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Microeconomic Theory of the Household and Nutrition Programs

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**Whether a nutrition program works depends on whether, and
how, individual households make use of it.**

Lack of food is no longer the major cause of malnutrition. Many households and individuals remain malnourished when income and supplies of food are inadequate. Nutrition policy and programs must be based on sound knowledge of household behavior patterns. Any increase in household resources, whether through policy programs or through growth and development, stops at the household. The family can allocate the added resources in any way it sees fit — and often does so in ways that are incompatible with better nutrition and related goals.

Taboos about introducing solid foods for infants and appropriate foods during pregnancy and nursing do not change because there is more food in the house. The “shadow” price of food, at the household level, involves such considerations as whether family members understand the nutritional value of foods; are better off selling than eating the food they grow; value time spent earning income more than time spent preparing food or breastfeeding infants (and hence turn to processed foods and bottle feeding); or experience a psychological cost in eating certain foods

(as Jews or Moslems would in eating pork, for example).

The microeconomic theory of the household focuses on the household’s decisionmaking about scarce food resources based on such considerations as:

- The size of the family.
- The purchasing power of the family.
- The availability of healthful foods.
- The family’s food preferences.
- Environmental variables (such as ethnic traditions and the homemaker’s level of education).
- Family health (disease can limit the absorption of nutrients).

Such determinants should be monitored to anticipate malnutrition problems unrelated to food supplies.

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**Microeconomic Theory of the Household
and Nutrition Programs**

**Dov Chernichovsky
and
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I. INTRODUCTION

It is now generally accepted that malnutrition and hunger are problems of distribution rather than of production, and of households rather than of economies (Reutlinger, 1986).

The supply of food is still an issue in many developing areas, those of Sub-Saharan Africa in particular. The overall growth of this supply still does not match the rate of population growth (Mellor, 1986) and may not match it for some time (Knudsen and Scandizzo, 1979). Yet, a lack of global food supply has ceased to be the major cause of malnutrition. Important

¹We are indebted to B. Popkin and T. Barnea for helpful comments. We remain responsible for the views expressed in this paper.

food supply has ceased to be the major cause of malnutrition. Important developing countries, China, India and Indonesia, whose combined population constitutes the bulk of the human race, appear to have enough stocks of food energy to feed their people.

Indeed, economic growth and development and related macro-economic policy which are not offset by population growth, can secure availability of food in the long run. However, even then the risk of malnutrition may persist at least in the short run, requiring appropriate policy and interventions. Many households and individuals remain malnourished even where there is an overall adequate supply of food.

A variety of household factors are associated with the risk of malnutrition: size and composition, command over human and non-human resources, environmental conditions, and a host of cultural and social attributes. These affect the households' access to food, the way they use it, and how well food is absorbed biologically. The distribution of these factors in the population will usually determine which and how many households are at risk of malnutrition, the magnitude of the problem, and the resources that may be required for its solution.

Any increase in household resources, whether through growth and development or policy programs, stops at the household; the family can allocate these added resources in any manner it sees fit, and often in ways which are incompatible with improved nutrition and related policy goals. In fact, families do not, necessarily, buy "efficient" diets from a nutritional

perspective because of their gastronomic and aesthetical utility from food. Malnutrition is therefore not just an income problem; many if not all households can afford a technically defined "minimal diet" when food is available (Stigler, 1945). Economic development and social policy can affect households by changing tastes and attitudes, incomes, prices and even family size. How these would in turn affect health and nutrition remains in many ways unclear.

If policies and programs are to succeed, they must consider household behavior. This behavior, combined with program design and operations, is a major determinant of programs' impact and hence internal efficiency; how much is gained per unit of program resources. Moreover, nutrition policy and programs have potential benefits in other sectors such as education; meals in school may increase school attendance. Knowledge of the household's response to nutrition programs can thus help evaluate the social returns to the programs. Many policies and programs to date are designed and implemented, based on limited knowledge of the household's response: a major determinant of the internal and social efficiency.

The economic theory of the household and econometrics portray and measure household behavior in response to external stimuli such as those generated by market forces and policy interventions. The objective of this paper is to outline the potential contribution of this theory through a series of hypotheses and their empirical testing, to better policy making and programming.

This can help in several ways:

- (a) Establish which determinants of risk should be monitored to anticipate malnutrition problems which are not related to overall food supply;
- (b) Target interventions according to the hypothesized or observed determinants of the risks (rather on the basis of costly screening);
- (c) Decide whether to follow a health, nutrition or combined policy to improve nutritional status;
- (d) Design appropriate intervention;
- (e) Evaluate the household's response to the intervention;
- (f) Evaluate program impact.

This paper is divided into four additional sections. The second provides a general overview of economic theory of the household. The third applies the microeconomic approach to household nutrition. The fourth employs this approach to anticipate the short-term consequences and nutritional risk of economic development. The last section outlines the relevance of microeconomic theory for the efficient design of nutrition policy and programs.

II. AN ECONOMIC VIEW OF THE HOUSEHOLD

The economic theory of household behavior is a theory of choices. It focuses on the household's responses to changes in mostly external factors as a way to increase or protect the welfare of its members.²

The (new) theory of household economics views the household as a harmonious microcosm or entity which shares the same resources and aims to increase its utility or welfare through production and consumption of "commodities" such as good health, and aesthetical and gastronomic utility from food.³ The household "produces" these commodities by combining goods and services purchased in the market with time inputs and skills of its members.⁴

Real income and available time limit the household's ability to increase its welfare levels. The first constrains the household's ability to buy goods and services in the market. The second limits its ability to produce

²The definition of household is beyond the scope of this discussion. See Bender (1967). As outlined below, the theory and consequently the discussion fails to make valid distinctions between the household and its individual members.

³Home produced "commodities" are distinguished from market-purchased "goods". By viewing the household as a production rather than just a consumption unit, this theory (compared with the traditional theory) also permits us to deal with behavior concerning "production" and consumption of non-market commodities, e.g. health. In addition, the theory enables us to deal with farm households, which are common in developing economies, and which often combine food consumption with food production decisions (Barnum, and Squire, 1979).

⁴The approach presented here has been influenced by Becker (1965) and Lancaster (1966).

income through labor (when work is available) and household commodities through home production.

For households which depend on wages and income from capital assets for their livelihood, variations in wage rates and in interest and rental rates, alter their nominal income, the money value of the household income. Similarly, variations in market prices of goods and services change the households' real income or how much they can buy in the market place with a given nominal income. Relatively higher prices, for example, reduce the household's real income.

In contrast, households which sell or consume their own produce will benefit from higher prices of their products and lower prices of inputs. Consequently, at any moment in time the household's command over market goods and services is determined by their own production, market prices and money wages, interest and rental rates.

Behavior is interpreted as the allocation and reallocation of scarce resources among competing utilitarian objectives or commodities whose consumption the household strives to maximize. The allocation of any given level of resources, available through time and income, towards meeting competing ends depends on the opportunity cost or shadow price of attaining any such end. The shadow price of diet encompasses the market value of the foods for which other goods and services could have been bought, and the value of time invested in food preparation that could have been used elsewhere. This implies that the shadow price of a commodity, such as a

particular diet, may increase with a rise in the market price of goods used for it, and the wage rate or any other variable that would increase the value of time employed in its production.⁵ For example, as a household's income rises, especially through wages, the value of its members' time also increases. It is, therefore, inclined to spend less time on food preparation by, for example, eating more processed foods, employing others to cook, and eating in restaurants.

Higher market prices are likely to raise the relative shadow price of those commodities which are relatively intensive in market goods while higher incomes and wages will change the relative shadow price of those commodities which are relatively time-intensive (Becker, 1964).

Behavior is viewed as a result of two effects: income and substitution. The income effect leads to more consumption of all so-called normal commodities when real income rises. The substitution effect induces more consumption of those commodities whose relative price has declined. At times, the effects of income and substitution induce conflicting behavior. For example, in the case of people who grow their own food and are net sellers, an increase in prices of the produce, induces an income effect in favor of more food purchasing. The substitution effect induces the opposite because selling the produce rather than consuming it, is more rewarding financially when prices are higher. Only an empirical analysis can determine

⁵Time is a finite resource, whose use is irreversible. As a result, an increase in income, especially through higher wages, increases the value of time relative to goods which can be obtained through income.

which effect dominates, or how those households would actually behave when prices of produce change.

Optimal behavior suggests the allocation of each additional unit of resources to the activity or commodity which renders the highest marginal utility or gain in satisfaction. Maximum possible welfare from given resources is attained when the allocation of resources from one activity to another, will not bring about any net gain in welfare or utility.

Some of the limitations of the economic theory of the household must be highlighted. Theoretically, this theory strives to explain all behavior: family formation through marriage and procreation, income generation, human and non-human capital formation, etc. Practically, however, the theory cannot adequately deal with all behavior because it is an analysis of the effects of external or predisposing factors on behavior. The more behavior it attempts to explain, the fewer remaining predisposing factors the theory can be based on. Therefore, it deals with so-called partial equilibria. It identifies a subset of behavior which is the subject of analysis and assumes other behavior external to this subset or ignores that behavior altogether. The focus on external factors, largely income and prices, ignores internal issues which may be crucial to resource mobilization and allocation such as motivation, cognition and a host of psychological and cultural factors.

The view of the household as a harmonious microcosm is clearly limiting. Economic theory needs to make strides in understanding intra-household resource allocation. While for institutional and cultural reasons some role

allocation, like who goes to school or who cooks, is known, discriminating behavior, such as who may receive more food within the household, and why, are still beyond the grasp of economic theory.

