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CHILD SURVIVAL, NUTRITIONAL STATUS AND HOUSEHOLD CHARACTERISTICS: EVIDENCE FROM BRAZIL

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Abstract

The economic model of the household predicts that child survival and indicators of child nutritional status should respond to parental investments in resources and time in a similar way. Using survey data from Brazil, this paper tests whether household characteristics affect child survival, height (conditional on age) and weight (conditional on height). Maternal education has a very strong positive effect on both child height and survival. Both outcomes are affected by father's education although to a lesser degree in the case of survival. Income effects are significant but small in magnitude. Parental height has a large positive impact on child height for age and on survival rates even after controlling for all other observable characteristics. This is the first time the association between child survival and parental height has been demonstrated empirically with micro–level data. There is, in addition, considerable inter–regional variation in Brazil; maternal education, height and household income tend to have bigger effects in the poorer Northeast.

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1. INTRODUCTION

This paper is concerned with child survival and indicators of child nutritional status. Nutritional status is known to affect basic demographic outcomes such as mortality levels. Deficient child nutrition can be directly related to low infant survival through low birthweight (eg. Chen, Chowdhury and Huffman, 1980; Lechtig et al., 1977; Martorell and Ho, 1984). Both child survival and nutrition outcomes are important components of household welfare and are used as indices of living standards. As indicators of the general health status of children child anthropometric outcomes may condition subsequent skill development as adults (Ciavioto and Arrieta, 1986) having a subsequent impact on adults' productivity and health.

Conditional on underlying individual and parental endowments, the economic model of the household would predict that both sets of outcomes respond to parental investments in resources and time in a similar way. We attempt to measure the impact of household characteristics — in particular household income, parental education and stature — on child survival, height and weight for height where the latter two are adopted as proxies for nutritional status. Height for age is usually considered to be a good measure of long–run nutrition status, whereas weight–for–height tends to reflect more short run fluctuations.[1]

The literatures on child anthropometrics and child survival have recently been surveyed by several authors. Cochrane, Leslie and Ohara (1982) review studies on both the determinants of child anthropometric outcomes and child survival, Martorell and Habicht (1986) present a nutrition scientists' view of the anthropometric literature. Schultz (1984) and Mensch, Lentzner and Preston (1986) survey the child survival literature. Although the interdependence of child nutrition status and child survival is recognized, apart from Wolfe and Behrman (1982), there is little intersection of the two literatures on their underlying socio–economic determinants. This paper attempts to bridge this gap. We provide evidence that child survival probabilities and indicators of child nutrition status do indeed respond similarly to socio–economic determinants.

The child survival literature has documented the importance of maternal education (Caldwell, 1979;

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[1]See Waterlow et. al. (1977) for a discussion of using child anthropometric measurements as indicators of nutritional status. Fogel (1986b) uses height extensively to measure the long run economic well being of eighteenth and nineteenth century populations.

Schultz, 1980; Farah and Preston, 1982; Rosenzweig and Schultz, 1982; Mensch, Lentzner and Preston, 1986). Its importance for child nutrition outcomes has been demonstrated less often, partly because of flaws in many of the early analyses and partly because of small sample sizes (see for example Delgado et al., 1986).

An important difficulty existing in former studies relates to the modeling problems resulting from not maintaining a clear distinction between estimating the production of child nutrition outcomes (or its proximate determinants) and indirect relationships (or reduced form). For instance, Wolfe and Behrman (1982) use birthweight to explain child mortality; child height and weight are regressed on household caloric intake and months of breastfeeding. Although these variables surely belong in production functions for survival and anthropometric outcomes, they are jointly endogenous. The problems of simultaneity are typically not addressed but see Rosenzweig and Schultz, (1983) and Pitt and Rosenzweig, (1986) for exceptions.

Those studies which have examined child heights or weights have been constrained to small sample sizes (Behrman and Deolalikar, 1985; Strauss, 1986) and/or little socio–economic information. Reduced form results have therefore been hard to establish. On the other hand, child survival studies require large data sets in order to obtain enough mortality events, and have typically relied on census data or special surveys such as the World Fertility Survey. Unfortunately these datasets have very little socio–economic information — such as income in the WFS case — and no anthropometic measurements.

