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The Demand for Calories in Developing Countries

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This paper employs characteristic demand theory to estimate demand functions for calories for a set of developing countries and to investigate the potential impact of income growth, redistribution, and price changes on alleviating underconsumption of calories. The analysis finds that, although calorie elasticities with respect to income are substantial for the poorer consumers, income growth above historical rates is required for the food needs of the entire population to be satisfied within the next fifteen years, even if calorie prices remain constant and income distribution does not become more unequal.

Key words: calorie consumption, demand theory, economic development, income distribution.

This paper uses household survey data on consumption to analyze the determinants of calorie intakes in developing countries. The paper relies on characteristic demand analysis for a demand function specification for calories. It explores the effect of calorie price differences, income, and other socioeconomic factors on the intracountry and intercountry distribution of calorie intakes. Using the estimated functions, we make broad macroestimates of the potential impact that income growth and redistribution could have on alleviating malnutrition.

The paper reaches three broad conclusions. First, both income and price elasticities of demand for calories are below unity and tend to cluster around 0.60 for the poorer consumers. They are much lower for higher income groups. Second, even a moderate increase in calorie prices implies a large nutritional sacrifice for the poor if present income growth and distribution trends continue. Only a considerable acceleration of economic growth trends would permit calorie needs for the entire population to be satisfied within the next fifteen years. Third, if moderate redistribution policies permit a substantial portion of the income increase to be allocated to the poor, sizable calorie price increases would not rule out elimination of malnutrition. In this case, price increases could generate production increases without ill effects on the nutritional status of the poor.

The Theoretical Model

The recent focus on malnutrition by economists has been through income-group-specific demand analysis. Three approaches have currency. One method used by Pinstrup-Andersen, Londoño, and Hoover is to estimate demand functions for specific commodities by income class using the Frisch method. By assuming want independence among commodities, a matrix of direct price and cross elasticities is derived using estimated income elasticities of demand, budget proportions, and a coefficient for the flexibility of money. This demand matrix is then converted to a matrix of direct and cross-price elasticities for nutrients and used to assess the nutritional status of low income groups under various income and pricing policies. The drawbacks of this method are the extensive data requirements, the crucial role of the separability assumption, and the need to use an estimated coefficient of money flexibility.

A second method by Timmer and Alderman uses Indonesian household data to estimate, for four income groups, calorie elasticities

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with respect to income and rice, cassava, and corn prices. Because calories and quantities are directly linked, this approach corresponds to analysis of commodity demand functions by income class, with the composite commodity estimates being redundant. Although this technique is preferable to the Frisch method, there are problems with cross elasticities between many commodities and other such interactions. It also requires extensive data, often unavailable in developing countries.

The third method, pioneered primarily by Reutlinger and Selowsky, uses a less elaborate scheme in which relationships between a nutritional characteristic, calories, and income levels are made. Using this characteristic demand function along with income distribution data, the nutritional status of the poorest income group can be estimated and projected. Demand functions for individual commodities need not be estimated. This paper uses the characteristic demand function method but differs from the Reutlinger and Selowsky approach by using household data instead of average countrywide data and by estimating a characteristic price elasticity. This allows price effects to be added to the demand estimates and predictions.

Characteristic demand theory as presented by Lancaster assumes that products are consumed because of the utility derived from their characteristics or properties. For food these would include nutrient content, texture, color, taste, etc. Following this approach, the utility of a representative consumer can be expressed as a function of the characteristics of the goods consumed while the budget constraint is stated in terms of commodities:

$$\text{(1)} \qquad \max U = U(x_1, \ldots x_m),$$

$$\text{(2)} \quad \text{subject to } x_i = f_i(q_i, \ldots q_n); \quad i = 1, 2 \ldots m, \text{ and}$$

$$\text{(3)} \qquad \sum_{j=1}^{n} p_j q_j - Y = 0.$$

In (1)–(3), U is the utility indicator; $x_i (i = 1, 2, \ldots, m)$, the ith characteristic; q_j the quantity consumed; and p_j the market price of the jth commodity; Y represents the consumers' income; and f_i, the functional relation that links each characteristic to the n goods.

