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Valero-Gil, Jorge and Valero, Magali

Universidad Autonoma de Nuevo Leon, University of Michigan-Dearborn

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The Effects of Rising Food Prices on Poverty in Mexico

Jorge N. Valero-Gil¹

and

Magali Valero²

Abstract

We evaluate the impact of the rise in food prices during 2006-2008 on the poverty and extreme poverty rates in Mexico. We concentrate on the poor's consumption of staple foods, and analyze the change in their consumption brought about by changed prices. We also allow households receiving income from the farming and livestock sector to benefit from increases in prices of food products. We find a modest increase in poverty using 2006-2007 prices, however, there is a daunting effect on the poor once the 2008 prices are taken into account. After considering the positive effects of public policies announced in 2008, such as reduced taxes and tariffs on food products and greater subsidies to the extremely poor, the poverty rate measured through consumption increases from 25% to 33.5%, and the extreme poverty rate from 10.58% to 16%, given the increase in food prices. Further analysis using the theory of optimal taxes suggests policies oriented towards relieving the food price pressure on the Mexican poor should aim at lowering the prices of eggs, vegetable oil, milk, and chicken.

JEL classifications: H21, I32, I38, Q11, Q18

Keywords: Food price changes, Poverty, Mexico

¹ Universidad Autónoma de Nuevo León, Facultad de Economía. Loma Redonda 1515 Pte. Col. Loma Larga, Monterrey, Nuevo León, Mexico. Phone (52) (818) 329-4150. Email jnvalero@gmail.com

² University of Michigan-Dearborn. 19000 Hubbard Dr., Dearborn, MI, 48126. Phone (313) 583-6532. Email mvalero@umd.umich.edu

The Effects of Rising Food Prices on Poverty in Mexico

1. Introduction

The world food crisis is a cause of great concern to policy makers in many developing economies. According to the International Monetary Fund's (IMF) index of primary commodity prices³, in the 36 months leading up to July 2008 global food prices have increased by 75%. Maize, the main ingredient in the most consumed food product by the Mexican poor, tortillas, has increased 153% in those same 36 months, and it has already increased by 29% during the January to July 2008 period.

The increase in food prices is mainly attributed to increased bio-fuel production, and is expected to continue in the coming years. In fact Tyner et al. (2008) reviewed 25 studies and cite three forces driving food prices: 1) the change in the production and consumption of key commodities around the world; 2) the depreciation of the dollar; and 3) an increased production of bio-fuels. Of primordial importance is the impact that the rising food prices will have on poverty. As the poor people of a country spend a higher percentage of their income on food products, one would expect food price inflation to disproportionately impact the poor.

Individual country studies of the international food crisis are essential as the consumption patterns of individuals from different countries vary greatly. As the prices of food products rise in different proportions they impact countries' poverty rates differently depending on the specific consumption patterns of the poor. In fact, the Food

³ The IMF's index of internationally traded food commodities prices is a nominal dollar index of food commodity prices, where the individual index constituents are weighted by their global export values.

and Agriculture Organization of the United Nations (FAO) (2008) suggests that the potential losses and gains in household welfare are country specific. Similarly, the policy recommendations may vary by country depending on the consumption patterns of the country's constituents, especially the poor.

In this study we analyze the effect that the increase in food prices will have on the poor and on the extremely poor in Mexico. We study the staple foods consumed by the Mexican poor and estimate the increase in spending that would occur from rising food prices. We also allow households to benefit from increasing food prices if they receive income from the farming or livestock sector. Using these estimates, we analyze the impact of the increasing food prices of 2006-2007 on poverty, measured through consumption, in Mexico. We then consider two of the policy measures taken by Mexico in 2008 to reduce the impact of soaring prices: subsidies to the extremely poor and the reduction or elimination of tariffs on some agricultural products, and evaluate whether these policy measures are effective in alleviating the increase in poverty projected by the rising food prices. Additionally, given the continued increase in the price of food during 2008 we offer some projections on the poverty rates given the changes in the price of food during 2006 to 2008. Finally, we use the theory of optimal taxes to determine which food products would be the best targets for a public policy aimed at aiding poverty through the distribution of consumption.

We find that given the food price increase of 2006-2007, other things equal we would expect the poverty rate, measured through consumption, to increase from 25% to 27.83%, and the percentage of people in extreme poverty to increase from 10.58% to 12.11%. Further, the public policy measures taken would aid at slowing the increase in

poverty. Once we take these public measures into account, the poverty rate increases from 25% to 26.48% and the extreme poverty rate from 10.58% to 11.57%. Our analysis of prices up to 2008 shows that the international food crisis could potentially have a very strong detrimental effect on the poor. A study of the 2006-2008 prices suggests an increase from 25% to 33.5% in the percentage of poor, and an increase from 10.58% to 16% in the extremely poor, these figures accounting for the public measures taken to aid the poor. Our analysis using the theory of optimal taxes suggests that a policy geared towards helping the poor cope with the higher prices of food should be oriented to lowering prices of eggs, vegetable oil, milk and chicken.

2. Data and Methodology

We use data from Mexico's National Income and Expenditure Survey of Households (ENIGH) for the year 2006. In the case of food products, ENIGH collects household information on the amount of the good purchased, the price paid, and the expenditure for each household member. Our analysis is a partial equilibrium framework in that we only consider the direct impact that a changing food price will have on household expenditure, and we circumvent the general equilibrium model where other factors such as wages, inflation of non-food products, etc. also change. In our analysis we also allow net sellers of the food products to benefit from the increased prices. We follow prior literature and only consider the first-order impacts of changes in food prices on poverty (Chen and Ravallion, 2004; Ivanic and Martin, 2008). Therefore, we assume no substitution of food products upon their price change. The approach is reasonable given

that the possibility of making substitutions between food products is small when all food prices rise in conjunction.