In this paper we report reduced form estimates for both child nutrition outcomes and child survival using a large Brazilian household expenditure survey, Estudo Nacional da Despesa Familiar (ENDEF). While the ENDEF data have been tabulated at the regional level (see for example, Knight, Mahar and Moran, 1979 or National Research Council, 1983 for tabulations of child anthropometircs and child mortality respectively), there is no published work which exploits the richness of the dataset at the household or individual level. We shall fill this gap by examining how household level factors — including maternal education, education of her husband, and household income — affect child nutrition outcomes and survival. Since all household members' heights and weights were measured, we include parental stature as explanatory variables in both sets of analyses. The importance of parental height in explaining child height is obvious, and has been demonstrated many times, (see the survey by Mueller, 1986, for instance). The impact of parental stature on child survival, holding constant parental education and household income, has not been examined empirically. The effect of low birthweight on child survival suggests that maternal height should be an important determinant since it conditions birthweight. Furthermore, Fogel (1986a) presents evidence of a time–series association between average adult heights and average mortality rates in the U.S. Since he uses aggregate data he is unable to test whether this association holds controlling for other household level factors.

Our results show a very strong postive effect of maternal education on both child height and survival. Both outcomes are affected by husband's education although in the survival case, the effect is weaker than for the mother's education. Maternal height has a large effect on child survival. Income effects are non–trivial and apparently quite nonlinear. We also estimate regressions separately for the wealthier South and poorer Northeast, distinguishing urban from rural areas in each. The impacts of income and maternal education are stronger in the poorer Northeast, especially on child survival. The results also indicate small effects of maternal stature for younger mother cohorts in affecting survival, possibly a function of better health infrastructure and nutrition keeping alive more low birthweight babies.

2.a. A SIMPLE HOUSEHOLD MODEL

This section outlines a simple model of household behavior in which households exercise choice over consumption, including leisure, the number and quality of children. The quality of children might be affected by inter alia investments in their health and education. The formulation follows Becker's (1965) model as well as extensions by Willis (1973) and by Rosenzweig and Evenson (1977) to farm households. Schultz (1986) provides a useful review.

Outcomes such as number of children and their health are assumed to be produced by inputs, much as farm output is produced. Households exercise control over some, but not all inputs, and consequently exercise partial control over the outcomes. The focus of this paper is on long run decisions by households and therefore the model is static; issues of sequencing are ignored.

Formally households are assumed to maximize their present discounted value of lifetime utility, which depends on the consumption of a composite good, X, by each household member, i; the consumption of leisure, l, by each member; the services rendered by surviving children, Q; and the child survival rate, s.

$$U = U(X_i, l_i, Q, s) \tag{1}$$

The services of surviving children depends upon the number of survivng children, C, and their quality. The number surviving is simply the product of the number of children ever born, CEB, and the survival function s. We shall assume the effect of child quality on services depends on each child's nutrition and education:

$$Q = Q(C, N, E)$$

and (2)

$$C = s.CEB$$

where N and E are vectors whose elements are the nutrition status and education of each child respectively.

Each of these outcomes — number of surviving children, children ever born, their nutrition and education status can be thought of as being produced by a set of inputs which include market purchased goods (some of which may be part of X), time inputs of the household members, and those variables which affect the underlying production conditions. At the community level the incidence of particular diseases will affect the child survivor function as will a similar group of household specific factors. For example education of the mother and father may directly affect the production of these "outputs," or it may only affect the household's choice of inputs, either through income or better knowledge of how inputs can be combined most effectively. Letting Z^* represent the vector (C, s, N, E), then the production function for each outcome, k, can be written

$$Z_k^* = f_k(X_k, t_{jk}, \mu_h, \mu_c) \tag{3}$$

where X_k is the investment of consumption goods in the production of Z_k^* and t_{jk} is the investment of time by person j (presumably including the mother and father); μ_h and μ_c are vectors of relevant household and community level factors, some observable (to the household or data analyst), some not. For example, education of the parents might be included in the vector μ_h. Since the probability a child survives is likely to depend on the mother's nutritional status, we might also include the parents' health. μ_h also includes unobservable biological and genetic factors affecting these outcomes.

Each individual has a time constraint T_i which is allocated over leisure, production of household produced items, and market work. Full income, Y, is equal to the sum of the value of time of each household member plus unearned income, π. Thus

$$Y = \Sigma_i \lambda_i T_i + \pi \tag{4}$$

where λ_i is the value of time for the ith person.