Central to the theory of the household is the assumption that the consumer or the household has full knowledge or perfect information about the values and attributes of its resources and the consequences of their allocation. This is a dubious assumption especially with regard to health and nutrition. For example, most households cannot be expected to know the nutritional value of the food they consume and the health consequences of their behavior.

These theoretical limitations are well recognized by students of household economics, and are dealt with to a substantial extent by econometrics, the empirical theory complementing economics. Central to econometrics is the notion that some factors explaining behavior across households and over time are either unrecognized, at least by economic theory, unobserved, or simply incorrectly measured. That is, there is residual behavior that cannot be explained by theory, but can be handled in its empirical testing. Therefore, "non-economic" variables such as religion, ethnicity, location, etc. that affect behavior are incorporated in the empirical study as "control" variables which qualify the effects of the economic variables, but in ways economic theory cannot always predict.⁷

⁷A more qualitative definition of the shadow price may incorporate "psychological cost" of behavior. For example, Moslems and Jews would have a higher shadow price for consuming pork than Christians. That is, one could predict, for empirical purposes, how religion may affect pork consumption.

Econometrics also deals extensively with interdependent circular behavior or simultaneous relationships. It can establish the direction of the "simultaneity bias" associated with disregarding such relationships. For example, in low income settings, the income determines, on the one hand, the level of food consumption, but, on the other hand, food consumption can determine levels of energy and income. Disregarding this simultaneous relationship, in the estimation of, say, the effect of income on food consumption, would produce upward biased estimates of that effect. Econometrics suggests mathematical and statistical solutions to such interdependence that can substantially improve microeconomic research in nutrition.

III. THE ECONOMICS OF HOUSEHOLD NUTRITION

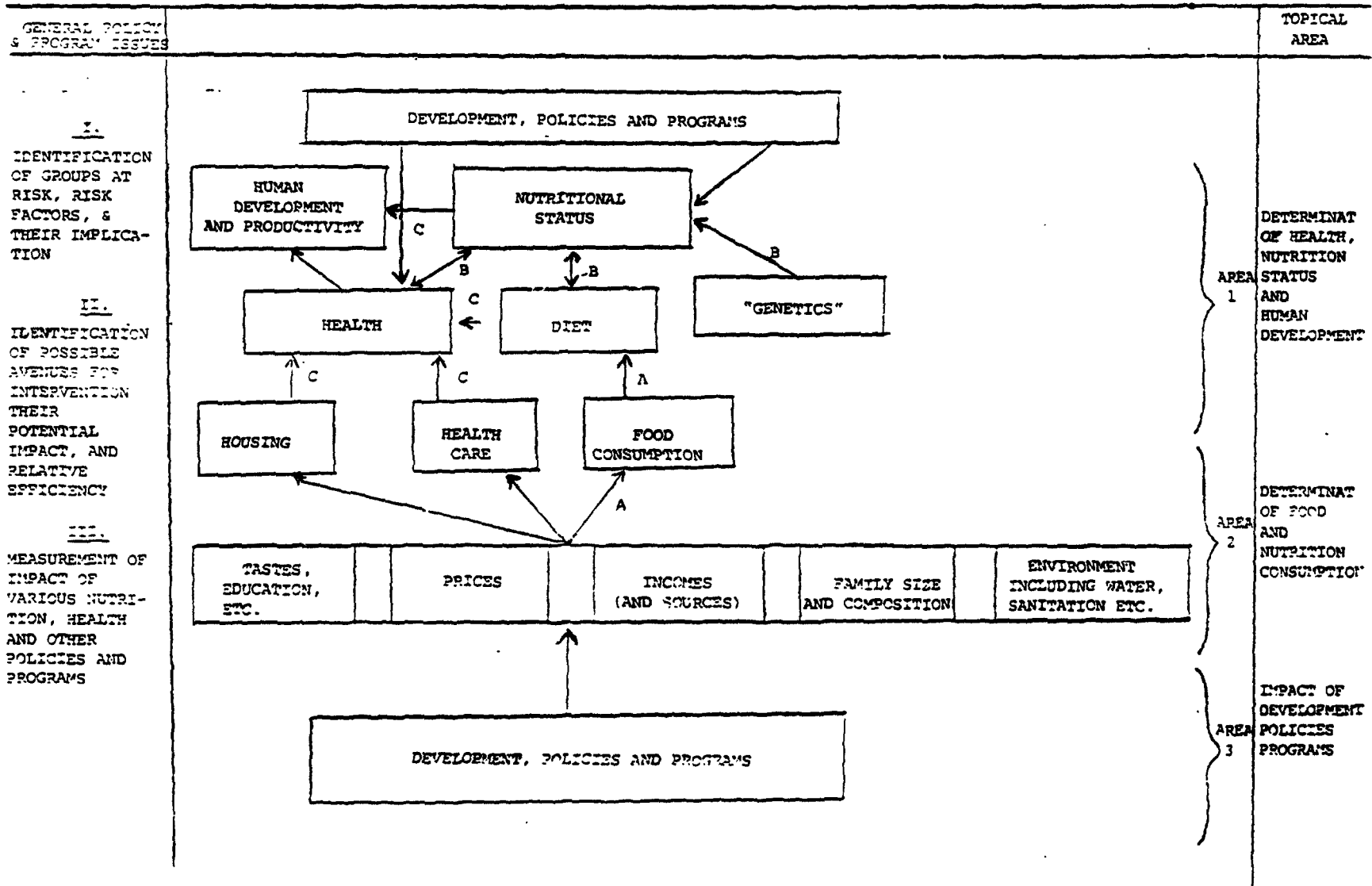
III.1 Basic Relationship

The nutritional and health status of an individual is based on the complex interaction of genetic, behavioral and environmental factors on one's intake and absorption of nutrients. In addition, since the intake and absorption of nutrients is affected primarily by the presence or absence of disease, nutritional status is largely affected by health, and hence the strong synergistic relationship between infection and food absorption and vice versa. A general outline of these relationships is presented in Figure 1 where they are separated into possible topical study areas (right panel) and their relevance to policy making and programming (left panel).

Health and nutritional status are determined by food health care, and housing and hygienic practices (topical area 1) which are in turn affected by market prices, incomes, family size and composition, education and other "taste" variables (topical area 2). These are all affected by economic development and growth as well as policy. Policy and programming would naturally follow issues, I through III in the left panel of the figure.

Although it may be difficult to single out the effects of each factor on nutritional status and health, it is important to try to do so. Such an identification is important to appropriately anticipate, design, manage and monitor interventions through the determinants of risk to identify nutritionally at risk households.

FIGURE 1 : A SCHEMATIC OUTLINE FOR ORGANIZING RESEARCH IN NUTRITION



Although no single definition of nutritional risk exists, it can be considered "the chance of death, ill health, malfunction, poor achievement in body size or hunger due to insufficient food" (McLean, 1987). To that end, we specify a set of structural relationships which are assumed to portray the nutritional and health aspects of household behavior. In the paradigm of partial equilibria, the microeconomic study of nutrition has focused on several critical relationships. These relationships, as portrayed in Figure 1, depict an economic view of common factors affecting the diet and nutritional status:

- (a) Incomes and prices - purchasing power and food availability in the household;^a
- (b) Tastes - food preferences, education, etc.
- (c) Family size and composition - per capita purchasing power and food availability;
- (d) Food consumption, quantity and quality;
- (e) Health care and practices;
- (f) Environment;
- (g) Development and policy .

The type of intervention that will be most efficient in alleviating malnutrition will depend on whether, and to what extent, the above-mentioned causal factors contribute to the problem at the household level. This would help identify the means and the social cost of the intervention. Clearly,

^a Situations of famine in which food is not available in sufficient quantities for the entire community are not considered here explicitly, in part because the situation is beyond household control.

many interventions aim at particular members or groups within the household, e.g., children and pregnant women. In this particular regard we lack a clear theory that can predict behavior which would effects program efficiency.

We start with a household utility function which outlines the behavioral aspects which the household wishes to maximize and which are relevant to the discussion. They are, in this case, health (H), nutritional status (NS), diet (D) and all other utilitarian commodities (Z) as well as leisure time (Tl). The last two are not of direct concern to this discussion. That is,

$$\dot{U} = u(H, NS, D, Z, Tl). \quad (2.1)$$

This function, which is not directly observable but implied from behavior, determines how much the household values different commodities at different levels of consumption. It usually assumes that the additional or marginal gain in utility, falls with increased consumption. This is the economic formulation of the sense of approaching saturation.

The second relationship concerns the "production" of the diet:

$$D = d (Xd, Td, NS; E) \quad (2.2)$$

Household diet (D) is produced through a vector of market goods and services (Xd) which include foods, appliances, etc. and the time (Td) needed for its

preparation.⁹ In addition, the level of the diet is assumed to be conditioned by the nutritional status (NS) of household members as can be estimated by their heights and weights, for example: heavier and taller persons may need more calories. The production of the specific diet is also determined by environmental variables (E) such as ethnicity, tradition, and homemaker's education which may determine food preparation patterns; educated homemakers may avoid overcooking to prevent loss of vitamins, etc. This relationship refers to lines marked A in Figure 1.

The third relationship deals with the determination of nutritional status:

$$NS = n(D, G, H) \quad (2.3)$$

NS is assumed to be determined by the diet (D), pertinent genetic factors (G) and health (H), as outlined by lines B in the figure.¹⁰ Health is believed to determine the efficiency of the diet in the production of NS. For example, disease can limit the absorption of nutrients.