Using individual household data, we compare the household's achievable expenditure level before and after the increase in food prices, and using this along with an established poverty line we determine which households will fall into poverty and which will emerge from poverty given the price changes.

3. Defining the poor

In order to measure changes to poverty one has to define the poverty measures to be used. We have the choice of measuring poverty through income or consumption (spending) of the household, as we are using monetary measures and the ENIGH. It has been argued that consumption or spending are better measures to use when evaluating poverty than income. Coudouel et al. (2002) argue that consumption is a better indicator than income because of three reasons: 1) consumption is a better outcome indicator than income as it is more closely related to well-being of a person; 2) consumption may be better measured than income and thus can be more reliable; and 3) consumption better reflects a household's actual standard of living and ability to meet basic needs. We use household's consumption to define the poor. We adjust for differences between households' size by dividing household consumption by the number of members of the family. We also adjust for two other issues. First, our expense calculations include imputed rent, a hypothetical rental value for those households not paying rent. Second, we adjust for differences in prices of rural and urban households by using the rural and

urban poverty lines from Cortés et al. (2002). In particular, they define a poverty line as the income necessary to cover the cost of the minimum necessities for nutrition, which is \$15.4 and \$20.9 daily year 2000 pesos per person in the rural and urban areas, respectively. Therefore, income of households in rural areas (smaller than 15,000 habitants) is adjusted by a factor of 1.34 before establishing a poverty line.

We take all households in the sample and calculate the sum of their quarterly expenses, which include the imputed rent. We then sort the sample based on their per-capita quarterly expenses and divide it into four quartiles. We use a relative poverty line and define the poor as households in the lowest quartile of this distribution. Households where the expenditure per family member falls below \$3,528 pesos per quarter fall in the lowest quartile. Quartile 2 is for families in the \$3,529 - \$5,788 range. The third quartile is \$5,789 – \$10,128. The highest quartile is formed of households where the expenditure per family member is higher than \$10,128 pesos per quarter.

We also consider an additional poverty line that captures the impact on the extremely poor. According to The National Council for Evaluation of Social Development Policy (CONEVAL, 2008), in 2006 Mexico's extreme poverty was 19.5% households in the rural sector (populations lower than 15,000) and 5.9% households in the urban sector. Using these benchmarks, we estimate an extreme poverty line at less than \$1,677.64 pesos per quarter for rural households and less than \$2,721.84 pesos per quarter for urban households. Households where the quarterly expenditure per family member falls below these guidelines are considered in extreme poverty.

4. Impact of food price increases on the poverty rate

4.1 Consumption patterns of the poor

The importance of rising food prices on the poverty rate stems from the observation that the poor allocate a higher percentage of their spending to the consumption of food products. In our study, the percentage of consumption spent on food is 29% for the full sample. However, the individual quartile measures are 44%, 39%, 33%, and 21%, respectively, for quartile 1, 2, 3 and 4. The percentage of consumption spent on food is 27% for households in quartiles 1, 2, and 3 combined. Seeing as the poor spend on average 44% of their consumption on food, while the non-poor spend 27%, one would expect an increase in food prices to disproportionately affect the poor, and to have an adverse effect on the poverty rate in the country.

We select the 11 food products, out of 247, most consumed by the lower expenditure-quartile of the population which are, in order from most consumed to least consumed: tortillas, chicken with bone, soft drinks, milk, eggs, tomatoes, beans, beef, pastries, sugar, and vegetable oil. These products are listed in Table 1 along with the proportion of total expenditure and the proportion of expenditure on food that they represent, for poor and non-poor households, respectively. Tortillas is the food product most consumed by the poor population. On average, the poor household spends 4.77% of their total expenditure on tortillas, and 10.86% of their expenditure on food is spent on this good. On the other hand, non-poor households spend 1.30% of their total expenditure on tortillas, and 4.80% of their total food consumption on this good. Overall, column 6 in the table shows that the proportion of expenditure that goes to tortillas, from both poor

and non-poor households is 1.62%. The lowest row in the table presents the totals for the 11 food products chosen. These 11 food products chosen represent 20.61% of the total expenditure of the poor and 7.97% of the total expenditure of the non-poor. In terms of food consumption, the products chosen represent 46.98% of spending on food for poor and 29.53% of spending on food for non-poor. The last column in the table which shows the fraction of the good that is consumed by the poor provides some interesting results. If all the population consumed the same food products, each number on the column would be 25. The poor consume proportionally more tortillas, eggs, beans, sugar, and vegetable oil than the rest of the population; while consuming proportionally less chicken, soft drinks, milk, tomatoes, beef, and pastries. The poorest 25% of the population consumes 36.3% of the total beans, and only 12.8% of the total beef. Thus, although these 11 goods are those food products in which the poor spend most of their money, they are still for some products, consuming a lot less than their non-poor counterparts are.

4.2 International food prices

The recent food price crisis is worrisome because of its potential impact on the well-being of the poor. Table 2 shows the 11 food products chosen along with their 2006-2007 price increase. The second column of the table presents the main raw good of which the final product is composed, along with the percentage of the raw good in the final good's price in column 3. For instance, we can see that the tortilla is mainly made with maize, which constitutes 70% of the price or cost of a tortilla. The fourth column shows the price increase of the raw good for 2006-2007. The price increases shown for maize, chicken, sugar, milk, beef, wheat, and vegetable oil, come from OCDE-FAO (2008)

estimations; while the price increases for eggs, tomatoes, and beans are calculated from estimations in the U.S. Department of Agriculture (USDA 2008a, 2008b) website. In the last column the price increase for the final product is estimated. The products with the strongest price increase for the 2006-2007 period are milk, followed by eggs and vegetable oil. The price of tomatoes dropped 6.97% during this same time period.