Maximizing utility, (1), subject to the production functions, (3), time and budget constraints, (4), will result in reduced form equations for each of the variables in the utility function, household chosen inputs in the production function, and therefore outputs of the production function. In this paper we are estimating such reduced form equations for child survival probabilities, child height and child weight for height.

Letting Z represent this triple, the functions to be estimated can be written:

$$Z_{ki} = Z(p, \lambda, \pi, \mu_h, \mu_c, \epsilon_{ki}) \tag{5}$$

where p is a vector of market prices, ϵ_{ki} is a random disturbance for outcome k with respect to person i and the remaining variables have been defined above.

2.b. EMPIRICAL MODEL

It is seldom reasonable to assume that errors are homoskedastic when using large scale household survey data — and in the regressions we present a Lagrange Multiplier (LM) test statistic for the assumption of homoskedasticity (see Breusch and Pagan, 1979). Since the assumption is violated in all cases, least squares estimates of the variance–covariance matrix are not consistent. White (1980) has suggested an estimator which is consistent in the presence of heteroskedasticity and mis–specification. This estimator is identical to the infinitesimal jackknife in the linear regression model (see Efron, 1978). There is considerable evidence that the jackknife, proposed by Tukey (1958) performs better than the infinitesimal jackknife; see MacKinnon and White (1985) for an example in the linear regression case. In fact, relative to the least squares estimates, the jackknife performs very well even in the absence of heteroskedasticity, and a good case can be made for its use in all linear regressions. See Wu (1986) for a persuasive argument.

The jackknife, like the bootstrap, is essentially a resampling technique. Whereas the bootstrap randomly resamples observations, the jackknife deletes one observation at a time and recomputes the β coefficients as many times as there are observations. The variation in these "pseudo–values" of $\hat{\beta}$ is then used to estimate the standard error associated with the coefficient estimate (see Efron, 1978). We report quasi–t statistics and Wald test statistics based on jackknifed variance–covariances in the regressions below.[2]

Estimation of child mortality regressions is not straightfoward. Ideally we would like to estimate a hazards model of child survival where the probability a child attains some age, a, depends on his mortality risk, μ

$$p(a) = e^{\int_0^a \mu(t)dt}$$

This risk will, in turn, depend on a set of covariates, X, and a stochastic term, ϵ:

$$\mu(a) = e^{X\beta+\epsilon}$$

[2]It turns out that the jackknife and infinitesimal jackknife estimates of standard errors are very similar and, typically, about 15–30% bigger than the least squares estimates. These results are not, however, uniformly true. There are some instances in which the infinitesimal jackknife estimates are smaller than either the OLS or jackknife estimates although none of the differences are very large. We know that the differences tend to increase when the design matrix is unbalanced; a situation we have avoided in these regressions through our choice of covariates.

Unfortunately, the data demands for the estimation of this model are non–trivial. For each mother, we need to know the date of every birth and the age of death of each child not alive at the time of the survey. Few large scale socio–economic surveys obtain a complete child–bearing history for every woman, and ENDEF is no different. Few fertility surveys, however, collect extensive socio–economic information on household members. It is our aim to exploit the richness of the ENDEF survey to determine how socio–economic factors affect child mortality. We have information on the number of children ever born to each mother and the number still alive; it is the ratio of the latter to the former — the survival rate, s — which we seek to explain:

$$s = f(X, \beta) + \epsilon \tag{6}$$

We would like to standardize the proportion of children surviving by an expected survival rate from life tables (see, for example, Trussell and Preston, 1982). These standardizations might be based either on time since first birth, menarche, or on marital duration. Unfortunately we do not have any of this information. The only potential variable to standardize on is the mother's current age. It is, however, inadequate since better educated mothers of the same age may delay child–bearing and thus will have younger children. Faute de mieux, therefore, the reported survival rate regressions are unstandardized. This may bias mother's education coefficient upwards as well as bias the coefficients of mother's age downward, because children of less educated or older mothers will tend to have longer exposure to risk of mortality. Trussell and Preston compare regression analyses of child survival based on life–table standardizations of mother's age and marital duration. Unfortunately they do not include unstandardized regressions in their comparisons. They find the impact of mother's education is lowered by some 10% – 25% when marital duration is used. Although this does not seem overly large relative to the imprecision in the regression estimates, it should be born in mind when interpreting the results below.