⁹This function can be spelled out in terms of probability of being malnourished or at risk of malnutrition. In that case D would be a qualitative (dummy or categorical) variable standing for being below a particular level of nutritional requirement.

¹⁰This function can be spelled out in terms of probability of being at risk. In that case NS would be a qualitative variable standing for being below a particular level of nutritional status.

The fourth relationship concerns health:

$$H = h (NS, Xh, The; E) \quad (2.4)^{11}$$

Good health is assumed to be produced by nutritional status (NS), goods and services (Xh), such as medical care, and time (The). Here again, the production process can be conditioned by environmental variables (E): education of household members as well as community level variables such as safe water, sanitation, etc. These are outlined by the family of lines marked C in figure 1.

Relationships 2.2 - 2.4 outline periodic flows of food consumption and diets and accumulated stocks of health and nutritional status produced over time. The synergistic relationship between health and nutritional status is depicted in relationship 2.3 and 2.4.¹²

¹¹As NS and H are "stocks", compared with the "flow" of the diet, it is often common to use recursive models where the stock of period t is determined, among other things, by the stock in the previous period, t-1, e.g. $H_t = h(H_{t-1} \dots)$. This approach would lead to inclusion of initial endowments, e.g. birth weight in a nutrition status equation, especially of children. See, for example, Chernichovsky and Coate (1980, 1984), Heller and Drake (1979), and for more recent approaches, see Strauss (1986). This approach is not taken here, as we wish to keep the discussion simple without too much loss of generality. Related statistical issues are beyond the scope of this paper. While most analyses use cross sectional data which are more readily available, panel data, preferably generated under experimental conditions, would be more appropriate for measurement of the relationships discussed here.

¹²Other relationships such as one dealing with birth weight may be added.

Apart from the diet, the household enjoys other commodities (Z). The production of these is depicted by:

$$Z = z (Xz, Tz; E) \quad (2.5)$$

That is, Z is produced by market goods and services (Xz), household members' time (Tz) and pertinent environmental variables (E).

The next three relationships deal with income and productivity of household members. A farm household can be characterized by a farm production function:

$$Q = q(Tif, A, S, NS, D) \quad (2.6)$$

that links household resources with the product (Q) it produces through a particular technology.¹³ This product, which can be sold for the price P, is produced by the labor, the time (Tif) household members devote to work on the farm, physical assets (A), e.g., land and equipment (when they apply), skill levels (S), nutritional status (NS) when physical strength may be required, and the diet (D) largely as a determinant of energy levels which may determine productivity.¹⁴ In addition, family members can work part of

¹³Q is stated here in general terms to include food cultivation and may stand for more than one product. It may be a "composite product" made up of several goods with adjustment for their relative prices.

¹⁴A function of a similar nature that considers production over a life cycle can incorporate learning as a major determinant of productivity.

their time (T_{iw}) as employees for wage rate W and earn WT_{iw} in wage income.

Household income may vary not just because of changes in household resources but also because of changes in farm technology and market conditions: improved marketing systems, farm prices and higher wages. All can increase family incomes with identical resources.

To the income produced by the household, transfers or resources given to it by social programs (V), are added. These are obtained by:

$$V = v(X_v, T_v; E) \quad (2.7)$$

indicating that household can obtain such transfers through investment of some of its own resources (X_v), e.g. school uniforms, transportation, etc., and time (T_v) and environmental variables (E). If the cost of these exceed the perceived gain from the transfer (V), the household will not participate in the program.

To "close" this system of relationships, two resource constraints that limit household production and consumption possibilities, are identified.

The first is the income constraint:

$$\begin{aligned} I &= PQ + WT_{iw} + V \\ &= P_x d X_d + P_x n X_h + P_x z X_z + P_x v X_v \end{aligned} \quad (2.8)$$

This relationship indicates that the household's income from all sources, own production, wages, and transfers, is exhausted on all goods and services

purchased in the market: foods and related goods and services (X_d), investment in health (X_h) and goods and services for use in all other commodities (X_z) as well as for utilization of public programs (X_v). The second constraint is time:

$$T = T_d + T_{he} + T_z + T_v + T_l + T_{if} + T_{iw} \quad (2.9)$$

which indicates that the household's time endowment is allocated between labor (T_{if} and T_{iw}), on the one hand, and household production of D , H , Z , and V , and leisure, on the other hand.

While relationship (2.1) determines how much the household values the different commodities, relationships (2.2) - (2.5) and (2.7) determine how much it would cost to produce them, subject to resource availability determined by income, time, and market wages.

Of the above, D , H , Z and I are choice variables and the relationships whereby they are determined are behavioral. In other words, the household must decide what levels of scarce resources it allocates to the "production" of any of these. Given the contribution of each commodity to its welfare, and the cost of achieving it, the household decides how much it would produce of each. The diet (D), health levels (H) and nutritional status (NS) are thus co-determined by choice.¹⁵

¹⁵It should be noted that the value of NS is in part what determines the levels of H and D .

There are numerous ways by which even this relatively simple set of relationships could become complicated, making it a more realistic portrayal of reality, but probably less manageable analytically. For instance, days worked or working time (T_{if} and T_{iv}) could be related to health and nutritional status. Work could be assumed a determinant of NS, for example, inasmuch as deficient energy for physical activity may reduce body weight. But, we may not be able to solve or establish how particular variables are determined, even in this relatively simple model, because of the limited number of predisposing variables it assumes at any particular time, G , S , A , T , and E , compared with the number of endogenously co-determined variables, H , M , S , D , Z , T^1 . Elimination of NS and D from relationship 2.6 can facilitate a solution at the expense of assuming that NS and D do not affect productivity and income. While such a tradeoff is probably of no consequence in well-nourished populations, it might be significant in malnourished populations. This exemplifies the importance of taking into account the nature and environment of the population under study and the specific objectives of the study.

Any of the above structural relationships can be estimated separately. All should and, under particular conditions, can be estimated together because of their interdependence. An example of related estimates is given in Table 3.1. Various measures of NS are co-determined with health (colds) by G and E which stands for a host of socioeconomic and environmental variables. The estimated parameters, even when biased, are crucial to program and policy formulation for diverse populations.

Table 3.1 Structural Equation Estimates for Children's Growth and Health: Three-Stage Least Squares^a

| Independent Variables ^b | Dependent Variables | | | | |
|------------------------------------|---------------------|------------------|--------------------|------------------|------------------|
| | G | | | H | |
| | Height | Weight | Head Circumference | Colds | |
| D { | Protein | .087 (4.39) | | .22 (11.76) | .01 (1.49) |
| | Calories | | .002 (5.02) | | |
| | Vitamin C | | | | .011 (.10) |
| G { | Age | .84 (31.52) | .09 (5.71) | .24 (8.57) | -.17 (-8.60) |
| | Age squared | -.002 (-9.45) | .001 (5.10) | -.002 (-7.10) | .001 (6.91) |
| | Sex | .48 (2.63) | .13 (1.28) | .36 (1.84) | -.82 (-6.11) |
| | Birth weight | .003 (8.53) | .02 (11.06) | .002 (.72) | |
| | Birth order | -.19 (-3.82) | -.07 (-4.21) | .19 (3.36) | |
| | Mother's height | .51 (20.80) | -.11 (-.92) | .42 (23.96) | |
| | Father's height | .40 (18.11) | -.06 (6.13) | | |
| | Mother's weight | .002 (1.03) | -.008 (5.61) | -.01 (-7.30) | |
| | Race | 1.24 (5.19) | 3.10 (2.53) | -.71 (-3.24) | |
| | I,E { | Income | | | |
| Household size | | | | | .06 (1.86) |
| Schooling 2 | | | | | .72 (-4.90) |
| Schooling 3 | | | | | -1.40 (-6.83) |
| Schooling 4 | | | | | -.79 (22.84) |

Notes:

^aN = 2515.

^bItalics indicates endogenous variable.

Specific relationships are discussed below in more detail for their policy and program relevance.

III.2 The diet: Relationship (2.2)

Household consumption analysis, including food consumption, is one of the oldest and most established of economic analyses. Relationship 2.2 is an association between the diet and how it is prepared. There is the level and composition of the diet, given particular inputs, and implicitly its shadow price, reflecting how it is produced.

The approach taken here views the demand for foods as derived from the demand for a particular diet and gastronomic and aesthetical utility of food. This formulation (Lancaster, 1966) which is central to the theory of the (new) household economics, may be quite debatable. It assumes that consumers have full knowledge of the nutritional value of foods. This is a strong assumption that is not borne out by some research (Ben-sira, 1976) and would clearly be questionable in developing economies. As argued below, the approach is useful, nonetheless, for understanding and predicting how the household produces its diet in view of changing market conditions.

For practical purposes this assumption is not central, however, to explaining the composition of food consumption and the diet. From policy and program perspectives, it is important to know what people consume, and explain this behavior by variables that can possibly be manipulated, such as incomes through wages (W), transfers (V) and prices (P). As there is a

strict linear relationship between foods purchased by the household and their dietary value, we can look at foods the household chooses, derive the diet and explain the correlates of this choice, either of foods or nutrients.¹⁶

That is, we can deal with food or diet consumption as identical choices and work around the traditional consumption analysis where:

$$F = f(I, P_f, P_o; E) \quad (3.1)$$

Where I is household income, P_f is a vector of food prices and P_o is a vector of prices of other related goods and services (e.g., appliances).¹⁷ "E" would include the homemaker's education as a proxy for her value of time and, hence, as a determinant of the diet's shadow price. As a particular vector of D can be produced by many food combinations and in many ways, the household, given its "taste" for food and other items, will choose the least costly diet with its endowments and production technology.

