques. Said variables were: rural household location, household possession of a refrigerator, presence of children under 12 years old, presence of household members older than 65 years old, total household income and household size. So as to correct for the problem of censored data in consumption, the Shonkwiler and Yen (1999) methodology was utilized. The demand system to be estimated is then given as:

$$w_i = \Phi(z'_i\theta_i) \left\{ \alpha_i + \sum_{j=1}^n \gamma_{ij} \ln p_j + \beta_j \ln \frac{m_i}{a(\mathbf{p})} + \frac{\lambda_i}{b(\mathbf{p})} \left\{ \ln \frac{m_i}{a(p)} \right\}^2 \right\} + \delta_i \phi(z'_i\theta_i) \quad i = 1, \dots, n$$

where  $\Phi$  and  $\phi$  are the normally distributed accumulated function and the density function, respectively. These were obtained through the estimation of a probability model utilizing exogenous variables  $z$  and estimated parameters  $\theta$ .

# Appendix C: Tables and Figures

Figure 1: General CPI

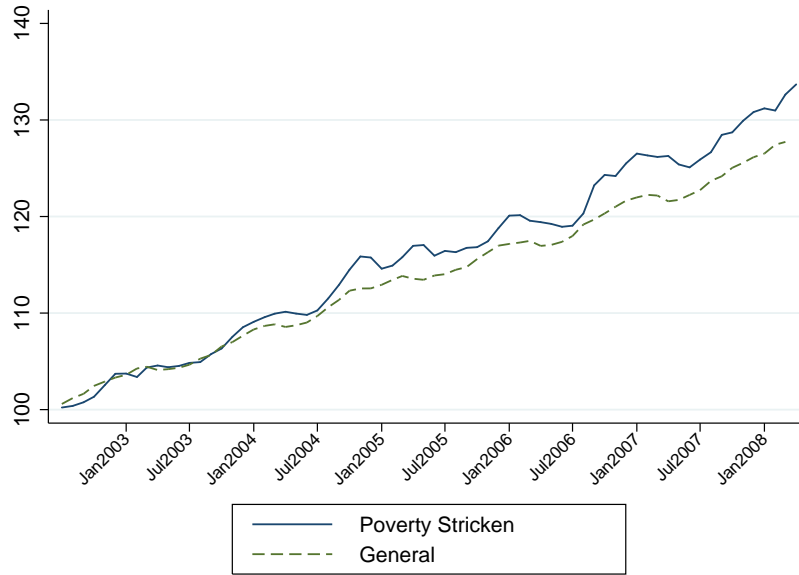


Figure 2: Food CPI



Figure 3: Poverty Line Inflation

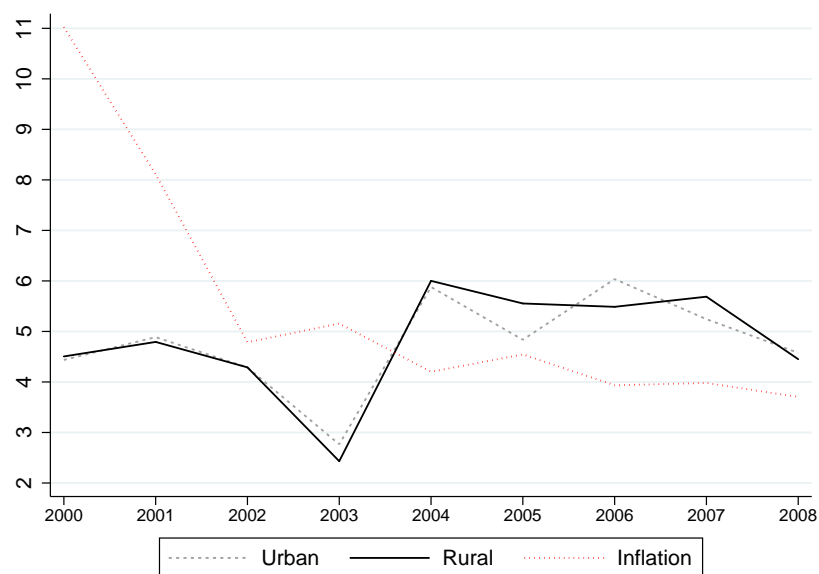


Table 1: Total Food Expenditure as a Percentage of Total Expenditure

	Poverty Stricken	Not Poverty Stricken	Total
<b>Rural</b>	47.5%	38.7%	40.4%
<b>Urban</b>	42.7%	30.6%	31.3%
<b>National</b>	45.7%	33.1%	34.4%

