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CALORIE INTAKE RESPONSES TO MACROECONOMIC ADJUSTMENT

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The paper characterizes the responses of household calorie intake to stabilization and structural adjustment. Using a model of calorie intake response derived from a food demand model of Philippine households, it shows that elasticities of total calorie intake with respect to prices and income in absolute terms tend to fall with income, implying an increasing vulnerability to malnourishment of lower income groups to adverse shocks. Then using a general equilibrium model of the Philippine economy, it shows that the effect of the structural adjustment program (specifically the 1988-1992 tariff reform program) is small but positive on calorie intake, with higher proportional increases in consumption of calorie sources for the lower income groups. The study indicates that growth policies probably involve no short-term trade-off with nutrient intake, whereas implementation of stabilization policies requires close integration with targeted programs on nutrition intervention and food price subsidies.

1. Introduction

Policy imperatives place a great weight on understanding the effects of macroeconomic policies on nutritional status. While macroeconomic adjustment may not have a direct effect on household welfare, they do affect intermediate economic variables, such as prices, which in turn directly influence the household. Hence, nutrition policy must be conducted within an economic environment which is constantly subjected to these policy changes.

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The objective of this paper is to characterise the effects of changing economic conditions (particularly on the macrolevel) on household calorie intake. Whenever possible, these nutritional impacts should be distinguished among the different types of households, especially the different income groups. Some of the important questions are: Do stabilization and structural adjustment policies have favorable or short-term adverse impacts on household nutrient intake? How significant are these impacts, and how are these impacts distributed? How should programs (at the macro- and micro-level) be designed to take into account these impacts?

In this paper, the nutrient to be studied is energy, measured in calories (actually, kilocalories). According to the 1993 Nationwide Nutrition Survey (NNS), adequacy of nutrient intake for the Philippines is below 90 percent — a critical shortfall, as the effects of insufficient energy intake are felt more quickly by the household than inadequacies in the consumption of other nutrients. This is also consistent with the focus of other related studies, as well as the methodology of computing subsistence income and poverty thresholds.

2. Related Studies

The study of effects of economic shocks on nutrient intake usually dovetails the study of household food demand. Numerous elasticity estimates for food consumption have been done for the Philippines; Regalado (1984) and Quisumbing (1987) have explicitly used the estimated demand parameters to undertake simulations on the effects of hypothetical price and income changes on nutrient intake. The former is distinguished by its emphasis on distributional impacts, while the latter places standard analysis of price and income policies on a surer empirical ground.

Simulation approaches to the study of the impacts of macroeconomic policies on households have been undertaken (a prominent example is Balisacan, 1995); these however have focused on poverty and income distribution impacts. The closest that has been done towards a quantitative study of the nutritional impacts of macroeconomic policy is Bouis (1990). His methodology, exploiting characteristics-demand model, has the advantage of lowcost data requirements. General macroeconomic concerns are addressed: How adversely has the nutrient status of urban and rural poor been affected by the downturn in the economy? Are the poor in a position to absorb a significant share of the burden of the debt? What policy suggestions can be made to improve nutrition during economic recovery? He concludes that an adjustment program which incorporates debt service payments and economic contraction should be so structured as to avoid burdening the poor households, who are already nutritionally at-risk. Targeted food subsidies are one way to protect these households during the period of economic stabilisation.

3. Methodology

Behrman (1993) outlines a framework for studying the impacts of macroeconomic adjustment policies down to the level of the household. Microeconomic determinants of household constraints and behavior are affected by the larger macroeconomic context through intermediate or "meso" variables. The main conduits for the transmission of macroeconomic policies are markets and infrastructure. Markets may be classified as product, factor, and financial; infrastructure refers to publicly provided physical capital and services.

To evaluate the impact of macroeconomic policies on the mesovariables, the ideal approach would be to use an economywide model that includes the explicit details of the macroeconomic policies and controls for other shocks, and determines the changes in the mesovariables, which are taken to be endogenous. If such a model is unavailable, it is probably most sensible to employ a reduced-form approach to determine the changes in the mesovariables. Meanwhile the standard economic conceptualisation of meso-micro relations includes a set of allocation rules, household production functions, budget constraints, predetermined assets of the household, and exogenous markets and infrastructure. Application of the allocation rules leads to reduced-form demand relations.