¹⁶That is, if D is a vector of k nutrients $D = \{d_1, \dots, d_k\}$, and F is a vector of m food items $F = \{f_1, \dots, f_m\}$ then

$$D = [A] F$$

where $[A]$ is a matrix of $(k \times m)$ coefficients converting foods into their nutrition values. The amount of nutrient d_j consumed due to a vector of m food items (and quantities):

$$d_j = \sum_j a_{ij} f_i$$

where a_{ij} is the amount of nutrient d_j in a given quantity of food f_i .

¹⁷When diets of individuals are considered, F and I can be expressed in "per capita" terms. Household size can be measured, for example, also in "adult equivalent" energy consumption units.

The major objective of this analysis is to determine the effect of household income or expenditures, food prices and other relevant variables on food consumption and the diet. This effect is customarily measured in terms of so-called sensitivity or responsiveness measures - income and price elasticities.

Income elasticity - the percentage change in quantity of food consumed as a result of a given percentage change in income - is made up of two parameters: (a) the share of expenditures on foods in income (PfF/I); and (b) the marginal propensity to consume [$MPC = (\Delta PfF)/\Delta I$], or the change in expenditures on foods (ΔPfF) that follows a particular change in income (ΔI). The higher the MPC for food, the more the added spending on food with a change in household income. For example, an $MPC = \$0.60$ would imply that from each additional dollar in income the household would increase food consumption by \$0.60. Or, to induce the household to raise its expenditures on food by one dollar, its income must be raised by about \$1.60. The relative effect of a change in income is higher, the higher its income elasticity.

One of the basic laws established for food consumption is "Engel's Law". This law states that while food consumption rises with income, the share of expenditures on food falls because MPC for food declines as income rises and there is a "saturation" process with regard to food.

From a programmatic viewpoint, the higher the MPC for food, the higher the impact of an income transfer. This parameter may depend on the permanence of the change in income, its source, and who in the household receives it.

A clear distinction is made in economics between the MPC from a transitory change in income, and the MPC from a permanent change. The MPC from the former is lower because the household does not adjust long-term consumption patterns to a transient change in income. It may adjust consumption only to a fraction of that change. Consequently, a change in income from a source of a permanent nature, will bring about a higher MPC. In addition, income received in kind, in food for example, will result in a higher MPC for the food because the household cannot exchange this food for other commodities as easily (and for the same value) as it could with cash. It is also argued that income received by women will induce higher expenditures on food than income received by men (Bender, 1967).

The (own) price elasticity - the percentage change in the quantity consumed of any food as a result of a percentage change in its price -- is determined by two effects related to the income and substitution effects discussed before. When prices of particular goods rise, consumption of these goods will fall because higher prices mean lower real incomes, hence the income effect, and a shift away from these foods for substitutes whose relative prices are lower, hence the substitution effect. The effect of a rise in the price of one good on consumption of others is measured by cross price elasticities.¹⁸

The appropriate income and price elasticities for specific nutrients with respect to income and food prices, can be established as demonstrated

¹⁸It can be shown that when the price elasticity of a commodity is low, as may be the case for basic foods, an increase in price, will result in a decrease in other consumption as well.

in Annex 1, indicating that the change in consumption of a particular nutrient with regard to a change in income or prices, depends on the income or price elasticities of the foods, and the contribution of any particular food item to the total consumption of that nutrient.

Much can be said about the relative magnitudes of income elasticities from general knowledge. For instance, relatively low income groups are likely to have high shares of expenditures on foods and high MPCs, usually leading to high income elasticities, and low price elasticities for basic foods which have no substitutes. Staples like rice and wheat are likely to be major contributors to consumption of calories and proteins in low income populations and, therefore, consumption of these nutrients is sensitive to changes in prices of these staples. At the same time, actual values of the elasticities are a matter of empirical evaluation.

Tables 3.2 and 3.3 (upper panels) exemplify estimates of income elasticities for foods and nutrients based on Indonesian data.¹⁹ It is noteworthy that while the estimated income elasticity for rice fall with income, it rises for dairy products for example. The elasticities fall, however, for most nutrients, but their levels of consumption rise with income (Table 3.3, panel 2).

In addition to the quantitative composition of the food basket, there is likely to be a qualitative change in food consumption as income changes.

¹⁹For discussion and pertinent price elasticities, see Chernichovsky and Meesook (1984).

Table 3.2 : Income-Related Parameters for Food Consumption in Indonesia

| Expenditure Group | Rice | Corn | Wheat | Cassava | Potatoes | Fish | Meat | Eggs & Poultry | Dairy | Vegetables Products | Legumes | Fruit | Other |
|---|-------|--------|--------|---------|----------|-------|-------|----------------|-------|---------------------|---------|-------|-------|
| <u>TOTAL EXPENDITURE ELASTICITIES OF DEMAND FOR FOOD, INDONESIA, 1978</u> | | | | | | | | | | | | | |
| <u>Java</u> | | | | | | | | | | | | | |
| Lower 40% | 3.022 | -0.622 | 0.061 | 0.238 | 0.539 | 1.317 | 3.948 | 1.143 | 0.076 | 0.953 | 2.613 | 1.901 | 1.243 |
| Middle 30% | 0.914 | -0.435 | -0.027 | 0.790 | 1.238 | 1.825 | 2.162 | 2.871 | 0.783 | 0.990 | 1.991 | 3.708 | 0.911 |
| Upper 30% | 0.034 | 0.203 | 0.943 | -0.074 | 1.673 | 0.979 | 2.534 | 2.544 | 2.203 | 0.559 | 0.653 | 2.617 | 0.696 |
| <u>PROPORTIONS OF THE FOOD BUDGET ALLOCATED TO DIFFERENT FOOD GROUPS, INDONESIA, 1978, (%)</u> | | | | | | | | | | | | | |
| Lower 40% | 36.29 | 6.41 | 0.82 | 2.80 | 0.77 | 5.38 | 0.86 | 0.59 | 0.14 | 8.04 | 2.75 | 1.67 | 32.99 |
| Middle 30% | 36.36 | 2.68 | 0.48 | 1.65 | 0.69 | 6.75 | 2.04 | 0.96 | 0.49 | 7.05 | 3.14 | 2.42 | 34.78 |
| Upper 30% | 28.31 | 1.15 | 0.47 | 0.96 | 0.74 | 7.24 | 4.94 | 1.77 | 1.66 | 6.62 | 3.68 | 3.71 | 39.04 |
| <u>PER CAPITA DAILY CONSUMPTION OF FOODS FOR HOUSEHOLDS REPORTING CONSUMPTION, INDONESIA, 1978</u> (in grams, except for eggs which are in units) | | | | | | | | | | | | | |
| Lower 40% | 310.7 | 261.6 | 110.1 | 215.2 | 157.7 | 34.2 | 32.2 | 0.16 | 24.6 | 143.4 | 41.2 | 88.1 | 181.0 |
| Middle 30% | 346.3 | 194.6 | 73.1 | 170.2 | 117.4 | 41.4 | 30.2 | 0.15 | 18.2 | 142.0 | 43.3 | 92.8 | 211.5 |
| Upper 30% | 369.3 | 155.2 | 49.8 | 139.5 | 76.5 | 54.3 | 33.1 | 0.20 | 20.2 | 158.8 | 62.1 | 113.0 | 295.5 |
| <u>PRICES OF FOODS FOR HOUSEHOLDS REPORTING CONSUMPTION, INDONESIA, 1978</u> (in rupiah per kilogram except for eggs which are in rupiah per unit) | | | | | | | | | | | | | |
| Lower 40% | 139 | 63 | 115 | 27 | 59 | 324 | 902 | 34 | 738 | 91 | 166 | 96 | 335 |
| Middle 30% | 141 | 68 | 121 | 27 | 67 | 349 | 936 | 38 | 733 | 105 | 176 | 107 | 375 |
| Upper 30% | 149 | 74 | 131 | 31 | 86 | 419 | 994 | 42 | 737 | 125 | 194 | 129 | 651 |

Table 3.3 : Income-Related Parameters for Nutrition Consumption in Indonesia

| | Calories | Protein (gr) | Fat (gr) | Carbohydrates (gr) | Calcium (mg) | Iron (mg) | Vitamin A (IU) | Thiamine (mg) | Riboflavin (mg) | Niacin (mg) | Vitamin C (mg) |
|--------------------------------|----------|-----------------|-------------|-----------------------|-----------------|--------------|-------------------|------------------|--------------------|----------------|-------------------|
| <u>REGRESSION COEFFICIENTS</u> | | | | | | | | | | | |
| <u>Java</u> | | | | | | | | | | | |
| Lower 40% | 0.789 | 0.914 | 1.224 | 0.702 | 0.805 | 0.759 | 0.992 | 0.933 | 0.753 | 0.790 | 0.876 |
| Middle 30% | 0.543 | 0.682 | 0.952 | 0.479 | 0.900 | 0.660 | 1.535 | 0.652 | 0.642 | 0.559 | 1.450 |
| Upper 30% | 0.298 | 0.424 | 0.604 | 0.218 | 0.611 | 0.438 | 0.836 | 0.366 | 0.507 | 0.362 | 0.820 |

PER CAPITA DAILY CONSUMPTION OF NUTRIENTS, INDONESIA, 1978

| <u>Expenditure class</u> | | | | | | | | | | | |
|--------------------------|------|-------|-------|-----|-----|-------|------|------|------|------|-----|
| Lower 40% | 1747 | 41.97 | 23.20 | 346 | 254 | 8.56 | 5367 | 0.76 | 0.62 | 12.6 | 146 |
| Middle 30% | 1988 | 49.95 | 28.63 | 385 | 274 | 9.58 | 5337 | 0.88 | 0.67 | 14.6 | 146 |
| Upper 30% | 2279 | 62.90 | 41.54 | 418 | 349 | 11.30 | 6423 | 1.05 | 0.31 | 17.4 | 165 |

This change may take several dimensions. Food items may be of different nutritional quality. They may also require different levels of preparation. The lower panel of Table 3.2 indicates, for example, that Indonesian households of higher income groups, pay higher prices for their foods than their lower income counterparts.

