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## Towards a Model for Analyzing the Impact of Macroeconomic Adjustment Policies on Households: A Review

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**Philippine Institute for Development Studies**

Towards a Model for Analyzing the Impact  
of Macroeconomic Adjustment Policies  
on Households: A Review of Empirical  
Household Models in the Philippines

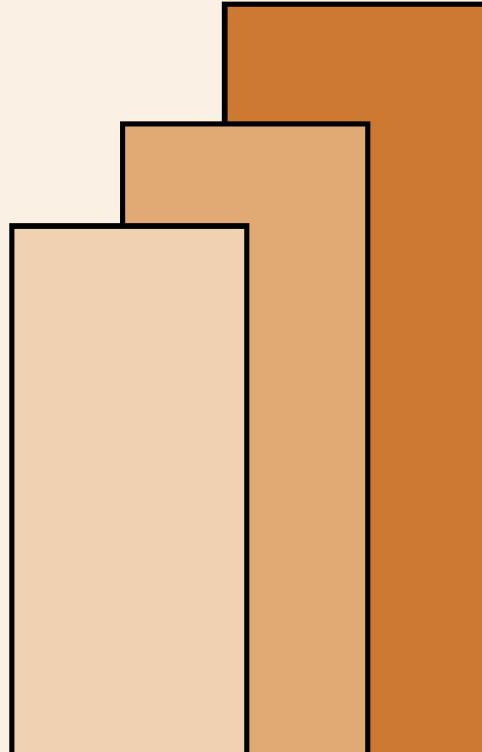
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**TOWARDS A MODEL FOR ANALYZING THE IMPACT OF MACROECONOMIC  
ADJUSTMENT POLICIES ON HOUSEHOLDS: A REVIEW OF EMPIRICAL  
HOUSEHOLD MODELS IN THE PHILIPPINES**

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# **TOWARDS A MODEL FOR ANALYZING THE IMPACT OF MACROECONOMIC ADJUSTMENT POLICIES ON HOUSEHOLDS: A REVIEW OF EMPIRICAL HOUSEHOLD MODELS IN THE PHILIPPINES<sup>\*</sup>**

**Aniceto C. Orbeta, Jr.<sup>\*\*</sup>**

## **1. Introduction**

Macroeconomic adjustment policies are designed to put the economy on the desired growth path. While the movement of macroeconomic variables are the primary indicators for the success or failure of the introduction of adjustment policies, it is well known that there are profound implications on household outcomes. These household impacts can either undermine or facilitate the attainment of the adjustment objectives. It is of interest, therefore, that the implications of the changes in adjustment policies on household outcomes be understood well.

A framework for analyzing the micro impact of macroeconomic policy change was laid out in Lamberte, et al. (1991). Highlighted in the framework is the importance of the workings of the product and input markets as well as the provision of public services in conveying the impact of macro policy changes to the household. The outcomes in these markets are said to be conditioned by the institutional factors within which these markets operate. The review papers summarized in Lamberte, Llanto and Orbeta (1992) examined the transmission mechanisms in detail. The review identified changes in prices of outputs and inputs as well as changes in the provision of public services as the primary transmission mechanisms. Given the changes in these parameters, households respond accordingly. These household responses are what analysts endeavor to understand and model. Modeling this household response is the subject of this paper.

The paper has two objectives, namely: (a) determine and assess how existing empirical household models are able to capture the effects of changes in the macroeconomic variables on the welfare of the Filipino household, and (b) identify research gaps in the literature and suggest possible ways of modifying some of the models so as to be able to capture the effects of changes in macroeconomic variables on household welfare.

Numerous household models were developed in the past to explain household outcomes in terms of individual member's characteristics as well as household and community characteristics. To keep the review manageable, the paper will focus on those models that have the potential of contributing to the understanding of the impact of market outcomes on household outcomes. Given the initial work done in Lamberte, et al. (1990) and the papers summarized in Lamberte, Llanto and Orbeta

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\* This paper has benefitted from the comments of Alejandro Herrin, Michael Alba and the other participants at the First Technical Workshop of the Micro Impacts of Macroeconomic Adjustment Policies, 17-18 February, 1994, Caylabne Bay Resort. The usual disclaimer applies.

\*\* Research Fellow, Philippine Institute for Development Studies. Research assistance by Ms. Mildred Belizaro and layouting assistance from Ms. Vanessa Ann Mina are highly appreciated.

(1991), the focus of the review will be models that explicitly consider prices of outputs and inputs as well as the availability of social services as determinants of household welfare outcomes. This focus is also dictated by the emphasis of the review in providing initial quantitative assessment of the impact of changes in macroeconomic variables on household outcomes.

Another useful organizing aspect for the review is the classification of dependent variables into "short-run" or intermediate or marginal effect variables and "long-run" or level variables. The short-run variables include health care utilization for health, enrollment or participation rates for education, dietary intake for nutrition, birth rates for fertility, and labor force participation. The long-run variables include illness incidence for health, educational attainment for education, nutrition status such as weight-for-age, weight-for-height and height-for-age, and number of children or family size for fertility. The advantage of focusing on the first set is that they respond to policy changes within shorter periods of time. The advantage of the latter set is that these are the variables that analyst and policy makers consider as ultimate outcomes. Given the time period of the project, it can be argued that the proper focus of the review will be the short-run variables.

Section two of this paper deals with the review conceptual frameworks behind current modelling of the household decision process. This is followed by a review of empirical household models including the methodologies for simulating these models to study impact of policy changes. The final section presents an evaluation of what needs to be done in order to build an empirical model of household decision making that can translate changes in market outcomes and government provision of public goods into household outcomes such as health and nutrition status and schooling of individual members, among others.

## **2. A Survey of Conceptual Frameworks**

Although there are a lot of paradigms in the study of the household, this review will focus on the economic models - those that consider optimization of a household objective subject to some resource constraints. The purpose of presenting a conceptual framework is to have an organizing paradigm for the review rather than develop a model for a specific problem. Thus, the emphasis of the presentation will be the basic elements that motivate the models reviewed. There is then no attempt to make this review of conceptual frameworks comprehensive. After all the review of empirical rather than conceptual models is the subject of this paper. Presented in this section is the New Household Economics (NHE) framework and some important variants of the NHE. Also presented as an alternative organizing framework to study intrahousehold allocation is a prototype of a household bargaining model.

### **2.1 The New Household Economics (NHE)**

The NHE household demand framework assumes that the household maximizes a utility

function subject to resource constraints. This household utility function can either be the utility function of a dictator (the one who decides for the household) or a consensus utility function that considers the preferences of each and every member.

The arguments of the household utility function are "goods" which are produced and consumed at home. These home goods are produced by combining goods purchased in the market ( $x_i$ ) and time inputs of household members ( $t_i = \sum_j t_{ij}$ ), i.e.,

$$Z_i = Z_i(x_i, t_i) \quad (1)$$

The basic ideas of this model were provided in Becker (1965). The maximization of utility is subject to two other constraints, namely: the budget constraint and the time constraint.

The household problem is

$$\begin{aligned} & \text{Maximize } U = U(Z_i) \\ & \text{s.t. budget constraint : } \sum_i p_i x_i = I \\ & \text{and time constraint : } \sum_i \sum_j t_{ij} = \sum_j T^j \end{aligned} \quad (2)$$

where

$p_i$  = price of good  $i$

$I$  = market income which is the sum of the wage and non-wage incomes

$T^j$  = total time for member  $j$

The two constraints can be combined into the so-called full-income constraint, i.e.,

$$\begin{aligned} \sum_i p_i x_i &= (\sum_j w_j T^j - \sum_i \sum_j w_j t_{ij}) + \Omega \\ &\text{or} \\ \sum_i p_i x_i + \sum_i \sum_j w_j t_{ij} &= \sum_j w_j T^j + \Omega \equiv \text{full income}(Y) \end{aligned} \quad (3)$$

where

$w_j$  = market wage rate for member  $j$

$\Omega$  = nonwage income

The first component of the right-hand-side (RHS) of equation (3) measures wage income of the household as the difference of the total market value of available time and the use of time in the production of  $Z$  goods.

The solution to the problem yields the reduced-form demand equations for household commodities:

$$Z_i = Z_i(p, w, T, \Omega) \quad (4)$$

From equation (4) the reduced-form derived demand equations for market commodities and time inputs can be solved. These are:

$$\begin{aligned} X_i &= X_i(p, w, T, \Omega) \\ t_i &= t_i(p, w, T, \Omega) \end{aligned} \tag{5}$$

The basic assumption of this framework is that members of the household supplies labor in the market given market determined wages. Wage income then are combined with other "unearned income" to yield household market income. Note that market income is clearly endogenous in this framework because it depends on the labor -leisure decision of the household. The full income constraint replaces market income as the exogenous resource constraint.

Pollak and Wachter (1975) pointed out that for full income and the shadow price of household commodities to be exogenous under this framework, the production function (for home commodities) must exhibit constant returns to scale and the absence of joint production otherwise commodity prices depend on household preferences. Household goods must also be produced by the market, and all members of the family must work sometime in the market. These conditions assure that opportunity value of the goods produced at home, and opportunity wage of household member's time spent on home activities are fixed by the market and will not depend on the consumption of the household.

## 2.2 Consumption-Production (Household-Firm) Framework

The framework presented above considers the household as mere buyers of market goods. In many instances, market goods are also produced at home. These products need not go the market and may be consumed directly within the household (pure subsistence). These considerations highlight the interdependence of consumption and production decisions. The basic framework was provided by Jorgenson and Lau (1969) and extended by Lau, Lin, and Yotopoulos (1980) and Singh, Squire, and Strauss (1986).

The implication of these considerations on the framework presented above is that more constraints are added, in particular, the production functions for market goods. In many models, family labor spent on household production of market goods is augmented with nonfamily (hired) labor. This is adopted in the paper.

Suppose market good 1 is produced at home with production function,

$$Q = Q(t_1 + l, A) \tag{6}$$

where:

$l$  = hired labor

A = other factors such as land

The time constraint in the household will still be equation (2). The addition of hired labor will only affect the budget constraint. The budget constraint becomes

$$\sum_{i=2} p_i x_i = I + p_l(Q - x_l) - w_l l \quad (7)$$

Combining the three constraints, yields the following full-income constraint:

$$\sum_i p_i x_i + \sum_i \sum_j w_j t_i^j = \sum_j w_j T^j + (p_l Q - w_l l) + \Omega \equiv Y \quad (8)$$

Equation (8) highlights an important characteristic of the consumption-production framework. Price changes will now have, in addition to the income and substitution effects, what is known in the literature as the profit effect (generated from the second term of the RHS of equation (8)). Under the assumption of the existence of markets for both good 1 and for labor and the perfect substitution between family and hired labor and between home produced and market produced good 1, the model will become recursive. The production and consumption decision will be separable (Strauss 1984). Conditional on the production decision, the consumption decision will be reduced to the one presented in the preceding section. Only under a pure subsistence economy, where there is neither labor nor product market, will production and consumption be determined simultaneously.

Solving the problem yields demand functions

$$\begin{aligned} x_i &= x_i(p, w, T, \Omega, A) \\ t_i &= t_i(p, w, T, \Omega, A) \\ l &= l(p, w, T, \Omega, A) \end{aligned} \quad (9)$$

### 2.3 Specific Home Goods Production Functions

This section discusses several variations of equation 1 to provide more specifics to the production processes of home goods such as health, education and nutrition. Starting from Becker's basic idea of home goods being the result of the combination of market goods and time inputs of household members, current specifications have included such factors as efficiency of production (i.e. biological and socioeconomic characteristics) for both the decision makers (usually parents) and the other passive members (usually children) as well as community factors not internal to the household. The efficiency factors usually include education and health status and other human capital variables. Community factors, on the other hand, include the availability of both public and private social services as well as other environmental characteristics.

The specifications that will be presented here are based on those proposed in Behrman (1990). Besides being comprehensive for the purposes of this review, it already incorporates many of the current thinking in this area as well as the variables that proved to be robust in the estimations.

### 2.3.1 The Health Production Function

The health production function is seen as the relationship between health inputs (i.e., food consumption and utilization of medical services) and the time used to prepare these inputs and health outcomes (morbidity, anthropometric status). This was first formally introduced in Pitt and Rosenzweig (1985). The usual specification is the following:

$$H^j = H(N^j, C_h^j, t^j, t^m, S^j, S^m, R, E^j, E^m) \quad (10)$$

where

$N^j$  = nutrients consumed

$C_h^j$  = other health-related inputs

$t^j$  = Time use of the individual

$t^m$  = Time use of the mother/wife/primary health care provider

$S^j$  = Schooling of the individual

$S^m$  = Schooling of the mother/wife/primary health care provider

$R$  = General environment

$E^j$  = Endowments related to inherent robustness and capabilities of the individual

$E^m$  = Endowments related to inherent robustness and capabilities of the mother/wife/primary health care provider

One can readily notice that nutrient consumption and other health-related inputs as well as time inputs of both the individual and the care-giver are among the determinants. Furthermore, endowments of the individual as well as the care-giver are also among the determinants. The general environment variable ( $R$ ) will include sanitation indicators as well as the availability of public and private health and allied services. In many models, the impact of health inputs are conditioned on individual endowment ( $S$  and  $E$ ) and community characteristics ( $R$ ).

### 2.3.2 The Nutrient Status Function

The nutrient status of individuals is assumed to depend on food consumption, health status of the individual, the time spent and capacities of the one preparing food at home, i.e., the mother (Behrman 1990). Thus, the nutrient intake function is of the form

$$N^j = N(C_f^j, H^j, t^m, S^m, E^m) \quad (11)$$

where

$C_f^j$  = food intake of the individual

### 2.3.3 The Schooling of Children Function

The schooling outcome of children is a function both personal characteristics such as health status, nutrient intake, and endowment in terms of ability and household and community characteristics such as time of parents in assisting children education at home, i.e. homework preparation and the availability and the quality of schools (components of R).

$$S^j = S(H^j, N^j, t^m, E^j, R) \quad (12)$$

### 2.3.4 The Number of Births Function

The number of births is determined by a "biological supply function" in the spirit of Easterlin, Pollak and Wachter (1980), the demand for children and contraceptive use (Easterlin and Crimmins 1985). Thus, we have the following function

$$B = B(C_c^m, S^m, S^f, H^m, H^f, N^m, N^f, E^m, E^f) \quad (13)$$

where

$C_c^m$  = contraceptive use

### 2.3.5 Reduced Form and Conditional Demand Relations

Solving for the household problem considering these specific production relations yields the following reduced form relations for market goods and time inputs:

$$\begin{aligned} c_i^j &= (p, w, T, \Omega, S, R, E) \\ \text{where } c_i^j &= \{C_i^j, t_i^j\} \end{aligned} \quad (14)$$

These functions relates output and input prices, non-wage income, community characteristics as well as personal characteristics of household members to the demand for market goods and time allocation of household members. These relations motivate many of the estimated models of intermediate outcomes (such as food consumption, health care utilization, and school attendance) as a function of changes in market outcomes (output and inputs prices) as well as changes in the provision of public services (components of R). Many models explaining level variables such as health, education and nutrition status, on the other hand, are based on the home production relation conditioned on the optimal values of the input variables, e.g., market goods and time inputs of members.

## 2.4 *Intrahousehold Concerns*

Up to this point, we did not touch the issue of the individual decision-maker within the household. The modeling thus far has assumed that there is a single decision-maker or unified household utility function.

What happens if we allow individual members of the household to have different preferences? Three frameworks have dealt with this issue. One assumes the existence of a family social welfare function which is essentially a representation of the consensus of the family (Samuelson 1956). The household then acts as if it is maximizing a family social welfare function. Arrow (1963), however, has shown that is impossible to aggregate preference ordering of more than one individual into a unique ranking. The second framework is the altruistic model of Becker (1981). The model hypothesizes the presence of an altruistic member who makes decisions based on what is best for the household as a whole while all other members can act in a self-interested way. Becker has shown that the household will be induced into maximizing the utility function of the altruistic member even if he does not have sovereign power. Conflict solution was demonstrated in what is known as the "rotten kid theorem." The theorem argues that if the rotten kid decides to raise his own consumption at the expense of the altruist, the altruist will simply reduce his transfer to that kid. Therefore, the rotten kid has no incentive to express his rottenness in this way and will find that it is to his best interest to work towards the maximization of the altruist member's utility. Thus, we are back to the single utility function for the household without assuming its existence in the first place. There is, however, the assumption of the presence of an altruist member. One may ask why the sudden appearance of an altruist among self-interested individuals. The third framework is one where conflicts are resolved by a bargaining process. Gains in forming a household relative to separate individual units are divided based on the relative strengths of the bargaining power of individual members. This bargaining power, in turn, is dependent on the contracting party's fall-back position (threat point) and his ability to threaten the other party. Here individuals perceived as making larger contribution can expect to achieve an outcome that is more favorable to him. Given that the first two frameworks simplify to the prototype discussed above, what will be presented here will be the bargaining framework only.

The cooperative bargaining model was presented in Haddad (1993) will be adopted here. Haddad (1993) attributed basic ideas to McElroy (1990).