Effects of adjustment policies on intermediate variables

The two types of adjustment policies to be studies are stabilization and structural adjustment. The objectives and circumstances of these policies are different. The former is usually undertaken during the period of internal and external disequilibrium, with the objective of restoring the macroeconomy to equilibrium. The latter is aimed at inefficiencies and structural bottlenecks, and may be interpreted as shifting the equilibrium growth path of the economy to a higher level.[1]

Instead of a reduced-form estimation of macro-intermediate relations suggested by Behrman, this paper opts for a more stylised approach in the analysis of the impact of stabilization policies. The intention behind scenario-building is to prefigure the patterns and magnitudes of a more rigorous model.

However, to analyze the impacts of structural adjustment, this paper does make use of an economywide model. The Agricultural Policy Experiments (APEX) model, described in Clarete and Warr (1992) is a computable general equilibrium (CGE) model developed for the Philippines. It is the most highly disaggregated and empirically-based model of the Philippine economy. An important virtue of the APEX is that virtually all the structural parameters were obtained by econometric estimation specifically for this model.

While there is a need to evaluate the impacts of an entire package of structural adjustment policies, for ease of interpretation, a specific structural adjustment program, i.e., the tariff reform measures implemented between 1988-1992, will be used in the simulation. Tariff reform is a typical component of a structural

[1] In reality, stabilization and structural adjustment policies cannot be neatly separated. Stabilization policies can also promote structural adjustment objectives, and vice-versa. For example, devaluation, while addressing external imbalance, also restrains resource flows out of the tradable sector. Nevertheless, the distinction between the two kinds of policies figures prominently in the literature (such as in the issue of "sequencing").

adjustment package, and is an excellent example of the move towards a more market-oriented economic system which characterizes structural adjustment reforms. From a partial equilibrium perspective, a reduction in tariffs should reduce relative domestic prices of tradeables and raise consumption levels in general. However, CGE models such as the APEX are needed to account for intersectoral effects, and to examine whether specific commodities (such as food) experience increases in demand. Moreover, the distributional breakdown of the changes in food demand can be investigated only through a sufficiently disaggregated economywide model.

The APEX adopts the Walrasian market-clearing approach. There are five households in the model, representing the five quintiles. These households consume seven final goods, which are the aggregation of the intermediate goods obtained from the 50 production sectors. The "production" by households of consumer goods using producer goods is described by Leontief technology, or fixed proportions. Households also receive income from the ownership of primary factors (land, labor, and capital).

Among the numerical outputs of the APEX are the changes in aggregate household demand for consumer goods, which may be further broken down by quintile. The consumer goods in the APEX household model which contain food items are: i) Cereals, fruits and vegetables, roots and tubers; ii) Meat, dairy, and marine products; and iii) Beverages, tobacco, and other foods. These changes are stated in percentage terms; with information on the calorie contribution of these consumer goods as a share in total calorie consumption, these household demand changes may be translated into changes in calorie intake.

In employing the APEX, the macro-meso-micro modelling is made theoretically more rigorous, i.e., it is cast within a general equilibrium framework. However, due to the level of aggregation adopted for household variables, this rigor is gained at the expense of important detail regarding household responses. Hence APEX simulation complements the analysis of stabilization impacts described above, not only in subject matter, but also in method and approach. Another limitation in the APEX (as well as any Walrasian CGE model) is the model's reliance on comparisons of static equilibria. In reality, structural adjustment policies such as tariff reform may be affecting the economy which is in the meantime not in an equilibrium position.

Effects of intermediate variables on the household

In principle, any one of the food demand systems which relates food consumption to the price and income variables, in conjunction with the appropriate calorie conversion, will give the calorie intake responses. It is probably more convenient, however, to directly relate the intermediate variables to households calorie intake.

From the demand model, it is known that

$$x_i = x_i(p, m)$$

where x_i is quantity demanded of the ith food commodity, p is the price vector, and m is total food expenditure. The calorie intake function is simply

$$(1) \quad C(p,m) = c_i x_i(p,m)$$

where C is total calorie intake, and c_i is the number of calories per unit of the ith food commodity. These calorie equivalents can be computed with the help of the official Food Composition Table of the FNRI.

Before proceeding further, we make two important observations. First, demand estimation usually lumps food items into aggregate commodities. To compute calorie equivalent c_i, it is necessary to determine the manner of aggregation in order to identify possible changes in the composition of each aggregated commodity. The simplest approach would be to assume that the food items are combined in fixed proportions, such that c_i is constant, as in (1). This is the assumption adopted in this paper.[2]

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[2] It is of course possible to use less restrictive aggregation techniques employing flexible functional forms.