The increase in international food prices will pass through to the domestic economies. Mundlak and Larson (1992) show that most of the variation in the world agricultural prices is transmitted to the domestic economies, and that the variation constitutes a dominant component in the variation of domestic prices. However, when and at which rate it passes-through depends on several factors. For instance, the government can control the exchange rate to minimize the pass-through to the domestic economy, or other public policies can be used such as tariffs, taxes, quotas, etc. These policies would slow the transmission of international food prices in the short run so that adjustments in the domestic economy take place gradually. By studying the domestic economy upon international food price changes we are estimating the impact of international food prices on poverty. For the reasons outlined above, the international prices of food may not pass-through completely immediately but our study will snapshot the effect on poverty once those prices pass-through completely to the domestic economy. To get an insight as to how much have domestic prices adjusted to international prices, Table 3 presents the observed price changes in the Mexican economy along with the international price changes. The information on price changes in Mexico for 2006-2007 comes from CIE (2008), and the increase 2007-2008 (up to July 2008) from Consultores Internacionales (2008). The international prices are estimated using the

food price indexes from the IMF⁴, except in the case of eggs, tomatoes and beans where the international figure refers to the 2006-2007 price increase of USDA (2008a, 2008b), and in the case of milk where it reflects the 2006-2007 price increase according OECD-FAO (2008) since the 2008 prices were not found. When we compare the 2006-2008 price changes for Mexico (in Column 4) and internationally (in Column 5), we observe that for most products the full adjustment of the international price increase has still not taken place. On some of these food items, like milk, tortillas, and pastries, international prices might not have fully passed-through to the domestic economy yet because of the government policies in place. As an example take the price of milk, which has increased domestically by 15% during 2006-2008 while the international price has jumped by 68.6% during the same period. The 6.2% increase during 2007-2008 is small compared to the international expected adjustment, and might be due to government policies to keep prices of milk low, as the price increase appears to be stronger according to Consultores Internacionales (2008) on related products such as fresh cheese (23.2%) and butter (20.2%).

By using the price increase in each of the 11 food products weighted by their proportional expenditure for all households, we determine that the weighted average price increase for these food products is 23.84% for all households. Using this figure along with the price increase for all food products we can estimate the price increase on the other food products not selected. In particular, we use the International Monetary Fund's Index of Commodity Prices to calculate food price inflation for 2006-2007, which according to the IMF index is 15.2%. If the food price increase calculated by the IMF

⁴ The 2006-2008 international price changes are calculated as the percentage change in the index from its January -July 2006 value to its January-July 2008 value.

applies to Mexico, and if by our estimates households had a price increase of 23.84% on the 11 food products chosen, then the price increase in all other food products is 11.12%. These estimates along with the estimates for the poor are presented in Table 4. The left hand side of the table shows the estimated price increases for all households and the right hand side of the table the estimates for poor households. According to their consumption patterns, the weighted price increase of the 11 products for poor households is 22.36%, and if we assume a price increase on other food products of 11.12% (equal to the one for all households), then given their consumption patterns the food prices for the poor are increasing by an estimated 16.40% during the 2006-2007 period. Given their consumption spending on certain products, poor households experience 10.53% higher prices on food products compared to the full population of households.

4.3 Income from the farming and livestock sector

Just as there is a negative impact on households' expenditure because of higher food prices, households whose income depends on the farming and livestock sector could benefit from increasing food prices. In Table 5 the households that have income from the farming and livestock sector are summarized. Of a total of 26,541,327 households in our sample, 5,856,070 are rural households. Rural households are defined as those which are in a town with population of 2,500 or less. Among the poor, 15.75% report income from farming and livestock activities, while 43.76% of the rural poor report this type of income. Of the farming and livestock reported income, 23.09% goes to quartile 1, while the majority of this type of income is for those with the highest consumption patterns (the

fourth quartile)⁵. We allow a 15.2% increase in the income from farming/livestock activities of rural households. The 15.2% is the average food price increase estimated by the IMF for the 2006-2007 time period. We do not adjust the income of urban households since we assume that farmers in the rural area will capture the rents generated by the increasing prices.

4.4 Impact of rising food prices on the poor

The overall impact of rising food prices on the poor considers both 1) the effect of higher spending on food products, and 2) the higher income of households with proceeds from the farming and livestock sector. To calculate the impact on the poverty rate of the recent increase in food prices, we first establish the poverty lines as outlined in the prior section. Then, we calculate the impact on expenditure of the increase in food prices of the 11 most consumed products as shown in Table 2, and an increase of 11.12% in the prices of other foods as shown in Table 4. We re-calculate the total per-person expenditure of each household using the new prices. We then re-evaluate the poor to be those households where the original total expenditure minus the increase in expenditure due to higher prices is lower than the poverty line.

The results of these estimations are presented in Table 6, where in Panel A we report the effect on poverty and in Panel B the effect on extreme poverty. When considering only the effect of higher prices on spending, the poverty rate increases from 25% of the population to 27.83% of the population – an increase in the poverty rate of 2.83%. When considering only the effect of higher food prices on the income from

⁵ The farming and livestock sector income that we consider is that where individuals report income from this source related to their own business and we do not consider the farming/livestock income of corporations. We do this because of our interest in the effects on poverty.

farming/livestock activities of rural households, there is a reduction on the poverty rate of 0.10%. The total effect of increased food prices on poverty is presented in the last two columns of the table. The 2006-2007 food price increases have the overall effect of increasing poverty by 2.77%, or from 6.64 million households to 7.37 million households.