We use data on all women who have ever born a child. For many women, the survival rate is unity and so estimation of [6] by least squares would generate biased estimates of the coefficients, β. We specify the model in terms of an unobservable latent variable, s^*

$$s_i^* = X_i\beta + \epsilon$$

where (7)

$$s_i = s_i^* \qquad \text{if } s_i^* < 1$$
$$= 1 \qquad \text{if } s_i^* \geq 1$$

Assuming the errors, ϵ, are distributed as guassian, then we have an upper censored Tobit model with likelihood function

$$L = \prod_{s_i^* < 1} \phi\left[\frac{s_i - X_i\beta}{\sigma}\right] \prod_{s_i^* \geq 1} [1 - \Phi\left[\frac{1 - X_i\beta}{\sigma}\right]]$$

where $\phi(\cdot)$ and $\Phi(\cdot)$ are the pdf and cdf of a standard normal respectively. It is these estimates which are reported in this paper.

The expected value of the probability of a child surviving for the ith mother is:

$$E(s_i | X_i) = X_i\beta\Phi(r_i) - \sigma\phi(r_i) + 1 - \Phi(r_i) \qquad (8)$$

$$r_i = \frac{1 - X_i\beta}{\sigma}$$

and its derivative with respect to the jth covariate is

$$\frac{\partial E(s_i | X_i)}{\partial X_{ij}} = \beta_j\Phi(r_i)$$

which is reported for all continuous covariates at the mean of vector X. In the case of dummy variables, the slope is approximated by the difference between $E(s_i | X_i)$ when the dummy is turned on and when it is turned off. Other variables are set at their means except for the dummies which are associated with the one of interest; they are of course all turned off in both computations.

3. DATA AND SAMPLE SELECTION

Estudo Nacional da Despesa Familiar (ENDEF) is a large scale household expenditure survey carried out in Brazil from August 1974 to August 1975. Not only is the dataset large in terms of the number of households enumerated — there are just under 55,000 usable observations — but also in the breadth of questions asked. It is the extent of the survey — in both directions — which makes it especially useful for the kind of questions analysed here.

Detailed information was gathered, inter alia, on food and non–food consumption and expenditure; labor supply, and income; occupation and education; heights and weights of all household members; fertility and child mortality data for each woman. The data have been very thoroughly and carefully screened for coding, enumerator and computational errors; our impression from discussions with IBGE staff involved in the project is that the collection and processing of the data has been very professional. Our experience with the data bears out this impression.

Prices and community characteristics enter the reduced form, [5], but we do not observe either. We allow for interregional heterogeneity by estimating regressions separately for two large regions. For the purpose of the survey, the country was divided into the same seven regions used in the Pesquisa Nacional de Amostra Domiciliar (PNAD) surveys. In this paper we analyse all but two of these regions[3]: the Northeast is the poorest region in the country; the other four, Rio de Janeiro, Sao Paulo, the South East and Brasilia are aggregated together into what we shall call the South. In all, we use information on 41,233 households. We shall distinguish urban and rural sectors within each region. The urban South is by far the richest — mean annual real per capita expenditure (PCE)[4] is Cr$7200 almost double that in the urban Northeast, two

[3]The excluded regions are Minas Gerais and the Central West–North. Data were collected only for urban households in the latter.

[4]PCE is defined as monetary and imputed expenditure excluding savings, expenditure on durables and housing semi–durables such as furniture and appliances. Nominal values are deflated by price indices generated by IBGE from published sources.

and a half times mean PCE in the rural South and five times as large as it is in the rural Northeast. Table 1 presents mean real incomes and expenditures for each of our regions as well as for the PNAD definitions.[5] At least for these measures, the regions making up the South are very similar — with the possible exception of rural households in Brasilia. Since these account for less than .1% of the sample, their influence is unlikely to be large. While PCE is probably a better measure of long run welfare — because, for example, reported incomes tend to reflect a larger proportion of transitory shocks than expenditures — we would expect child nutrition and survival rate outcomes to be jointly endogenous with expenditures. We therefore use certain components of household real income as explanatory variables in the regression below. The inter–regional pattern described above holds for household income although the magnitude of differences is larger; see Table 1.