Forming the Lagrangean for the maximization in (1)–(3), after substituting (2) into (1) yields

$$\text{(4)} \quad L = U[f_1(q_1 \ldots q_n), \ldots, f_m(q_1 \ldots q_n)] - \lambda\left(\sum_{j=1}^{n} p_j q_j - Y\right).$$

Differentiating with respect to $q_j (j = 1, 2, \ldots, n)$ and equating to 0 yields

$$\text{(5)} \qquad \sum_{i=1}^{m} (\partial U/\partial x_i)(\partial f_i/\partial q_j) - \lambda p_j = 0,$$

where $j = 1, 2 \ldots n$. Indicating with $\rho_i = (\partial U/\partial x_i)/\lambda$, the shadow price for the ith characteristic, and with $a_{ij} = \dfrac{\partial f_i}{\partial q_j}$, the marginal "yield" of good j in terms of characteristic i, we can rewrite expression (5) as

$$\text{(6)} \qquad p_j = \sum_{i=1}^{m} a_{ij} \rho_i,$$

where $j = 1, 2 \ldots n$. Expression (6) states that the market price of each commodity is equal to a weighted linear combination of the prices of its characteristics, the weights being the amounts of each characteristic provided by one additional unit of the commodity.

At a level of income Y and prices p, let a commodity bundle of food $(q_1, q_2, \ldots, q_J)$ be purchased containing only characteristics $i = 1$ to I. Then from equation (6) total food expenditure $E(Y,\rho)$ will be

$$\text{(7)} \qquad E(Y,\rho) = \sum_{j=1}^{J} p_j q_j = \sum_{j=1}^{J} \sum_{i=1}^{I} a_{ij} \rho_i q_j.$$

Because of the technical relationship between characteristics and commodities, $x_i = \sum_{j=1}^{J} a_{ij} q_j$, (7) can be written as

$$\text{(8)} \qquad E(Y,\rho) = \sum_{i=1}^{I} x_i \rho_i.$$

Expressing expenditures in terms of the characteristic "energy" measured in kilocalories per day (indicated for simplicity as "calories"), (8) can be rewritten as

$$\text{(9)} \qquad P(Y, \rho) = \frac{E(Y,\rho)}{x_c(Y,\rho)} = \rho_c + \frac{\sum_{i=c}^{I} \rho_i x_i}{x_c},$$

where $P(Y,\rho)$ denotes the average expenditure per calorie; ρ_c, the implicit price of calories; and $x_c(Y,\rho)$, the amount of calories consumed. Expanding $P(Y,\rho)$ with a truncated Taylor series yields the linear approximation,

$$\text{(10)} \qquad P(Y,\rho) = P(Y_o,\rho) + \alpha(Y - Y_o),$$

where $P(Y_o,\rho) = \lim_{Y\to Y_0} P(Y,\rho)$, $Y_o = \min Y$, and $\alpha = \frac{\partial P(Y,\rho)}{\partial Y}$ evaluated at Y_o.

As income goes toward its minimum level, we can expect food expenditure to be devoted more and more to procuring the most fundamental nutrient, calories. Therefore, we can write

$$(11) \quad P(Y_o,\rho) = \lim_{Y\to Y_0} \frac{\sum_{j=1}^{J} P_j q_j}{x_c} = \rho_{co},$$

where ρ_{co} denotes the price of calories in what can be termed a basic bundle. Substituting (11) into (10) and the resulting expression into (9), we finally obtain

$$(12) \quad P(Y,\rho) = \rho_{co} + \alpha(Y - Y_o).$$

In practice, consumers will face the same basic calorie price except for a random factor reflecting differences in information, location, and other factors. Therefore, assuming that Y_o is sufficiently small, we can rewrite (12) for the kth consumer as follows:

$$(13) \quad P(Y_k,\rho_{ck}) = \rho_{ck} + \alpha Y_k = \rho_{co} + \alpha Y_k + u_k,$$

where Y_k indicates the income of the kth sample unit, ρ_{ck} is the basic calorie price, and u_k is a random disturbance having mean zero and constant variance.

Equation (13) says that the average expenditure per calorie can be decomposed into three parts: (a) a basic calorie price equal for all consumers, (b) a term depending on the consumer's income, and (c) a random element. Indicating with hats appropriate estimates of equation (13), we can conclude that

$$(14) \quad \hat{\rho}_{co}(k) = \hat{P}(Y_k) - \hat{\alpha} Y_k = \rho_{co} + u_k$$

is an estimate of the basic price of calories facing the kth consumer. This estimate can be obtained as the residual of the regression through the origin of Y_k against $P(Y_k)$. In turn, this estimate can be used to evaluate the responsiveness of calorie consumption to variations in its own price.