Second, (1) can be characterized as a "passive" model of household calorie intake, rather than an "active" model of demand for calories. The latter would involve calorie intake as one of the choice variables, either of a utility function, or of a household production function. In (1), the household regards only the x_i's as choice variables in the utility function, with calorie consumption simply as a consequence of food intake.

Elasticity of calorie intake with respect to income is

(2) $\mu = e\Sigma S_i \eta_i$

where S_i = share of x_i in total calorie intake
η_i = food expenditure elasticity of x_i
e = elasticity of food expenditure with respect to income.

Meanwhile elasticity of total calorie intake with respect to the price of item j is

(3) $\nu_j = \Sigma_i S_i \varepsilon_{ij}$

where ε_{ij} = price elasticity of x_i for p_j.

We expect energy intake to rise with income, at least initially, and to fall with an increase in the price of an energy source: hence, $\mu > 0$ and $\nu_j < 0$. It may however be possible for $\nu_j > 0$. Own-price, and the prices of complements exert a negative effect on calorie intake, whereas the prices of substitutes exert a positive effect on calorie intake. If the substitution effects dominate the complementary and own-price effects (weighted by their respective energy shares), the price calorie elasticity might turn out to be positive.

We are also interested in the distribution of elasticities. If demand elasticities and energy shares are broken down by income group, calorie elasticities can be computed for these groups. We can therefore examine whether low-income households are more or less vulnerable to changes in their economic environment compared to other households.

4. Results and Discussion

The household model

The demand system selected as the basis of calorie elasticity computations is the Extended or Quadratic Almost Ideal Demand System (QUAIDS) estimated by Balisacan (1994). The data set was obtained from the 1985, 1988, and 1991 FIES. The model adopts a two-stage budgeting framework. Food expenditure is allocated to six categories: rice, corn, other cereals, dairy and meat, fruits and vegetables, and other foods. While the QUAIDS model uses numerous dummy variables, for this paper, only the dummy for urban areas is used. Income and price elasticities (computed at the sample mean) are presented in Table 1. The mean elasticity of food expenditure with respect to income is only 0.138. The own-price elasticities are all negative and mostly close to unity in absolute value. In this estimation (as in most other consumption studies), food demand is income inelastic. Corn, a staple for some groups in the population, is an inferior good.

The QUAIDS model also contains values for income and own-price elasticities broken down by income quartile and urbanization (Table 2). Own-price elasticities do not change much across income groups, except for corn. This seems to be consistent with the findings of Regalado (1984) and Timmer (1981), but contrasts with those of other major demand studies. For both urban and rural areas income elasticity falls moderately as income increases.

Calorie elasticities

Energy shares based on the 1987 NNS were used to compute calorie elasticities from the food demand system. The computed energy shares of the QUAIDS categories to total average calorie intake (equal to 1753 kcal.) based on NNS data are presented in Table. 3. Applying (2) and (3), the income and price calorie elasticities for the average household are also shown. Price calorie elasticities are negative, except for the small positive price elasticity of fruits and vegetables. As expected, calorie intake is most sensitive to the price of rice. The high value for the calorie elasticity for the

Table 1 - Uncompensated Price, Expenditure, and Income Elasticities for the Extended AIDS

Commodity	Uncompensated elasticity with respect to the price of						Elasticity w/ respect to food expenditure	Income elasticity a/
	Rice	Corn	Other Cereals	Dairy and Meat	Fruits and Vegetables	Other Foods		
Rice	-0.931	-0.018	0.005	-0.098	0.155	0.292	0.595	0.082
Corn	0.138	-1.078	-0.027	-0.423	-0.216	1.937	-0.332	-0.046
Other Cereal	0.192	-0.101	-1.102	0.341	-0.049	-0.311	1.415	0.195
Dairy	-0.466	-0.21	0.092	-0.94	-0.137	-0.051	1.714	0.236
Fruits	0.101	-0.208	-0.053	-0.278	-0.104	-0.425	1.967	0.271
Other food	0.119	0.16	-0.012	0.109	0.002	-1.256	0.877	0.121

a/ Food expenditure elasticity multiplied by elasticity of food expenditure with respect to income
Source: Balisacan (1994)