Consider two individual, m and f. Separately their utility functions are

$$\begin{aligned} U_m^0(x_0, x_m, L_m) \text{ and} \\ U_f^0(x_0, x_f, L_f) \end{aligned} \tag{15}$$

where

$x_0$  = public good consumed by both

$x_m, x_f$  = good consumed only by m and by f, respectively

$L_m, L_f$  = leisure of m and of f, respectively

Let  $w_j$  and  $p_i$  be the wage rates of m and f and prices of  $x_j$ , and  $\Omega_j$  be the nonlabor incomes. Individually maximizing their utilities yields the following indirect utility functions:

$$\begin{aligned} V_m^0(p_o, p_m, w_m, \Omega_m; \alpha_m) \text{ and} \\ V_f^0(p_o, p_f, w_f, \Omega_f; \alpha_f) \end{aligned} \tag{16}$$

where

$\alpha_i$  = extrahousehold environmental parameters affecting the bargaining power of contracting parties

Cooperation will only be beneficial to both if

$$U^j - V^j > 0 \quad \text{for } j = m, f \tag{17}$$

The gains from cooperation will be divided by maximizing the Nash product of gains function

$$\begin{aligned} N = (U_m - V_m)(U_f - V_f) \\ \text{s.t.} \\ p_0 x_0 + p_m x_m + p_f x_f + w_f L_f + w_m L_m = (w_f + w_m)T + \Omega_m + \Omega_f \end{aligned} \tag{18}$$

Solution to this problem will yield demand functions of the form

$$\begin{aligned} x_i = x_i(p, w, \Omega_m, \Omega_f; \alpha_m, \alpha_f) \\ L_i = L_i(p, w, \Omega_m, \Omega_f; \alpha_m, \alpha_f) \end{aligned} \tag{19}$$

McElroy (1990) argued that the single utility household model is a special case of this model with the  $\alpha$  set to zero and  $\Omega$ 's are pooled. The appearance of individual non-labor incomes ( $\Omega_j$ ) and not the pooled  $\Omega$  distinguishes this from the NHE framework.

Given the recent empirical evidences indicating that household decision outcomes are very much influenced by the one who controls the household income (e.g. Senauer, Garcia and Jacinto (1988), Garcia (1990), and Thomas (1990)), this formulation has generated considerable appeal as a framework.

## 2.5 Intertemporal Concerns

Many decisions of the households cannot be treated adequately in a static manner. Schooling decisions, presumably done by parents, may have old-age support motivations rather than just mere consumption motives, i.e., parents are happy to have educated children. The same argument can be used for childbearing motivations. This is particularly true when one is attempting to model level variables, i.e., educational attainment or family size.

Since the author did not find an empirical household model using Philippine data explicitly dealing with these issues, there is little reason for providing it more space than mentioning that these motivations do exist.

### **3. A Survey of Empirical Implementations**

A review of existing models estimated using Philippine data from national and sub-national surveys is presented in this section. While the conceptual frameworks generally talks about simultaneous decision over several household decision problems, it was found that only few studies venture into estimating these models as a whole. Most studies dealt only with specific decision problems using reduced-form equations generated from these more generalized household models. The usual reason cited is data limitations. Simultaneity problems are usually dealt with via instrumental variable estimation.

The primary purpose of the review is to present estimation results, discuss what variables were used and found to be significant, and comment on the conceptual soundness of the model and the estimation procedures. Given the purpose of the review, the discussion of exogenous variables will be focused on prices of outputs and inputs as well as government services. The choice of what model to include in the review is dictated by the presence of these variables among the determinants. However, in absence of models of the desired specification, models that capture important household outcomes, even if do no directly address the purposes of the review, are also included to provide the reader a flavor of what has been done in the area.

#### **3.1 *Models Dealing with Two or More Household Decision Problems***

The focus of this section will be models that cover at least two of the household outcomes of interest simultaneously.

##### **3.1.1 *Banskota and Evenson (1978)***

Banskota and Evenson (1978) presented a five-commodity household decision model developed along the lines of the NHE household demand framework presented above. The arguments of the utility function include: the number of children, human capital per child, leisure of parents, leisure per child, and a composite commodity. This is maximized subject to the usual full-time income constraint and Becker's simple production technology for each of the arguments of the utility function.

In the empirical implementation of the model only three decision variables were estimated, namely: the number of children, investment in schooling, and work of children. It was argued that using the reduced forms allows unbiased estimation using ordinary least squares. The data set used was generated from a survey specifically done for the purposes of the study. The survey was conducted in 1977 covering 320 of the sample households studied by the Farm and Home Development Office (FHDO) of the UPLB in 1963 and 1968. The estimation procedure used was ordinary least squares (OLS). Predicted wages was used for the wage of the mother and the children using OLS regressions to take care of irregularity of these variables and the possible simultaneity between child wages and

education. However, for these regressions, no sample selection bias correction was done. The estimation procedure of the primary equations also failed to correct for the right censoring of the both the education attainment of children and the children ever born variables. The final education attainment of children cannot be observed except for what has been completed at the time of the survey. Likewise, sample households used are not those who have completed family sizes so that the children ever born refers to what has been observe during the survey.

The definition of variables used in the estimation is given in Annex 1. The estimation results are presented in Annex 2.

The results highlighted the importance of child wage as a positive determinant of family size, investment in education and child work. This can be gleaned clearly from the elasticities computed at the means presented in **Table 1**. This result presents a dilemma for policy makers. On the one hand, reducing child wages will reduce fertility but this will also mean reduction in investments in the human capital of children. The other important determinants are the mother's wage and education. Increase in the mother's wage decreases family size and decreases the quantity of schooling but increases its quality as measure by the expenditures on schooling. Increasing the mother's education holding her wage constant has the opposite effects. This indicates that raising the education of women without raising employment opportunities and wages may not produce the desirable effect.

### 3.2.1 Gonzales (1992)

A household model was recently estimated in Gonzales (1992). Using the NHE household demand framework a model determining the number of children, their health status, their average schooling and a composite of consumption goods was presented. There are two differences in the specification of the production of home good from the specification of B&E model. First, the efficiency of parents in the production process were explicitly considered. Second, exogenous environmental variables were assumed to affect production of home goods. Thus, the model merged household-level and community-level variables.

Using the notation above, the production relation is of the form

$$Z_i = Z_i(x_i, t_i^j, E^j) + R \quad (20)$$

The reduced form demand equations are

$$Z_i = Z_i(p_i, Y, E, R) \quad (21)$$

where

$\pi_i$  = is the vector of prices for home produced goods

$Y$  = is the full income constraint

In the estimation of the model only health indicators and schooling attainment were used as endogenous variables. The number of children was dropped because accordingly the estimation procedure was considered not suited for the analysis of this particular problem. Program measures such as family planning services, health services and education services were used as proxies for the price variables since direct price variations were not available in the data set. Parental schooling are expected to capture the income, efficiency and value of time effects. Village-to-town-center distance is an indirect index to the accessibility of government facilities most of which are located in the town-center.

The program variables are assumed to be correlated with the latent individual and community variables. It was argued that public programs may not be randomly planned, and might be determined by the underlying real factors such as health endowments of the population. The households, on the other hand, may sort themselves in response to availability of program inputs. Hence, unbiased and efficient estimation requires that this correlation be purged first before proceeding into the estimation of the system. These peculiarities were initially treated in Rosenzweig and Wolpin (1986). But even then these assumptions were tested in the estimation. The data set used are the 1978 and 1983 Bicol Multipurpose Surveys. The variable definition and descriptive statistics are given in Annex 3.

Given the foregoing hypotheses, the Hausman and Taylor (1981) estimation procedure was used. The OLS and within group estimates are also provided for comparison purposes. The OLS specification, by necessity, assumes that program variables are independent of the environment variables. The within-group estimates, on the other hand, effectively drop the environmental variables. Three instrumental variable (IV) specifications were tried. The first IV specification considers all program variables as exogenous, i.e., not correlated with individual and community latent variables. The second specification assumes all program variables as endogenous. The third specification considers school variables as exogenous. Obviously, parental schooling and distance from barangay to town are considered exogenous. These different specifications were tested with the within group estimates as benchmark. Presented in Annex 4 to 6 are the estimation results using OLS, within-group, and the IV three specifications. The chi-square test-statistic is highest under the assumption that all program variables are exogenous.

On the child health models, the availability of health centers appears to be not significant. The availability of doctors has positive effects on long-run nutritional status (age-for-height). The supply of midwives and nutritionists were significant determinants of weight-for-age but have the wrong signs. The number of nurses is not a significant determinant for all health indicators. These results indicate that the presence of health practitioners more than the presence of health centers affect child health.

On child schooling, the availability of primary school affects positively schooling outcomes although the explanatory power appears to be weak.

The coefficients of most health and nutrition program variables on the child health and schooling equations behave in an identical fashion as far as direction is concerned. This implies that health and education can be considered complements with respect to health and nutrition interventions.

To give an indication of the relative strengths of the explanatory variables, **Table 2** presents the estimated elasticities computed at the difference of the mean values. The table shows the importance of maternal schooling. However, this should be taken with caution because the coefficient on which the elasticity was based is not statistically significant.

While the model have program variables on the RHS, prices of inputs and outputs are conspicuously absent in the model.

### **3.2 Models on Specific Decision Variables**

#### **3.2.1 Health Outcomes**

Health outcomes can be measured in terms of ultimate outcomes like illness or inputs like utilization of health services. Health input equations reviewed are those for provider choice, health expenditures and utilization of facilities. Illness functions are reviewed for health outcomes.

##### *Provider Choice*

Akin et al. (1986) estimated demand functions for medical services (from various providers), pre-natal visits, type of child delivery service, well-baby care, and infant immunization. The explanatory variables include cash prices (visit price, drug cost, transport cost), time cost (waiting time, transportation time), household income and a vector of socioeconomic and demographic factors. Various limited dependent variable estimations techniques were employed. The data set used are those generated from the 1978 Bicol Multipurpose Survey and the 1981 Bicol Multipurpose Supplemental Survey. The description of variables and descriptive statistics are given in Annex 7 to 9.

The estimation results show that prices appear to have little effect on either the use of the service or the choice of a practitioner. Distance and waiting time appears not to be important deterrents to the use of medical services. The same can be said about the drug cost. It appears that the study do not support the widely held assumption that economic costs are important determinants of the demand pattern for health care.

Quality, approximated by the identity of the practitioner, does not significantly affect the medical service choice. However, when illness is perceived to be serious private physicians are favored. Traditional providers continue to be important providers of health care service. The poorest households either stay at home or use private clinics for outpatient care. The poorest pregnant women are the least likely to use pre-natal, well baby or immunization services. They also prefer to use traditional midwives for delivery. These kinds of behavior of the poor imply that free public clinics may have benefited the higher income patients. The authors hastened to add that it is not poverty per se that caused these medical choices, but other factors that are related to income such as education and urban residence. Annex 10-15 shows the estimation results.

The results on economic variables such as the price of services may have resulted from mis-

specification errors. Gertler, Locay and Sanderson (1987) argues that price effects are not independent of income. The impact of price changes need not be identical between poor and rich households. For example, price increases need not deter rich households from choosing higher price/higher quality alternative. The modeling employed by Akin et al. (1986) assumes the independence of prices and income. In addition, the authors did not test for the validity of the independence of irrelevant alternatives assumption which multinomial logit models imposes a priori. This is a strong assumption given the problem at hand. Another important peculiarity is that data on prices and service availability variables were not taken at the same time as the individual information but were generated in a supplemental survey done 3 years after the original one.

A model for provider choice (public, private and self-care) that takes care of many of these specification problems was estimated in Ching (1991). The data set used is a subset of the 1981 National Health Survey involving 502 children under the age of 15 who have recovered from an illness during the survey week. The model used a conditional logit model based on the earlier work of Gertler, Locay and Sanderson (1987). In contrast to earlier models where prices are independent of income, i.e. Akin, et al. (1986), this study allows a natural relation between price and income. It is argued that if health is a normal good, an increase in price is less likely to dissuade richer individual from choosing higher price/higher quality alternative than poorer individuals. The price of a visit for each alternative was computed using hedonic pricing methods with seriousness of illness, age and sex, urban residence and characteristics indicative of the competitiveness of market such as the number of doctors, the population in the regions which the child lives and the probability of being seen by a doctor as explanatory variables. Hedonic travel time equations were also used with market variables, urban residence as explanatory variables. Both of these hedonic relationships were corrected for sample selection bias. In addition, the independence of irrelevant alternatives assumption was tested. The model passed the test making the conditional multinomial logit procedure appropriate for model estimation. The definition of variables and estimation results are given in Annex 16 and 17.

The results show that prices and travel time are important negative determinants of provider choice in contrast to results obtained by Akin et al. (1986). Price elasticities vary by income group with higher elasticities for lower relative to higher income groups (**Table 3**). As expected, care from private providers has higher elasticities than that from public providers. This result provides a reason to doubt the validity of the prescription that raising user fees will not affect health care service utilization, particularly, across the board increase. The result on travel time shows that an increase in travel time by one minute reduces the probability of seeing a doctor by 1.08 percent. This bolsters the argument on the importance of availability in the utilization of services.

Using data on 16,964 households in the 1985 FIES merged with four regional variables on public hospital beds and private hospital beds per thousand population, regional GDP per capita, and percent electrification, Herrin (1992) estimated health expenditure equations using standard demand equations. The health expenditure categories included are: medical services, hospital services, drugs, dental services, and other health care. The determinants include, per capita total expenditures, household type<sup>1</sup>, education of household head, sex of the household head, urbanity, demographic

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<sup>1</sup> Used HOMES household types, namely: intact, single headed, primary individual, and one person.

structure of the household, and the four regional variables mentioned earlier. Given the incidence of zero expenditure on some expenditure categories, tobit specifications were used.

The estimation results show that income elasticities are all greater than one with hospital and dental services being most sensitive to income. In addition, households in the lowest income quartile are more sensitive to changes in income (**Table 4**). Another interesting result is the impact of the availability of services on health expenditures (**Table 5**). The expansion of public hospitals reduces the expenditure shares for medical services, hospital services, and dental services. The expansion of private hospitals, however, results in higher expenditures particularly for hospital services and for other health care. Thus, households are able to capture subsidies from the government through the health care sector.

Herrin (1992) estimated equations for utilization of health care facilities, particularly, government hospital, private hospital, community hospital, rural health unit, and barangay health stations. The data used is the 1987 National Health Survey involving some 18,000 households. Merged to this data set are four provincial supply variables obtained from the DOH, namely: number of public and private hospital beds per capita, the number of rural health units (RHUs) within the province, and the number of barangay health stations (BHSs) within the province. In addition, the regional gross domestic product per capita and percent electrification of the region were added. The estimation procedure used is a probit. The explanatory variables include: per capita household income, urbanity, type of the household, demographic structure, characteristic of the head such as age, occupation, regional dummy and the variables mentioned earlier.

The estimation results show that the probability of using government hospital decreases with income while the probability of using a private hospital increases with income. In addition, the probability of using frontline service facilities like RHUs and BHSs also decline with income (**Table 6**). The impact of the availability of facilities suggests substitutions between facilities (**Table 7**). An increase in the number of public hospitals reduces the probability of household using private hospitals. In addition, an increase in either type of hospital reduces the probability that households will use RHUs. An increase in the number of RHUs increases the probability that households use government hospitals and reduces the probability of using a private hospital. On the other hand, an increase in the number of BHSs increases the probability that households use RHUs. This indicates some form of a referral relationship between primary, secondary and tertiary institutions. A puzzling result, however, is that an increase in BHSs increases the probability that households use private hospitals.

### *Illness Functions*

Garcia (1990) estimated probability of illness functions (one for fever and another for diarrhea) using children below 7 years old as the sample. The explanatory variables include nutritional status (dummy for being underweight), price of rice, cooking oil and non-food items, child care time, child characteristics such as age and gender, parent's characteristics such as education and age, household characteristics such as household size and location as explanatory variables. The estimation results indicate that being underweight is an important determinant of the probability of having fever but not significant for diarrhea. The price variables are all positive determinants of fever but not significant for

diarrhea. The positive income effect due to the mother doing market work overcomes the negative effects of less childcare time. Also shown is the interaction between nutrition and health where low weight for age is associated with a significantly higher probability for diarrhea or fever. Mother's education appears to be a significant determinant of illness. Annex 18 shows the estimation results.

The data set used by Garcia (1990) came from the four-rounds of survey done between 1983 to 1986 in the three provinces of Abra, Antique, and South Cotabato. Estimation used is a maximum likelihood probit procedure which is appropriate given the dichotomous nature of the dependent variable.

### 3.2.2 Nutrition Outcomes

Nutrition outcomes come in two forms: status variables such as weight-for-age, weight-for-height and height-for-age or inputs such as nutrient intake. Nutrient intake functions for calorie, protein and vitamin A are reviewed. On the nutrition outcome side, models for standardized indicators of nutritional outcomes both in terms of levels and in terms of probability of falling below recommended levels are discussed.

#### *Nutrient Intake*

Bouis and Haddad (1990) presented a four equation system that recursively relates household income to food expenditure, food expenditure to household calories, household calories to preschooler calories, and finally preschooler nutritional status to his nutritional status. These estimations used prices of rice and corn, demographics and parents characteristics are included as explanatory variables. The simultaneity of the endogenous and exogenous variables were tested, in all of these stages. Instrumental variable techniques are used whenever simultaneity was found to exist. The data set used came from survey done in 1984/85 involving 510 corn and sugar farming households in Bukidnon. Only the pooled sample results will be discussed here.

The household calorie intake function did not yield significant coefficients for the price of rice and the price of corn. The calorie intake elasticity with respect to food expenditure is 0.17. As a determinant of preschooler calorie intakes, the household calorie intake is significant with an elasticity equal to 1.18. Sickness incidence is a negative determinant but was only marginally significant.

Ybanez-Gonzalo and Evenson (1978) estimated an nutrient production equation relating the aggregate nutrient ingested and inputs like the value of raw food served to the household; the time used to prepare the meal; home capital such as value of stove, refrigerators, cooking utensils; a work dummy for the mother (=1 when employed, 0 otherwise) and the number of adult equivalents in the household consuming food. To compute for the aggregate nutrient consumed, several weighing procedures were utilized. The one showing the best performance was the one using the implicit prices as weights. The estimation used data from 573 households in the Laguna survey. Home time spent on preparing food is a significant positive determinant. The number of adult equivalent has a high elasticity of 0.54 indicating economies of scale in food preparation. The value of food, on the other hand, has a relatively low elasticity of 0.26.