Estimates of Calorie Demand Functions

The method for estimating the calorie demand function is summarized in three steps. First, we calculate calorie consumption by expenditure groups using data from household consumption surveys (expenditure is used as a proxy for disposable income). For each country in the study, the average quantity of the various food items consumed by households in each expenditure group is converted to calorie levels using FAO calorie consumption tables. Second, we estimate a weighted regression relating the average expenditure per calorie to per capita total expenditure. We then use the sum of the constant term and the residuals as an estimate of the basic price of calories. Third, we estimate a series of functions relating calorie intake to total expenditure levels and to the basic price estimate. We use weighted least squares because sample sizes are different in each expenditure class. The ratios between sample and population sizes (sample "shares") are used as weights.

Because our information consists of income class data for six different countries, all regressions are also subject to the test that (a) the coefficient of any variable and (b) the value of the constant are significantly different from one country to the other. Furthermore, we test for the effect of five country-specific characteristics: food production per capita, urbanization rate, literacy rate, population size, and adult population to total population ratio.

Table 1 presents the estimates for the average basic prices of calories for each country, computed according to expression (14) and to the estimated cross-country regression between average per capita expenditure per 1,000 calories (converted in U.S. currency at parity exchange rates) and per capita total expenditure. The basic prices vary from 7¢ to 24¢ per 1,000 calories at the parity exchange rate and from roughly 3¢ to 12¢ at official rates. In both cases there is no apparent correlation between the estimated basic prices and the selected socioeconomic characteristics (i.e., food production per capita, urbanization rate, literacy rate, population size and adult ratio).

Table 2 presents selected estimates of calorie demand functions based on the cross-section sample. The functional form is semilogarithmic, a useful form because of the implied inverse relationship between absolute elasticities, income, and prices. For the estimated functions, the basic price indices estimated according to equation (14) are used as price variables. The per capita expenditures (in national currency) are used as income

Table 1. Estimated Average Basic Prices of 1,000 Calories

Country	Currency	In Domestic Currency[a]	Parity Exchange Rate[b]	Official Exchange Rate[c]
Bangladesh	(Takas)	0.48	11.9	6.0
India	(Rupees)	0.54	18.9	6.8
Indonesia	(Rupiah)	51.00	23.2	12.3
Morocco	(Dirhams)	0.50	23.9	9.9
Pakistan	(Rupees)	0.22	6.9	2.8
Sri Lanka	(Rupees)	0.56	14.4	5.6

[a] Units: Domestic currency/1,000 calories.
[b] Units: U.S. ¢/1,000 calories at parity exchange rates as estimated by Kravis, Heston, and Summers.
[c] Units: U.S. ¢/1,000 calories at official exchange rates. The estimated equation used for the above estimates is

$$P_c = 23.5 + 0.85\,Y + 0.129\,(Y \cdot D_1) - 0.029\,(Y \cdot D_4) + - 101.\,D_1 - 16.2\,D_5 - 8.9\,D_6,$$
$$(20.6) \quad (6.8) \quad (-3.1) \quad (-4.5) \quad (-9.7) \quad (-5.2)$$

where $R^2 = 0.95$; P_c is per capita food expenditure in U.S. ¢/1,000 calories; Y is expenditure/capita/month (US$ at parity exchange rate); and D_1 is dummy variables for Bangladesh, D_4 is Morocco, D_5 is Pakistan, D_6 is Sri Lanka (t-ratios are in parentheses).

variables. Separate functions are also estimated for people below and above the calorie-poverty line which is defined as the expenditure level just sufficient to purchase the FAO calorie requirement.

Regressions (1)–(3) in table 2 show that the income coefficients for Bangladesh and Pakistan and the price coefficients for Bangladesh, India, Morocco, and Sri Lanka are not significantly different from each other. Furthermore, factors other than incomes and prices appear to affect calorie consumption across countries. This is indicated by the significant dummy variable coefficients on the intercept and by the significance of per capita food production in explaining residual cross-country differences.