The new economic theory of the household emphasizes one qualitative dimension of food preparation through its preoccupation with the shadow price of a diet that includes also the price or value of time. As indicated previously, the cost of any particular diet is not just a matter of objective market food prices but also of the subjective value of time. It follows that whatever will cause a rise in the value of time, such an increase in household incomes, through employment opportunities and wages of women in particular, will induce time-saving production of diets. This can imply a host of behavioral changes from substitution of breast feeding for bottle feeding to substitution of labor intensive home-cooking for appliance-intensive cooking, ready-made foods, and foods eaten away from home. Data from the Phillipines indicate that women working outside the home are more likely to initiate mixed feedings by adding breast milk substitutes after the third month (Akin, J.S. et al. 1985). Additional data presented in Table 3.4 based on the Indonesian experience, show that more educated homemakers, presumably with higher incomes and value of time, tend to have lower consumption of nutrients, all other things equal.

**Table 3.4 : REGRESSION COEFFICIENTS ON EDUCATION OF SPOUSE OF HEAD OF
HOUSEHOLD, WITH CONSUMPTION OF NUTRIENTS AS DEPENDENT VARIABLES**

| Region/Level of Education | Calories | Protein (gr) | Fat (gr) | Carbohydrates (gr) | Calcium (mg) | Iron (mg) | Vitamin A IU | Thiamine (mg) | Riboflavin (mg) | Niacin (mg) | Vitamin C (mg) |
|-------------------------------------|----------|-----------------|-------------|-----------------------|-----------------|--------------|-----------------|------------------|--------------------|----------------|-------------------|
| Java | | | | | | | | | | | |
| Education of Spouse of Head: | | | | | | | | | | | |
| Elementary School | * | * | 0.1245 | * | * | * | * | * | * | * | * |
| Junior High School | -0.1397 | * | * | -0.1409 | * | * | * | -0.1264 | * | -0.1303 | * |
| Senior High School | -0.1939 | -0.1654 | * | -0.1755 | * | -0.1800 | * | -0.2570 | * | -0.1802 | * |
| Higher Education | * | * | * | * | * | -0.3482 | * | -0.3920 | * | * | * |
| Outer Islands | | | | | | | | | | | |
| Education of Spouse of Head: | | | | | | | | | | | |
| Elementary School | * | * | 0.0699 | * | * | * | * | * | * | * | * |
| Junior High School | -0.1011 | * | * | -0.0924 | * | -0.0727 | * | -0.0982 | * | -0.0956 | * |
| Senior High School | -0.1445 | -0.1022 | * | -0.1524 | * | -0.1028 | * | -0.1078 | * | 0.1199 | * |
| Higher Education | -0.2358 | * | * | -0.2893 | * | -0.2113 | * | -0.2610 | * | -0.2022 | * |

III.3 Nutritional Status: Relationship (2.3)

The NS relationship measures or accounts for how the household produces NS subject to its genetic endowments, knowledge and the private cost of producing NS through H and D. It focuses on the intervening variables, health or diet, through which socioeconomic status affects NS. This relationship highlights how the "efficiency" of a diet relates to health status: substantial "waste" of a diet may result from presence of disease. In a world of perfect information, knowledge of this relationship would help decide on the optimal combination of diet (D) and health (H) the household or society should choose to produce a particular level of NS. That is, given the shadow prices of D and H, an optimal behavior - and policy - would be to spend any given amount of additional resources on the D or H which would yield the highest gain in NS (at the margin). At the optimum, the gain in NS from spending a unit of resources on either D or H, should be the same.

Knowledge of this interaction would help determine whether to follow a health policy or a nutrition policy or some combination thereof. The Narangwal experience in India, for example, shows that the presence of diarrhea (Table 3.5) has a negative effect on NS when measured in height. Indeed, a combined nutrition - medical care program proved more efficient than free- standing interventions (Kielmann, 1983).

Table 3.5 : Summary of Empirical Relationships: Partial Regression Coefficients

| Dependent Variable | Growth (G) | | Diet (D) | | Health (H) | Genetic and parental (Z) | | | Socioeconomic (E) | | | Constant | |
|--------------------|------------|--------|----------|---------|---------------------|--------------------------|--------------------|-------------|-------------------|-----------------|---------------|----------|-----------------|
| | Weight | Height | Calories | Calcium | Diarrhea prevalence | Age | (Age) ² | Sex (boy=1) | Maternal height | Land cultivator | Civil servant | | Area cultivated |
| Weight | | | | | | 0.34 | -0.003 | 0.93 | | 0.95 | .50 | | 2.65 |
| Weight | | | | | | 0.30 | -0.003 | 0.58 | 0.09 | 0.81 | .62 | | -9.83 |
| Weight | | | | | | 0.25 | -0.002 | 0.48 | 0.11 | | | 0.14 | -12.38 |
| Height | | | | | -1.99 | 1.23 | -0.012 | 1.92 | 0.35 | 4.52 | 0.91 | | 1.50 |
| Height | | | | | -1.84 | 1.07 | -0.009 | 1.78 | 0.40 | | | 1.00 | -4.65 |
| Calories | | | | | | 48 | -0.3 | 172 | | 180 | -30 | | 268 |
| Calories | | | | | | 50 | -1.2 | 257 | 16 | | | 31 | 291 |
| Calcium | | | | | | 5 | 0.6 | 255 | ... | | | 39 | 929 |
| Weight | | | 0.004 | | | 0.11 | 0.0001 | 0.17 | | | | | 1.79 |
| Calories | 100 | | | | | | | | | 78 | -212 | | 121 |

... Zero or negligible.

SOURCE: Chernichovsky, Kielmann, et al, in Kielmann (1983).

III.4 Health: Relationship (2.4)

Like the NS relationship, the health relationship is a production function.²⁰ This function is a variant of the formulation by M. Grossman (1972). At any particular age, health is viewed as an accumulated stock, a result of an optimal program by which the individual or household invests in health over time. The returns could be determined (and measured) by healthy days and wage rates, the value people put on being healthy, and the time horizon of these benefits from good health. The costs of holding the stock are determined by, among other things, age: a key determinant of how fast this stock deteriorates. A major prediction of this approach is that, all other things equal, there is a higher propensity to invest in the health of the young because they have a longer horizon of returns, on the one hand, and a lower deterioration rate, on the other hand, than the old.

Actual levels of periodic investment in health depend among other things on household income, which determines the level of inputs in health, and the shadow price of producing the additional stock. Just as food is an input to the diet, medical care and other goods and services (e.g. safe water and sanitation) are inputs in the formation of health. These, in addition to pertinent community variables, are the intervening variables in production of health (Rosenzweig and Wolpin, 1982a, 1982b). To understand how health, and through it NS, can be manipulated by policy programs, it is essential to understand how incomes and prices as well as pertinent

²⁰In many ways the two functions, 2.3 and 2.4, measure identical things. NS can measure health, and health can be indicative of NS. The two can be treated conceptually in similar ways.

environmental factors determine the use of medical care and other variables producing health.

How health is produced is important also from the viewpoint of delivery, for example of food supplementation. As many nutritional interventions may be incorporated with health services, utilization of such services must be studied since they may not be used, by the poor in particular (e.g. Akin et al., 1986; Chernichovsky, and Meesook, 1986).

III.5 Productivity and Nutrition: Relationship (2.6)

Measurement of productivity, largely in the form of studying the determinants of earnings, has been a major preoccupation of economic theory. Productivity is not only limited to adults. The performance of children in school can also be studied either as indicated in relationship (2.6), productivity and household income, or children's learning, can be related to diet and nutritional status. Discussions of these issues can be found, for example, in Horton and King (1981).

The types of analyses implied by the relationship (2.6) relating Q and D and NS , are essential to the characterization of the malnutrition problem and its definition from a policy perspective. Except for severe cases, malnutrition is measured according to some absolute standards of nutritional requirements and various estimates of weight, height and combination thereof. It is clear that malnutrition, especially if severe, could affect learning

(Selowsky, 1976) and interventions could affect productivity (Basta, 1974). The meaning of body size for productivity and the role of nutrition (or mild malnutrition) in productivity are still unclear, however. These measures are at times controversial, especially in view of potential regulatory and adaptation mechanisms that could maintain given "productivity" levels with moderate but sustained variations in diets (Waterloo, 1986). "Is big beautiful, smart and productive?" is a serious policy question, especially if "size" is going to be attained in part through public resources. On a practical side, it is difficult to differentiate between nutrition intervention programs which primarily affect size, and those that improve the nutritional status to some minimal level, from a productivity perspective.