Demand for nutrient equations were also estimated in Ybanez-Gonzalo and Evenson (1978). Per capita dietary intake of calorie, protein and vitamin A were related to income, wealth, household size education and employment status of the mother. The elasticities with respect to income and wealth are significant but very low in value. Household size is a significant negative determinant of dietary intake. The education and employment status of the mother is not significant for all equations except for vitamin A where employment significantly lowers per capita vitamin A intake.

Popkin (1983) estimated nutrient intake equations whereby intakes of calories and protein were made a function of the mother's characteristics such as labor force participation, education and age, the number of children by age-group and the presence of elasticity. The data used came from a survey of 573 households in 34 barrios in Laguna done in 1975. The estimation results indicate that mother's employment is associated with higher consumption of calories but not protein intake. Mother's education also positively affects calorie intake but not protein intake. The number of children age 0-1 negatively affect both Calorie and Protein intake. The estimation results are given in Annex 19.

#### *Nutrition Status*

The Bouis and Haddad (1990) four-equation recursive system includes an equation for weight-for-height. The determinants of weight-for-height are calorie intake, illness incidence, parent's characteristics. Calorie intake is significant with an elasticity of 0.39. The diarrhea and illness episodes were significant negative determinants of weight-for-height. Multiplying the estimated elasticities of 0.65, 0.17, 1.18, and 0.39 in the four-equation recursive system yields an estimate of the elasticity of weight-for-height with respect to changes in income amounting to 0.05 - a very small value. This prompted the authors to conclude that income is a necessary but not a sufficient condition for substantially improving preschooler nutrition.

The model for the determinants of nutritional status of preschoolers given in Battad (1978) did not present the underlying household decision framework. The author argued instead that the principal interest of the paper was determining the role of socioeconomic, in particular income and education, and demographic factors in determining the nutritional status of preschoolers (6 months to 83 months) and went ahead fitting a linear model. The estimation results show that the effect of income is positive and increasing with age of children. Mother's education is a significant positive determinant for all age groups. Mother's income-generating activities were associated with declines in the nutritional status of preschoolers. Annex 20 to 22 presents the estimation results.

Garcia (1990) estimated probability functions for being underweight, wasting, and stunting for children below 7 years old. The estimation procedure used is maximum likelihood probit given that the dependent variable is dichotomous. The estimation results show that the effects of maternal income (employment) is positive for the probability of being underweight (a short-run nutritional status indicator) but negative for stunting (a long-run or permanent nutritional status indicator). Prices of rice, cooking oil and non-food items were not significant determinants except for stunting where the price of rice was a significant negative determinant. There is also a clear interaction between nutrition and health status. A diarrhea and fever episode during the past week is associated with higher probability of

being underweight and stunted. The presence of food subsidy lowers the probability of being underweight but is not a significant determinant of the longer run nutrition status indicators such as wasting and stunting. Household size is a negative determinant of the probability of being underweight. Annex 23 presents the estimation results.

A nutrition status equation was also estimated in Popkin (1983). The average child weight as a percentage of normal weight- for-age and height as a percentage of normal height-for-age were estimated as functions of child care time of father, mother and older siblings, intake of calorie and protein, mother's nutritional status and presence of piped water in the house. The simultaneity between childcare time and nutrient intake and the dependent variables were corrected by using instrumental variables. The estimation results show that the mother's employment has a very little effect on the nutrition status (child height to normal height for the age) of preschoolers. In addition, the use of older siblings for childcare has negative impact on the nutritional status of children. Nutrient intake, on the other hand, is not significant determinants of nutritional status. The estimation results are given in Annex 24.

Barrera (1990) estimated an equation for standardized height-for-age (a long-run measure of nutritional status). The determinants include child age and sex, household characteristics such as maternal education, age and height, community variables such as price of milk, rice, cooking oil and kerosene, wage rate for women, water sufficiency, source of water, sanitation, and travel cost to least-cost health facility. The data set includes 3,821 children below 15 years from the 1978 Bicol Multipurpose Survey and the 1981 Supplemental Survey. Several age group equations were estimated but only the full sample equations will be discussed. Estimation used ordinary least squares method.

The estimation results show that prices and income are not significant determinants of height-for-age. Neither is travel time to the health facility a significant determinant. Cleanliness (absence of excreta) improves the child's nutritional status. Mothers's age, height and schooling are all significant positive determinants. Since the data set used is identical to the one used in Akin et al. (1986), these results suffers the same infirmities, i.e. the prices and facilities variables generated from the supplemental survey in 1981 may not identical to those existing in 1978 when the individual information was taken.

**Table 8** summarizes the models of nutrition outcomes in terms of determinants and the signs of their coefficients.

### 3.2.3 Schooling Outcomes

Education outcomes can either be measured as education status such as attainment or as inputs such as enrollment or participation rate. Schooling attendance functions are reviewed while on the outcome side, schooling attainment models are discussed.

#### *Schooling Attendance*

DeGraff et al. (1993) estimated a model of time allocation between schooling, market work

and home production. The data used involves 2,679 children 7 to 17 years old who have never been married, who still live with their parents and excludes those who were interviewed during the summer vacation selected from the 1983 Bicol Multipurpose Survey. The model consists of a three-equation simultaneous system with child characteristics such as age and sex; household characteristics such as mother's education and age, number of siblings, travel time to the nearest high school, land holding, housing material (a proxy for income) and whether the family derives income from family business; and community characteristics such as urbanity, child wage, presence of electricity and a day care center in the barangay as explanatory variables. The dependent variables used are dichotomous indicating participation and non-participation in the activities. Thus, the estimation method used is a two-stage probit procedure using the estimated probabilities of endogenous variables computed from reduced form specifications in the first stage as explanatory variables in the second stage estimations. The definition of variables and estimation results are given in Annex 25 and 26, respectively.

Market work and home production were found to be significant negative determinants of school enrollment.

The estimation results show that travel time from the house to the nearest high school is a negative determinant of the probability of being in school. This is particularly true for girls than for boys. This points to the importance of the availability of schools in the schooling enrollment decision of households. An increase in the distance of the nearest high school by 10 minutes will reduce the probability of children being enrolled in school by 2 percent.

Herrin (1993) estimated schooling participation equation for children 7-12 and 13-17 years old using data from 444 households in Misamis Oriental. The explanatory variables include child characteristics such as age, sex and birth order, household characteristics such as number of siblings, education of mother, distance to school; and community characteristics such as monthly wages of father and of child, distance of the barangay to the poblacion and distance to the city. A logit model was estimated.

The estimation results show that both the distance to the elementary and high school are not significant determinants of schooling participation of 7-12 and 13-17, respectively. The wage rate of children was found to be a significant negative determinant of the probability of school participation among 7-12 years old but not for children 13-17 years old.

### *Educational Attainment*

Paqueo (1985) estimated schooling attainment functions for children 7-12 and 7-13 years old with child characteristics such as age, household characteristics such as assets, mother's wage and education; and community characteristics such presence of electricity, distance from school among others as explanatory variables. The data set used is the 1982 HSMS. Weighted least squares was used in the estimation. The definition of variables and the estimation results are presented in Annex 27 to 28.

The results indicate that the father's wage, household asset and borrowing capacity and the availability of electricity in the locality are significant positive determinants of the educational

attainment of children. The mother's education is a significant positive factor but her predicted wage is not. The number of children has a negative effect on schooling attainment. Freedom from a persistent or chronic disease increases the schooling attainment of children. The availability of unskilled jobs lowers schooling attainment. The presence of elementary school, on the other hand, appears not to affect the educational attainment of children. Neither are the returns to education significant determinant to schooling attainment.

Herrin (1993) also estimated a schooling attainment (number of years completed as of interview date) equation using the same set of explanatory variables as the schooling participation equation. The estimation procedure used is ordinary least squares. The estimation results show that the distance to both elementary and high schools are not significant explanatory variables of schooling attainment. Wage of children is a significant determinant of schooling attainment among children 13-17 years old but not among children 7-12 years old.

These results, however, have to be taken with caution because of several factors. Both the models of schooling attainment in Paqueo (1985) and Herrin (1993) failed to correct for the both the left and right censoring of schooling attainment. Schooling attainment is truncated at zero or left censored. In addition, schooling attainment observed at survey date need not be the final attainment of the child but what was observed at the time of the survey. The final attainment is not observable - or right censored too. Another important determinant of schooling not considered is the innate ability of the child. Paqueo's model used a variable which was based on the subjective judgement of the mother on the child's diligence in school work which can be endogenous and self-serving. Herrin's data set, on the other hand, does not contain any variable to capture this aspect. Finally, following Rosenweig and Wolpin (1986) the distribution of schools need not be independent of schooling outcomes.

### **3.2.4 Time Allocation**

Using data from the Laguna survey, Quizon (1978) estimated a time allocation model for father's and mother's home production and leisure time. The explanatory variables include their own and their spouse's individual characteristics such as education and age and the number of children by age group.

The results show that wages, education, number of children, and assets positively affects the market time of husbands. For wives, wage, education and age significantly affect her participation in the labor market. For household activities, the presence of infants increases the father's home time while the number of children in school decreases it. The more educated wife is related to less home time for the husband. The estimation results are given in Annex 29 and 30.

Garcia (1990) estimated a time allocation model for both market work and household chores. Equation for wives and husbands were estimated using, in addition to their own and their spouse's individual characteristics, their own and their spouse's market and home time allocation. The results showed that, as expected, the presence of young children reduces the labor market time of wives while the presence of adults increases it. Education of the wife increased her ability to do market work. The estimation results are given in Annex 31 to 32.

Popkin (1983) estimated the time allocation models for rural mothers. The dependent variables include the time for childcare, home production, leisure and market production. The explanatory variables include own labor force participation, education and age, per capita household income, number of children by groups, and the availability of electricity. Estimation results show that the education of mothers is a negative determinant of home time but not significant in market time. Age of the mother is a negative determinant of home production time and a positive determinant of market production time. While the presence of children 0 - 6 years old increases home production time, only the presence of children 0 - 1 year old reduce the market production time. The estimation results are given in Annex 33.

**Table 9** summarizes the models of time allocation in terms of the determinants and signs of coefficients.

### 3.2.5 Intrahousehold Allocation Concerns

Garcia (1990) estimated several household reduced form equations primarily to determine the impact of the source of income on food consumption patterns, nutrient consumption, individual food consumption, child health and nutrition, and time allocation.

The study found that income of women has a statistically significant effect on calorie and protein consumption. In addition, the differential effect is larger in the case of protein consumption indicating that increases in women income is strongly associated with better food variety. It was also found that the mother's wage and earning have significant negative effect on short-run nutrition status (underweight) while positive income effects tend to dominate in the long-run (stunting).

Senauer, Garcia and Jacinto (1988) found evidence that the value of time of household members affect the intrahousehold distribution of food. In particular, the estimated wage rate of the mother has a significant positive impact of the relative calorie allocation of both herself and her children and a negative effect on the husband's allocation (see also Garcia 1990). An increase in the wage of the husband and father increases his own and his wife's allocation but reduces the children's. Thus, a positive policy approach to modify the pattern of intrahousehold resource allocation is to improve the employment opportunities and the investment in human capital for women.

## 3.3 *Simulation Ideas*

Presented in this section are simulation ideas using household models. A couple of illustrative simulation using these ideas is also presented. In particular, the impact of tariff reduction and devaluation on calorie and protein intake of households was computed.

### 3.3.1 Simulating the Effects of Food Policies on Nutrition

Quisumbing (1985) presented a framework for simulating effects of food policies on nutrition.

Three types of policy instruments were identified: supply shifters, demand shifters, and price wedges.

Given the estimated demand curves for food ( $q_i$ ), the percentage change in quantities demanded can be expressed as:

$$\hat{q}_i = \sum_{j=1}^n e_{ij} \hat{p}_j^d \quad (22)$$

where

$\hat{\cdot}$  = indicator of percentage change

$e_{ij}$  = direct and cross-price elasticities of demand

$\gamma$  = income elasticity of demand

$y$  = income

Supply changes can be represented as

$$\hat{q}_i = \sum_{j=1}^n S_{ij} \hat{P}_j^s + \delta_i \quad i = 1, \dots, n \quad (23)$$

where

$S_{ij}$  = supply elasticities

$\delta_i$  = supply shift variable

To allow for price subsidies, the equilibrium relationship is specified as follows:

$$\hat{p}_i^s = \hat{p}_i^d + \beta_i \quad i = 1, \dots, n \quad (24)$$

where

$\beta_i$  = size of subsidy wedge for commodity  $i$

In matrix form the three sets of  $n$  equations can be expressed as

$$\begin{bmatrix} -H & O & I \\ O & -S & I \\ -I & I & 0 \end{bmatrix} \begin{bmatrix} \hat{P}^d \\ \hat{P}^s \\ \hat{Q} \end{bmatrix} = \begin{bmatrix} \Gamma \hat{y} \\ \Delta \\ \hat{B} \end{bmatrix} \quad (25)$$

where

$H$  = an nxn matrix of demand elasticities,  $e_{ij}$

$S$  = an nxn matrix of supply elasticities,  $S_{ij}$

$P^d$  = an nx1 vector of demand prices,  $p_i^d$

$P^s$  = an nx1 vector of supply prices,  $p_i^s$

$Q$  = an nx1 vector of quantities,  $q_i$

$\Gamma$  = an nx1 vector of income elasticities of demand,  $\gamma_i$

$\Delta$  = an nx1 vector of supply shifts,  $\delta_i$

$B$  = an nx1 vector of price subsidies,  $\beta_i$

The solution for the changes in equilibrium prices and quantities as a function of the policy variables is

$$\begin{bmatrix} \hat{p}^d \\ \hat{p}^s \\ \hat{Q} \end{bmatrix} = \begin{bmatrix} (S - H)^{-1}(\Gamma\hat{Y} - \Delta - S\hat{B}) \\ (S - H)^{-1}(\Gamma\hat{Y} - \Delta - H\hat{B}) \\ H(S - H)^{-1}(SH^{-1}\Gamma\hat{Y} - \Delta - S\hat{B}) \end{bmatrix} \quad (26)$$

Given the changes in the equilibrium consumption of commodities, the percentage change in the equilibrium level of nutrient consumption is

$$\hat{N} = K\hat{Q} = KH(S - H)^{-1}(SH^{-1}\Gamma\hat{Y} - \Delta - S\hat{B}) \quad (27)$$

where

$K_i$  = 1xn vector of  $K_i$ , the fraction of initial total nutrient consumption provided by commodity

The framework allowed the author to compute for the changes in calorie and protein consumption under policy changes affecting the market for food. It was pointed out that for more general policies, a general equilibrium model is needed.

### 3.3.2 Impact of Tariff Reduction on Nutrient Intake of Households

Using the framework presented above, the impact of a tariff reduction on nutrient intake of households is computed.

Cororaton (1994) simulated the impact of a one percent reduction of tariff rates across the board using the APEX CGE model. The APEX's 7 consumer goods was found to be uninteresting for the implementation of the framework in Quisumbing (1985) which used 16 food items. In addition, of the 7 consumer goods in the APEX model only 3 are food items. In order to utilize the sixteen food items in Quisumbing, we started with price and income changes to compute for changes in the consumption of each food item. **Table 10** presents the correspondence between the APEX sectors and

Quisumbing's food items used in the simulation. Changes in producer prices are used for price changes and changes in consumption expenditures as a proxy for the changes in food expenditures. It should be noted also that APEX has five household income groups while Quisumbing used quartile groupings. Interpolation was used to convert the quintile groups in APEX to quartile groups in Quisumbing<sup>2</sup>. To compute for the percentage change in consumption of each food item we utilized equation (22). The demand elasticities used are the SURE estimates given in Quisumbing (1985). It should be noted that these price and expenditure changes are derived from the results of simulating a CGE, thus, these are equilibrium values and it should not matter which equation to use in computing for changes in consumption. **Table 11** presents the percentage changes in producer prices and consumption expenditures used in the simulation as well as resulting percentage change in consumption for each of food items. Prices of most commodities declined (except of starch roots and tubers which is largely non-traded) and expenditures increased. It is not surprising, therefore, that consumption of most commodities rise except for corn and sugar for some income groups. On the other hand, due to price increase the consumption of starchy roots decline. We then used equation (27) to compute for changes in calorie and protein intake of households. **Tables 12 & 13** presents the contribution of each food item to household calorie and protein intake as reported in Quisumbing (1985). The consumption patterns is such that as income increases the dependence on rice for both calorie and protein intake declines while the dependence on the relatively more expensive sources such as other cereal products, meat, poultry, eggs and milk products increase. The results show that across the board tariff reduction is shown to favor lower income groups. This is particularly clear in case of calorie intake (**Table 14**).

### 3.3.3 Impact of Devaluation on Nutrient Intake of Households

The simulation results of a one percent devaluation using the APEX model reported in Cororaton (1994) are not interesting. A simulation was done using a different version of the APEX model. **Table 15** presents the impact on producer prices and consumption expenditures. Percentage increase in producer prices is around 2 percent while consumption expenditure changes ranged from 1.4 percent for the highest income class to 1.9 percent for the lowest income class. As expected, the general price increase resulted into the reduction of consumption of most food items. These changes in consumption of food items generated a reduction of calorie and protein intake for all income groups except for protein intake of the lowest income group. Devaluation appears to have a mixed effect (**Table 16**). The highest reduction in calorie intake is shown to be experienced by the second quartile followed by the lowest income quartile, then the highest income quartile and, finally, the third income quartile. The impact on protein intake is similar except for the lowest income quartile where the effect is positive. The lowest income quartile was able to prevent a decline in protein intake by consuming more fish and seafoods while all other income groups have decreased their consumption.