We repeat our previous exercise for extreme poverty, and re-classify the poor after allowing a price increase in food and increased income from farming/livestock activities as outlined before. The results on the extreme poverty rate appear in Panel B of Table 6. The overall extreme poverty rate in 2006 was 10.58%, or 2.8 million households. Although there is a positive effect of food prices on households receiving income from the farming and livestock sector, the effects are very small compared to the negative impact on households whose consumption would be adversely affected because of the increase in prices. Overall, the extreme poverty rate increases from 10.58% to 12.11%. An additional 407,655 Mexican households will be extremely poor.

5. Effect of public policy programs in combating the poverty increase

The government has not been inactive in front of the food price situation. It has taken several actions that aim at reliving some of the household's pressure because of food price inflation. In this section we evaluate the effects that some of these policies will have in the combat against increasing poverty rates.

In face of the international food crisis the government of Mexico announced on May 25th, 2008 several measures to support families. These measures are subdivided into

three categories: 1) measures oriented towards facilitating the access and supply of food at the best international prices to Mexican consumers; these include actions like the elimination of tariffs on wheat, rice, and maize, quotes without tariffs for beans, and the reduction of tariffs on milk; 2) measures oriented to foster food production and improve productivity in the countryside; such as reduction of tariffs on nitrogenous fertilizers, preferential credits to small agricultural producers, etc.; and 3) measures oriented to protect income and strengthen the economy of the poor; such as a program that gives additional money subsidies for food to the extremely poor, and programs designated to reduce the prices of milk and tortillas paid by the extremely poor. Of the programs announced, we evaluate those that would affect food prices of staple foods or household consumption in the short run, which are encompassed in categories 1) and 3) above. In particular, we study the creation of the “Better Living” program which is geared towards giving money subsidies to the extremely poor, and we also evaluate the impact of eliminating the tariff on maize and of reducing the tariff on milk to half its previous level.

One other measure not evaluated here is the effect of programs designated to reduce the prices of milk and tortillas paid by the extremely poor. Many such policies were already in place in 2006: policies intended to reduce the prices paid by the extremely poor on milk, tortillas, and other staple foods. However, as shown in Table 7, such policies do not seem to have been effective in lowering prices for the poor. For instance, the average price paid for a liter of milk is 9.3 pesos for all households, 9.1 for poor households, and 9.0 for extremely poor households. The policy in place for milk is to have milk accessible to extremely poor households at 4 pesos per liter; and one of the policies of the May 25th 2008 decree is to maintain this measure in place. We observe in

Table 7 that the prices paid by the poor and extremely poor are very similar to those paid by the entire population of households, even when many such measures aimed at reducing prices for the poor were already in place in 2006.

We evaluate the creation of a food support program, “Better Living”, which is a monetary complement designed to strengthen the income of the poorest families of the country. This support will allow a family enrolled in Oportunidades⁶, which received on average 535 pesos per month, to receive on average 655 pesos per month. The impact of this public policy measure on poverty is estimated by increasing the income of each household who is shown in the ENIGH as receiving transfers from the Oportunidades program by 120 pesos per month. The results are presented in Table 8 in which, for comparison purposes, the number of poor before the price hike and the number of poor after (from Table 6) are also shown. We observe an improvement in the poverty rate upon the establishment of the Better Living program. The poverty rate, which is expected to increase to 27.77% because of the price hike, would increase to only 26.89% thanks to the program. Still, the effect on the poor remains as 501,829 additional households would still fall under the poverty line. The Better Living program, as intended, seems to be better able to aid the extremely poor. Of an expected increase in the poverty rate to 12.11% the Better Living program would help so that the poverty rate would only increase to 11.44% or by 0.86%. Nevertheless, the transfers of the program do not seem

⁶ Oportunidades is a Federal Government Program that seeks to improve human development of the extremely poor. Oportunidades provides support for education, health, nutrition and income. Participants are selected exclusively by the socioeconomic characteristics of the household, and commit to certain activities to keep the support, like attending good health doctor’s visits, attending school, etc. About 70% of households enrolled in Oportunidades are rural, and 30% are urban.

to be targeted towards the poor. According to the households registered in the ENIGH⁷ as receiving support from Oportunidades, the government would spend \$25.3 million pesos on the Better Living program, of which according to the number and income of households reporting being part of Oportunidades in the ENIGH, only \$1,348,560 pesos would be distributed among the poor (those in the lowest quartile), and of these, \$729,000 pesos would be distributed among extremely poor households. The rest of the money is distributed among households where the expenditure per capita is in the top three fourths of the distribution.

We next look for the impact of lifting the tariff on maize and of reducing the tariff on powdered milk to half its level⁸ (Diario Oficial, 2008). Of our 11 most consumed products, the reduction in the tariff of milk and that of maize would impact the prices of tortillas and milk. If we adjust the price of milk and tortillas to reflect the lower domestic price due to reduced tariffs and go through the calculations again, we can obtain the poverty relief of such measures. These results are also presented in Table 8. There seems to be a very small effect on poverty of reducing the tariffs on milk and maize. Instead of increasing to 27.77% (or 12.11% for extreme poverty), the poverty rate increases from 25% (10.58%) to 27.34% (11.82% for the extreme poor) once we incorporate the effect of the reduced tariffs.

⁷ The ENIGH could be not representative of the total amounts spent on the social programs, as discussed in Leyva-Parra (2001).