Table 2 - Own-price and Income Elasticities, by Quartile and Urbanization

	Quartile 1	2	3	4
Own-price elasticity				
Rural				
Rice	-1.007	-0.927	-0.908	-0.829
Corn	-1.017	-1.114	-1.404	-2.422
Other cereals	-1.122	-1.103	-1.092	-1.075
Dairy and Meat	-0.849	-0.925	-0.945	-0.964
Fruits and Vegetables	-1.011	-1.180	-1.181	-1.171
Other Food	-1.331	-1.194	-1.186	-1.173
Urban				
Rice	-0.93	-0.916	-0.876	-0.781
Corn	-1.04	-1.2	-1.829	-3.238
Other cereals	-1.111	-1.091	-1.075	-1.073
Dairy and Meat	-0.904	-0.939	-0.956	-0.966
Fruits and Vegetables	-1.181	-1.172	-1.177	-1.18
Other Food	-1.199	-1.188	-1.178	-1.163
Income Elasticity				
Rural				
Rice	0.234	0.166	0.106	0.01
Corn	0.066	-0.31	-1.035	-1.273
Other cereals	0.359	0.281	0.216	0.09
Dairy and Meat	0.53	0.369	0.258	0.098
Fruits and Vegetables	0.234	0.192	0.151	0.067
Other Food	0.247	0.219	0.179	0.077
Urban				
Rice	0.14	0.08	0.027	-0.002
Corn	0.084	-0.211	-0.568	-0.129
Other cereals	0.326	0.201	0.106	0.013
Dairy and Meat	0.489	0.257	0.125	0.014
Fruits and Vegetables	0.639	0.406	0.229	0.028
Other Food	0.149	0.108	0.063	0.008

Source: Balisacan (1994)

Table 3 - Calorie Elasticities for the Mean Household

QUAIDS Category	Food Expenditure Share	Calorie Intake Share	Calorie elasticity (with respect to the price of)
Rice	0.266	0.573	-0.55
Corn	0.044	0.046	-0.063
Other cereal	0.048	0.073	-0.076
Dairy	0.154	0.076	-0.114
Fruit	0.089	0.045	0.016
Other food	0.399	0.187	-0.024
Food expenditure	1		0.812
Income			0.112

Sources: Food expenditure data - Balisacan (1994)
Shares in calorie intake - NNS
Calorie elasticities - author's computations

price of rice may be attributed to the rich energy content of rice (3,460 kcal./kg.) as well as its large share in the average food budget (26.6 percent). Corn and other cereals are also rich energy sources, but their budget shares are much smaller (4.4 and 4.8 percent, respectively). On the other hand, the income elasticity of calorie intake is rather small, but comparable to the computations of Bouis and Haddad (1990). The low income calorie elasticity suggests that price policies should be preferred over income policies in targeting improved nutrient intake.

Data on calorie shares by income quartile and urbanization are available from Bouis (1991), based on the 1978 NNS. This data set is the basis for computing calorie shares of the eight household groups for the QUAIDS items (Table 4). Rice is the main source of calories for all income groups; its calorie share as expected declines with income, with a faster decline evident in urban households. Other foods (which include such rich calorie sources as sugars, syrups, fats and oils, and starchy roots and tubers) are next in importance. Naturally, the higher the income group, the greater the dependence on the more expensive calorie sources, particularly dairy and meat as well as other cereals (e.g. wheat products).

Table 4 - Calorie Shares by Quartile and Urbanization, 1978

Commodity	Urban				Rural			
	1	2	3	4	1	2	3	4
Rice	0.63	0.55	0.52	0.46	0.62	0.62	059	0.55
Corn	0.03	0.03	0.01	0.01	0.10	0.05	0.03	0.03
Other cereal	0.07	0.10	0.11	0.11	0.04	0.05	0.07	0.08
Dairy	0.07	0.12	0.13	0.18	0.05	0.08	0.09	0.13
Fruit	0.05	0.04	0.04	0.05	0.05	0.05	0.04	0.05
Other food	0.16	0.17	0.18	0.19	0.15	0.17	0.17	0.18

Source: Author's computations based on Bouis, 1991
(Totals may not sum to one due to rounding off)

The fact that most of the income and own-price elasticities fall with income suggests that lower income groups would exhibit greater responsiveness of calorie intake to economic variables. Table 5 presents calorie elasticities of the urban and rural household quartiles. Income elasticity of total calorie intake is highest for the first quartile, and indeed declines with income, becoming vanishingly small for the urban fourth quartile. Rural consumers, except for those in the richest quartile, exhibit greater income responsiveness to calorie intake. The poorest households, in particular those in the rural areas, whose diets are already inadequate, are the least able to protect their nutrient status during aggregate income contractions. On the other hand, this implies that the greatest proportional improvement in energy intake in response to an income policy will be exhibited by the poor households. However, though the poorest rural households have doubled the intake response compared to the average, its value is still quite low (0.24) in comparison to the magnitude of nutrient inadequacy (probably more than the average inadequacy of 12 percent). This confirms the idea that an income approach to nutritional adequacy is usually not sufficient (as in Herrin, 1992). Other approaches (e.g. information dissemination) would be needed to supplement income generation.