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<sup>2</sup> If  $x_{ij}(j)$  is the change in income of income group  $j$  in study  $i$  ( $i=$ Apex, Quisumbing), the following interpolation procedure was used:  $xQ(1)=.8xA(1) + .2xA(2)$ ;  $xQ(2)=.6xA(2) + .4xA(3)$ ;  $xQ(3)=.4xA(3) + .6xA(4)$ ;  $xQ(4)=.2xA(4) + .8xA(5)$ .

## 4. Summary and Next Steps

This section provides a summary highlighting the important elements in developing a model for analyzing the impact of macro adjustment policies on households. It also lists the succeeding steps towards building this model.

### 4.1 *On Nutrition*

The illustrative simulation presented in the previous section has demonstrated that given price and income changes from simulating policy changes using a CGE model, estimated price and income elasticities and contribution of food items on nutrient intake of households, one can generate the impact of macro policy changes on the nutrient intake of households. Actually if the disaggregation of consumptions goods is detailed enough to cover major sources of nutrients of interest, one can code equation (27) into a CGE model to make the impact calculation automatic.

It should be noted, however, that the review has identified other important determinants of nutritional intake. These include number of children, sickness incidence and the labor force participation of the mother. Thus, limiting nutrient intake determinants to changes in prices and income may results to omitted variables bias.

On nutritional status variables weight-for-age, which is considered a short-run measure of nutritional status, can be included among the nutritional outcomes that respond readily to macro policy changes. The determinants of this variable should include personal characteristics of the individual including nutrient intake and health status; household characteristics such as income, education of the mother and family size; and community characteristics which shall, at the minimum, include prices of major sources of nutrients.

### 4.2 *On Health*

The review did not find a study using Philippine data that simulated the effects of macro policy changes on health outcomes. What are the requirements of simulating the impact of macro policy changes on health outcomes of households? First, let us identify the dependent variables of interest. Utilization of health care services should be an important intermediate variable that responds readily to changes in the economic environment. Illness incidence is another variable that responds readily to changes in the economic environment of the household.

Herrin (1992) has estimated a model of utilization probabilities for different health facilities using a nationally representative data. Included among the determinants are measures of availability of health facilities. Conspicuously absent among the determinants are price variables. While these can proxied by the availability of health facilities, the waiting time cost cannot be reflected because this is dependent on wage rates. Neither is there a variable for the seriousness of illness and possession of an health insurance policy which are important determinants of the choice of health facilities.

Illness probability functions were estimated in Garcia (1990). Prices of rice, cooking oil, and non-food items were found to be significant determinants of the probability of having fever but not for diarrhea. One major weakness of the model is the limited coverage of the data set (only from three provinces of Abra, Antique and South Cotabato). There is also no variable indicating the availability of primary health care facilities.

The major transmission mechanisms of health status are the availability of health facilities and changes in wages and incomes and prices of drugs. Unfortunately, there are no available studies that translate the impact of macro adjustment policies both on the availability of supply of health facilities and on cost of drugs.

#### ***4.3 On Education***

Like those on health, no study has simulated the effects of macro adjustment policies on education variables using Philippine data.

The variables of interest here will primarily be school enrollment. Schooling attainment is a long-run outcome which do not respond readily to changes in macro policy.

Two studies have estimated enrollment equations (DeGraff et al. (1993) and Herrin (1993)). The model in DeGraff et al. (1993) has travel time to the nearest high school, indicating availability of schools, among the determinants which was found to be a significant negative determinant of schooling participation. Given that the subject children are of ages 7 to 17, availability of elementary schools is more relevant. Prices of school materials are also not included among the determinants. In addition, income was proxied by type of housing materials. The community wage variable was also not included among the determinants of school participation. Finally, the data set used is the 1983 Bicol Multipurpose Survey which limits the applicability of the results. The model in Herrin (1993) has the distance to the relevant school level among the determinants but these were not found to be significant. Wages rate was found to be significant negative determinant among elementary school age children (7-12 years) but not among children 13-17 years old. Again since the data used was only for Misamis Oriental, applicability of the results is limited.

It was also found that there are no studies that translate macro policy changes to changes in availability of schools and prices of school materials.

#### ***4.4 Next Steps***

Given the foregoing assessment, the task of building a model to analyze the impact of macro policy changes on household outcomes must include:

- (1) Estimating models of household outcomes with prices (of outputs and inputs), income and the

availability of services among the determinants and using nationally representative data. Alternatively, since MIMAP is interested on the impact on vulnerable groups, representative sample for these groups can be used;

- (2) Developing a model that translates macro policy changes into changes in government budget, its allocation between sectors and finally, in the availability of public services particularly those that are relevant to household outcomes;
- (3) Developing a model (macroeconometric or computable general equilibrium type) that will generate for the household model changes in the prices (of outputs and inputs), incomes and availability of social services; and
- (4) Special case studies on intra-household allocation, household-resources interactions, and gender issues.

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**Table 1**  
**ELASTICITIES: PHILIPPINE HOUSEHOLD DATA**

<b>Dependent variables</b>	<b>Children born</b>	<b>Education of sons</b>	<b>Education of daughters</b>	<b>School expenditures</b>	<b>Child employment</b>
Elasticities with respect to:					
Mother's wage	-0.27	-0.39	-0.16	1.43	-0.47
Mother's education	0.09	0.11	0.09	-0.38	0.19
Child wage	0.74	1.70	1.24	1.09	1.25
Full income	0.02	0.05	0.04	0.36	-0.09
Home technology	-0.16	-0.02	0.01	0.13	-0.23

Source: Banskota & Evenson (1978)

**Table 2**  
**Elasticities Computed at Mean Values**  
**(From IV Estimates Specification (1))**

	Height for age	Weight for age	Years of Schooling
<b>PROGRAM VARIABLES</b>			
<i>Health and Nutrition</i>			
Doctors	1.8064 *	0.0612	0.0164
Nurses	0.6006	-0.5055	-0.3266
Midwives	0.3306	0.2381 ***	-0.0750
Nutritionists	0.3367	-0.0874 **	-0.1752
Maternity clinics	a	a	a
Dare care centers	a	a	a
Rural health units	a	a	a
<i>Education</i>			
Primary schools	-5.1960 *	-0.3145 *	0.7272
Secondary schools	1.7616 *	0.1267 **	0.1999
<i>Family Planning</i>			
Family planning motivators	-0.1276	0.0746	0.0131
<i>Household-Community</i>			
Mother's schooling	0.6116	1.9250	0.8506
Father's schooling	-0.4599	0.2677	-0.6756
Barangay-poblacion distance	0.0469	0.0936	-0.0928

\* - coefficient significant at .10 level

\*\* - coefficient significant at .05 level

\*\*\* - coefficient significant at .01 level

a - variables not computed, dummy variables used

Source: Gonzalez, E. (1992).

**Table 3**  
**Point Elasticities by Income Quartile**

Alternatives	Quartiles			
	1 (lowest)	2	3	4 (highest)
Public	-6.77	-6.50	-5.94	-3.84
Private	-11.78	-11.31	-10.34	-6.70

Source: Ching (1991)

**Table 4**  
**Estimate Income Elasticities of Health Expenditures**

Income Quartile	Medical Services	Hospital Service	Drugs	Dental Services	Other Health Services	Total Health Care
I	2.599	3.468	1.435	2.904	1.469	1.533
II	2.130	2.761	1.326	2.443	1.414	1.408
III	1.855	2.340	1.256	2.156	1.375	1.331
IV	1.487	1.777	1.152	1.757	1.312	1.220
Mean	1.974	2.523	1.282	2.278	1.390	1.363

Source: Herrin (1992)

**Table 5**  
**Expenditure Elasticity with Respect to Bed Supply**  
**per Thousand Population**

Sector	Medical Services	Hospital Services	Drugs	Dental Services	Other Health Services	Total Health Care
Public	-0.377	-0.286	-0.103	-0.242	-0.072	-0.083
Private	0.111	0.245	0.103	0.038	0.335	0.09

Source: Herrin (1992)

**Table 6**  
**Predicted Probabilities of Use of Income Quartile**

Income Quartile	Government Hospital	Private Hospital	Community Hospital	Rural Health Unit	Barangay Health Station
I	0.330	0.236	0.122	0.324	0.332
II	0.323	0.315	0.106	0.305	0.317
III	0.318	0.370	0.097	0.293	0.307
IV	0.305	0.451	0.084	0.276	0.292
Mean	0.319	0.339	0.101	0.299	0.312

Source: Herrin (1992)

**Table 7**  
**Elasticity of Predicted Utilization Probabilities With**  
**Respect to Hospital Beds Per Thousand Population**

Supply	Government Hospital	Private Hospital	Community Hospital	Rural Health Unit	Barangay Health Station
Public Hospital Beds Per Capita	0.007 d	-0.159 a	0.339 a	-0.228 a	0.016 d
Private Hospital Beds Per Capita	-0.187 a	0.195 a	-0.093 c	-0.158 a	0.050 b
Rural Health Units	0.112 a	-0.110 a	-0.361 a	0.270 a	0.018 d
Barangay Health Stations	-0.105 a	0.084 a	-0.182 a	0.097 a	0.046 d

a - coefficient significant at 0.01 level

b - coefficient significant at 0.05 level

c - coefficient significant at 0.10 level

d - not significant

Source: Herrin (1992)

**Table 8**  
**Signs of Coefficients of Explanatory Variables**  
**in Nutrition Functions**

Independent Variables	Nutritional Status				Intake							
	Weight as % of Normal Weight-for-Age		Standardized Height-for-age	for-	Calorie			Weight-Height	Protein			Vitamin A
	Battad (1978)	Popkin (1983)	Barrera (1990)	Bouis & Haddad	Garcia (1990) (1990)	Popkin (1983)	Ybanez-Evenzon (1978)	Bouis & Haddad	Garcia (1990) (1990)	Popkin (1983)	Ybanez-Evenzon (1978)	Ybanez-Evenzon (1978)
Education of Mother	+	na	+	+	+	+	ns	+	+	ns	ns	ns
Labor force participation of mother	-	na	na	na	na	+	ns	na	na	ns	ns	-
Mother's nutrition	+	ns	+	+	na	na	na	na	na	na	na	na
Children below 6 years	-	na	na	na	-	-	na	na	-	-	na	na
Income/wealth	+	na	ns	na	+	ns	+	na	+	ns	+	+
HH size	na	na	na	na	-	na	-	-	-	na	-	-
Sickness	-	na	na	na	na	na	na	-	na	na	na	na
Diarhea	na	na	na	-	na	na	na	na	na	na	na	na
Fever	na	na	na	-	na	na	na	na	na	na	na	na
Prices of Goods	na	na	ns	na	na	na	na	ns	na	na	na	na
Calorie intake	na	ns	na	+								
Protein intake	na	ns	na	na								

Notes:

+ positive and significant at least at 0.10 level

- negative and significant at least at 0.10 level

ns not significant

na variable not available

**Table 9**  
**Signs of Coefficients of Explanatory Variables in**  
**Time Allocation Equations of Mothers / Wives**

Independent Variables	Home Production			Market Production		
	Quizon (1978)	Popkin (1983)	Garcia (1990)	Quizon (1978)	Popkin (1983)	Garcia (1990)
Education of mother	ns	-	-	+	ns	+
Age of mother	ns	-	-	+	+	+
Market production of mothers	na	ns	-			
Home production of mothers				na	-	-
Market production of husband	na	na	na	na	na	-
Children 0-6 yrs	+	+	+	ns	-	-
HH Income / wealth	ns	ns	na	ns	-	na

Notes:

- + positive and significant at .10 level or higher
- negative and significant at .10 level or higher
- ns - not significant
- na - not available

**Table 10**  
**Correspondence Between APEX Sectors**  
**and Quisumbing Food Items**

APEX SECTOR	Quisumbing Food Items
1 irrice	Rice
2 rrice	
3 corn	Corn
	Oth Cereals
8 roots	Starch roots
5 sugar	Sugar
7 veg	Dried beans
	Vegetables
6 fruits	Vit C
	Other fruits
14 marine	Fish & seafood
15 inland	
10 hogs	Meat
12 lives	
23 meat	
22 oils	Fats & Oils
26 ofoods	Misc

**Table 11**  
**Impact of a 1 % Decline in Tariff Rates**

A. Percentage Change in Prices and Expenditure					B. Percentage Change in Demand				
Food Item	Income Quartile				Income Quartile				
	1	2	3	4	1	2	3	4	
Rice	-0.0722	-0.0722	-0.0722	-0.0722	0.2727	0.1188	0.1030	0.0732	
Corn	-0.0818	-0.0818	-0.0818	-0.0818	-0.4033	0.0649	-0.0897	0.0903	
Oth Cereals	-0.0818	-0.0818	-0.0818	-0.0818	0.2950	0.2663	0.2236	0.0677	
Starch roots	0.0402	0.0402	0.0402	0.0402	-0.2575	-0.2469	-0.0640	-0.0030	
Sugar	-0.0082	-0.0082	-0.0082	-0.0082	-0.0482	0.0754	0.1566	-0.0531	
Dried beans	-0.1333	-0.1333	-0.1333	-0.1333	0.1452	0.1212	0.2606	0.0897	
Vegetables	-0.1333	-0.1333	-0.1333	-0.1333	0.2033	0.4278	0.4184	0.1555	
Vit C	-0.1882	-0.1882	-0.1882	-0.1882	0.5304	0.6300	0.4108	0.3296	
Other fruits	-0.1882	-0.1882	-0.1882	-0.1882	0.4742	0.4755	0.2621	0.3340	
Fish & seafood	-0.1143	-0.1143	-0.1143	-0.1143	0.0312	0.1205	0.0994	0.0659	
Meat	-0.0706	-0.0706	-0.0706	-0.0706	0.1385	0.3322	0.0698	0.4661	
Poultry	-0.1261	-0.1261	-0.1261	-0.1261	0.1779	0.2183	0.1794	0.3054	
Eggs	-0.1261	-0.1261	-0.1261	-0.1261	0.6760	0.3050	0.3816	0.2912	
Milk & Milk products	-0.1140	-0.1140	-0.1140	-0.1140	0.2286	0.4040	0.0935	0.0726	
Fats & Oils	-0.1422	-0.1422	-0.1422	-0.1422	0.0211	0.3140	0.2494	0.0689	
Misc	-0.1711	-0.1711	-0.1711	-0.1711	0.2038	0.1701	0.1835	0.2161	
Expenditure	0.0051	0.0064	0.0074	0.0111					

**Table 12**  
**CALORIE CONTRIBUTION(1) BY COMMODITY, BY INCOME QUARTILE,**  
**1978 FNRI SURVEY**  
**(In percent)**

Commodity	Quartile			
	I	II	III	IV
Rice and rice products	64.08	59.36	55.65	45.16
Corn and corn products	9.02	7.31	3.56	1.35
Other cereal products	2.55	3.84	5.14	7.00
Starchy roots and tubers	2.89	2.04	1.36	1.02
Sugar and syrups	3.06	3.74	4.22	4.71
Dried beans, nuts and seeds	1.13	1.30	1.14	1.83
Green leafy and yellow vegetables	0.56	0.52	0.44	0.35
Vitamin C-rich foods	0.56	0.85	0.97	1.39
Other fruits and vegetables	3.02	2.83	3.20	3.26
Fish and seafoods	3.49	4.10	3.91	4.12
Meat	1.57	2.77	4.74	8.38
Poultry	0.29	0.51	0.48	0.93
Eggs	0.35	0.48	0.85	1.40
Milk and milk products	3.07	5.04	7.52	10.36
Fats and oils	3.76	4.61	5.98	8.48
Miscellaneous	0.60	0.69	0.82	0.86

(1) Each entry gives the fraction of total calorie consumption accounted for by the commodity, i.e.

$$\frac{k}{ci} = \frac{\text{Calorie (Commodity } i\text{)}}{\text{Total Calorie}}$$

**Table 13**  
**PROTEIN CONTRIBUTION(1) BY COMMODITY, BY INCOME QUARTILE,**  
**1978 FNRI SURVEY**  
**(In percent)**

Commodity	Quartile			
	I	II	III	IV
Rice and rice products	47.84	40.95	37.36	28.14
Corn and corn products	7.91	5.96	2.86	1.03
Other cereal products	2.62	3.71	4.95	6.27
Starchy roots and tubers	0.80	0.55	0.37	0.38
Sugar and syrups	0.02	0.02	0.05	0.05
Dried beans, nuts and seeds	2.60	2.83	2.44	2.37
Green leafy and yellow vegetables	1.56	1.31	1.07	0.80
Vitamin C-rich foods	0.43	0.55	0.61	0.68
Other fruits and vegetables	3.06	2.73	3.00	2.56
Fish and seafoods	23.41	25.73	25.69	22.98
Meat	2.86	5.29	7.96	11.69
Poultry	1.05	1.34	1.44	3.00
Eggs	0.97	1.23	2.15	3.28
Milk and milk products	4.04	6.91	11.00	15.55
Fats and oils	0.36	0.31	0.31	0.54
Miscellaneous	0.46	0.60	0.74	0.67

(1)Each entry gives the fraction of total protein consumption in the quartile accounted for by the commodity, i.e.

$$\frac{k}{\pi} = \frac{\text{Protein (Commodity } i)}{\text{Total Protein}}$$

Source: Quisumbing (1985).