Table 2: Consumption of Grains, Beans and Root Vegetables

		Corn	Wheat	Rice	Beans	Root Vegetables
<b>Rural</b>	<b>Poverty Stricken</b>	6.4%	2.5%	0.6%	3%	0.7%
	<b>Not Poverty Stricken</b>	3.7%	2%	0.3%	1.1%	0.5%
<b>Urban</b>	<b>Poverty Stricken</b>	5.3%	2.5%	0.3%	1.3%	0.6%
	<b>Not Poverty Stricken</b>	1.8%	1.5%	0.1%	0.4%	0.3%

Table 3: Distributional Characteristics of Food Products

<b>Aggregate Group</b>	$\delta_i^1$	<b>ranking</b>	$\delta_i^2$	<b>ranking</b>
Expenditure related to food preparation and processing	2.901	1	2.977	1
Beans	1.296	2	1.297	2
Sugar and Honey	1.048	3	0.996	3
Rice	0.993	4	0.940	4
Eggs	0.924	5	0.844	6
Oils	0.921	6	0.891	5
Fats	0.900	7	0.735	8
Corn	0.853	8	0.805	7
Coffee	0.792	9	0.728	9
Raw or Fresh Root Vegetables	0.723	10	0.677	10
Spices and Dressings	0.620	11	0.557	12
Other Meats	0.619	12	0.497	17
Processed Vegetables and Pod Vegetables	0.602	13	0.514	16
Fresh Vegetables and Pod Vegetables	0.595	14	0.555	13
Chicken	0.573	15	0.497	18
Wheat	0.559	16	0.553	14
Pork	0.543	17	0.528	15
Processed Beans	0.508	18	0.574	11
Non-Alcoholic Drinks	0.451	19	0.460	19
Fresh Fish	0.447	20	0.302	31
Milk	0.445	21	0.440	20
Processed Fish	0.433	22	0.364	28
Processed Red Meats	0.424	23	0.370	27
Cheeses	0.418	24	0.409	21
Chocolate	0.370	25	0.377	25
Te	0.370	26	0.371	26
Seeds	0.366	27	0.260	34
Other Grains	0.360	28	0.395	22
Fresh Fruits	0.348	29	0.390	23
Foodstuffs Donated to the Household	0.324	30	0.317	29
Beef and Veal Meat	0.322	31	0.259	35
Processed Root Vegetables	0.282	32	0.267	33
Other Milk Derivatives	0.280	33	0.252	36
Candy and Desserts	0.262	34	0.279	32
Other Diverse Food Products	0.254	35	0.105	43
Processed Poultry Meat	0.254	36	0.302	30
Seafood	0.218	37	0.247	37
Tobacco	0.207	38	0.183	40
Food products prepared for consumption at home	0.200	39	0.201	39
Food products prepared for babies	0.178	40	0.086	44
Food and Beverage consumed outside of the home	0.171	41	0.378	24
Alcoholic Beverages	0.165	42	0.180	41
Processed Fruits	0.138	43	0.130	42
Domesticated Animal Food	0.105	44	0.208	38
Expenditure on packaged food and/or beverages	0.060	45	0.016	45
Other Fish Products	0.000	46	0.000	46

Table 4: Poverty Impacts utilizing Linear Approximation (Food Products)

	0%	5%	10%	15%	20%	25%	30%
$\alpha = 0$							
<b>Urban</b>	7.5%	8.2%	8.7%	9.2%	9.7%	10.6%	11.2%
<b>Rural</b>	24.5%	25.3%	26.5%	27.6%	28.4%	29.5%	30.8%
<b>National</b>	13.8%	14.5%	15.2%	15.9%	16.6%	17.5%	18.4%
$\alpha = 1$							
<b>Urban</b>	2.0%	2.1%	2.3%	2.4%	2.6%	2.9%	3.1%
<b>Rural</b>	8.3%	8.7%	9.2%	9.8%	10.3%	10.9%	11.5%
<b>National</b>	4.3%	4.5%	4.8%	5.1%	5.5%	5.8%	6.2%
$\alpha = 2$							
<b>Urban</b>	1.4%	1.5%	1.6%	1.7%	1.8%	2.0%	2.1%
<b>Rural</b>	4.1%	4.3%	4.7%	5.0%	5.4%	5.8%	6.3%
<b>National</b>	2.4%	2.5%	2.7%	2.9%	3.1%	3.4%	3.7%

Table 5: Poverty Impacts utilizing Demand System Estimation (Food Products)

	0%	5%	10%	15%	20%	25%	30%
$\alpha = 0$							
<b>Urban</b>	7.5%	8.1%	8.6%	9.1%	9.5%	10.0%	10.7%
<b>Rural</b>	24.5%	25.3%	26.3%	27.1%	27.8%	28.4%	29.6%
<b>National</b>	13.8%	14.5%	15.1%	15.7%	16.2%	16.8%	17.6%
$\alpha = 1$							
<b>Urban</b>	2.0%	2.1%	2.2%	2.4%	2.6%	2.7%	2.9%
<b>Rural</b>	8.3%	8.6%	9.0%	9.5%	9.9%	10.4%	10.8%
<b>National</b>	4.3%	4.5%	4.7%	5.0%	5.3%	5.5%	5.8%
$\alpha = 2$							
<b>Urban</b>	1.4%	1.5%	1.6%	1.7%	1.8%	2.0%	2.1%
<b>Rural</b>	4.1%	4.3%	4.5%	4.8%	5.1%	5.4%	5.7%
<b>National</b>	2.4%	2.5%	2.7%	2.9%	3.0%	3.2%	3.4%