According to the theoretical model of Section 2, household unearned income should enter the reduced form (equation 5).[6] It comprises real income from rent (including rent of land), financial and capital assets, pensions, and sales of immobile assets (such as land, livestock or automobiles). In the urban sectors, unearned income accounts for about 20–25% of total income and only 12–13% in the rural sectors. In terms of unearned income the interregional differences are thus further magnified. It turns out that zero unearned income is reported by almost half the urban households and over 60% of rural households. Many households rely exclusively on labor incomes. For some, however, especially in the rural sector, we just do not have a good measure of unearned income, particularly net income from self–employment. To the extent that there are errors in measurement, then coefficients on other covariates correlated with this measurement error will be biased.

As a pragmatic strategy we adopt a second approach and include non–mother's earned income as an

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[5]The annual income data are based on a twelve–month recall. Since inflation was about 30% per annum during the survey period, it is important to use delators which refer to the same period. Expenditure data were collected with one month, three month and twelve month recall periods depending on the nature of the expenditure. It is natural to adopt the deflators used for expenditures based on annual recall, which include inter alia energy, education, furnishings. To avoid sparse cell and endogeneity problems, price indices were computed using the average for all expenditures within a municipality in any month.

[6]Recall that we are using education in part as a proxy for the value of time.

additional variable in the regression. This would be justifiable if, firstly, only mother's time is allocated to produce child health and nutrition and, secondly, if husband's leisure is separable from all other consumption (including mother's leisure). Under these strong conditions, the husband's wage will have only income effects — and no substitution effects — on child health outcomes, and should have no effects separate from non–mother's earned income. If earned and unearned income are treated equally then the coefficients on the income terms should be the same. If either of the assumptions above are false, or if there are differential measurement errors in the types of income, then the equality restriction on income and zero restriction on husband's wage need not hold.

In the urban South, mean non–mother's earned income is about CR$2500 and about sixty percent of that in the urban Northeast. In both areas, mother's earnings account for about 10% of total earnings. The average household in the rural South has less than half the non–mother's earned income of its urban counterpart and twice that of its rural Northeast counterpart. In the rural sector, mothers account for slightly less of total earnings than in urban areas.[7]

Parental value of time, λ, enters the reduced form [5]. In a competitive equilibrium, it would equal the market wage if the person works in the market. For those working only at home, it will be their shadow wage. It is, however, very hard to measure the shadow value of time; we assume it depends on attained education of the person at the time of the survey which we use as a proxy for λ in the regressions. The substitution and income effects of wage changes are therefore subsumed in the education coefficients along with the allocative impact of education on health input choices, and any direct impact on the health production functions. The separate effects of education cannot be disentangled.

(a) **Anthropometrics**

We wish to determine how household — and in particular parents' — characteristics are related to the height and weight outcomes of children. Modeling the heights and weights of children is

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[7]Part of this difference arises because self–employment (eg. farming) is more important in rural areas. In the survey net income from household enterprises was attributed to the person selling the output, which is typically not the mother.

straight–forward. Clearly a child's height will vary systematically with age and sex, and weight will also depend on height. We could include a high order polynomial in age with sex dummies in the regressions to replicate this growth function. Instead, we follow a more parsimonious approach. We use the NCHS tables (NCHS, 1976) to convert all heights to a percentage of the median height of a child of the same age (in months) and sex in the United States population; weights are similarly standardized conditional on height of the child. Evidence (Habicht et.al., 1974; Martorell and Habicht, 1986) exists that well nourished children of many ethnic groups grow similarly to North American or European children. This is also true in the ENDEF data, for the urban South, where standardized heights for children in the top PCE decile are, on average, the same as the US median across all age groups. Since the NCHS weight–for–height standards exist only up to heights of 145 cm for males and 137 cm for females, we have restricted the sample to children under nine years of age to avoid obvious sample selection problems. Weight measurements were recorded to only the nearest kilogram. This resulted in such large measurement errors that it was decided to exclude children under two years from the weight–for–height regressions. The older children are broken into two age groups. Heights were measured in centimeters resulting in small rounding error even for small children. All children are therefore included in the standardized height regressions, and four ages are distinguished.

The structure of the household roster relates each member to the head. Since we are interested in parent's characteristics we are required to restrict our analysis to only children of the head. Of the children for whom we have height data[8] only 1.4% are not relatives of the head and among the relatives, 91% are children of the head. It turns out that conditional on age the heights and weights–for–heights are remarkably similar for the two groups.