**Table 14**  
**Impact of a 1 Percent Decline**  
**in tarriff rates (%)**

Income Quartile	calorie intake (% Change)	protein intake (% Change)
1	0.1722	0.1579
2	0.1586	0.1717
3	0.1233	0.1223
4	0.1180	0.1414

**Table 15**  
**Impact of a 1 Percent Devaluation**

A. Percentage Change in Prices and Expenditure					B. Percentage Change in Demand				
Food Item	Income Quartile				Income Quartile				
	1	2	3	4	1	2	3	4	
Rice	2.7104	2.7104	2.7104	2.7104	-1.1590	-0.6715	-0.8552	-2.1414	
Corn	2.0286	2.0286	2.0286	2.0286	1.9343	-5.3233	0.5826	1.3855	
Oth Cereals	2.0286	2.0286	2.0286	2.0286	-3.6789	0.0511	0.2074	-1.6730	
Starch roots	2.9388	2.9388	2.9388	2.9388	-8.2568	-6.2511	-3.5992	-2.3605	
Sugar	2.3109	2.3109	2.3109	2.3109	-0.8224	-3.2934	1.9291	1.1321	
Dried beans	2.5340	2.5340	2.5340	2.5340	-0.3612	0.9097	-1.6509	-1.9024	
Vegetables	2.5340	2.5340	2.5340	2.5340	-0.7385	-7.3839	-6.8464	-0.7143	
Vit C	2.0020	2.0020	2.0020	2.0020	-0.0628	-3.8738	-0.8489	-1.3498	
Other fruits	2.0020	2.0020	2.0020	2.0020	-2.2260	-0.8195	0.2575	-2.5153	
Fish & seafood	1.9990	1.9990	1.9990	1.9990	3.8086	-0.4082	-0.9156	-0.4595	
Meat	2.6332	2.6332	2.6332	2.6332	-1.0662	-2.4212	3.9415	-0.1058	
Poultry	2.8650	2.8650	2.8650	2.8650	-2.3954	-3.6231	-1.5457	-2.9555	
Eggs	2.8650	2.8650	2.8650	2.8650	-11.6236	-1.7509	-2.5723	-3.5398	
Milk & Milk prod	2.0104	2.0104	2.0104	2.0104	0.4366	0.6018	3.5047	3.4621	
Fats & Oils	2.0000	2.0000	2.0000	2.0000	3.0089	-1.4466	-1.2050	2.8086	
Misc	2.0000	2.0000	2.0000	2.0000	0.1607	0.1300	-0.0288	-0.2764	
Expenditure	1.89904	1.76752	1.63612	1.4274					

**Table 16**  
**Impact of a 1 Percent Devaluation**

Income Quartile	calorie intake (% Change)	protein intake (% Change)
Inc 1	-0.8056	0.0990
Inc2	-1.2653	-1.0054
Inc3	-0.1480	-0.0334
Inc4	-0.6847	-0.5971

Annex 1  
VARIABLES DICTIONARY: RURAL LAGUNA HOUSEHOLDS

Variables	Definitional notes	Mean	S.D.	No. of Observations
<b>I. ENDOGENOUS DEPENDENT</b>				
1. Children ever born	The number of children born to the household (includes stillborn children)	6.84	2.85	320
2. Education of sons	Number of years of school completed by sons - based on older sons in hh. where younger sons were still in school	8.18	3.07	233
3. Education of daughters	Number of years of schooling completed by daughters - based on older daughters in hh. where younger daughters were still in school	8.50	3.68	227
4. Schooling expenditure	Expenditure on tuition, books, food and clothing per year per child	222.04	443.37	225
5. Child employment	A dummy variable + 1 if children between 8 and 16 were reported to be working on farm or nonfarm tasks	0.55	0.50	320
<b>II. EXOGENOUS DEPENDENT</b>				
1. Infant deaths	Number of stillborn and infant deaths	0.69	1.13	320
2. Education of father	Number of years of school completed by fathers	4.06	4.56	320
3. Education of mother	Number of years of school completed by mothers	3.52	4.55	320
4. Wage of father (63)	Wage rate per day for employed father in 1963 pesos	3.07	4.27	320
5. Wage of mother (P) <sup>a</sup>	Predicted daily wage rate of mothers in 1968 pesos	9.93	5.45	320
6. Wage of child (P) <sup>b</sup>	Predicted daily wage rate of children in 1977 pesos	8.75	1.65	320
7. Full income	A measure of full income in 1968 pesos computed as labor income of mother and father plus 10 per cent of the value of farm and household assets	1649.24	1557.16	320
8. Home technology index <sup>c</sup>	An index based on the number of home management practices actually adopted in 1963	37.88	31.27	320
9. Land	Land in (hh.s) under cultivation by the hh.	11.83	32.15	320
10. Years married	Year of marriage (+1900)	48.20	10.75	320
11. Father farmer	Dummy variable = 1 if father is a farmer	0.48	0.50	320
12. Mother farmer	Dummy variable = 1 if mother is a farmer	0.03	0.18	320
13. Mother nonfarmer	Dummy variable = 1 if mother has nonfarm occupation	0.58	0.49	320

a. The wage of the mother was predicted wage rate. Only 170 of the mothers had wage data for 1963 and 1968. The measures were also quite erratic. It was desirable then to devise a predicted wage to expand the sample utilizing this variable and to smooth out some of the irregularities in the measure. The prediction equation was:

$$\text{Mother's wage} = 15.981 - .203 \text{ Year married} + .0031 \text{ Farm assets} - 1.829 \text{ Mother's health} .63 + .68 \text{ Mother's education } (R^2=.12)$$

$$(1.107) \quad (.009) \quad (1.815) \quad (.265)$$

The mother's health Index is 1 for good health, 2 for poor, 3 for bad. Farm Assets and mother's health are excluded exogenous variables.

b. The child wage rate was a predicted wage for two reasons. First only 177 households had observable wage rates and it was desirable to analyze the full sample. But more importantly, child's wages and child education are related through the productivity of schooling creating a simultaneity problem. The child's wage is not strictly exogenous. The predicted wage is then a two stage least squares procedure. The predicting equation was:

$$\text{Child's wage} = 7.015 - .326 \text{ Child health index} + .128 \text{ Child education} + .021 \text{ Years of marriage} - .017 \text{ Land rented}$$

$$(.683) \quad (.056) \quad (.040) \quad (.027)$$

$$+ .0009 \text{ Farm assets} + .971 \text{ Father farmer} - .104 \text{ Mother farmer} + -.103 \text{ Mother nonfarmer} + .008 \text{ Land owned } (R^2 = .14)$$

$$(0.0008) \quad (.671) \quad (1.379) \quad (.619) \quad (.035)$$

c. Farm assets, the child health index, land rented and land owned are the excluded exogenous variables.

Source: Banskota & Evenson, (1978).

Annex 2  
REGRESSION COEFFICIENTS: LAGUNA HOUSEHOLD DATA

<b>INDEPENDENT VARIABLES</b>	<b>DEPENDENT VARIABLES</b>				
	Children ever born	Completed education of sons	Completed education of daughters	Schooling Expenditure per child	Employment of children
Infant deaths	0.92166 (0.12503)	-0.08574 (0.16332)	-0.04460 (0.03608)	1.12521 (31.83800)	0.00312 0.02555
Education of father	-0.04944 (0.03452)	0.03021 (0.04538)	0.02460 (0.05343)	0.09817 (7.39536)	-0.00437 (0.00705)
Education of mother	0.17219 (0.05205)	0.25465 (.07314)	0.22300 (0.08668)	-23.70830 (11.41064)	0.02911 (0.01064)
Wage of father (63)	-0.02228 (0.03272)	-0.00016 (0.04093)	0.03417 (0.04882)	11.11335 (6.14572)	0.00120 (0.00669)
Wage of mother *	-0.18414 (0.05951)	-0.34569 (0.09491)	-0.14411 (0.10960)	31.97361 (12.02390)	0.02652 0.01216
Wage of child **	0.57505 (0.03812)	1.58735 (0.24376)	1.20129 (0.28044)	27.93008 (28.74437)	0.07863 (0.02822)
Full income	0.00006 (0.00010)	0.00024 (0.00013)	0.00022 (0.00015)	0.04850 (0.01826)	-0.00003 (0.00002)
Home technology index	-0.03530 (0.00445)	-0.00359 (0.00684)	0.00112 (0.00931)	0.88904 (1.109462)	-0.00410 (0.00091)
Land	0.00686 (0.0454)	-0.01009 (0.00553)	-0.00371 (0.00651)	-0.14743 (0.83491)	-0.00205 (0.00093)
Year married	-0.03904 (0.01871)	-0.10305 (0.02972)	-0.04462 (0.03608)	0.66365 (4.05529)	-0.00800 (0.00382)
Father farmer	0.70862 (0.34047)	0.44104 (0.44776)	-0.15501 (0.55022)	-5.96042 (73.37958)	0.13662 (0.06957)
Mother farmer	0.82284 (0.74334)	-0.44927 (1.06449)	1.48336 (0.07885)	-145.87323 (152.00739)	0.36083 (0.015189)
Mother nonfarmer	0.22070 (0.28441)	0.29151 (0.38205)	0.12773 (0.01714)	76.53250 (58.86663)	-0.04114 (0.05812)
No. of Cases	320	233	227	226	320
R2	0.408	0.329	0.384	0.310	0.191
F	7.4610	6.608	4.590	3.301	2.557

Source: Banskota & Evenson, (1978).

**Annex 3**  
**DEFINITION AND DESCRIPTIVE STATISTICS, SELECTED VARIABLES**

<b>Variable</b>	<b>Description</b>	<b>1978</b>		<b>1983</b>	
		<b>Mean</b>	<b>Standard deviation</b>	<b>Mean</b>	<b>Standard deviation</b>
<b>DEPENDENT VARIABLES</b>					
Height for age	Z-score, height for age of preschool children, household mean	-	2.14	1.64	-
Weight for age	Z-score, weight for age of preschool children, household mean	-	1.65	2.46	-
Grade attainment	Age- and gender-standardized years of schooling, all children aged 6+		1.03	1.76	1.07
<b>PROGRAM VARIABLES</b>					
<u>Health &amp; Nutrition</u>					
Doctors	Number of government physicians per thousand barangay population	0.49	1.20	0.33	0.63
Nurses	Number of government nurses per thousand barangay population	1.04	1.78	0.65	1.28
Midwives	Number of government midwives per thousand barangay population	0.68	0.97	0.87	1.29
Nutritionists	Number of government nutritionists per thousand barangay population	0.38	0.61	0.51	1.33
Maternity clinics	Present in barangay = 1; otherwise = 0	0.02	0.15	0.07	0.25
Day care centers	Present in barangay = 1; otherwise = 0	0.26	0.44	0.47	0.50
Rural health units	Presence (=1) of rural health unit or barangay health station in barangay	0.40	0.49	0.65	0.48
<u>Education</u>					
Primary schools	Number of public elementary schools with at least 4th grade level per thousand barangay population	0.85	0.68	0.61	0.50
Secondary schools	Number of public secondary schools per thousand barangay population	0.11	0.34	0.07	0.20
<u>Family Planning</u>					
Family planning motivators	Number of government family planning motivators per thousand barangay population	1.08	2.15	0.79	1.47
<b>OTHER VARIABLES</b>					
Mother's schooling	Years of mother's schooling	5.31	3.06	5.31	3.06
Father's schooling	Years of father's schooling	5.39	3.12	5.39	6.10
Barangay-poblacion distance	Number of kilometers from barangay point to poblacion center	5.46	6.10	5.46	6.10

Number of observations = 669, except for height for age (307) and, weight for age (309).  
Not shown: household variables-mother's age, household wealth, percentage of non-residential household members, backyard gardening, community variables - price of rice, price of milk, electricity, irrigation, urban location.

Source: Gonzales, E. (1992)

Annex 4  
Regressions on Child Health

Dependent Variable: height for age

Number of Observations: 307

	OLS	Within Groups	Instrumental Values (1)	Instrumental Values (2)	Instrumental Values (3)
<b>PROGRAM VARIABLES</b>					
<i>Health and Nutrition</i>					
Doctors	0.0405 (0.472)	0.1168 (1.563)a	0.1129 (1.446)a	0.0963 (1.504)a	0.1182 (1.611)a
Nurses	0.0322 (0.679)	0.0173 (0.393)	0.0154 (0.338)	-0.0044 (-0.121)	-0.0083 (-0.197)
Midwives	0.0717 (1.161)	-0.0030 (-0.047)	0.0174 (0.286)	-0.0159 (-0.334)	-0.0287 (-0.502)
Nutritionists	0.0875 (1.349)a	0.0079 (0.117)	0.0259 (0.385)	0.0085 (0.164)	-0.0192 (-0.315)
Maternity clinics	0.1942 (0.663)	0.3048 (1.055)	0.2918 (0.996)	0.1710 (0.764)	0.1548 (0.581)
Dare care centers	-0.0724 (-0.557)	0.1530 (1.261)	0.0724 (0.592)	0.0951 (0.957)	0.1557 (1.327)
Rural health units	-0.0135 (-0.100)	0.1152 (0.678)	0.0717 (0.460)	-0.0067 (-0.062)	0.0283 (0.211)
<i>Education</i>					
Primary schools	-0.2366 (-1.885)b	-0.2660 (1.488)a	-0.2165 (1.297)a	0.0098 (0.098)	-0.2007 (-1.061)
Secondary schools	0.3903 (1.898)b	0.5928 (1.696)b	0.4404 (1.562)a	0.0076 (0.044)	0.5095 (1.452)a
<i>Family Planning</i>					
Family planning motivators	0.0131 (0.348)	-0.0080 (-0.183)	-0.0044 (-0.105)	-0.0288 (-0.730)	-0.0069 (-0.181)
Mother's schooling	0.0324 (1.035)		-0.2465 (-0.698)	-0.3812 (0.244)	0.6802 (0.407)
Father's schooling	0.0159 (0.533)		0.1826 (0.648)	0.6656 (0.417)	-0.7842 (-0.464)
Barangay-poblacion distance	-0.0119 (-0.842)		-0.0184 (-0.664)	0.0098 (0.140)	0.0049 (0.100)
Specification test (Chi-squared values)	16.39		12.68	4.42	3.55

a: significant at .10 level, using one-tailed test

b: significant at .05 level; c:significant at .01 level

Note: t-ratios in parentheses

Not shown: household variables - mother's age, household wealth, percentage of non-residential household members, backyard gardening; community variables - price of rice, price of milk, electricity, irrigation, urban location.

Source: Gonzalez (1992).

Annex 5  
Regressions on Child Health

	Dependent Variable: weight for age	Number of Observations: 309			
	OLS	Within Groups	Instrumental Values (1)	(2)	(3)
<b>PROGRAM VARIABLES</b>					
<i>Health and Nutrition</i>					
Doctors	0.0576 (0.545)	0.1132 (1.207)	0.0995 (1.047)	0.0370 (0.494)	0.0394 (0.533)
Nurses	-0.0095 (-0.163)	-0.0521 (-0.941)	-0.337 (-0.599)	-0.0126 (-0.299)	-0.0081 (-0.192)
Midwives	0.3124 (4.089)c	0.3456 (4.339)c	0.3258 (4.107)c	0.1514 (2.759)c	0.1547 (2.749)c
Nutritionists	-0.0894 (-1.114)	-0.1872 (-2.205)b	-0.1747 (-2.035)b	-0.0833 (-1.401)a	-0.0894 (1.533)a
Maternity clinics	-0.0043 (-0.012)	0.2897 (0.795)	0.3700 (1.006)	0.1367 (0.532)	0.1641 (0.644)
Dare care centers	-0.0335 (-0.209)	0.1278 (0.835)	0.0866 (0.560)	0.1023 (0.884)	0.1405 (1.196)
Rural health units	-0.1247 (-0.748)	0.3551 (1.659)b	0.2394 (1.146)	0.0774 (0.0628)	0.0798 (0.0638)
<i>Education</i>					
Primary schools	-0.0024 (-0.015)	-0.4188 (-1.858)b	-0.3407 (-1.521)a	-0.516 (-0.470)	-0.2771 (-1.308)a
Secondary schools	0.0667 (0.262)	0.9990 (2.266)b	0.8233 (1.927)b	0.0033 (0.018)	0.5690 (1.298)a
<i>Family Planning</i>					
Family planning motivators	0.0061 (0.132)	0.0834 (1.511)a	0.0669 (1.214)	0.0304 (0.845)	0.0340 (0.926)
Mother's schooling	-0.0037 (-0.095)		-0.7758 (-0.752)	-0.5686 (-0.095)	-0.8535 (-0.110)
Father's schooling	0.0114 (0.311)		-0.1063 (-0.127)	-0.6301 (-0.099)	-0.3190 (-0.043)
Barangay-poblacion distance	0.0082 (0.468)		-0.0367 (-0.439)	-0.0610 (-0.227)	-0.0625 (-0.233)
Specification test (Chi-squared values)	28.80		14.18	12.06	10.85

a: significant at .10 level, using one-tailed test

b: significant at .05 level, c:significant at .01 level

Note: t-ratios in parentheses

Not shown: household variables - mother's age, household wealth, percentage of non-residential household members, backyard gardening; community variables - price of rice, price of milk, electricity, irrigation, urban location.