Price calorie elasticities are also found to decline consistently with income. For the expensive calorie sources (dairy and meat, fruits and vegetables, and others), price calorie elasticity eventually becomes positive as income increases; this indicates a shift towards foods with low calorie contributions per peso purchased. This happens quite rapidly for fruits and vegetables for rural households, suggesting the importance of this commodity within the rural setting. The calorie intake of the bottom half of urban households is more sensitive to the price of rice than their rural counterparts, but the situation is reversed for the upper half. Next to rice, calorie intake is most sensitive to the prices of dairy and meat products, which is understandable given their large (second only to rice) contribution to calorie intake.

Comparing the price with the income calorie elasticities, it becomes obvious that income policies are far less effective in attaining nutrient adequacy than price policies. For the poorest one-fourth, where many of the malnourished are located, the elastici-

Table 5 - Calorie Elasticities, by Quartile and Urbanization

	Household Group			
Elasticity of total calorie intake	1st	2nd	3rd	4th
		Rural		
With respect to price of				
Rice	-0.678	-0.521	-0.511	-0.387
Corn	-0.119	-0.049	-0.062	-0.077
Other cereal	-0.085	-0.069	-0.065	-0.041
Dairy	-0.241	-0.134	-0.113	0.032
Fruit	-0.068	0.040	0.022	0.105
Other food	-0.052	0.197	0.135	0.355
With respect to income	0.241	0.178	0.106	0.004
		Urban		
With respect to price of				
Rice	-0.789	-0.577	-0.392	-0.297
Corn	-0.049	-0.045	-0.017	-0.039
Other cer	-0.161	-0.137	-0.029	-0.047
Dairy	-0.376	-0.277	0.091	-0.011
Fruit	-0.110	-0.007	0.163	0.157
Other food	-0.178	0.047	0.195	0.196
With respect to income	0.204	0.123	0.057	0.005

ties indicate that a one percent increase in calorie intake requires a 10 percent increase in income — a rather unlikely event in the Philippines. Meanwhile, the same increase in calorie intake requires at most a mere 1.5 percent reduction in the price of rice. This is easily accomplished, for example, by relaxing regulations on the importation of rice.

Stabilization scenario

The calorie elasticities may be used in conjunction with stylized scenarios in order to give an idea of how calorie intake responds to macroeconomic stabilization. The proposed mesovariable changes capture something of the pattern of a moderate adjustment. (It is not advisable to examine scenarios of drastic adjustment, as the calorie elasticities are point estimates which are appropriate for analyzing changes at the margin.)

Income shock. Macroeconomic stabilization usually involves a growth slowdown or even a contraction of aggregate income in order to cut down on domestic absorption. Suppose that an expenditure cutdown implies an aggregate income contraction of 2 percent. This is around the order of magnitude of the fall in real per capita GDP during the year following the 1990 BOP crisis, when the worst effects of the adjustment had already passed. (In 1990, the contraction of real per capita GDP was 2.8 percent.) The manner in which the contraction is spread throughout the eight household groups in the population is depicted in three scenarios:

DNG - distributionally neutral growth (equal percentage decline in income of each group)
I - the bottom half suffers 1 percent contraction
II - the bottom half suffers 3 percent contraction

The DNG scenario implies that income distribution is not affected by the contraction. Scenario I depicts a progressive change in income: based on 1991 FIES data on income shares, this scenario would imply a 2.2 percent contraction in the incomes of the upper half. Scenario II depicts a regressive change in income; the implied contraction for the upper half would be 1.61 percent.

The results of the simulation are presented in Table 6. As calorie intake is income-inelastic, the resulting changes are quite small. What is more interesting are the distributional implications: for distributionally-neutral growth, energy intake adequacy for the first quartile would fall from 82.5 percent to only 80.7 percent in urban and rural areas — certainly not a negligible outcome, given the concentration of malnutrition in this household group. Adequacy levels for the higher income groups are hardly affected. On the other hand, progressive distribution of income change (Scenario I) cuts down the energy reduction of the bottom 50 percent of households by one-half, without much altering the calorie intakes or adequacy levels of the upper half of households. Regressive distribution of income change (Scenario II) which increases the intake reductions of the bottom half by one-half likewise shows negligible change in the calorie intakes of the upper half. Unfortunately, II seems to be the most realistic scenario: from 1988 to 1991, when aggregate incomes stagnated and per capita real GDP increased by only 0.2 percent, the income share of the bottom half fell from 24 to 19 percent.