Table 6: Behavior Effects and Poverty (Grains)

	5%	10%	15%	20%	25%	30%
$s^0$						
<b>Urban</b>	2.65	2.48	1.17	1.47	1.25	1.12
<b>Rural</b>	2.08	1.09	1.30	1.59	1.69	1.71
<b>National</b>	2.41	1.52	1.24	1.53	1.46	1.40
$s^1$						
<b>Urban</b>	1.67	1.52	1.51	1.53	1.55	1.58
<b>Rural</b>	1.70	1.62	1.62	1.65	1.68	1.72
<b>National</b>	1.69	1.59	1.59	1.61	1.64	1.67
$s^2$						
<b>Urban</b>	1.23	1.19	1.21	1.23	1.26	1.29
<b>Rural</b>	1.76	1.67	1.68	1.71	1.75	1.79
<b>National</b>	1.62	1.53	1.53	1.56	1.59	1.62

Table 7: Targeting Efficiency

		Universal Transfer	Subsidy	Transfer via Oportunidades	Transfer to Poverty Stricken
<b>Participating</b>	<b>Poverty Stricken</b>	11.3	11.3	5.0	11.3
	<b>Not Poverty Stricken</b>	88.7	88.7	9.8	0.0
<b>Not Participating</b>	<b>Poverty Stricken</b>	0.0	0.0	6.3	0.0
	<b>Not Poverty Stricken</b>	0.0	0.0	78.9	88.7
<b>Efficiency</b>		0.113	0.156	0.338	1.0

Table 8: Compensated Variation Given a Grain Price Increase

Price Change (%)	Without Intervention			Universal Transfer			Subsidy			Oportunidades			Transfer to Poverty Stricken			Perfect Targeting		
	30	50	70	30	50	70	30	50	70	30	50	70	30	50	70	30	50	70
<b>Income Bracket (tenths)</b>																		
<b>I</b>	57.5	89.5	117.9	39.8	71.8	100.2	53.9	85.8	114.2	12.9	44.9	73.3	-34.5	-2.5	25.9	0.0	0.0	0.0
<b>II</b>	77.6	120.6	158.8	59.9	103.0	141.1	72.7	115.7	153.8	42.0	85.1	123.2	28.2	71.3	109.4	0.0	32.0	98.1
<b>III</b>	89.4	139.0	182.7	71.7	121.3	165.0	83.9	133.3	177.1	63.4	112.9	156.7	70.4	119.9	163.7	46.8	139.0	182.7
<b>IV</b>	97.5	151.5	199.1	79.8	133.8	181.4	91.5	145.4	192.9	75.1	129.1	176.7	86.9	140.8	188.5	97.5	151.5	199.1
<b>V</b>	105.7	164.1	215.5	88.0	146.4	197.8	99.1	157.4	208.8	89.4	147.7	199.2	102.4	160.7	212.2	105.7	164.1	215.5
<b>VI</b>	114.6	177.9	233.6	97.0	160.2	215.9	107.5	170.7	226.4	99.7	163.0	218.7	113.3	176.5	232.2	114.6	177.9	233.6
<b>VII</b>	119.8	185.7	243.8	102.1	168.0	226.1	112.3	178.2	236.3	109.9	175.9	233.9	119.4	185.4	243.4	119.8	185.7	243.8
<b>VIII</b>	128.7	199.4	261.6	111.0	181.7	243.9	120.7	191.4	253.6	123.7	194.5	256.7	128.7	199.4	261.6	128.7	199.4	261.6
<b>IX</b>	134.8	208.8	273.8	117.1	191.1	256.1	126.5	200.4	265.3	132.7	206.6	271.6	134.8	208.8	273.8	134.8	208.8	273.8
<b>X</b>	116.6	180.5	236.5	98.9	162.8	218.8	109.4	173.2	229.2	115.8	179.7	235.7	116.6	180.5	236.5	116.6	180.5	236.5