Source: Gonzalez, (1992)

Annex 6  
Regressions on Child Schooling

	Dependent Variable: years of schooling		Number of Observations: 669		
	OLS	Within Groups	Instrumental Values		
			(1)	(2)	(3)
<b>PROGRAM VARIABLES</b>					
<i>Health and Nutrition</i>					
Doctors	-0.0356 (-0.677)	0.1324 (2.581)c	0.0041 (0.075)	0.1314 (2.252)b	0.1301 (2.267)b
Nurses	-0.0274 (-0.888)	-0.895 (-2.878)c	-0.0335 (-1.070)	-0.0840 (-2.371)c	-0.0863 (-2.498)c
Midwives	0.0413 1.049	-0.1213 (-2.668)c	-0.0158 (0.392)	-0.1493 (-3.050)c	-0.1483 (-3.126)c
Nutritionists	-0.0117 (-0.285)	-0.1730 (-3.698)c	-0.0539 (-1.185)	-0.1717 (-3.283)c	-0.1563 (-3.093)c
Maternity clinics	0.0255 (0.127)	0.1712 (0.840)	0.0956 (0.437)	0.1318 (0.569)	0.1195 (0.526)
Dare care centers	-0.0766 (-0.875)	-0.1114 (-1.259)	-0.1032 (-1.171)	-0.0915 (0.928)	-0.0782 (-0.808)
Rural health units	-0.0024 (-0.027)	0.0684 (0.550)	0.0345 (0.339)	0.1054 (0.857)	0.0555 (0.448)
<i>Education</i>					
Primary schools	0.1097 (1.435)	0.1804 (1.585)a	0.1212 (1.178)	0.1281 (1.169)	0.1588 (1.242)
Secondary schools	0.1450 (0.955)b	-0.0094 (-0.037)	0.1999 (1.147)	-0.0721 (-0.297)	0.0579 (0.280)
<i>Family Planning</i>					
Family planning motivators	-0.0068 (-0.249)	0.0048 (0.186)	0.0018 (0.066)	0.0067 (0.232)	0.0142 (0.502)
Mother's schooling	0.0357 (1.881)		0.1650 (0.953)	0.1370 (0.350)	-0.3859 (-0.950)
Father's schooling	0.0169 (0.909)		-0.1291 (-0.723)	-0.2384 (-0.547)	0.5201 (1.015)
Barangay-poblacion distance	-0.0095 (1.128)		-0.0175 (-1.275)	-0.0295 (0.947)	0.0177 (0.543)
Specification test (Chi-squared values)	35.04		20.88	4.24	4.91

a: significant at .10 level, using one-tailed test

b: significant at .05 level; c:significant at .01 level

Note: t-ratios in parentheses

Not shown: household variables - mother's age, household wealth, percentage of non-residential household members, backyard gardening; community variables - price of rice, price of milk, electricity, irrigation, urban location.

Source: Gonzalez (1992)

Annex 7  
INDEPENDENT VARIABLE DEFINITIONS

<b>Independent Variables (Unit of Measure)</b>	<b>Variable Definitions</b>
Visit (P) Waiting time (min) Attendant: Traditional Public Private Drug cost (P) Traditional practitioner does not treat five common illnesses	These are facility-reported variables for the cost, waiting time, usual attendant, and index of drug costs for each service (outpatient, prenatal, etc.). We select prices from the closes facility of each type for all 100 sample barangays to use as the prices that face people in each barangay. The usual attendant is used as a quality variable. For traditional healers, the quality variable is a dummy variable for whether they treat any of the five common illnesses asked about in the survey.
Transport time (min) Transport cost (P) Traditional Public Private	Transport time and transport cost are given for a one-way trip from the center of the barangay of residence to each type of facility, using the most common means of transport. Walking trips have zero cost but positive transport time.
Insured?	We know whether each household has health insurance and who is covered. This variable equals 1 if: the individual is covered by health insurance.
Asset value	We do not have a reliable income estimate for the Bicol sample because of coding errors embedded in the raw data. As a proxy, we use the value of personal assets - house, lot, furniture, appliances, and vehicles. This variable probably is a better measure of permanent income than of current income.
Age Mother's age	Age of the individual. For child outpatients, we use mother's ages on the assumption that the mother makes medical service consumption decisions for her children.
Sex Baby's sex	These qualitative variables equal 1 if the individual is male.
Education Mother's education	Highest completed grade. Mother's education is used where appropriate for children (see "age" above).
Serious illness	The household respondent, usually the mother, was asked whether anyone in the household was sick in the previous month and whether that illness was very serious, serious, or not serious. If she replied very serious, this qualitative variable equals 1.
Mother home	If the mother either does not work or works at home, this variable equals 1.
No. of living children	Self-explanatory.
Had modern delivery?	If the baby who is considered eligible for well-baby care or immunizations was delivered by a trained midwife or a physician, at home or in a clinic, this variable equals 1.

Source: Akin et.al.,(1986)

Annex 8  
SAMPLE STATISTICS FOR OUTPATIENTS (BICOL REGION, PHILIPPINES, 1978)

<b>Independent Variables</b>	<b>Adults</b>		<b>Children</b>	
	<b>Mean</b>	<b>SD</b>	<b>Mean</b>	<b>SD</b>
Cash price (P):				
Traditional	2.1	2.0	1.8	1.5
Public	0.3	0.9	0.4	1.2
Private	11.0	8.9	12.5	7.2
Transport cost (P):				
To traditional	0.1	0.4	0.1	0.5
To public	1.7	4.6	1.1	2.0
To private	1.1	1.4	1.2	1.3
Transport time (min):				
To traditional	5.4	10.9	7.5	23.6
To public	24.0	33.8	25.0	39.0
To private	24.6	31.7	26.3	38.8
Waiting time (min):				
Traditional	3.4	15.1	4.2	18.0
Public	4.2	6.9	3.5	6.1
Private	4.5	8.4	3.3	7.3
Usually examined by a doctor:				
Public (0 = no, 1 = yes)	0.6	0.5	0.5	0.5
Private (0 = no, 1 = yes)	0.8	0.4	1.0	0.1
Traditional practitioner does not treat five common illnesses (0 = does treat, 1 = does not)	0.2	0.4	0.1	0.3
Drug cost index (P):				
Traditional	0.2	0.7	0.4	1.4
Public	18.1	43.8	22.7	49.2
Private	179.6	227.9	273.6	282.7
Sick person insured (1 = insured)	0.1	0.3	0.1	0.3
Current value of household assets (P)	5,197	12,540	4,240	12,111
Age of sick person (years)	40.3	17.5	5.0	3.7
Sex of sick person (0 = female, 1 = male)	0.5	0.5	0.5	0.5
Location of residence (0 = rural, 1 = urban)	0.2	0.4	0.3	0.4
Education of sick adult (or mother, for children) (completed grades)	6.6	3.6	7.3	3.3
Seriousness of illness (0 = not serious, 1 = serious)	0.3	0.4	0.2	0.4
Mother either works at home or does not work (1 = home)	...	...	0.8	0.4

Source: Akin, et al. (1986)

Annex 9  
SAMPLE STATISTICS FOR PRENATAL, DELIVERY, WELL-BABY, AND INFANT IMMUNIZATION MODELS

Independent Variables	Prenatal		Delivery		Well-Baby		Immunizations	
Visit price:								
Public	0.4	(1.2)	26.9	(35.8) *	0.5	(1.4)	1.5	(6.1)
Private	9.0	(9.4)	...	(21.9)	...	...	...	...
Traditional	...		36.2		...	...	...	...
Transport cost:								
Public	1.5	(3.0)	...		1.5	(2.9)	1.5	(2.9)
Private	1.1	(1.4)	...		...	...	...	...
Transport time:								
Public	30.5	(40.0)	23.9	(34.4) *	31.1	(40.5)	30.1	(40.5)
Private	25.9	(31.2)	...		...	...	...	...
Traditional	...		3.4	(5.9)	...	...	...	...
Waiting:								
Public	2.9	(5.8)	...		6.6	(15.7)	4.1	(11.8)
Private	4.7	(10.5)	...		...	...	...	...
Modern practitioner (1 = physician)	...		0.1	(0.2)	...	...	...	...
Health insurance (0 = no, 1 = yes)	0.1	(0.3)	0.1	(0.3)	0.1	(0.3)	0.1	(0.3)
Asset value	3,236	(11,226)	3,744	(11,840)	3,466	(12,188)	3,474	(12,132)
Mother's age	31.3	(6.5)	30.5	(6.9)	31.2	(6.4)	31.3	(6.4)
Residence (0 = rural, 1 = urban)	0.2	(0.4)	0.2	(0.4)	0.2	(0.4)	0.2	(0.4)
Mother's education	7.5	(3.1)	7.5	(3.1)	7.5	(3.1)	7.5	(3.1)
No. of living children	4.5	(2.7)	4.8	(2.7)	4.7	(2.6)	4.6	(2.6)
Baby's sex (1 = male)	...		...		0.5	(0.5)	0.5	(0.5)
Modern delivery (1 = modern)	...		...		0.4	(0.5)	0.4	(0.5)
Mother home? (1= stays home)	0.9	(0.4)	...		0.9	(0.3)	0.9	(0.3)

NOTE - Numbers without parentheses are means. Those in parentheses are SD.

\* Delivery cost variables are for the nearest modern practitioner, whether public or private, but the statistics are listed under "public" to save space.

Source: Akin, et al. (1986)

Annex 10  
Multiple Logit Results for Adult Patient

Independent Variables	$\frac{P(\text{Pub})}{P(\text{Trad})}$	$\frac{P(\text{Priv})}{P(\text{Trad})}$	$\frac{P(\text{None})}{P(\text{Trad})}$	$\frac{P(\text{Priv})}{P(\text{Pub})}$	$\frac{P(\text{None})}{P(\text{Pub})}$	$\frac{P(\text{None})}{P(\text{Priv})}$
Constant	2.428	1.677	3.409	- 0.751	0.980	1.731
Traditional cash price	0.195	0.166	0.207	- 0.029	0.013	0.042
Public cash price	0.587 **	0.427 *	0.454 **	- 0.160	- 0.133	0.027
Private cash price	- 0.003	- 0.019	- 0.020	- 0.016	- 0.018	- 0.002
Traditional transport cost	0.569	0.420	0.418	- 0.149	- 0.152	- 0.002
Public transport cost	- 0.281	- 0.065	- 0.038	0.216	0.243	0.028
Private transport cost	- 0.503	- 0.277	- 0.350	0.226	0.153	- 0.074
Traditional transport time	- 0.013	- 0.043 *	- 0.018	- 0.030	- 0.005	0.025
Public transport time	0.014	0.003	0.006	- 0.011	- 0.007	0.004
Private transport time	0.002	- 0.002	- 0.003	- 0.003	- 0.004	0.000
Traditional wait time	- 0.001	0.011	- 0.003	0.012	- 0.002	- 0.014
Public wait time	0.021	- 0.030	0.029	- 0.051	0.008	0.059 **
Private wait time	- 0.044	- 0.015	- 0.051 *	0.029	- 0.007	- 0.035
Usually examined by doctor - public	0.083	0.541	0.520	0.458	0.437	- 0.021
Usually examined by doctor - private	- 1.560	- 1.378	- 0.797	0.180	0.761	0.581
Traditional practitioner, not treat five ills	0.675	0.730	1.191 **	0.054	0.516	0.461
Traditional drug cost	0.540	0.442	0.470	- 0.098	- 0.071	0.027
Public drug cost	- 0.017 ***	- 0.022 ***	- 0.015 ***	- 0.004	0.003	0.007
Private drug cost	- 0.003 **	0.000	- 0.001	0.003 **	0.001	- 0.001
Sick person insured (1 = yes)	9.239	9.790	10.090	0.546	0.853	0.307
Current value of household assets	0.000	0.000 *	0.000 *	0.000	0.000	0.000
Age of patient	- 0.006	0.000	- 0.023 *	0.006	- 0.017	- 0.024 ***
Sex (0 = female, 1 = male)	- 0.535	0.054	0.236	0.789 **	0.771 **	- 0.019
Urban (0 = rural, 1 = urban)	- 0.205	0.206	- 0.029	0.411	0.176	- 0.236
Education of sick person	- 0.012	- 0.032	- 0.112 *	- 0.021	- 0.101 *	- 0.080 *
Serious illness (1 = serious)	0.343	0.902 **	- 0.782 *	0.559	- 1.126 ***	- 1.685 ***

Note: - P = probability; Pub = public visit; Trad = traditional visit; Priv = private visit; None = no visit;  $P(\text{Pub}) / P(\text{Trad})$  = natural log of the probability of a public visit relative to a traditional visit; N = 401.

\* Significance at 0.10 level.

\*\* Significance at 0.05 level.

\*\*\* Significance at level 0.01 level.

Source: Akin et.al.(1986).

Annex 11  
Multiple Logit Results for Child Outpatients, Ages 0-13

Independent Variables	P(Pub) P(Trad)	P(Priv) P(Trad)	P(None) P(Trad)	P(Priv) P(Pub)	P(None) P(Pub)	P(None) P(Priv)
Constant	- 8.949	- 0.799	- 12.020	8.149	- 3.074	- 11.220
Traditional cash price	0.077	0.147	0.362 ***	0.070	0.285 ***	0.215
Public cash price	- 0.176	- 0.267 *	- 0.033	- 0.091	0.142	0.233
Private cash price	- 0.021	0.008	- 0.036	0.030	- 0.015	- 0.045
Traditional transport cost	0.666	0.020	0.068	- 0.646	- 0.598	0.048
Public transport cost	0.037	- 0.049	0.052	- 0.086	0.015	0.100
Private transport cost	- 0.016	- 0.017	0.152	- 0.001	0.168	0.169
Traditional transport time	0.002	0.013	0.014	0.011	0.012	0.000
Public transport time	- 0.017	0.018	- 0.003	0.036 **	0.014	- 0.022
Private transport time	0.006	- 0.021	- 0.004	- 0.027 *	- 0.009	0.018
Traditional wait time	- 0.019	- 0.009	- 0.004	0.010	0.015	0.005
Public wait time	0.040	- 0.003	0.023	- 0.042	- 0.017	0.026 **
Private wait time	- 0.045	- 0.034	- 0.019	0.010	0.026	0.016
Usually examined by doctor - public	0.147	- 0.247	- 0.173	- 0.394	- 0.320	0.073
Usually examined by doctor - private	9.767	0.706	12.440	- 9.062	2.668	0.117
Traditional practitioner, not treat five ills	0.484	0.880	0.173	0.397	- 0.311	- 0.708
Traditional drug cost	0.054	0.112	0.094	0.058	0.040	- 0.018
Public drug cost	- 0.004	- 0.007 *	- 0.001	- 0.003	0.003	0.006
Private drug cost	- 0.000	0.000	0.000	0.000	0.000	0.000
Sick child insured (1 = yes)	- 0.135	0.431	0.293	0.567	0.429	- 0.138
Current value of household assets	0.000	0.000	0.000	0.000	0.000	0.000
Age of child	- 0.031	- 0.020	0.116 ***	0.010	0.147 ***	0.137 ***
Sex (0 = female, 1 = male)	0.008	- 0.144	- 0.312	- 0.153	- 0.320	- 0.167
Urban (0 = rural, 1 = urban)	0.629	0.088	- 0.043	- 0.541	- 0.672 *	- 0.131
Education of mother	0.050	0.107 *	0.010	0.057	- 0.040	- 0.097 *
Serious illness (1 = serious)	- 0.301	0.566	- 1.138 ***	0.867 ***	- 0.837 **	- 1.704 ***
Mother home ? (1 = stays home)	- 0.278	0.195	0.274	0.474	0.552 *	0.078

Note: - P = probability; Pub = public visit; Trad = traditional visit; Priv = private visit; None = no visit; P(Pub) / PTrad = natural log of the probability of a public visit relative to a traditional visit; N = 566.

\* Significance at 0.10 level.

\*\* Significance at 0.05 level.

\*\*\* Significance at level 0.01 level.

Source: Akin et.al.(1986).

Annex 12  
Multiple Tobit Results for Choice of Modern Clinic Delivery, Modern Home  
Delivery, or Traditional Home Delivery

Independent Variables	<u>P(Modern Clinic)</u>		<u>P(Trad Home)</u>	<u>P(Trad Home)</u>
	<u>P(Modern Home)</u>		<u>P(Modern Home)</u>	<u>P(Mod Clinic)</u>
Constant	-	4.595	1.250	5.845
Price of home delivery - traditional midwife		0.010	0.007	- 0.003
Price of home delivery - closest modern practitioner		0.014 ***	0.000	- 0.014 ***
Transport time for traditional midwife		0.000	- 0.009	- 0.009
Transport time to closest modern facility		0.002	0.010 *	0.008
Modern home practitioner is a physician	-	2.215 *	- 0.229	1.985 *
Mother insured (0 = not insured, 1 = insured)	-	0.364	- 0.233	0.131
Current value of household assets		0.000	- 0.000	- 0.000
Age of mother		0.025	- 0.005	- 0.030
Location of residence (0 = rural; 1 = urban)		0.335	- 0.685 ***	- 1.020 **
Mother's education		0.189 ***	- 0.077 *	- 0.266 ***
No. of living children	-	0.029	0.027	0.056

Note: -P = probability; Trad = traditional midwife; Mod = modern trained attendant;  
 $P(\text{Modern Clinic}) / P(\text{Modern Home})$  = natural log of the probability of a modern clinic delivery relative to a modern home delivery; N = 482.

\* Significant at .10 level. \*\* Significant at .05 level. \*\*\* Significant at .01 level.

Source: Akin, et al. (1986)

Annex 13  
Tobit Results for Number of Prenatal Visits

Independent Variables	Coefficient		Asymptotic T-Statistic
Constant	- 4.517	-	2.459
Price of prenatal visit - public	- 0.44	-	2.046
Price of prenatal visit - private	- 0.310	-	1.130
Transport cost to public facility	0.111		1.150
Transport cost to private facility	0.239		0.707
Transport time to public facility	- 0.019 *	-	2.022
Transport time to private facility	- 0.023	-	1.413
Usual wait for prenatal visit - public facility	0.017		0.374
Usual wait for prenatal visit - private facility	- 0.01	-	0.382
Mother covered by health insurance ( 0 = no; 1 = yes )	- 0.202	-	0.216
Current value of household assets	0.000 *		2.570
Mother's age	0.155 **		2.594
Location of residence (0 = rural; 1 = urban)	1.371		2.117
Mother's education	0.328 **		3.637
No. of living children	- 0.36 **	-	2.413
Mother works at home or does not work (0 = works away, 1 = stays at home)	- 0.420	-	0.594

Note: - N = 495. \* Significant at .05 level. \*\* Significant at .01 level.