Consider regressions (4)–(6) and (7)–(9) in table 2 and the elasticities shown in table 3. They indicate that calorie response to increases in income at the poverty line varies from a maximum of 0.56 for Morocco to a minimum of 0.18 for Sri Lanka. This indicates that individuals consuming just at the level of the FAO calorie requirement will increase calorie intake between 2% and 6% for every 10% rise in income, if the calorie price is constant. Moreover, the countries with the most malnutrition—Bangladesh, India, Indonesia—all show considerably higher income elas-

Table 2. Calorie Demand Functions across Country and Expenditure Classes

Dependent Variable	Constant	LN(Y)	India LN(Y)* D_1	Indonesia LN(Y)* D_2	Pakistan LN(Y)* D_3	Morocco LN(Y)* D_4	Sri Lanka LN(Y)* D_5	LN(IP)	India LN(IP)* D_1	Indonesia LN(IP)* D_2
Overall caloric intake										
1. Calories/capita/day	−5,180.7	664.9	362.7	217.5	−90.1	583.6	−238.2	−1,072.5	1,077.2	1,105.4
		(6.6)	(1.7)	(2.1)	(−0.5)	(4.1)	(−1.4)	(−3.3)	(1.0)	(3.2)
2. Calories/capita/day	−5,211.9	698.7	139.9	183.8		582.0	−345.5	−1,024.1		1,056.9
		(9.0)	(5.0)	(2.2)		(4.7)	(−2.2)	(−4.0)		(3.6)
3. Calories/capita/day	−18,340.5	651.8	293.5	222.8	150.5	535.0	−251.0	−852.0	1,750.1	927.4
		(5.2)	(1.2)	(1.7)	(0.7)	(3.0)	(−1.2)	(−2.25)	(2.3)	(2.4)
Low calorie intake —below CR										
4. Calories/capita/day Below CR	−6,711.3	702.6	208.6	454.9	567.0	429.4		−1,495.7	1,717.9	343.4
		(3.1)	(0.9)	(2.0)	(1.8)	(1.9)		(−2.4)	(2.3)	(0.5)
5. Calories/capita/day Below CR	−6,262.0	968.9		101.3	48.7	90.5		−919.6	1,271.5	
		(68.2)		(4.4)	(7.1)	(17.3)		(−19.3)	(2.1)	
6. Calories/capita/day Below CR	−4,564.2	899.6		188.4	172.6	234.8		−970.6	−431.3	
		(22.0)		(2.7)	(3.2)	(4.2)		(−10.5)	(−1.9)	
High calorie intake —above CR										
7. Calories/capita/day Above CR	−3,412.7	534.4	53.1	345.1	33.3	473.0	−107.6	−772.8	1,635.6	660.9
		(2.1)	(1.0)	(1.3)	(0.1)	(1.3)	(−0.3)	(−1.3)	(.04)	(1.3)
8. Calories/capita/day Above CR	−932.1	415.6	78.6	403.2		778.1		−261.0		
		(3.9)	(2.2)	(3.0)		(2.7)		(2.6)		
9. Calories/capita/day Above CR	−1,404.7	467.3	63.1	357.7		731.2		−222.1		
		(3.7)	(1.0)	(2.5)		(2.4)		(−1.4)		

Table 2. (Continued)

Dependent Variable	Pakistan LN(IP)* D_3	Morocco LN(IP)* D_4	Sri Lanka LN(IP)* D_5	India D_1	Indonesia D_2	Pakistan D_3	Morocco D_4	Sri Lanka D_5	Food Production /Capita	Urbanization Rate	R^2	No. of Observations
Overall caloric intake												
1. Calories/capita/day	898.7 (2.4)	−509.0 (−0.9)	1,868.4 (1.7)	1,901.5 (0.5)	2,512.8 (2.3)	3,823.9 (3.2)	−3,768.6 (−2.3)	7,528.7 (2.3)			0.99	60
2 Calories/capita/day	931.2 (332)				2,544.0 (2.7)	3,564.0 (3.5)	−2,456.0 (3.4)	2,285.4 (2.6)			0.99	60
3. Calories/capita/day	514.9 (1.15)	822.4 (1.3)	−1,370.2 (−2.2)						84.1 (2.1)	−7,470.2 (−0.9)	0.98	60
Low calorie intake —below CR												
4. Calories/capita/day Below CR	−58.3 (−0.1)	530.0 (0.8)		4,619.7 (3.2)	−631.0 (−0.7)	−3,152.2 (−1.0)	−59.2 (−0.1)				0.99	23
5. Calories/capita/day Below CR				4,273.3 (2.5)							0.99	23
6. Calories/capita/day Below CR									−7.0 (−.6)	−2,725.5 (−1.9)	0.99	23
High calorie intake —above CR												
7. Calories/capita/day Above CR	592.4 (0.9)	−961.1 (−1.1)	1,568.7 (1.02)	−232 (0.0)	995.1 (0.3)	2,064.4 (0.6)	−4,372.1 (−1.1)	5,760.7 (1.1)			0.99	37
8. Calories/capita/day Above CR				−2,080.4 (−2.6)			−4,120.4 (−2.2)				0.98	37
9. Calories/capita/day Above CR				−1,868.1 (−2.2)			−4,041.4 (−2.2)		0.63 (.01)	1,077.2 (1.1)	0.98	37