⁸ Although the tariff on wheat, an input in pastries which is one of the staple products selected, was also temporarily eliminated, we do not evaluate it here since according to the Organization for Economic Co-operation and Development (OECD, 2008) the domestic and the international price of wheat in Mexico are the same, and because this measure is said to be only temporary. The OCDE (2008) reports a consumer national protection coefficient (CNPC), the ratio between the domestic price paid by consumer (at the farm gate) and the border price (at the farm gate), of 30% for maize, of 20% for powdered milk, and of 0% for wheat. Therefore, the decrease in prices will be of 30% for maize and 10% for powdered milk. We do not include the elimination of tariffs on quotas for beans because the possible effects on consumption prices are unknown.

The effect of incorporating both public programs is shown in the last row of Table 8. The table shows that the effect of the food price hike of 2006-2007 on the poverty rate is modest, once we account for 1) the increased expenditure of consumers; 2) the increased income of households with income from the livestock and farming sector; 3) a subsidy offered to the households enrolled in the Oportunidades program; and 4) the price relief on milk and tortillas due to decreased tariffs on milk and maize. The poverty rate is expected to increase from 25 to 26.48%. The poverty rate for the extremely poor would increase from 10.58 to 11.17%. Although the public policies established aid the poor and the poverty rates estimated only slightly increase, of concern is the fact that the prices of food staple goods have continued to increase since 2007 and in some cases at an increasing rate.

6. Projected poverty impact of 2006-2008 prices

The previous sections evaluate the impact of the rising food prices of 2006-2007 on the poverty rate. During the first half of 2008, we have continued to observe food price inflation in the World. According to the food commodity price index of the IMF, the price of food has increased by 15.7% in the months between January and July 2008. Being Mexico a net consumer of food, at the higher prices we would expect more important effects on the poverty rate of the country. In this section we evaluate the impact of the food price increase of 2006-2008 on the poverty rate in Mexico.

To start the analysis, we present in Panel A of Table 9 the 2006-2008 food price changes that we use for the 11 staple foods analyzed. Following the food price indexes of

the IMF for the 2006-2008 period⁹ and using the percentage of the raw good in the final products' price reported in Table 2, we estimate the price increase in each food product for the 2006-2008 period. The IMF does not provide an index of food prices for milk, eggs, tomatoes or beans, so we use the price changes estimated previously for the 2006-2007 period for these goods. According to the IMF's food index, the price of food during this period increased by 56%. Given that we find the expense-weighted price change for these 11 goods to be 39%, we assume, after our estimation using microdata from the ENIGH, an increase in the prices of other food products of 64%.

The impact of the 2006-2008 food price increase on poverty is presented in Panel B of Table 9. The total effect that includes both the negative effect on consumer income and the positive effect on the income of the farming/livestock sector is shown in the fifth row of the table. Without any adjustments or government intervention, the international food crisis could potentially have a very strong detrimental effect on the poor. The poverty rate could increase from 25% to 34.94%, or by 39.77% due to increased food prices. The impact on the extremely poor is even more daunting. The extreme poverty rate could increase from 10.58% to 17.56% or by 66% due to increased food prices. The next two rows in the table show the independent effects of establishing the "Better Living" program and the reduction in the tariffs on milk and maize. Although both programs would help in alleviating the poverty increase, we can observe from the table that the "Better Living" program is superior at aiding the poor.

The last row in Panel B of Table 9 shows the ultimate effect of the 2006-2008 food price increase on the poverty rate, once we account for increased expenditure in

⁹ The price change is calculated as the percentage change in the index from the January-July 2006 value to the January-July 2008 value.

food products, increased income from farming and livestock sector, households enrolled in Oportunidades receiving an extra subsidy through the “Better Living” program, and tariffs on milk and maize being reduced. The poverty rate’s impact from higher food prices is an increase from 25% to 33.5%, or by 34%. The strongest effect would be on the people more economically disadvantaged. The extreme poverty rate of 10.58% increases to 16%, or by 51% because of increased prices of staple food products.

7. Alternative policy options: prices and social policy

In this section we question which price increases generate a greater impact on the distribution of consumption. As discussed in Table 1 the poor’s consumption is more than proportional on goods like tortillas, eggs, beans, sugar and oil; which indicates that these goods would have the greatest redistributive impact. However, reduced taxes or tariffs, and social price-support programs can have serious implications on losses of efficiency. The best method is to lower prices of those goods that will most impact the welfare of the poor, but that will have the smaller impact on economic price distortions.

We can formalize this idea by considering the international price increases as taxes, and then applying the theory of optimal taxes. Following the procedure in Ahmad and Stern (1984), we call W the social welfare function, τ_i the tax on good i (an increment in the international price in our case), and R the tax collection or governmental spending. The cost on social welfare W of saving one peso of government income R is given by:

$$\lambda = -(\partial W / \partial \tau_i) / (\partial R / \partial \tau_i) \quad (1)$$

The first term in the equation refers to the distribution or equity effect, and is the change in welfare that results from a change in taxes. The second term, the efficiency effect, is the change in government revenue or expenditure given a change in taxes, which occurs as households adjust their consumption. According to optimal tax theory, goods with high cost-benefit ratio λ are candidates for low taxes and those with low cost-benefit ratio λ are candidates for high taxes. In our setting, food products with high λ would represent the best targets for policies oriented towards aiding the poor.