An analysis of the functional consequences of malnutrition would provide a more concrete definition and measures of the problem and its social efficiency. It would characterize malnutrition and interventions in terms that are more amenable to social and political debate than the anthropometric measures in current use.

III.6 Participation in the Program: Relationship (2.7)

As the household may have to sacrifice resources to participate in a program, the family's or individual's participation or use of program resources is not guaranteed. In some cases, participation in a welfare program may involve a stigma, adding a non-monetary cost, to use of the program.

As participation in a program is a necessary condition for the effective intervention, the study of relationship (2.7) is essential to the understanding of program impact and assuring its effectiveness and efficiency. Little research to date has dealt with this issue in the context of nutrition policy and programming (or intervention) impact. A study about the impact of United States' federal transfer program of the nutrient intake of elderly individuals (Akin et al., 1985) evaluates as part of program impact, the eligible individuals' propensity to participate in the program; the study proves that this propensity is related to individual and household characteristics, such as age, sex, education and socioeconomic status etc.

IV. GROWTH AND DEVELOPMENT; LONG-TERM PROMISE AND INTERIM RISKS

Economic growth and development will do much to reduce malnutrition. However, new risks may arise and old risks may persist. It is claimed that once sufficient economic growth takes place and income and agricultural production increase, the problem of malnutrition will disappear. Broad macro policies concerning incomes and prices are based on the same tenet. Development is generally not fast enough, however, and often not equitable enough, to be a sufficient solution to malnutrition. Moreover, the process of development and related policy, like structural adjustment involving at times higher food prices, carry numerous intermediate risks.

Economic growth and development can be characterized by an increase in real incomes, in urbanization, in agricultural production accompanied by a change to cash crops, and in female labor force participation. The objective of this section is to outline these general trends and illustrate briefly how the microeconomic framework can be applied to predict short-run nutrition problems associated with development.²¹

IV.1 Per-Capita Incomes: Levels and Sources

Development is generally associated with, and measured by, an increase in real per capita income led by investment and technological change that increase labor productivity which can be depicted by relationship 2.6. The

²¹Long term problems e.g., obesity are not discussed here.

rise in income appears both in the urban and agricultural sectors and among both men and women.

The claim that malnutrition will disappear with development rests on several assumptions. The first is that an increase in real per capita income will translate into an increase large enough to be of nutritional significance among the poor. This is not always the case. It is also based on the assumption that even a (would be) sufficient increase in income among the poor leads to an adequate increase in the amount the household spends on food and on nutrition consumption. This may not be, however, the case in the short run. As the income of the poor increases, other non-food items compete with food for the increased purchasing power of the household. In addition, although the amount of money spent on food may increase, the types of foods purchased may change, resulting in a less nutritious diet. The "poor man's" food of grains and cereals or home-grown foods may be replaced with highly processed foods of lesser nutritional quality.

There are three questions, relating to the relationship between income and NS that need empirical evaluation. The first is, as income rises, how does the quantity and quality of food change? The second is, how does the change in sources of income affect consumption? The third, how does the intrahousehold distribution of food change with a rise in income and the change in its sources? These can be answered through a thorough examination of relationships 2.2 and 3.1.

As far as the first question is concerned, relatively higher incomes, are, but not necessarily, associated with a nutritionally better diet. As shown in Table 3.2, in Indonesia higher income groups spend a smaller proportion of their food budget on rice, corn, wheat and cassava, and a higher proportion on fish, meats and poultry, eggs, dairy products, fruits and other foods which include soft drinks and convenience foods. This shift in composition is associated with an actual fall in consumption of corn, wheat, cassava and potatoes. Overall nutritional intake is higher among the higher income groups nonetheless (Table 3.3).

With respect to the second question of how sources of income affect the diet, data from Indonesia suggest (Table 3.6) that, all other things being equal, including level of incomes, people whose main income source is agriculture do better almost across the board as far as consumption of nutrients is concerned than people whose main source of income is industry. (Exceptions are likely to be iron and calcium). This may be because people involved in agriculture can benefit first from technological change and are less prone to a reduction in real incomes as prices of produce rise. Another categorization of sources of income is by gender. There is some evidence that women's earnings have a greater MPC on food than men's earnings and that children (but not necessarily infants) of wage-earning mothers are nutritionally better off than children of non-wage earners. The phenomenon is particularly important when one considers that between 25 - 35%, of households in the developing world, are headed by women (Huffman, 1987).

Table 3.6 : REGRESSION COEFFICIENTS ON SOURCES OF INCOME, WITH CONSUMPTION
OF NUTRIENTS AS DEPENDENT VARIABLES

| | Calories | Protein (gr) | Fat (gr) | Carbohydrates (gr) | Calcium (mg) | Iron (mg) | Vitamin A IU | Thiamine (mg) | Riboflavin (mg) | Niacin (mg) | Vitamin C (mg) |
|------------------------------------|----------|-----------------|-------------|-----------------------|-----------------|--------------|-----------------|------------------|--------------------|----------------|-------------------|
| <u>Java</u> | | | | | | | | | | | |
| <u>Source of Household Income:</u> | | | | | | | | | | | |
| Agriculture | 0.1296 | 0.1103 | * | 0.1445 | * | 0.0739 | * | * | 0.1099 | 0.1669 | * |
| Industry | 0.2037 | - 0.0783 | * | 0.1178 | 0.1051 | 0.0901 | * | 0.0918 | 0.0740 | 0.0792 | 0.2297 |
| Government | * | * | * | * | * | * | * | * | * | * | * |
| Other | -0.1086 | -0.0764 | * | * | * | -0.0976 | * | * | * | * | * |
| <u>Outer Islands</u> | | | | | | | | | | | |
| <u>Source of Household Income:</u> | | | | | | | | | | | |
| Agriculture | 0.1747 | 0.0932 | 0.0560 | 0.2076 | 0.0837 | 0.1279 | * | 0.1626 | 0.1085 | 0.1114 | 0.2612 |
| Industry | 0.0592 | * | * | 0.0789 | * | * | * | * | 0.0509 | 0.0567 | 0.1817 |
| Government | * | * | * | * | * | * | * | * | * | * | * |
| Other | * | * | * | * | * | * | -0.1551 | * | * | * | * |

The third question suggests that the distribution of additional food into the household does not necessarily mean that all members of the family will benefit. Young children, pregnant and lactating women are not always beneficiaries of the increased purchasing power of the food. Taboos about the introduction of solid foods for infants and appropriate foods during pregnancy and nursing will not change because there is more food in the house. Data on how food is distributed within the household is scarce.

IV.2 Urbanization and Migration

Economic development is often accompanied by a decline in the agricultural sector leading to migration to the cities. While the effect of migration and urbanization can be captured by a host of environmental variables in all the relationships outlined in section II, a considerable number of nutritional implications can be studied through urban/rural variations in prices, incomes, and sources of income.

Urbanization may mean higher income for the household but not necessarily improved nutrition for several reasons (Austin, 1976). First, food prices are likely to be higher in urban areas than rural areas with harsher implications for inhabitants of the former because higher food prices in rural areas tend to improve the incomes of farmers. Second, the variety and relative prices of foods are likely to differ between the two areas, thereby upsetting customary diets that have been established over generations. Third, city life offers more options which compete with food consumption for household income. Fourth, there is little in the urban environment that can

support the poorest diets because of limited sources of income. Food gathering is often impossible and there is less space for home gardens and livestock which can be good stable sources of nutritious food in view of especially short term variations in income.

Indeed, data from Indonesia (Chernichovsky and Meesook; 1988), for example, indicate that while the urban population is wealthier and better off in terms of protein and vitamin C consumption, it is worse off in terms of consumption of calories and other micro nutrients. One of the reasons for this is that absolute and relative prices are different between rural and urban areas. These differences move consumption away from grains towards foods that are rich in fat and protein. The price differentials between the areas, higher prices in urban areas, seem, in this case, to outweigh the higher income in the urban areas as far as food consumption is concerned. Moreover, the evidence suggests that a higher proportion of the population in the urban areas is at risk from malnutrition.

Urbanization offers, however, means for efficient market interventions to cope with nutrition because of the population's dependence on the market for food. It is, therefore, easier to implement subsidies in urban areas than in rural areas. A serious policy issue is how to keep urban food prices low without affecting rural households who sell the produce (e.g. Gittinger et al. 1987).

IV.3 Agricultural Development and Cash Crops

The decline in the number of people employed in the agricultural sector is associated with technological changes and the transfer to cash crops. This transition can be marked by two phenomena: higher prices of produce and a change in sources of income.

For households producing their own food, the income and substitution effects come into play as a result of higher prices of produce (Section II). In general, the increase in food prices benefits the agricultural sector by improving incomes of all households which are net-sellers of food. Assuming that most small-scale farmers produce for the market and for their own consumption, but must also purchase a proportion of their food needs, some of this added income will be used to improve the nutritional needs of the household.

However, when an increase in farmers' income is facilitated by a switch to cash crops as is often the case, the effect on nutritional status is less clear. The food the farmers now purchase is not necessarily more nutritious than that which they once grew and consumed at home. On related issues it is stated:

"Taken together, the evidence presented ... makes a convincing case that some - perhaps many - agricultural projects have had adverse nutritional outcomes. Beyond this very general conclusion, however, very little can be said with confidence. This is partly a reflection of the weaknesses of the

literature, discussed elsewhere (Martin, 1982), and partly a consequence of the fact that most research in this area has not aimed at defining causal mechanisms. This last consideration leads to the rather casual description of causes evident in much of the material quoted above" (Martin, 1983, P.47).