Table 2 presents, for each region and age group, mean weights and heights. Within each age group children are tallest and heaviest in the urban South, and within each region, taller and heavier in urban areas. Mean standardized heights–for–age, weights–for–age and weights–for–heights are also presented.

[8]Many of the people in the survey are guests or visitors for whom height and weight data were not systematically collected. They were not included in these calculations.

The distribution of standardized heights and weights–for–heights are reproduced for all age groups in Figure 1. We reproduce the distributions by age only for the urban Northeast in Figure 2.

Relative to standards in the inter–regional patterns of heights and weights are, of course, unchanged although none of the differences are significant. It is now possible to meaningfully compare data for all age groups; the entire distribution of standardized heights shifts to the left as we move from the urban to rural South to urban Northeast and finally to rural Northeast. There are, it appears, important regional differences in child nutrition outcomes which are independent of income; recall, on average, income is higher in the urban Northeast than rural South.

Within each region, the distribution of standardized heights shifts substantially to the left as we move from babies (0–5 months old) to older children; in all areas except the rural Northeast, almost half the babies are taller than the U.S. median. This proportion halves for 6–23 month olds and declines monotonically with age in each region. Using 90% of the U.S. median as an indicator of stunting (see Waterlow et. al, 1977) 10 percent or more of children fall below this standard, with roughly 1/3 of all children in the rural Northeast below this threshhold.

Standardized weights follow a similar pattern — although there is considerably more heterogeneity in weights than heights for each group. Conditional on heights, however, much of the inter–regional differences in body mass disappear; the distributions for all four regions look remarkably similar. In fact, on average, children from Southern Brazil and the United States have the same weight given height; children from the Northeast tend to be lighter given stature. There is, however, a good deal of dispersion about the mean. Less than 3% of children between 2 and 8 years of age fall below 80% of the U.S. median weight for height (considered wasting by Waterlow et. al.,); similar proportions are reported for sub–Saharan Africa (Svedberg, 1987).

Mean standardized heights–for–age and weights–for–height by deciles of per capita expenditure[9] and education of the mother and father are presented in Figure 3 and Table 3 respectively. In all regions, standardized heights rise with PCE, faster in the urban sector; we should expect, therefore, larger income

[9]Deciles are computed separately for each of the four regions.

effects in urban areas. Weight–for–height also tends to rise with PCE, although not as fast as height–for–age. There seems to be a lot of noise, especially in the rural areas and around the center of the PCE distribution.

In the urban sector, we distinguish four educational categories: illiterate, literate, completed elementary schooling and completed more than elementary schooling. Since the highest category accounts for very few households in the rural sectors, we aggregate it with elementary schooling. The same definitions will be used in the regressions below.

Mean heights and weights–for–heights rise with education of the mother and father, again — at least in the case of heights — faster in the urban areas. The similarity of means, whether conditional on mother's or father's education is striking. Since these are not conditional on income, if income is more highly correlated with father's than mother's education, then we should expect mother's education, ceteris paribus, to have a larger impact on children's nutrition outcomes. We shall find evidence to support this in the regressions below.

(b) **Survival Rates**

The level of observation for the survival rate analysis is the mother; four age groups are distinguished. The mean number of children ever born, survival rate and proportion who have never lost a child are reported for each age group and region in Table 4. As with the standardized anthropometrics, average survival rates can be ordered from the urban South to rural South to urban Northeast and finally rural Northeast. Survival rates also decline with age — as they should since children of older mothers will tend to have been exposed to mortality risk for longer. The differences between the urban and rural South are small — although rather fewer mothers have lost a child in the urban sector. In the Northeast, mortality rates are higher and the difference increases with age; in addition there is a significant difference between the urban and rural sectors. These regional differences are well known and have been documented in several places (see, for example Merrick, 1983, and National Research Council, 1983).