Table 10: Compensated Variation after a Food Price Increase

Price Change (%)	Without Intervention			Universal Transfer			Subsidy			Oportunidades			Transfer to Poverty Stricken			Perfect Targeting		
	15	20	25	15	20	25	15	20	25	15	20	25	15	20	25	15	20	25
<b>Income Bracket (tenths)</b>																		
<b>I</b>	118.7	157.2	195.1	101.1	139.5	177.4	111.7	150.0	187.7	74.2	112.6	150.5	26.7	65.2	103.1	0.0	0.0	15.7
<b>II</b>	175.5	232.3	288.3	157.8	214.6	270.6	165.2	221.6	277.4	140.0	196.7	252.8	126.1	182.9	238.9	115.8	210.5	288.3
<b>III</b>	217.1	287.4	356.7	199.4	269.7	339.0	204.3	274.2	343.1	191.1	261.3	330.7	198.1	268.3	337.6	217.1	287.4	356.7
<b>IV</b>	250.6	331.8	411.8	232.9	314.1	394.1	235.8	316.5	396.2	228.2	309.4	389.4	240.0	321.1	401.2	250.6	331.8	411.8
<b>V</b>	286.9	379.8	471.4	269.2	362.1	453.8	269.9	362.3	453.5	270.5	363.5	455.1	283.5	376.4	468.1	286.9	379.8	471.4
<b>VI</b>	326.5	432.3	536.7	308.8	414.6	519.0	307.2	412.4	516.3	311.5	417.3	521.8	325.1	430.9	535.3	326.5	432.3	536.7
<b>VII</b>	364.2	482.4	599.0	346.5	464.7	581.3	342.7	460.2	576.2	354.4	472.5	589.2	363.9	482.0	598.7	364.2	482.4	599.0
<b>VIII</b>	431.1	571.2	709.6	413.4	553.5	691.9	405.6	544.9	682.5	426.2	566.2	704.6	431.1	571.2	709.6	431.1	571.2	709.6
<b>IX</b>	514.2	681.7	847.4	496.5	664.0	829.7	483.7	650.3	814.9	512.1	679.5	845.2	514.2	681.7	847.4	514.2	681.7	847.4
<b>X</b>	722.4	961.9	1200.3	704.7	944.2	1182.6	679.0	916.8	1153.5	721.6	961.1	1199.5	722.4	961.9	1200.3	722.4	961.9	1200.3



Table 12: Impact of Different Public Resource Allocation Mechanisms on Poverty, Given a 30% Increase in Grain Prices

		$\alpha = 0$	$\alpha = 1$	$\alpha = 2$
<b>Without Intervention</b>	<b>Urban</b>	0.083	0.021	0.015
	<b>Rural</b>	0.257	0.088	0.044
	<b>National</b>	0.147	0.046	0.026
<b>Universal Transfer</b>	<b>Urban</b>	0.081	0.021	0.015
	<b>Rural</b>	0.253	0.086	0.043
	<b>National</b>	0.144	0.045	0.025
<b>Subsidy</b>	<b>Urban</b>	0.082	0.021	0.015
	<b>Rural</b>	0.255	0.087	0.044
	<b>National</b>	0.146	0.045	0.025
<b>Oportunidades</b>	<b>Urban</b>	0.082	0.021	0.015
	<b>Rural</b>	0.245	0.082	0.040
	<b>National</b>	0.142	0.043	0.024
<b>Transfer to Poverty Stricken</b>	<b>Urban</b>	0.079	0.018	0.013
	<b>Rural</b>	0.247	0.075	0.036
	<b>National</b>	0.140	0.039	0.021
<b>Perfect Targeting</b>	<b>Urban</b>	0.080	0.020	0.014
	<b>Rural</b>	0.249	0.083	0.041
	<b>National</b>	0.142	0.043	0.024

Table 13: Impact of Different Public Resource Allocation Mechanisms on Poverty, Given a 15% Increase in Food Prices

		$\alpha = 0$	$\alpha = 1$	$\alpha = 2$
<b>Without Intervention</b>	<b>Urban</b>	0.091	0.024	0.017
	<b>Rural</b>	0.271	0.095	0.048
	<b>National</b>	0.157	0.050	0.029
<b>Universal Transfer</b>	<b>Urban</b>	0.090	0.024	0.017
	<b>Rural</b>	0.269	0.093	0.047
	<b>National</b>	0.156	0.049	0.028
<b>Subsidy</b>	<b>Urban</b>	0.090	0.024	0.017
	<b>Rural</b>	0.269	0.094	0.048
	<b>National</b>	0.156	0.049	0.028
<b>Oportunidades</b>	<b>Urban</b>	0.090	0.024	0.017
	<b>Rural</b>	0.263	0.089	0.044
	<b>National</b>	0.153	0.047	0.027
<b>Transfer to Poverty Stricken</b>	<b>Urban</b>	0.090	0.021	0.015
	<b>Rural</b>	0.267	0.082	0.039
	<b>National</b>	0.155	0.043	0.024
<b>Perfect Targeting</b>	<b>Urban</b>	0.090	0.023	0.015
	<b>Rural</b>	0.259	0.087	0.042
	<b>National</b>	0.152	0.046	0.025