In order to evaluate social welfare, we use Atkinson's (1970) social welfare function:

$$W = \sum_{h=1}^H \frac{n_h}{1 - \varepsilon} \left(\frac{x_h}{n_h} \right)^{-\varepsilon} \quad (2)$$

where x_h is the total expenditure of household h , n_h is the number of members of household h , and ε measures risk aversion to poverty, where higher values of ε represent a greater weight of the poor in the social welfare function. Following Deaton (1988, 1997a) and Ahmad and Stern (1984, equations 11 and 13), changes in R and W will be explained by:

$$\frac{\partial R}{\partial \tau_i} = \sum_{j=1}^N q_{ij} + \sum_{j=1}^N \sum_{i=1}^M \tau_i \frac{\partial q_{ij}}{\partial p_i} \quad (3)$$

$$\frac{\partial W}{\partial \tau_i} = - \sum_{j=1}^N \beta^j q_{ij} \quad (4)$$

Where q_{ij} is the consumption of good i by household j , p_i is the price of good i , and the β^j indicate the change in welfare from giving one extra peso to household j . Equation (3) is the efficiency effect and equation (4) the equity effect of having higher prices.

In order to estimate equations (1) to (4) we follow Deaton's (1997a) methodology which estimates the equations using cross-sectional information, and where more detailed information can be found. The programs used for our estimations can be found in Deaton (1997a, 1997b). Both the 2004 and the 2006 ENIGHs are used in the estimations and the evaluations are made at the international prices indicated in Table 3.

The results of the estimation are presented in Table 10, where we use three values for the weight of the poor in the social welfare function: $\varepsilon = 0, 1$ and 2 . The table presents both the equity effect of equation (4) and the total effect or the cost-benefit ratio λ for each value of ε . When $\varepsilon = 0$ every household has the same weight in the social welfare function of equation (2), and thus only the efficiency effects are important. In this case, the best targets for food price policy are milk and eggs. Considering $\varepsilon = 2$, where the poor are more highly weighted in the social welfare function compared to the non-poor, we find that the most important equity effects are for sugar, beans, vegetable oil, and eggs (same results as in Table 1), but once we include the efficiency effects in the last column, the selected goods in order (best target first) are eggs, vegetable oil, milk, and chicken. Therefore, the results suggest lower taxes or prices on eggs, oil, milk and chicken; and higher taxes on beef and on other non-food goods would be the best targets at aiding the poor.

8. Summary and Conclusion

This paper studies the consequences that the world food crisis will have on the poverty rates in Mexico. We use the price change of 11 staple foods consumed by the

poor along with an overall food price index over the period 2006-2007 and 2006-2008, and use detailed data on household consumption for 2006, to evaluate changes in spending due to increased food prices. We find that the old household consumption cannot be sustained at the new world food prices. In particular, the food price changes of 2006-2007 generate an increase in the poverty rate, as measured through consumption, from 25% to 27.77%; and an increase in extreme poverty from 10.58% to 12.11%. When measured using the food price changes from 2006 to 2008, the poverty rate jumps from 25% to 34.94% and the extreme poverty rate from 10.58% to 17.56%. Public policy programs, such as subsidies to the extremely poor and the reduction of tariffs on milk and maize have a small impact on poverty, of less than a two percentage point reduction in the poverty rate for both policies combined. Our analysis suggests that policy should be geared first towards lowering prices of eggs, vegetable oil, milk and chicken, before turning to the more commonly targeted tortillas or beans, if the goal is to aid the consumption of the poor. The study provides a snapshot of the impact that rising international food prices could have on poverty once these prices pass-through to the domestic economy.

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Table 1
Food products most consumed by the lower quartile of the population

| | Proportion of total expenditure | Proportion of expenditure on food | Proportion of total expenditure | Proportion of expenditure on food | Proportion of expenditure | Fraction of good consumed by poor |
|-------------------|---------------------------------|-----------------------------------|---------------------------------|-----------------------------------|---------------------------|-----------------------------------|
| | Poor | | Non-poor | | All | |
| Tortilla | 4.77% | 10.86% | 1.30% | 4.80% | 1.62% | 27.9 |
| Chicken with bone | 2.50% | 5.69% | 1.00% | 3.72% | 1.14% | 20.7 |
| Soft drinks | 2.31% | 5.26% | 1.13% | 4.19% | 1.24% | 17.7 |
| Milk | 2.04% | 4.65% | 1.33% | 4.94% | 1.40% | 13.9 |
| Eggs | 1.86% | 4.24% | 0.49% | 1.83% | 0.62% | 28.3 |
| Tomatoes | 1.63% | 3.72% | 0.60% | 2.21% | 0.69% | 22.3 |
| Beans | 1.51% | 3.43% | 0.28% | 1.03% | 0.39% | 36.3 |
| Beef | 1.28% | 2.91% | 0.91% | 3.38% | 0.95% | 12.8 |
| Pastries | 1.08% | 2.47% | 0.52% | 1.94% | 0.58% | 17.8 |
| Sugar | 0.93% | 2.11% | 0.20% | 0.76% | 0.27% | 32.2 |
| Vegetable oil | 0.72% | 1.63% | 0.20% | 0.73% | 0.25% | 27.8 |
| Total | 20.61% | 46.98% | 7.97% | 29.53% | 9.17% | 21.4 |

Table 2
Price increase of 11 most consumed goods by poor, 2006-2007

| Final product | Raw good | % raw good in final products price | International price increase raw good 2006-2007 | Price increase final product |
|-------------------|---------------|------------------------------------|---|------------------------------|
| Tortilla | Maize | 0.70 | 25.86% | 18.10% |
| Chicken with bone | Chicken | 1.00 | 7.67% | 7.67% |
| Soft drinks | Sugar | 0.10 | 0.05% | 0.00% |
| Milk | Powdered milk | 0.80 | 85.72% | 68.58% |
| Eggs | Eggs | 1.00 | 65.70% | 65.70% |
| Tomatoes | Tomatoes | 1.00 | -6.97% | -6.97% |
| Beans | Beans | 1.00 | 21.59% | 21.59% |
| Beef | Beef | 1.00 | 18.63% | 18.63% |
| Pastries | Wheat | 0.50 | 52.27% | 26.13% |
| Sugar | Sugar | 1.00 | 0.50% | 0.50% |
| Vegetable oil | Oil | 0.80 | 35.03% | 28.02% |

The information on prices for maize, chicken, sugar, powdered milk, beef, wheat, and oil comes from OCDE-FAO (2008). The prices of eggs, tomatoes and beans come from USDA (2008a, 2008b).