Note: Where LN(Y) is logarithmn of expenditures per capita converted to U.S. $ at parity exchange rates; LN(IP)*, logarithmn of the implicit price of calories converted to U.S. $ at parity exchange rates; D_1, dummy variable for India; D_2, dummy variable for Indonesia; D_3, dummy variable for Pakistan; D_4, dummy variable for Morocco; D_5, dummy variable for Sri Lanka; CR, FAO caloric requirement; and t, statistics in parentheses.

ticities and, hence, higher calorie response as income increases. The poorest 25% in these countries have calorie income elasticities between 0.61 and 0.74, indicating that a 10% rise in income will increase calorie intakes by 6% to 7% for the poorest group.

The calorie responses to price increase also show a similar pattern. The poorest 25% of the population from all countries show an average 4.5% to 8.8% fall in consumption in response to an increase of 10% in the calorie price. As for the top 25% of the income distribution, it appears that price responsiveness decreases more than income responsiveness as income increases. A 10% increase in price would cause consumption to fall about 1%, while a 10% increase in income would cause consumption to raise by amounts varying between 1.6% and 3.3%. Therefore, consumers with a calorie intake above FAO requirements exhibit price elasticities of demand that are low with respect to a calorie price relevant to the lowest basis of consumption. This is to be expected as the consumption bundle for these consumers is composed of different and higher quality types of food than for the lower income consumers. The fact that the elasticity is not zero, however, suggests that the low income

Table 3. Calorie Income and Price Elasticities

	Calorie Income Elasticity			Calorie Price Elasticity		
Country	At the Poverty[a] Line	Lowest Quartile[b]	Highest Quartile[c]	At the Poverty[a] Line	Lowest Quartile[b]	Highest Quartile[c]
Bangladesh	0.35	0.67	0.17	−0.51	−0.63	−0.11
India	0.44	0.61	0.16	−0.54	−0.88[d]	−0.09
Indonesia	0.39	0.74	0.28	−0.51[d]	−0.63	−0.09
Morocco	0.56	0.69	0.33	−0.45	−0.60	−0.07
Pakistan	0.34	0.53	0.18	−0.47[d]	−0.48	−0.10
Sri Lanka	0.18	0.17[a]	0.17	−0.51	−0.45	−0.11

[a] Computed from regression 2, table 2.
[b] Computed from regression 5, table 2.
[c] Computed from regression 8, table 2.
[d] Computed from regression 6, table 2.

Table 4. Distribution of Calorie Intake

	FAO/WHO-Recommended Per Capita Calorie Intake[a]	Percentage of Population Consuming below:					
		2,400 Calories	2,200 Calories	2,000 Calories	1,800 Calories	1,600 Calories	1,400 Calories
Bangladesh	2,020	91	75	55	35	18	8
India	1,910	60	48	35	22	12	5
Indonesia	1,920	74	64	53	41	26	12
Morocco	2,276	48	39	30	21	13	7
Pakistan	2,050	97	90	44	2	0	0
Sri Lanka	2,000	84	41	7	0	0	0

[a] Adjusted to account for individual variability.

bundle (the "basic" bundle) is also consumed, although in different proportions and jointly with other goods, by the higher income group.

Implications of the Estimates

These estimates can serve two interrelated purposes. First, they can be used to derive estimates of the calorie intake distribution and related measures of malnutrition directly from income distribution data. Second, they can be utilized to explore the ability for income growth, redistribution and price adjustment to alleviate underconsumption. The estimates obtainable from income distribution statistics have two basic components: (*a*) the percentage of households consuming below the recommended nutritional standard and (*b*) the size of the nutrient deficit by income group. Table 4 contains estimates of the first of these two components for the case of calorie consumption.