Price shock. The cutdown in domestic absorption can also be accomplished by relative price increases. In practice, devaluation often does this by raising the relative prices of tradables. Cereals, dairy, and meat — the major calorie sources — are some of the tradables which often experience price increases. Assume that, in the short-run, devaluation causes changes (in percentage terms) in the prices of the following:

rice	3.56
corn	4.85
other cereal products	2.24
dairy and meat	2.67

These figures are not completely arbitrary; a macroeconomic model by Bautista (1992) has shown that a five percent increase in the exchange rate, coupled with a five percent contraction in the money supply, raises agricultural prices. In adopting these price increases for other cereals as well as dairy and meat, we assume that the price of the final product rises in the same proportion as the price of its main ingredient. These figures represent a relatively tame adjustment scenario. Actual change in the exchange

Table 6 - Simulation Results for Income Adjustment Scenarios

Quartile		Percentage change					
		DNG Scenario		Scenario I		Scenario II	
	Income Elasticity	Income	Calorie Intake	Income	Calorie Intake	Income	Calorie Intake
Rural							
1st	-0.241	-2.000	-0.483	-1.000	-0.241	-3.000	-0.724
2nd	-0.178	-2.000	-0.356	-1.000	-0.178	-3.000	-0.533
3rd	-0.106	-2.000	-0.213	-2.250	-0.239	-1.610	-0.171
4th	-0.004	-2.000	-0.009	-2.250	-0.010	-1.610	-0.007
Urban							
1st	-0.204	-2.000	-0.407	-1.000	-0.204	-3.000	-0.611
2nd	-0.123	-2.000	-0.246	-1.000	-0.123	-3.000	-0.370
3rd	-0.057	-2.000	-0.114	-2.250	-0.128	-1.610	-0.091
4th	-0.005	-2.000	-0.009	-2.250	-0.010	-1.610	-0.008
All	-0.112	-2.000	-0.220				

rate for 1990 was a high of 35 percent; the inflation rate for 1990-1991 was actually 15.4 percent. For rice, cereals, and dairy and meat, actual price changes were 10.6, 8.2, and 19.7 percent, respectively.

Using our calorie elasticities, for the mean household the change in calorie intake is -2.94 percent. Unfortunately, for a population at only 87.8 percent adequacy, this represents a further drop in this indicator by 2.63 percentage points.

It is more illuminating to break down the responses of calorie intake, in percent, according to the various income quartiles:

Quartile	Rural	Urban	All
1	-4.41	-3.83	
2	-3.32	-2.61	
3	-1.3	-2.57	
4	-1.76	-1.38	
All households			-2.74

All of the eight household groups are subjected to the same price changes. The changes in calorie intake are much larger than in the income scenario for two reasons: proportional changes are larger for prices than for incomes under moderate adjustment; and calorie intake is proportionally more responsive to price changes compared to income changes. Hence, the major cause of calorie intake reduction during periods of adjustment is probably attributable to price rather than income effects. Based on 1993 NNS estimates, for the first quartile, nutrient adequacy drops from 82.5 percent to only 77.5 percent in rural areas and 77.8 percent in urban areas. (In nutrition policy, the rule-of-thumb is that below 80 percent of the RDA, the malnourishment becomes a serious, even life-threatening state.) This occurs for a rather moderate range of price shocks under adjustment. The response drops rapidly: the first quartile responds around one-half (in urban areas) to one-third (in rural areas) times more than the second quartile, and two to three times more than the fourth quartile.

For more severe adjustment programs resulting in more drastic price and income changes, the adjustments in calorie intake are likely to be more significant but of the same pattern. It is apparent that the price shocks of typical adjustment programs have nontrivial effects on the prevalence of malnutrition; given the adjustment experiences of the Philippines, these effects are likely to be higher than in the scenario depicted above.

Effects of structural adjustment

Cororaton (1995) computes four sets of tariff changes for the 50 APEX production sectors, using the actual changes in tariff of the 169 sectors in the national Input-Output Table for 1988-1992. This paper employs the second computation, the changes in average tariffs, which are the nominal tariffs weighted by the value of domestic production and imports of commodities, based on 1988 data. Tariffs in the industrial category mostly declined (Table 7). These percentage changes in tariff rates are used to shock the import tariff rate of the APEX production sectors. Prices in the industrial category mostly fell. Changes in domestic supply show a contraction of many of the industrial sectors. A two percent increase in real GDP is also reported.