Table 3
Observed price changes in Mexico and Internationally, 2006-2008

| | Mexico 2006-2007 | Mexico 2007-2008 | Mexico 2006-2008 | International 2006-2008 |
|-------------------|---------------------|---------------------|---------------------|----------------------------|
| Tortilla | 5.20% | 14.40% | 20.35% | 87.68% |
| Chicken with bone | 13.80% | 16.30% | 32.35% | 19.83% |
| Soft drinks | 11.40% | 6.10% | 18.20% | -1.79% |
| Milk | 8.30% | 6.20% | 15.01% | 68.58% |
| Eggs | 16.80% | 39.40% | 62.82% | 65.70% |
| Tomatoes | -3.20% | 14.10% | 10.45% | -6.97% |
| Beans | 6.40% | 18.70% | 26.30% | 21.59% |
| Beef | 3.00% | 3.70% | 6.81% | 6.82% |
| Pastries | 12.30% | 17.90% | 32.40% | 50.66% |
| Sugar | 14.10% | -10.30% | 2.35% | -17.87% |
| Vegetable oil | 10.50% | 62.60% | 79.67% | 96.35% |
| Other foods | | | | 63.80% |

The information on prices in Mexico for 2006-2007 comes from CIE (2008), and the increase 2007-2008 (up to July 2008) from Consultores Internacionales (2008). The international prices are estimated using the food price indexes from the IMF, except in the case of eggs, tomatoes and beans where the international figure refers to the 2006-2007 price increase of USDA (2008a, 2008b), and in the case of milk where it reflects the 2006-2007 price increase according OECD-FAO (2008), since no prices for 2008 were found.

Table 4
Food price increase for All and Poor population

| | All | | | Poor | | |
|------------------------|-------------------------------------|------------------------------------|--------------|-------------------------------------|------------------------------------|--------------|
| | Proportion of total expenditure on: | Proportion of food expenditure on: | Price change | Proportion of total expenditure on: | Proportion of food expenditure on: | Price change |
| Selected food products | 9.17% | 32.08% | 23.84% | 20.61% | 46.98% | 22.36% |
| Other food | 19.41% | 67.92% | 11.12% | 23.26% | 53.02% | 11.12% |
| Total food | 28.58% | 100.00% | 15.20% | 43.87% | 100.00% | 16.40% |

Table 5
Households with income from farming/livestock sector

| | Total households | Rural* households | Households with income from farming/livestock sector | % of total households with income from farming/livestock | % of rural households with income from farming/livestock | % of farming livestock income |
|-------------------|------------------|-------------------|--|--|--|-------------------------------|
| Quartile 1 (poor) | 6,635,297 | 2,388,129 | 1,045,094 | 15.75 | 43.76 | 23.09 |
| Quartile 2 | 6,635,229 | 1,546,033 | 444,699 | 6.70 | 28.76 | 18.62 |
| Quartile 3 | 6,634,480 | 1,100,395 | 266,090 | 4.01 | 24.18 | 15.18 |
| Quartile 4 | 6,636,321 | 821,513 | 195,164 | 2.94 | 23.76 | 43.11 |
| All | 26,541,327 | 5,856,070 | 1,951,047 | 7.35 | 33.32 | 100.00 |

*Rural households are those in towns with population of 2500 or less.

Table 6
Effects of food price increase of 2006-2007 on poverty in Mexico

| Panel A. Impact on poverty, measured as lowest quintile | | | | | | | |
|--|-----------------------------|--------|--|--------|--------------|--------|--|
| | Effect on consumer spending | | Effect on income of farming/livestock sector | | Total Effect | | |
| | Number | % | Number | % | Number | % | |
| Total Households | 26,541,327 | 100.00 | 26,541,327 | 100.00 | 26,541,327 | 100.00 | |
| Poor before | 6,635,297 | 25.00 | 6,635,297 | 25.00 | 6,635,297 | 25.00 | |
| Poor after food price change | 7,386,482 | 27.83 | 6,607,482 | 24.90 | 7,369,494 | 27.77 | |

| Panel B. Impact on extreme poverty, measured as CONEVAL | | | | | | | |
|--|-----------------------------|--------|--|--------|--------------|--------|--|
| | Effect on consumer spending | | Effect on income of farming/livestock sector | | Total Effect | | |
| | Number | % | Number | % | Number | % | |
| Total Households | 26,541,327 | 100.00 | 26,541,327 | 100.00 | 26,541,327 | 100.00 | |
| Poor before | 2,807,186 | 10.58 | 2,807,186 | 10.58 | 2,807,186 | 10.58 | |
| Poor after food price change | 3,260,438 | 12.28 | 2,754,711 | 10.38 | 3,214,841 | 12.11 | |

Table 7
Food prices paid by the entire population, the poor, and the extremely poor

| | All | Poor | Extremely Poor |
|-------------------|------|------|----------------|
| Tortilla | 7.7 | 7.5 | 7.6 |
| Chicken with bone | 29.2 | 27.5 | 26.1 |
| Soft drinks | 7.1 | 6.9 | 6.7 |
| Milk | 9.3 | 9.1 | 9.0 |
| Eggs | 14.4 | 14.6 | 14.2 |
| Tomatoes | 14.6 | 13.6 | 13.4 |
| Beans | 13.5 | 13.0 | 12.8 |
| Beef | 60.8 | 58.7 | 58.5 |
| Pastries | 32.2 | 27.8 | 27.6 |
| Sugar | 10.5 | 10.3 | 10.2 |
| Vegetable oil | 13.4 | 12.8 | 12.8 |

Prices are quoted in 2006 pesos. The units of measurement for staple foods are a kilogram for tortillas, chicken, eggs, tomatoes, beans, beef, pastries and sugar; and a liter of soft drinks, milk, and vegetable oil.