Source: Akin, et al. (1986)

Annex 14  
Probit Results for Decision to Seek Well-Baby Care

Independent Variables	Coefficient		Asymptotic T-Statistic
Constant	- 1.546	-	3.020
Price of well-baby visit - closest public facility offering well-baby care	- 0.053	-	1.088
Transport cost to public facility	- 0.050	-	1.101
Transport time to public facility	0.000 ***	-	0.079
Usual wait for well-baby visit - public facility	0.014		3.162
Mother covered by health insurance ( 0 = no; 1 = yes )	0.246		0.865
Current value of household assets	- 0.000 ***	-	2.634
Mother's age	- 0.002	-	0.091
Location of residence (0 = rural; 1 = urban)	0.319 *		1.866
Mother's education	0.091 ***		3.414
No. of living children	0.023		0.555
Sex of baby (0 = female, 1 = male)	0.157		1.175
Type of delivery (0 = traditional, 1 = modern)	0.395 ***		2.729
Mother works at home or does not work (0 = works away, 1 = stays at home)	0.409 **		1.988

Note: -2.0 times the log of the likelihood ratio = 25.9906; regression significant at .01 level; N = 407.

\* Significant at .01 level. \*\* Significant at .05 level. \*\*\* Significant at .01 level.

Source: Akin, et al. (1986)

Annex 15  
Probit Results for Decision to Seek Infant Immunization

Independent Variables	Coefficient	Asymptotic T-Statistic
Constant	- 3.548	- 4.156
Price of immunization - closest public facility offering immunization	0.029 *	1.699
Transport cost to public facility	0.034	0.622
Transport time to public facility	- 0.011	- 1.472
Usual wait for immunization visit - public facility	0.004	0.416
Mother covered by health insurance ( 0 = no; 1 = yes )	0.771	2.359
Current value of household assets	- 0.000	- 1.349
Mother's age	0.074 ***	2.811
Location of residence (0 = rural; 1 = urban)	- 0.267	- 0.951
Mother's education	0.063 *	1.697
No. of living children	- 0.153 ***	- 2.229
Sex of baby (0 = female, 1 = male)	- 0.039	- 0.178
Type of delivery (0 = traditional, 1 = modern)	0.031	0.131
Mother works at home or does not work (0 = works away, 1 = stays at home)	0.041	0.125

Note: - -2.0 times the log of the likelihood ratio = 56.004; regression significant at .025 level, N = 406.

\* Significant at .10 level. \*\* Significant at .05 level. \*\*\* Significant at .01 level.

Source: Akin, et al. (1986)

**Annex 16**  
**Descriptive statistics for sick children**

Variable	Mean	SD
Went to a public alternative <sup>a</sup>	0.30	0.46
Went to a private alternative <sup>a</sup>	0.22	0.41
Stayed at home	0.48	0.50
Monthly family <sup>a</sup> income <sup>b</sup>	779.72	674.16
Price of visit to public alternative <sup>b</sup>	41.29	21.04
Price of visit to private alternative <sup>b</sup>	63.44	26.84
Price of home care <sup>b</sup>	35.81	17.26
Travel time to public alternative <sup>c</sup>	16.58	8.68
Travel time to private alternative <sup>c</sup>	16.47	7.13
Age	4.82	4.14
Education of household head (high school) <sup>a</sup>	0.28	0.45
Family size	7.35	2.80
Male <sup>a</sup>	0.51	0.50
Seriousness <sup>a</sup>	0.24	0.43
Urban <sup>a</sup>	0.41	0.49
Probability seen by a doctor in public alternative	0.38	0.21
Probability seen by a doctor in private alternative	0.96	0.05
Probability seen by a doctor at home	0.04	0.03
Sample Size	520	

<sup>a</sup> Dummy variable ( = 1 if answer is yes, = 0 otherwise) .

<sup>b</sup> Reported in the Philippine pesos. The exchange rate in 1981 was approximately 8 pesos per U. S. dollar.

<sup>c</sup> Travel time is reported in minutes.

Source: Ching (1991)

**Annex 17**  
**Mixed/ Conditional logit parameter estimates**  
**and t-statistics for sick children**

Variable	Coefficient	t-ratio
<b>All Alternatives <sup>a</sup></b>		
Consumption	0.25	53.64
Consumption squared	-0.35x10 <sup>-4</sup>	-20.89
Travel time	-1.08	-94.60
Prob. seen by doctor	-26.10	-58.94
<b>Public Alternative <sup>b</sup></b>		
Age	-0.48	-14.65
Education of household head	-12.05	-49.99
Male	-11.40	-53.40
Family size	-1.54	-41.02
Seriousness	-20.60	-70.85
Urban	-8.36	-32.91
Constant	78.49	411.61
<b>Private Alternative <sup>b</sup></b>		
Age	-1.04	-32.75
Education of household head	-12.68	-47.61
Male	-19.44	-81.02
Family size	-0.96	-24.40
Seriousness	-6.67	-21.62
Urban	-8.86	-35.92
Constant	88.95	394.60

<sup>a</sup> Only a single coefficient is estimated for each explanatory variable whose observational values vary across alternatives in the mixed / conditional logit model.

<sup>b</sup> Only a single coefficient is estimated for each explanatory variable whose observational values vary across alternatives in the mixed / conditional logit model, where J is the number of alternatives.

**Annex 18**  
**Maximum Likelihood Probit (Weighted) Estimates of Illness of**  
**Children Below 7 Years**

Independent Variables	Probability of Fever	Probability of Diarrhea
Intercept	-0.219	(0.80)*
Dummy (0-1), age below 6 months	0.803	(-5.41)*
Dummy (0-1), age 7-24 months	-0.358	(-4.19)*
Dummy (0-1), age 25-48 months	-0.173	(-1.78)*
Dummy (0-1), age above 48 months	-0.361	(-3.48)*
Total expenditures per adult equivalent unit	-0.081	(-0.52)*
Percent women's income total expenditures	-0.011	(3.95)*
Sex (1=male; 0=female)	-0.076	(-0.81)*
Birth order	-0.915	(-2.73)
Nutritional status dummy (1 = below 75% WA)	0.116	(1.71)*
Nutrition education dummy	-0.165	(-1.43)
Water supply dummy	0.017	(0.11)
Toilet dummy	0.132	(0.93)
Food assistance dummy	-0.293	(-2.27)*
Breastfeeding dummy	-0.238	(-2.10)*
Household size	-0.012	(-0.30)*
Education of the mother	-0.070	(-3.59)*
Age of mother, years	-0.020	(-2.23)*
Price of rice	0.121	(2.03)*
Price of cooking oil	0.006	(1.81)*
Price of non-food items	0.004	(4.24)*
Dummy Antique province	-0.265	(-1.77)*
Dummy South Cotabato province	-0.534	(-3.97)*
-2 log likelihood	-1,130.6	-928.7
Chi-squared	252.2	225.0
Number of observations	1,822	1,822

Note: Figures in parentheses are t-statistics.

Asterisks indicate significance level of 0.10 or better.

Source: Garcia (1990)

**Annex 19**  
**Determinants of Average Daily Calorie and Protein**  
**Intake (g.) of Preschoolers**

Independent variable	Calorie	Protein
Constant	35.16	23.20
Labor force participation of mother	145.40 **	3.10
Mother's Education	32.60 *	-0.02
Mothers Age	21.50 ***	0.30 *
Per capita income of other HH members	-6.00	-0.02
Electricity at home	30.50	2.40
Number of children aged 0-1 yr.	-176.40 **	-6.60 **
Number of children aged 1-6 yr.	-51.00	-1.80
Number of boys aged 7-15 yrs.	71.30 **	2.10 **
Number of girls aged 7-12 yrs.	60.00	2.70 **
Number of girls aged 13-15 yrs.	10.50	-0.80
Number of children aged 16-24 yrs.	-1.10	-0.90
Number of others living in the household	95.30 **	-2.10 *
Adj. R-Sqr.	0.48	0.28
F	8.39	4.13
n	70	70

\*\*\* Significant at .01 level

\*\* Significant at .05 level

\* Significant at .10 level

Source: Popkin (1983).

**Annex 20**  
**FACTORS ASSOCIATED WITH LAGUNA PRESCHOOLERS' PERCENTAGE  
 OF STANDARD WEIGHT BY AGE GROUP: REGRESSION**

Factors	Total	Age Group		
		6-23 months	24-47 months	48-83 months
		A	B	C
Income of others per capita	0.19 (2.238)**	0.04 (0.134)	0.12 (0.982)	0.26 (2.738)*
Level of education of mother	1.01 (2.487)*	1.90 (1.431)***	1.18 (1.583)***	0.63 (1.588)***
Age of child	-0.15 (-5.056)*	-1.39 (-3.566)*	0.4 (2.186)**	-0.08 (-1.313)***
Sex of child	-3.01 (-2.330)*	-4.86 (1.257)	-1.32 (-0.563)	-2.92 (-2.222)**
Mother's percentage of weight for height	0.07 (1.841)**	0.24 (1.951)**	0.06 (0.809)	0.02 (0.727)
Number of children from zero to six years	-1.82 (2.587)*	-1.11 (-0.484)	3.22 (-2.355)*	1.86 (-2.763)*
Constant	81.29	82.89	62.42	81.97
R <sup>2</sup>	0.09	0.15	0.09	0.08
$\bar{R}^2$	0.08	0.14	0.06	0.06
F	9.85*	3.27**	2.65***	4.16**
Cases	578	128	165	285

Note: The t-values are in parentheses. Levels of significance: \*\*\* =10% level; \*\* = 5% level; \* = 1% level.

Variable	Definition
Per cent of standard weight	Measure of child's nutritional status: $\frac{\text{actual weight of child}}{\text{standard weight for age and sex}} \times 100$ (Harvard std at 50th percentile)
Income of others per capita	Total household income less mother's income divided by household size (P100 units)
Level of education of mother	0-9 range: levels of formal schooling
Age of child	Age in months
Sex of child	1 = male 2 = female
Mother's percentage of weight for height	Mother's current nutritional status: $\frac{\text{actual weight of mother}}{\text{std weight for given height}} \times 100$ (Jelliffe std for women at 90th percentile)
No. of children 0-7 years	Incl. child himself + all children 0-83 months
Net wealth	Value of assets less liabilities, P1000 units
Participates in labor force	1 = mother participates; 0 = otherwise

Source: Battad (1978)

**Annex 21**  
**REGRESSION: FACTORS ASSOCIATED WITH LAGUNA PRESCHOOLERS' PERCENTAGE  
OF STANDARD WEIGHT INCLUDING WEALTH AND MOTHER'S  
OCCUPATIONAL STATUS BY AGE GROUP**

Factors	Total	Age Group		
		6-23 months	24-47 months	48-83 months
		A	B	C
Income of others per capita	0.16 (1.869)**	-0.01 (0.132)	0.08 (0.616)	0.27 (2.746)*
Level of education of mother	1.04 (2.558)*	1.94 (1.475)***	0.89 (1.172)	0.59 (1.422)***
Age of child	-0.15 (-4.961)*	-1.35 (-3.394)*	0.37 (2.032)**	-0.08 (-1.316)***
Sex of child	-3.05 (-2.361)*	-4.71 (-1.226)	-1.22 (-0.524)	-2.78 (-2.072)**
Mother's percentage of weight for height	0.06 (1.734)**	0.22 (1.811)**	0.06 (0.810)	0.02 (0.713)
Number of children from zero to six years	-2 (-2.833)*	-1.78 (-0.773)	-3.32 (-2.430)*	-1.84 (-2.706)*
Mother participates in labor force	-2 (-1.430)***	-5.45 (-1.202)	-2.35 (-0.957)	0.76 (0.530)
Net wealth	0.07 (1.743)**	0.15 (1.384)***	0.2 (1.631)***	0.01 (0.351)
Constant	82.35	85.99	64.29	81.44
R <sup>2</sup>	0.1	0.16	0.11	0.08
$\bar{R}^2$	0.09	0.12	0.07	0.06
F	0.08*	2.93**	2.42***	3.15**
Cases	578	128	165	285

Note: The t-values are in parentheses. Levels of significance: \*\*\* =10% level; \*\* = 5% level; \* = 1% level.

Variable	Definition
Per cent of standard weight	Measure of child's nutritional status: $\frac{\text{actual weight of child}}{\text{standard weight for age}} \times 100$ and sex (Harvard std at 50th percentile)
Income of others per capita	Total household income less mother's income divided by household size (P100 units)
Level of education of mother	0-9 range: levels of formal schooling
Age of child	Age in months
Sex of child	1 = male 2 = female
Mother's percentage of weight for height	Mother's current nutritional status: $\frac{\text{actual weight of mother}}{\text{std weight for given height}} \times 100$ (Jelliffe std for women at 90th percentile)
No. of children 0-7 years	Incl. child himself + all children 0-83 months
Net wealth	Value of assets less liabilities, P1000 units
Participates in labor force	1 = mother participates; 0 = otherwise

Source: Battad (1978)

**Annex 22**  
**REGRESSION: FACTORS ASSOCIATED WITH LAGUNA PRESCHOOLERS' PERCENTAGE  
OF STANDARD WEIGHT INCLUDING OCCURENCE OF DISEASE BY AGE GROUP**

Factors	Total	Age Group		
		6-23 months	24-47 months	48-83 months
		A	B	C
Income of others per capita	0.19 (2.213)**	0.06 (0.184)	0.13 (1.100)	0.25 (2.600)*
Level of education of mother	0.94 (2.310)*	1.86 (1.412)***	1.06 (1.41)***	0.61 (1.529)***
Age of child	-0.16 (-5.460)*	-1.38 (-3.557)*	0.36 (1.935)**	-0.09 (-1.433)***
Sex of child	-2.94 (-2.283)*	-4.84 (-1.257)	-1.29 (-0.557)	-2.87 (-2.182)**
Mother's percentage of weight for height	0.07 (1.895)**	0.26 (2.177)**	0.06 (0.798)	0.02 (0.710)
Children aged 0 - 6 years	-1.67 (-2.378)*	-0.55 (-0.239)	-2.8 (-1.982)**	-1.88 (-2.790)*
Got sick	-3.05 (-2.278)**	-5.76 (-1.384)***	-2.71 (-1.112)	-1.19 (-0.855)
Constant	82.74	81.84	64.49	83.14
R <sup>2</sup>	0.1	0.15	0.1	0.08
$\bar{R}^2$	0.09	0.11	0.06	0.06
F	9.24*	3.10**	2.45***	3.66**
Cases	578	128	165	285

Note: The t-values are in parentheses. Levels of significance: \*\*\* =10% level; \*\* = 5% level; \* = 1% level.

Source: Battad (1978).

**Annex 23**  
**Maximum Likelihood Probit (Weighted) Estimates of Malnutrition**  
**of Children Below 7 Years**

Independent Variables	Probability of Child Underweight		Probability of Child Wasting		Probability of Child Stunting	
Intercept	0.871	(0.87)	-0.043	(-0.58)	-0.139	(-1.37)
Dummy (0-1), age below 6 months	-0.226	0	-0.142	(-3.58)*	-0.068	(-1.15)
Dummy (0-1), age 7-24 months	-0.103	(-3.51)*	-0.079	(0.35)	-0.044	(-1.46)
Dummy (0-1), age 25-48 months	0.034	(0.98)	0.035	(1.37)	0.008	(0.24)
Dummy (0-1), age above 48 months	0.053	(1.45)	0.007	(0.02)	-0.036	(0.97)
Total expenditures per adult equivalent unit	-0.003	(-0.60)	-0.013	(-3.54)*	0.017	(0.33)
(Total expenditures per adult equivalent unit) <sup>2</sup>	-0.002	(-0.62)	-0.107	(-3.37)*	0.055	(1.24)
Percent women's income total expenditures	0.075	(1.70)*	0.144	(0.42)	-0.078	(-1.71)*
Sex (1=male; 0=female)	-0.083	(-2.56)*	-0.043	(-1.77)*	-0.053	(-1.61)
Birth order	0.010	(0.67)	0.009	(1.15)	-0.025	(2.14)*
Diarrhea dummy	0.173	(1.99)*	0.034	(0.53)	-0.204	(-2.32)*
Fever dummy	0.018	(2.02)*	0.012	(0.31)	-0.116	(-2.10)*
Food subsidy dummy	-0.087	(-2.17)*	-0.019	-0.96	-0.006	(-0.21)
Nutrition education dummy	-0.038	(-0.96)	-0.089	(-2.97)	0.022	(0.54)
Water supply dummy	-0.132	(-2.51)	0.051	(1.29)	-0.165	(-3.04)*
Toilet dummy	0.056	(1.14)	0.134	(3.61)	-0.030	(0.60)
Food assistance dummy	-0.009	(-2.14)*	0.016	(0.51)	0.031	(0.98)
Breastfeeding dummy	0.039	(1.06)	0.066	(2.27)*	0.054	(1.36)
Household size	-0.029	(-2.05)*	-0.001	(-0.15)	0.009	(0.62)
Education of the mother	0.007	(1.18)	0.002	(0.47)	0.006	(0.94)
Age of mother	0.013	(1.15)	-0.004	(-1.87)*	-0.007	(-1.97)*
Price of rice	-0.024	(1.21)	0.004	(0.33)	-0.096	(-4.74)*
Price of cooking oil	0.002	(1.65)	0.002	(2.26)	0.001	(0.98)
Price of non-food items	0.001	(0.36)	-0.003	(-0.13)	-0.007	(0.21)
Dummy Antique province	-0.093	(-1.79)	-0.227	(-5.76)*	0.087	(1.61)*
Dummy South Cotabato province	-0.026	(-0.55)	-0.177	(-4.96)*	0.212	(4.31)
-2 log likelihood	-1.137		-620		-1.193	
Chi-squared	149.33		142.70		119.62	
Number of observations	1,822		1,822		1,822	

Note: Figures in parentheses are t-statistics.

Asterisks indicate significance level of 0.10 or better.