The shock-induced changes in the aggregate demand for consumer goods are reported in Table 8. The demand for all consumer goods increases, with greater increases for the non-food categories. It is possible that the cheapening of goods in the industrial sector introduced income and complementary effects on household consumption, thus raising demand for consumer goods.

Table 7 - Tariff Changes and Simulated Changes in Prices and Domestic Supply, 1988-1992

APEX sector	Change (in percent)		
	Tariff rate	Price	Supply
1 irrigated rice	0.000	0.656	0.030
2 rainfed rice	0.000	0.872	0.040
3 corn	0.000	0.041	-0.070
4 coconut	85.190	0.000	-0.110
5 sugar	0.000	0.037	-0.130
6 fruits	0.000	0.000	-0.120
7 vegetables	4.350	0.597	0.030
8 roots	0.000	0.979	0.060
9 commercial crops	0.000	0.002	-0.070
10 hogs	-0.120	0.705	0.040
11 poultry	0.000	1.009	0.090
12 livestock	-27.030	0.754	0.030
13 agricultural services	-8.330	0.267	-0.010
14 marine	0.000	0.001	-0.190
15 inland fishing	-4.650	0.017	-0.270
16 forestry	-33.330	0.659	0.110
17 crude oil	0.000	0.026	0.060

Table 7 (continued)

APEX sector	Change (in percent)		
	Tariff rate	Price	Supply
18 other mining	-5.070	0.000	0.130
19 rice milling	0.000	0.584	0.030
20 sugar milling	0.000	0.000	-0.140
21 dairy	-9.510	-0.249	0.120
22 oils and fats	100.740	0.154	0.110
23 meat	-10.000	0.662	0.040
24 flour milling	0.000	0.302	34.000
25 animal feeds	-4.170	0.236	-0.090
26 other foods	-4.080	-0.003	1.400
27 beverages, tobacco	1.550	-0.158	0.090
28 textile	-10.130	-0.020	-0.090
29 other textile	-21.290	0.000	-0.040
30 garments	-3.090	0.000	-0.350
31 wood and paper	17.810	0.000	0.150
32 paper products	-9.040	-0.073	-0.100
33 fertilizer	-16.670	0.055	0.040
34 other rubber	-15.030	-0.400	0.020
35 coal products	-45.110	0.021	0.010
36 basic metal	-28.540	0.000	-0.150
37 cement	-8.250	-0.038	0.050
38 semiconductors	-38.460	0.000	0.640
39 metal products	-27.170	-0.903	0.030
40 electric machinery	-17.370	-0.310	-0.060
41 transport	-6.760	-0.347	-0.050
42 miscellaneous mfg	-11.630	-0.106	-0.150
43 construction	0.000	-0.002	0.160
44 electr, gas, water	0.000	-0.002	0.030
45 transport services	0.000	0.101	0.040
46 trade, storage	0.000	0.196	0.010
47 banks	0.000	0.298	0.020
48 insurance	0.000	0.185	0.070
49 general services	0.000	-0.054	-0.570
50 other services	0.000	0.120	0.000

The energy share of consumer goods Cereals, Meat and Dairy, as well as Beverages were computed using the 1987 NNS, a survey year antedating yet closest to the period of tariff reform. Cereals comprise the bulk of energy sources, taking up 75 percent of total energy intake; Beverages and other foods comprise 13.4 percent, while Meat and Dairy as well as marine products comprise 11.6 percent.

Changes in calorie intake can then be computed (Table 8). Though cereals experienced only a small increase in consumption, their large energy share implies the largest change in calorie intake from this source. Total change in calorie intake is 0.2 percent. Though the tariff reform program resulted in small changes in nutrient intake, it is significant that this change is positive. It seems unlikely that, at equilibrium, a reform towards a more market-oriented trade regime would have a deleterious effect on household nutrient intake.

Further breakdown of food demand responses reveals that poorer households have proportionately greater responses in food demand than higher income households. Table 9 shows the APEX simulation for the changes in the quantity demanded of consumption goods for the five quintiles. The expansion in cereal consumption is greatest for the poorest quintile, and diminishes with income. A similar pattern is seen for Meat and Dairy. Again for Beverages, the greatest increase is registered by the first quintile, followed by the fourth, and only then by the richest quintile.