IV.4 Female Labor Force Participation.

Economic development often results in an increase of women in the labor force, especially in urban areas. The model presented earlier makes a clear prediction about the potential (singular) impact of higher wages and labor opportunities for women on the diet through relationship 2.2. Housework, including food preparation and child-rearing, are time-intensive activities for women (Willis; 1973). When labor opportunities increase, the value of time and the shadow price of food preparation, breast feeding etc., will rise as well. As a result there will be substitution away from these activities in favor of ready-made, convenience foods, including infant formulas, and eating food away from home. The effect of this substitution on nutritional status and health can be harmful, particularly for infants under six months of age. The decline of breast feeding with development, particularly in urban areas, is of great concern. Alternative feeding can be an adequate substitute only if there is sufficient money, good food hygiene, and appropriate use of substitutes. Evidence about these theoretical predictions and their dietary implications, is still scanty. There is mounting evidence about breast-feeding (Popkin,1980) but not as much about the role and consequences of consumption of processed and ready-made food and of food eaten away from home.

V. POLICY AND PROGRAMS

Nutrition policy aims at alleviating hunger and improving NS and health in general. The discussion in this section concerns policy and programs which directly address food consumption by the household; that is, health and environmental interventions that may have related effects are not considered here explicitly.²²

The means by which pertinent policy is implemented are programs that transfer public resources to the household, which assumes the ultimate decision on whether and how to use these resources. In this regard, the concerns of planners and managers are:

- (a) household use of, or participation in, the program;
- (b) distribution-related leakages;
- (c) allocation-related leakages; and
- (d) nutritional "waste".

These determine the effectiveness and efficiency of any particular program effort which is measured by the resources allocated to the program.

Household use of, or participation in, the program, depends first on the program physically reaching the target household. Even then the program resources may go unused by the intended beneficiaries because the household

²²This is not to say that these policies may not be as efficient as direct nutrition interventions in improving nutritional status.

may perceive the benefits of the program of a lesser value than their cost (see Section III.6).

Distribution-related leakages occur when program resources are transferred to income groups that are not intended to be the beneficiaries of the program. This usually happens when the distribution of the malnutrition is unknown and when the target group is not easily accessible. Market-wide food subsidies are a common policy that produce this type of leakage since they benefit the entire population, including the rich.²³

Allocation-related leakages concern the use of (public) resources by the household for purposes not intended by the program. This can be done in two ways. First, the household may use the added resources in part or in full to purchase non-food items. Second, it may use the resources for family members other than the intended beneficiaries; that is, the entire household may share in the food which is meant, for example, for children.

Nutritional "waste" concerns the actual (net) nutritional impact of the program. Even when the program reaches the right people for the right food items, the internal substitution of consumption in the household may reduce the net effect of the program, and may be detrimental in some cases. Moreover, adverse health conditions may render supplementary diet inefficient.

²³There should be no confusion between distribution-related leakages and household use of the program. The two may lead to the same observation. The first means that the household does not have access to the program. The second means that the intended household simply chooses not to participate or that non-targetted households do participate.

These issues could be evaluated through an examination of relationships 2.2 and 2.5.

In this chapter we discuss how microeconomic theory and its empirical analysis can help identify the determinants of these leakages and their magnitude. To this end, the parameters and relationships, established in the second and third sections of this paper, are discussed below in conjunction with common policy programs.²⁴

Programs are divided into two groups, those that are market-wide and are not targeted at a particular population and those that are. It should be stressed that even "non-targeted programs" have intended groups of beneficiaries. The difference is in the means of the program rather than its intentions. Non-targeted programs usually work through market goods. Targeted programs work through identifiable groups of people. These categories are somewhat arbitrary; some programs can fit into either category depending on how the program is implemented.

²⁴ This discussion is not meant to be a comparative analysis of the relative efficiency of different interventions. For that purpose the reader is referred to Reutlinger and Selowsky (1977) and Kennedy and Alderman (1986). The limitations of such comparative analyses must be kept in mind in view of the discussion here. Programs that would be internally efficient (had we had better knowledge of critical parameters) might rank differently in terms of comparative efficiency. Moreover, as discussed below, combined programs may be more efficient than any of the individual programs.

V.1 Non-Targeted Programs

V.1.1 Food Price Subsidies

Subsidies are price supports that allow consumers to buy goods and services for prices lower than would prevail in the market without those supports. Subsidies are intended to induce consumption of those goods and services, in this case food items, the government is interested in supporting. The advantage of subsidies is that they are targeted to products rather than to consumers. This is particularly important when the poor are not easily identifiable or cannot be efficiently reached for other reasons.

Subsidies have, however, several shortcomings. First, a subsidy is given to the population at large, including high income households that the government may not wish to assist. The distribution leakage is particularly serious here when the subsidized items have high income elasticities (across income groups) and consequently high income groups would be the major beneficiaries from the program. As can be seen in Table 3.2, rice is consumed in larger quantities by the rich in Indonesia and, therefore, they benefit more from the subsidies.

Second, subsidies carry an income effect; the household can transfer part or the entire subsidy to consumption of other non-subsidized commodities. This problem would be relatively serious if households had low price elasticities for the subsidized goods, since the quantity response to the subsidy would be relatively small and the value of the subsidy would be

shifted to other consumption. It is usually hard to identify a food item consumed by the poor that has a high price elasticity.

Third, subsidies are often given to a particular product, usually a staple, without regard to the full nutritional consequences of this approach. If the subsidy seeks to enhance the consumption of a particular nutrient(s), the share of subsidized food in the consumption of that nutrient should be considered (see Annex 1). The lower this share, the more wasteful is the subsidy. Moreover, a subsidy induces substitution in favor of the subsidized food at the expense of other less subsidized foods. Consequently, the net nutritional gain from the subsidy is less than might be sought. When this substitution results in loss of consumption of some nutrients, the subsidy might be outright detrimental (Williamson - Gray, 1981).

In general, the higher the income elasticity of the subsidized food and the lower its price elasticity and contribution to consumption of particular nutrients, the higher the overall leakage from the subsidy.

V.1.2 Food Fortification

Fortification is the process whereby nutrients are added to widely-consumed foods to maintain or improve the quality of the diet of a group, a community or a population (Food and Agriculture Organization/WHO 1971). Fortification is meant to "circumvent" household behavior by "piggy-backing" on a particular food without changing its quality or price. There

is no reason to assume that fortification will alter the purchasing habits in favor of the fortified item, unless the product becomes more expensive or there are changes in its taste, texture or storage properties. More than in the case of the subsidy, the objective of fortification is the increased intake of a particular nutrient or micro nutrient.

If the fortified foods are consumed in sufficient quantities by the population, a reduction in vitamin and mineral deficiencies among participants can be expected. From the perspective of this discussion, foods with low price and income elasticities are good candidates for fortification. They are consumed by a wide population, the poor in particular, and the quantities consumed are not sensitive to changes in incomes and prices.²⁵

V.1.3 Formulated Foods

Formulated foods are nutrient-dense supplements generally prepared for infants and children. Preparation can take place in the home, at the village level, or through industrial processing.

The common production method is industrial processing with distribution through local markets. In all types of programs, the method of marketing and distribution will affect whether households accept the new food. The price of the product must be low enough to enable the target population to purchase it and develop consumption habits that would lead to low price and income

²⁵Consumption patterns should be known among other things to avoid possible toxicity amongst groups with very high consumption.

elasticities for reasons discussed above. A food that is thought to be processed and marketed for "the poor" may be looked at with suspicion and not purchased.

When formulated foods are for in-home preparation, for purchase at or provided through feeding programs, there is usually a need for appropriate education to enhance the production process.

V.1.4 Nutrition Education

Nutrition education refers to any communications system that teaches people to make better use of their resources. It is often integrated into other targeted and non-targeted programs but can also be the primary intervention by itself. The main focus of nutrition education programs is to change the deleterious belief patterns affecting food intake or the household utility and consumption functions, (2.1) and (2.2). These programs are often most successful when trying to change a specific behavior (Berg, 1973). Nutrition education may act in several ways. First, it can change detrimental belief patterns and practices including intra-household food allocation. Second, it can also help increase the purchasing power of the household by improving the types of food purchased and methods of preparation. This means to change the food consumption and production technology at the household level.

More than other nutrition interventions, success of a nutrition education program depends on the behavior and decision making process at the household

level. Not only must the nutrition message be disseminated and understood, it must also change behavior. It must also act within the constraints of food availability and purchasing power of the household.

V.2 Targeted Programs

V. 2.1 Income Transfer Programs

Income transfers are probably the most common form of transfer of public resources to the family because they serve to alleviate the consequences of poverty in general, beyond nutrition. The effect of an income transfer exists in any other form of support to households, as the family considers any net increase in its resources as a transfer of income that induces behavioral changes associated with the effect of income. This effect, especially if considered permanent, induces more consumption of all "normal" commodities.

The transfer of income is increasingly efficient, the easier it is to identify, and access the needy groups, and the higher the relevant income elasticities of food. The lower the income elasticity of the foods the government desires to support, the higher the leakage of the program from a nutritional perspective; the added income is spent on types of consumption the government or the public may not wish to support.

V.2.2 Food Stamps

Food stamps is a common program in the United States and has been tried also in Sri Lanka. It is a targeted program that combines the merits of a food price subsidy and an income transfer. The program aims at giving the household the market value of the differential between what it would consume without the program, and what it should consume from a programmatic viewpoint. It is an income transfer combined with an effective reduction in the price of food.