A second, possibly more significant, measure of the extent of malnutrition is the nutrition gap, which is the aggregate difference between food (calorie) availability to the households and their calorie requirements (table 5). This measures focuses on the overall nutritional deficit of a country and can be related to (*a*) the size of its undernourished population, (*b*) market demand, and (*c*) the amount of total food needs (i.e., market demand plus the nutrition gap).

Given these estimates, we can investigate the prospects of alleviating malnutrition by closing much of the nutritional gap by 1995. We conduct this analysis under four scenarios: (*a*) constant income distribution and constant calorie prices, (*b*) "optimal" income distribution (defined below) and constant calorie prices, (*c*) constant income distribution and calorie prices increasing at 1% per annum, and (*d*) "optimum" income distribution and calorie prices increasing at 1% per annum.

Under the "optimal" income redistribution scenario, the income of each group with average calorie consumption below the recommended intake is allowed to grow at the rate necessary to close the nutritional gap. The per-capita incomes of the other groups are assumed to grow at 1% per annum. The resulting

Table 5. Nutrition Gaps (Grain Equivalents)

		Total Gap	Average Per Capita Gap Per Year[a]	Proportion of Nutritional Gap to: Market Demand	Total Food Needs
		(millions metric tons)	(kg)	(%)	(%)
Bangladesh	(1974)	2.65	46	16.9	14.4
India	(1974)	9.43	39	6.8	6.3
Indonesia	(1970)	3.75	47	13.2	11.7
Pakistan	(1971)	1.56	66	11.5	10.1
Morocco	(1971)	0.50	26	12.4	11.0
Sri Lanka	(1970)	0.06	16	2.1	2.1

Note: Grain equivalents are converted at 3.5 million calories per metric ton.
[a] Population below the recommended calorie intake.

Table 6. Per Capita Income Growth Rates Necessary to Close the Nutritional Gap by 1995 with Rising Calorie Prices

Country	Historical Growth Rate 1960–76	Average Growth Rates Required to Close the Nutritional Gap[a]			
		Constant Income Distribution		Optimal Redistribution[b]	
		Constant Prices	Calorie Price Increase 1%	Constant Prices	Calorie Price Increase 1%
Bangladesh	−0.4	3.9	4.4	1.24	1.55
India	1.3	2.7	4.3	1.09	1.27
Indonesia	3.4	3.2	4.1	1.09	1.23
Morocco	2.1	4.0	5.0	1.20	1.36
Pakistan	3.1	1.6	1.6	1.00	1.15
Sri Lanka	2.0			1.00	1.00

Note: Based upon regression 4 in table 5 except for Sri Lanka, which used regression 8 and India, which used regression 5.
[a] These are the growth rates necessary to bring the mean consumption of the bottom 10% of the populations up to the FAO/WHO recommended calories intake, adjusted for individual variability.
[b] Those groups with consumption below the adjusted FAO/WHO recommended caloric intake receive an income growth rate necessary to close their nutritional gap; those consuming above the recommended intake are given a 1% growth rate.

average growth rates in per capita income can then be interpreted as minimum growth rates necessary to close the gap assuming a reasonable redistribution of incremental income.

As shown in table 6, the per capita growth rates necessary to close the nutritional gap without a change in income distribution vary from 1.6% to 5% with constant calorie prices. These rates appear rather high and unlikely to be achieved, especially for Bangladesh and India and when calorie prices are permitted to increase.

If we assume an "optimal" redistribution of growth, however, the necessary growth rates decline to about 1.0–1.6% per annum, even with sizable price increase. Thus, if income growth were focused on the poor, malnutrition could be eliminated with modest aggregate growth even with a concomitant rise in calorie prices. This growth would be well within historical rates.

Conclusions

This paper has focused on the determinants of calorie intakes for an important sample of developing countries. Using aggregate data from household budget surveys, the paper has shown that neither foreseeable price increases nor a slackening in economic growth would hamper improvement in the nutritional status of the population if the bulk of the additional income growth is channeled to the poor.

This conclusion, however, also holds in reverse. If the poor's participation in economic growth is less than the rest of the population, their nutritional status is likely to suffer proportionally more. Thus, policies are needed to ensure (*a*) that the undernourished are not excluded from the general improvement in living standards, and (*b*) that they are specifically helped to achieve minimum consumption standards if the process of growth slackens or if income distribution deteriorates.

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