Table 8 - Simulated Change in Calorie Intake for All Households

		Percent Change	
	Energy Shares	Consumption	Calorie Intake
Cereals	0.75	0.17	0.13
Meat	0.12	0.2	0.02
Beverage	0.13	0.39	0.05
Total	1		0.2

Table 9 - Simulated Changes in Consumption by Quintile, in Percent

	Household Group				
	1	2	3	4	5
Cereals	0.24	0.2	0.18	0.15	0.14
Meat	0.29	0.26	0.23	0.19	0.17
Beverage	0.49	0.34	0.44	0.4	0.36

It would be useful to employ this distributional breakdown for nutritional simulation. Unfortunately, data on calorie shares are not readily available by quintile. Nevertheless, simple inspection of the APEX results shows that the poorer quartiles would probably experience proportionately greater improvements in energy intake for two reasons. First, the items cereals and meat and dairy include most of the calorie sources, and the percentage changes consistently diminish as income increases. Second, the shares of richer calorie sources (such as rice) are higher for lower income levels.

In summary, these results suggest that tariff reform results in small improvements in nutrient intake of households, all other factors held constant. The improvement may be due to the intersectoral effects of the cheapening of most of the goods in the industrial sector, as the protection extended to this sector is gradually removed. Fears of adverse impacts on household welfare, at least in the area of nutrition, appear to be unwarranted. Nutritional improvement is progressively distributed, which adds support to implementing such adjustment programs, given that the poor households suffering from energy-deficiency need all the nutritional boost they can obtain.

5. Conclusion

The household model developed in this paper shows that calorie intake is rather inelastic to price changes, and more so to income changes. The absolute magnitude of elasticity of calorie intake to prices and income tends to fall with income. Hence, price and income policies tend to have greater effects on the calorie intake of the lower-income groups, where the households are relatively the most malnourished. Price policies (such as targeted food subsidies) appear to be more realistic means to raise calorie intakes than income policies, at least in the short run. On the other hand, the higher responsiveness of calorie intake of lower-income groups also implies that adverse price and income shocks hit hardest the sector where malnourishment is most prevalent. Such adverse shocks to households may arise from stabilization programs. The contraction of domestic absorption is typically passed on to the household in the form of income contraction (which is often regressively distributed) and increases in the prices of tradables, including the prices of major calorie sources. The household model suggests that even moderate adjustment policies have nontrivial effects on nutrient intakes of lower income groups. Even under conditions of fiscal constraint induced by stabilization, it would be worthwhile for the government to explore countermeasures for these impacts, such as targeted nutrient intervention programs and price subsidies for the vulnerable group.

Analysis of an actual tariff reform program using a CGE model confirms that price effects of the former raise consumption levels, including food consumption, all other factors equal. There is a resulting slight improvement in calorie intake. The increase in calorie consumption is greater for lower income groups. Abstracting from short-run rigidities (such as temporary unemployment in the import-substituting sectors), there seems to be no warrant for concerns regarding adverse household impacts of tariff reform, at least in terms of calorie intake. However, there is little cause for optimism that tariff reform (and growth-oriented structural adjustment programs in general) conducted for the macroeconomy will be sufficient to effectively reduce malnourishment at the household level; a similar idea is indicated by the low calorie elasticities obtained from the preceding household model. There is still no substitute for active nutrition intervention which is consistent with the way households react to economic conditions.

This paper is an attempt to contribute to the rapidly growing literature on the household welfare impacts of aggregate macroeconomic adjustment. Several avenues for further research may be proposed: First, there is a need to conduct nutritional policy simulation for the broad set of policy reforms in recent times, controlling for external shocks. This will give an idea of the sum total of effects of a policy regime, along with adequate projections for household food demand and calorie intake. A more meaningful comparison with nutritional surveys can then be made. A CGE model such as the APEX can be employed for this purpose; however, it is not clear how Walrasian-type CGEs such as the APEX can adequately capture financial shocks. Nonetheless, a model of macro-meso-micro interactions different from the one used in this study should contain sufficient detail on household food demand.

Second, there is a need to conduct studies in which household behavior is modelled in a disaggregated a manner as possible. Disaggregation should be for food items as well as for households (by income decile, by urbanization, by region, by occupation of household head, etc.)

Third, further work has to be done on modelling food intake of households. As food consumption is often stated in terms of aggregate commodities, a demand model which accounts for substitution among the food components of a commodity would be one way to refine current demand models. Information on the behavior of subsistence production of food will also be valuable.

While the work done by this paper is preliminary, the exercise shows that policymakers do have at their disposal a set of analytic and empirical tools to relate aggregate policy concerns to household welfare. Hopefully, these tools will be more frequently employed, and in the process, substantially improved.

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