As outlined by Reutlinger and Selowsky (1976) an optimal program could be designed if household food preferences had been known. Even the suboptimal, but more practical, program requires knowledge of the household's expenditures on food and pertinent income elasticities.

As food stamps require an initial outlay by the household to purchase the stamps, some households, the poorest in particular, may not be able to finance this outlay, and hence participate in the program (Section III.6).

V.2.3 On-site Feeding Programs

On-site feeding programs, commonly targeted for pregnant women and children, are meant to reduce the potential allocation leakage of program resources to other family members. This is clearly not a "foolproof" system; the household accounts for the child's food at school, for example, and may deprive him of the share of food he would have otherwise received at home.

Moreover, the withdrawal of food from the child at home may have a net detrimental effect on his/her diet.

When the household finds it worthwhile to participate in the program, the question usually is "how does this compare with an income transfer of the same value?".²⁶ Selowsky (1978) identifies two parameters that would determine the efficiency of the program which aims at increasing caloric consumption of children: "... (a) the food distributed (by the program) to each child as a fraction of the food previously consumed at home and (b) the marginal propensity to spend on children's food....." (p. 56). The product of these two (which are almost by definition less than unity) will yield the percentage increase in the caloric intake of the child. On the basis of this model, Knudsen (1981) shows with data from Tamil Nadu, India, that a food transfer of the value of 10% of family income, for example, will induce in a family with per capita caloric intake of 2,110 calories (80% of FAO requirements) to increase the caloric intake of a child with a ration of 290 calories by only 40 calories.²⁷

²⁶If the program is located in a school or day-care center, participation depends on the proportion who attend school and the regularity of their attendance. In many cases, the existence of the feeding program at the school may increase attendance by making school a more attractive option for the household. On-site programs also rely on regular attendance, which may be particularly difficult for children of working mothers.

²⁷However, as the child is likely to be fed by the program a more expensive diet than it would receive at home, the family's value of this diet might be lower, and consequently the child's net benefit from the ration may be even less than the benefit calculated above. As the household cannot withdraw the ration from the child, especially if it is food specifically consumed by children, the household will withdraw other foods from the child. If those foods are relatively intensive in calories, compared with the ration, actual caloric consumption of the child may even drop.

V.2.4 Take-home Feeding Programs

Take-home feeding programs are an alternative method of distributing food for feeding programs. An advantage of the take-home program is that the food is consumed in the home, the cost of participation to the household may be lower, and the cooking preferences of the household are respected. Participation in the take-home feeding program depends largely on the frequency and location of food distribution. As opposed to on-site feeding programs, food pick-up may be more convenient because of less frequent distribution and fewer lost working days (Section III.6). Household preferences for particular foods may not be satisfied by the types of foods distributed, which are often supplied by donations from other nations.

However, allocation leakages are a fundamental problem; the appropriate quantities of food may not be given to the members of the household who are at risk of malnutrition, usually young children from six months of age and pregnant and lactating women. In addition, when new foods are introduced, it is often difficult to acquire the acceptance of the participants to change the food consumption and cooking patterns. Kennedy and Alderman (1986) summarize:

"Supplementary feeding programs have the potential to improve consumption and nutritional status. But actual results have been discouraging." (p.15)

V.2.5 Nutrition Rehabilitation

Nutrition rehabilitation centers provide residential or non-residential treatment for the severely malnourished, usually infants and children. These centers assure consumption of required calories and nutrients and facilitate close monitoring of the condition. There is minimal leakage in this program since almost all of the child's nutrient requirements are provided at the center. In addition, nutrition education efforts can be easily incorporated into these programs. The problem is that the long-term effects of such programs are unclear since the children return to an unchanged environment.

Once again, the decision to participate is made by the household, although usually at this stage of malnutrition it is often a life or death situation. Non-residential programs require more effort by the household since they may require the mother to bring the child in daily which may be time-consuming and often results in lost wages.

These programs probably signify the ultimate attempt to circumvent the household's decision making process which leads to circumstances requiring drastic social intervention.

V.3 Integrated Policy and Programs

Because of the complexity of the malnutrition problem, there is no clear advantage of one policy or program over the other for solving it.

From the viewpoint of social efficiency, numerous tradeoffs emerge between the different interventions. Non-targeted programs, such as subsidies, save the cost of identifying needy households, administering interventions, securing household participation, and of allocation leakages. These programs entail, however, costs in terms of distribution leakages that can be considerable, economically and politically. Targeted programs, such as income transfers and more direct nutrition interventions, may eliminate some distribution leakages but involve the cost saved under non-targeted programs. Nutrition interventions may be wasteful, if health is not considered and vice versa.

Theory suggests that the advantages of various interventions can be exploited in integrated policy and programs. Through the consideration of the relationships and parameters discussed in this paper, and their distribution in the population, fine-tuned policy and program can improve the reliability of targeting (of households and food items) and household participation. It can also decrease the magnitude of leakages related to household behavior, and waste because of physiology and health.

Because of the close association between health and nutritional status, as well as institutional reasons, integrated programs have traditionally dealt with nutrition and health. Kennedy and Alderman (1986) summarize the experience of these programs as follows:

"Results from a limited number of health-nutrition interventions suggest that these programs are able to improve maternal child health with an appropriate mix of health/nutrition services." (p.45)

Integrated programs need not be confined, however, to health and nutrition. Conceptual efforts are underway to look at the potential of integrated programs that would combine, from a household's perspective, the advantages of both subsidies and income transfers. There is no a priori reason for considering, only subsidies or income transfers as mutually exclusive policies, or for considering only one staple and a single nutrient. It can be shown that a policy combining income transfers with consumer subsidies might achieve multiple nutritional (and income) objectives, and yield either better diets with given fiscal outlays, or a specified diet with less budgetary outlays (Ben Zion et al. 1986). Integration may go further, to combine both health and fiscal policy.

Those efforts need, however, detailed knowledge of the income distribution, the determinants of food and nutrition consumption, and the magnitude of their effect (price and income elasticities) in different income groups.

VI. CONCLUSION

Internal efficiency of nutrition policy and programs depends to a substantial degree on appropriate targeting, choice of intervention, and securing appropriate household behavior. All in turn depend on knowledge of the determinants of malnutrition at the household level, the household's potential response to the program, and the family's ability to use program resources.

The paper outlined the potential of household economics and econometrics as frameworks to organize and study determinants of the risk of malnutrition at the household level where the problem occurs.

In many ways the paper constitutes an agenda for research. Relatively few studies have been conducted, especially in program environments, to yield basic knowledge about the determinants of malnutrition and program impact (e.g. Narangwal). Some unique options for research (Tamil Nadu) have not been fully exploited. After a review of the nutritional consequences of agricultural projects, Martin (1983) remarks:

"a research program must be begun which generates the sort of quantitative data needed to permit an analytical determination of the links between adverse nutritional outcomes and their various causes. Initially, such research should probably concentrate on factors which may be considered important for theoretical reasons and for which there is supporting evidence in the existing literature." (p. 46)

While a relatively new application in nutrition, the microeconomic framework for studying and formulating nutrition policy and programs, as well as their evaluation, from the household perspective, is an indispensable tool.

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ANNEX 1:

Food and Nutrients; Some Technical Relationships

Suppose the household produces its diet (D) of k nutrients (d_j ; $j=1,..,k$) through a vector F of m food items (f^i ; $i=1,..,m$).

The diet can be expressed as a linear transformation of the foods through a matrix m x k coefficients a^{ij} ($i = 1, \dots, m$; $j = 1, \dots, k$) each transforming a particular quantity of food f^i into a quantity of nutrient d^j - that is:

$$d^j = \sum_{i=1}^m a^{ij} f^i \quad (1)$$

A basic system with (n + 1) equations, including demand for all other non-food items, follows from the above; that is:

$$f^i = f^i(P^1, P^2, \dots, P^{n+1}, I, E) \quad (2)$$

where $(P^1, P^2, \dots, P^{n+1})$ is a vector of prices, I is household income and E is a set of relevant control or environmental variables such as education levels etc. The implied demand for nutrients is thus:

$$d^j = \eta_j(P^1, P^2, \dots, P^n, P^{n+1}, I, E, E). \quad (3)$$

Relationships 1 - 3 imply that the sensitivity of demand for a particular nutrient to change in income or expenditures, its income or expenditure elasticity, is:

$$\eta_{d^j I} = \sum_{i=1}^m \frac{a^{ij} f^i}{d^j} \eta_{f^i I} \quad (4)$$

Where $(a^{ij} f^i / d^j) = s^{ij}$ is the share of food f^i in nutrient j and $\eta_{f^i I}$ is the income or expenditure elasticity of d^j . Correspondingly, the relevant price elasticity of demand with respect to a particular price P^k is:

$$\eta_{d^j P^k} = \sum_{i=1}^m \frac{a^{ij} f^i}{d^j} \eta_{f^i P^k} \quad (5)$$

Relationships 4 and 5 indicate that the impact of changes in income and prices on the consumption of nutrient d^j is the a function of:

- a) the share of each particular food item f^i in the total consumption of this nutrient; and
- b) the income and price elasticities of that food.

These relationships signify that the effect of a change in income or in price on the consumption of a particular nutrient is a function of the impact of the change of the entire food basket. It is not at all clear, a priori, how a particular change will affect the consumption of particular

nutrients.

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