Table 8
Impact of public policy measures on the poverty rate:
Better living program of Oportunidades and Tariff responses to increasing food prices

| | Poverty | | | Extreme poverty | | |
|---|-----------------------------|-------|------------------|---------------------|-------|------------------|
| | Measured as lowest quintile | | | Measured as CONEVAL | | |
| | Number | % | % Poverty change | Number | % | % Poverty change |
| Total households | 26,541,327 | 100 | | 26,541,327 | 100 | |
| Poor before | 6,635,297 | 25 | | 2,807,186 | 10.58 | |
| Poor after | 7,369,494 | 27.77 | 11.08 | 3,214,841 | 12.11 | 14.46 |
| Poor after, including "Better Living" program | 7,137,126 | 26.89 | 7.56 | 3,036,952 | 11.44 | 8.15 |
| Poor after, including tariffs of milk and maize | 7,256,774 | 27.34 | 9.37 | 3,137,248 | 11.82 | 11.72 |
| Poor after, including both public policy programs | 7,027,238 | 26.48 | 5.91 | 2,963,865 | 11.17 | 5.55 |

Table 9
Poverty impact of 2006-2008 prices

Panel A. Price increase of 11 most consumed goods by poor, 2006-2008

| Final Product | Price increase 2006-2008 | Final Product | Price increase 2006-2008 |
|-------------------|--------------------------|---------------|--------------------------|
| Tortilla | 87.68% | Beans* | 21.59% |
| Chicken with bone | 19.83% | Beef | 6.82% |
| Soft drinks | -1.79% | Pastries | 50.66% |
| Milk* | 68.58% | Sugar | -17.87% |
| Eggs* | 65.70% | Vegetable oil | 96.35% |
| Tomatoes* | -6.97% | | |

*The price increase for these goods up to 2008 was not available, we use 2006-2007 price increases for these products.

Panel B. Effects of food price increase of 2006-2008 on poverty in Mexico

| | Poverty - lowest quintile | | | Extreme Poverty - CONEVAL | | |
|--|---------------------------|--------|------------------|---------------------------|--------|------------------|
| | Number | % | % Poverty Change | Number | % | % Poverty Change |
| Total households | 26,541,327 | 100.00 | | 26,541,327 | 100.00 | |
| Poor before | 6,635,297 | 25.00 | | 2,807,186 | 10.58 | |
| Poor after -effect on consumer spending | 9,398,625 | 35.41 | 41.65 | 4,794,971 | 18.07 | 70.81 |
| Poor after - effect on income farming/livestock sector | 6,544,373 | 24.66 | -1.37 | 2,702,515 | 10.18 | -3.73 |
| Poor after - Total effect | 9,274,079 | 34.94 | 39.77 | 4,661,211 | 17.56 | 66.05 |
| Poor after, total effect +"better living" program | 8,935,897 | 33.67 | 34.67 | 4,317,737 | 16.27 | 53.81 |
| Poor after, total effect + tariffs on milk and maize | 9,077,612 | 34.20 | 36.81 | 4,452,142 | 16.77 | 58.60 |
| Poor after, total effect + both public policy programs | 8,891,564 | 33.50 | 34.00 | 4,246,582 | 16.00 | 51.28 |

Table 10
Prices and social policy

| | $\varepsilon = 0$ | | $\varepsilon = 1$ | | $\varepsilon = 2$ | |
|----------------------|-------------------|------------------------------|-------------------|------------------------------|-------------------|------------------------------|
| | Equity effect | Cost-benefit Ratio λ | Equity effect | Cost-benefit Ratio λ | Equity effect | Cost-benefit Ratio λ |
| Tortilla | 1 | 3.48 | 1.82 | 6.32 | 2.23 | 7.77 |
| Chicken with bone | 1 | 3.74 | 1.70 | 6.37 | 2.30 | 8.60 |
| Soft drinks | 1 | 2.59 | 1.48 | 3.83 | 1.90 | 4.92 |
| Milk | 1 | 14.82 | 1.24 | 18.38 | 1.06 | 15.74 |
| Eggs | 1 | 12.17 | 1.98 | 24.10 | 3.38 | 41.08 |
| Tomatoes | 1 | 0.93 | 1.76 | 1.65 | 2.68 | 2.50 |
| Beans | 1 | 0.63 | 2.45 | 1.55 | 5.32 | 3.36 |
| Beef | 1 | 0.82 | 1.25 | 1.02 | 1.10 | 0.90 |
| Pastries | 1 | 0.71 | 1.50 | 1.06 | 1.93 | 1.36 |
| Sugar | 1 | 0.74 | 2.49 | 1.85 | 5.91 | 4.39 |
| Vegetable oil | 1 | 3.99 | 2.12 | 8.47 | 4.28 | 17.08 |
| Other foods | 1 | 2.39 | 1.30 | 3.12 | 1.56 | 3.74 |
| Other non-food goods | 1 | 0.91 | 0.87 | 0.79 | 0.76 | 0.69 |

These estimations were obtained using ENIGH 2004 and 2006.