<sup>a</sup> Underweight defined as < - 2.0 ZWA.

<sup>b</sup> Wasting defined as < - 2.0 ZWH.

<sup>c</sup> Stunting defined as < - 2.0 ZHA.

Source: Garcia (1990)

**Annex 24**  
**Preschooler Nutritional Status, Dietary Intake and Child Care Time**

Independent Variables	Average Child Weight as Percentage of Normal Weight for Age	Ave. Child Height as Percentage of Normal Height for Age
Constant	69.2	70.7
Predicted per capita child care time of		
Father	-0.01	-0.10
Mother	0.01	0.04 *
Siblings	-0.10 *	-0.10 *
Ave. predicted preschooler intake of		
Calorie	0.0004	-0.0002
Protein	0.0400	0.0400
Percentage mother's weight to height	0.04	0.05
Piped water in house	0.47	1.00
R-Sqr		
Ajusted R-Sqr.	0.01	0.01
F	0.93	0.90
N	68	68

\* - significant at .05 level.

Source: Popkin (1983)

**Annex 25**  
**Definitions of Explanatory Variables and Descriptive Statistics for**  
**Exogenous Explanatory Variables, Children Aged 7 through 17, n = 2,679**

Variable	Definition	Mean	Standard Deviation
<i>Characteristics of child</i>			
Male child	Sex of child, 1=male	0.539	0.499
Age	Age of child in completed years	11.799	3.061
<i>Characteristics of household</i>			
Mother's education	Mother's completed years of school	5.827	2.756
Mother's age	Age of mother in completed years	41.814	7.730
Land holdings	Value of land owned, in thousands of pesos	5.079	22.797
Siblings aged 0-6	Number of siblings aged 0 to 6	1.291	1.227
Younger, female (7-17)	Number of younger female siblings of school age ( age 7-17 )	0.606	0.830
Younger, male (7-17)	Number of younger male siblings of school age ( age 7-17 )	0.649	0.858
Older, female (7-17)	Number of older female siblings of school age ( age 7-17 )	0.813	0.995
Older, male (7-17)	Number of older male siblings of school age ( age 7-17 )	1.071	1.126
Number of male adults	Number of males aged 18 or older	1.602	1.010
Number of female adults	Number of females aged 18 or older	1.573	0.934
Travel time	Perceived travel time from house to nearest high school in minutes	30.040	42.267
Family business	Family derives some income from family business, 1=yes	0.467	0.499
Housing material	Material house constructed of, 1 = least sturdy, 3 - most sturdy	1.313	0.588
<i>Characteristics of community</i>			
Urban	Family resides in urban barangay, 1 = yes	0.186	0.389
Semi-urban	Family resides in semi-urban barangay, 1 = yes	0.091	0.389
Log child wage	Natural logarithm of average community agriculture and service wage for children	1.727	0.886
Community electricity	Electricity in barangay, 1 = yes	0.807	0.395
Day care center	Day care center in barangay, 1 = yes	0.511	0.500

Source: DeGraff, et. al. (1993)

**Annex 26**  
**Results of Structural Model for School Enrollment, Market Work,**  
**and Home Production; Children Aged 7 through 17**

Variable	School Enrollment	Market Work	Home Production
<i>Endogenous variables (predicted)</i>			
Enrolled	NA	0.198	1.231 ***
Market work	-1.701 ***	NA	0.140
Home production	-1.497 **	1.211 **	NA
<i>Characteristics of child</i>			
Male child	-0.230 **	0.476 ***	-0.166 **
Age	2.083 ***	0.067 **	0.104 ***
Age squared	-0.082 ***	NA	NA
<i>Characteristics of household</i>			
Mother's education	0.043 **	-0.059 ***	-0.013
Mother's age	-0.013 **	-0.001	0.006
Land holdings	0.001	-0.001	-0.000
Siblings aged 0-6	-0.072 **	-0.033	0.072 ***
Number of siblings			
Younger, female (7-17)	-0.100 **	-0.007	0.044
Younger, male (7-17)	-0.141 ***	0.006	0.045
Older, female (7-17)	-0.121 ***	-0.009	-0.031
Older, male (7-17)	-0.078 **	-0.107 ***	-0.018
Male adults	-0.034	-0.038	-0.051
Female adults	0.101 **	0.010	-0.054
Travel time	-0.002 ***	NA	NA
Family business	NA	0.269 ***	NA
Housing material	0.138 *	0.012	-0.163 ***
<i>Characteristics of community</i>			
Urban	-0.016	-0.270 ***	0.229 ***
Semi-urban	-0.152	-0.230 **	-0.200 **
Log child wage	NA	0.031	NA
Community electricity	NA	-0.253 ***	NA
Day care center	NA	NA	-0.215 ***
Constant	-9.511 ***	-1.810 ***	-1.723 ***
Chi-Squared	472.01	400.16	303.72
n	2417	2622	2622

Significance levels: \* = 10 percent, \*\* = 5 percent, \*\*\* = 1 percent

The results for province dummies and seasonality dummies ( market work equation only )  
are not reported.

Source: DeGraff, et. al. (1993)

## Annex 27

<b>A. DEPENDENT VARIABLE</b>		
EDUCATION/C		child's highest level of education completed (0 = no schooling, 1 = kindergarten, 2 = grade 1, 3 = grade 2, ....)
<b>B. INDEPENDENT VARIABLES*</b>		
AGE/C AFFECTED	(+) (-)	child's age (in years) 1 if barangay in an "affected" (disadvantaged) school district as classified by the PRODED (Program for Decentralized Education Development); 0 if in "unaffected" district
ASSET BORROWCAP	(+) (+)	total household assets (in thousand pesos) borrowing capacity; the maximum amount of money the household can borrow to finance children's education, if needed and wanted. 1 = less than 100 pesos, 2 = 100-499, 3 = 500-999, 4 = 1,000-1,499 5 = 1,500-1,999, 6 = more than 2,000
CONTROLAX	(-)	index of mother's attitudes and beliefs regarding the supervision, guidance and control of school children. Range: 6 (strict) - 24 (lax)
DISTANCES	(-)	distance of community to the nearest school offering intermediate classes (in kilometers)
DRIVE	(+)	mother's characterizations of child's interest/diligence in reading, writing, and arithmetic: 1 = low, 2 = average, 3 = high
EDUCATION/M ELECTRICITY	(+) (+)	mother's highest level of education completed 1 if electricity is available in the barangay; 0 otherwise
HEALTHCON	(+)	1 if child has chronic or persistent disease, 2 otherwise
HEALTHKAP	(+)	index of modernity in health-related beliefs. Range: 0 (very traditional) - 3 (less traditional)
INTELLIGENCE	(+)	mother's characterization of child's intelligence: 1 = low, 2 = average, 3 = intelligent
INTERESTRATE JOB/C	(-) (-)	interest rate indicator (percent) indicator of availability of unskilled jobs for 7-15 years old. Range: 0 (unavailable) - 10 (high available). Wet and dry season average.
LOOKDOWN	(+)	mother's perception about people's attitude to an illiterate. Her opinion on the statement "We Filipinos tend to look down on a person who is unable to read and write in whatever language"; 1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree
MEDIA	(+)	mass media exposure of parents: frequency household head and his wife listen to the radio, view television or read newspapers and magazines (1 = never, 2 = sometimes, 3 = often, 4 = very often)
RETURN1	(+)	perceived earnings differential between an average adult person without schooling and one whose highest educational attainment is grade six. (in thousand pesos)
RETURN2	(+)	perceived earnings differential an average adult person with college education and one whose highest educational attainment is grade six. (in thousand pesos)
RURAL SEX SIBLINGS WAGE/C	(-) (-) (-) (?)	1 if household is rural; 0 otherwise 1 if male; 2 female number of living siblings community daily wage rate for children 7-15 years old doing unskilled work (pesos: dry and wet season average)
WAGE/F WAGE/M	(+) (?)	"predicted" potential wage of father (pesos per hour) "predicted" potential wage of mother (pesos per hour)

\* Expected sign of regression coefficient in parentheses after variable name.

Source: Paqueo (1985).

**Annex 28**  
**Regression equation estimates relating child's educational  
attainment and selected socioeconomic variables: 1982 HSMS Data**

VARIABLES	AGE 7-12	AGE 7-13
INTERCEPT	-7.44632	-7.77067
AGE/C	0.91654	(76.70)*
ELECTRICITY	0.4060	(8.40)*
BORROWCAP	0.0606	(4.42)*
SEX	0.21697	(5.26)*
SIBLINGS	0.02031	(-2.17)*
CONTROLAX	-0.02344	(-2.18)*
DRIVE	0.35200	(5.25)*
WAGE/C	0.01535	(4.51)*
LOOKDOWN	0.14253	(-4.74)*
JOB/C	0.02452	(-2.87)*
WAGE/F	0.08317	(3.00)*
EDUCATION/M	0.07264	(4.23)*
RURAL	0.23073	(3.97)*
INTELLIGENCE	0.03926	(0.60)
HEALTHCON	0.38089	(3.60)*
HEALTHKAP	0.03995	(1.52)*
INTERSTRATE	-0.00069	(1.89)**
MEDIA	0.05142	(2.06)**
ASSET	0.00033	(1.80)**
WAGE/M	-0.1065	(-1.54)
DISTANCE2	0.00172	(1.5)
RETURN1	-0.0493	(-1.04)
RETURN2	-0.01581	(-0.50)
AFFECTED	0.01778	(0.24)
Dependent Var = EDUCATION/C		
R <sup>2</sup>	0.67	0.071
F	286	391
N	3414	3907

Note: Figures in parentheses are t-values. Asterisks denote level of significance: \* ( 1% ), \*\* ( 5% ), and \*\*\* ( 10% ).

Source: Paqueo (1985)

**Annex 29**  
**REGRESSION COEFFICIENTS OF MARKET PRODUCTION TIME**  
(t-values in parentheses)

INDEPENDENT VARIABLES	DEPENDENT VARIABLES	FATHER'S MARKET TIME	MOTHER'S MARKET TIME
Own wage	99.71 ( 3.20 )		6.16 ( 1.67 )
Own education	26.69 ( 2.31 )		16.82 ( 1.87 )
Own age	0.82 ( 0.08 )		-13.42 ( 1.73 )
Own-age <sup>2</sup>	-0.03 ( 0.22 )		0.26 ( 2.14 )
Wage of spouse	4.76 ( 0.88 )		13.01 ( 1.22 )
Education of spouse	-14.29 ( 1.08 )		12.50 ( 0.31 )
Children, 0-1 year	-7.16 ( 0.16 )		-37.43 ( 1.23 )
Children, 1-6 years	12.47 ( 0.61 )		-3.68 ( 0.27 )
Children, 7-15 years	18.97 ( 1.28 )		9.03 ( 0.90 )
Children, 16+ years	-14.78 ( 0.69 )		-8.90 ( 0.55 )
Farm wealth	7.31 ( 2.56 )		2.39 ( 1.15 )
Wet season	14.60 ( 0.37 )		20.78 ( 0.77 )
Cool season	16.34 ( 0.36 )		-5.17 ( 0.17 )
(Constant)	266.06		196.63
R <sup>2</sup>	0.108		0.118
Number of cases	291		291

Source: Quizon (1978)

**Annex 30**  
**REGRESSION COEFFICIENTS OF HOME PRODUCTION TIME**  
(t-values in parentheses)

INDEPENDENT VARIABLES	DEPENDENT VARIABLES	FATHER'S HOME PRODUCTION TIME	MOTHER'S HOME PRODUCTION TIME
Own wage	-5.10 ( 6.89 )		-3.53 ( 0.95 )
Own education	5.56 ( 1.27 )		-4.19 ( 0.44 )
Own age	3.32 ( 0.91 )		10.78 ( 1.39 )
Own age <sup>2</sup>	-0.07 ( 1.24 )		-0.24 ( 1.98 )
Wage of spouse	-0.28 ( 0.04 )		-27.22 ( 2.52 )
Education of spouse	7.51 ( 1.48 )		-6.46 ( 0.79 )
Children, 0-1 year	27.35 ( 1.65 )		186.77 ( 6.08 )
Children, 1-6 years	-1.05 ( 0.14 )		37.18 ( 2.65 )
Children, 7-15 years	-6.96 ( 1.32 )		-5.47 ( 0.56 )
Children, 16+ years	5.85 ( 0.73 )		12.60 ( 0.78 )
House	1.56 ( 1.55 )		-2.90 ( 1.55 )
Consumer durables	-9.18 ( 1.57 )		29.35 ( 2.69 )
Season 1 - wet	-30.67 ( 2.11 )		-8.13 ( 0.30 )
Season 2 - cool	-19.84 ( 1.20 )		-5.03 ( 0.16 )
(Constant)	88.06		363.20
$\bar{R}^2$	0.113		0.320
Number of cases	291		291

Source: Quizon (1978).

**Annex 31**  
**Determinants of Time Allocation of Wives, Second-Stage Regressions<sup>a</sup>**

Independent Variables	Household Tasks <sup>b</sup> (WLS Estimates)			Market Work <sup>c</sup> (Tobit Estimates)		
Intercept	8.914	(	6.43 ) *	-0.633	(	-0.95 )
Education of wife, years	-0.803	(	-4.82 ) *	1.206	(	8.23 ) *
Education of husband, years	-0.187	(	-1.13 )	-0.124	(	-0.88 )
Age of husband, years	0.245	(	6.4 ) *	0.049	(	1.21 )
Age of wife, years	-0.246	(	-3 ) *	0.163	(	4.78 ) *
Market production time, wife, fitted value	-0.617	(	-1.93 ) *	...	(	)
Home production time, wife, fitted value	...			-0.435	(	-2.01 ) *
Total expenditures per adult equivalent unit	-0.430	(	-3.9 ) *	-0.12	(	-1.96 ) *
Percent of children under 6	0.400	(	12.31 ) *	-0.112	(	-1.89 ) *
Dummy own farm	2.263	(	1.7 ) *	-2.094	(	-1.60 ) *
Number of adults	1.003	(	2.9 ) *	0.817	(	1.94 ) *
Dummy Antique province	0.213	(	0.3 ) *	-0.633	(	-0.95 )
Dummy South Cotabato province	2.993	(	3.3 ) *	-0.021	(	-0.30 )
Child care time, husband	...			0.416	(	4.17 ) *
Market production time, husband	...			-0.039	(	-1.88 ) *
F-value	39.41*					
R <sup>2</sup>	0.35					
Number of observations	841			841		
-2 Log Likelihood				-747.21		

Note: Figures in parentheses are t-values. Asterisks indicate significance at 0.10 level or better.

<sup>a</sup> Time expressed in terms of hours per week.

<sup>b</sup> Includes all household work, including child care

<sup>c</sup> Includes work outside home for salaries and wages and work on farm.

Source: Garcia (1990).

**Annex 32**  
**Determinants of Time Allocation of Husbands<sup>a</sup>**

Independent Variables	Household Tasks <sup>b</sup> (Tobit Estimates)			Market Work <sup>c</sup> (WLS Estimates)		
Intercept	0.713	(	1.63 ) *	10.974	(	5.43 ) *
Education of wife, years	0.066	(	1.31 )	0.727	(	2.98 ) *
Education of husband, years	0.021	(	0.41 )	0.581	(	2.50 ) *
Age of husband, years	0.004	(	0.31 )	0.177	(	2.70 )
Total expenditures per adult equivalent unit	0.552	(	1.61 ) *	-0.325	(	-1.91 ) *
Percent of children under 6	-0.035	(	-3.96 ) *	0.144	(	2.64 ) *
Dummy wife working (1=yes)	0.049	(	4.30 ) *	-2.174	(	-1.13 )
Dummy own farm	-0.443	(	-1.36 )	-21.322	(	-11.53 ) *
Number of adults	-0.191	(	-1.25 )	-0.180	(	-0.25 )
Dummy Antique province	-0.119	(	-0.50 )	4.710	(	4.33 ) *
Dummy South Cotabato province	-0.571	(	-2.56 ) *	-0.387	(	-0.34 )
F - value				27.65*		
R <sup>2</sup>				0.24		
Number of observations	828			828		
-2 Log likelihood	-667.36					

Note: Figures in parentheses are t-values. Asterisks indicate significance at 0.10 level or better.

<sup>a</sup> Time expressed in terms of hours per week.

<sup>b</sup> Includes all household work, including child care.

<sup>c</sup> Includes work outside home for salaries and wages and work on farm.

Source: Garcia (1990).

**Annex 33**  
**Determinants of Household Time Allocation of Rural Mothers**

	Child Care	Home Production	Leisure	Market Production
Constant	9.80	52.30	108.36	8.80
Labor force participation	-1.20	2.70	-27.70 ***	
Education	0.20	-1.80 ***	1.20 *	0.70
Age	-0.20 ***	-0.20 **	0.30 **	0.30 ***
Per capita income of other HH members	-0.03	-0.03	0.10	-0.20 **
Electricity	0.30	2.10	-2.90	-1.70
Number of children aged 0-1 yr.	10.70 ***	0.04	-6.50 **	-7.70 **
Number of children aged 1-6 yr.	5.30 ***	2.80 ***	-8.40 ***	1.20
Number of boys aged 7-15 yrs.	-0.20	0.40	0.93	-2.00 **
Number of girls aged 7-12 yrs.	-0.30	-1.50	0.70	3.20 **
Number of girls aged 13-15 yrs.	0.10	-1.60	0.30	0.30
Number of children aged 16-24 yrs.	-0.40	-1.50 **	1.70	0.30
Number of others living in the household	1.10	-2.10 **	0.90	-0.90
Adj. R-Sqr.	0.27	0.05	0.22	0.03
F	18.3	3.7	14.4	2.77
n	571	571	571	571

\*\*\* Significant at .01 level

\*\* Significant at .05 level

\* Significant at .10 level

Source: Popkin (1983)