Survival rates tend to rise with PCE (Table 3) faster in the Northeast than South, and the proportion who have lost a child falls. The same patterns emerge with respect to education and again the effects of mother's and husband's education are remarkably similar. Conditioning on income, we should observe rather different results; see the discussion above.[10]

4. CHILD ANTHROPOMETRIC REGRESSION RESULTS

The results of regressing the logarithm of standardized child height for age on a set of household and individual covariates for all children under 9 years old are reported in Table 5. Table 7 reports the results of regressing the logarithm of standardized weight for height on the same covariates for children aged 24–107 months. In all cases, we allow for region–specific effects by estimating the regressions separately for each region.[11] Means and standard deviations of the variables used are presented in Table A.1. Included in the covariates are parents' education and stature. The inclusion of father's height — and thereby the exclusion of children without fathers present in the household — raises potential sample selection problems. The excluded children are somewhat shorter and have mothers from poorer households. Dropping father's height and running regressions with the larger sample including all children of the household head results in parental education coefficients rising by small amounts. Regressions using the smaller sample but excluding father's height leads to the conclusion that it is the sample composition, not the exclusion of father's height, which gives rise to this difference. Since the difference is not large in magnitude, and given the importance of father's height, the tables are based on the smaller sample. Results including father's height are discussed in the text.

Regression estimates for standardized height are estimated separately for ages 0–5 months, 6–23 months, 24–59 months and 60–107 months and reported in Table 6. This is intended to allow for different

[10]It has been argued that estimates of mortality based on the ENDEF data are high (National Research Council, 1983), although it is not clear whether or why this should be true. Our objective is not to reproduce aggregate mortality estimates but to evaluate individual household mortality outcomes as a function of economic resources and household behavior. Our results should not be affected by this discrepancy unless households have been non–randomly selected into the ENDEF sample in a manner related to those variables we wish to explain. There is no reason to believe the survey has systematically over–sampled households at low (or high) mortality risk and so we shall ignore the aggregate discrepancies.

[11]Regressions are presented including household non–earned income [second column] and, in addition, non–mother earned income [first column].

impacts of parental education, household income and parental heights for these groups. Nutritional stresses may vary with age. In particular the supplementation of breastfeeding with other foods, typically starting at 6 months, may give rise to problems stemming from unclean water or poorly prepared foods. As a child ages these pressures may become weaker as the transition into a solid food diet is completed. Consequently there may be a reduced impact of factors such as mother's education as the child ages past weaning (see Barrera, 1987, for such evidence from the Philippines).

(i) Height regressions: Pooled over child's age

Relative to weight–for–height, the height–for–age coefficients are much more precisely estimated and these are considered first. Mother's and father's education are positively and significantly associated with child height. In the urban South, for example, the Wald test statistic for all education coefficients equal to zero is 135 for mothers and 110 for fathers (with three degrees of freedom in both cases).

A child of a mother who is literate but did not complete elementary school can be expected to be 0.5 to 1.3 percent (depending on the region) taller than a child of an illiterate mother. The percentage differential rises to between 2.4 and 3.0 for children of mothers in urban areas having completed secondary school or higher. Notice that when non–mother's earned income is dropped from the regressions, the coefficients on secondary or higher education rise, although the changes are barely noticeable for other levels.

The significance of father's education, even after controlling for non–mother earned income, may reflect a component of permanent income, or it may reflect failure of the separability assumption (see Section 2(b)) say through the husband's participation in childcare. In fact the magnitudes of the coefficients are very similar to those of mother's education, except in rural areas where the impact of father's education is smaller. As for mother's education, it is only the father's secondary or higher education coefficient which rises when non–mother earned income is dropped.

Although the effects of non–mother's earned income are weak in magnitude, they are statistically significant with a p–value less than .01 in all regions. If non–mother earned income rises by a standard deviation, then the height of an average child will rise by 1/2 a percent in the urban South and just over 1%

in the urban Northeast. The magnitude of the effect is similar to the difference between a literate and illiterate mother or father in all regions except the urban South, where the effect is only half of the schooling effect. The household unearned income terms are not jointly significant in the two rural regions, and their coefficients are smaller in magnitude than for non–mother's earned income. This is consistent with substitutability between mother's and husband's time in child care. As husband's wage, and labor supply, rises the mother will devote more time to home activities if substitutability prevails. Provided this activity is intensive in mother's time, there should be an increase in child nutrition outcomes apart from the pure income effect.

Both mother's and father's heights are important determinants of child height. If parental heights affect child heights only for genetic reasons, then the coefficients on mother's and father's height should be equal. This restriction is rejected in all regions — with a p–value less than 0.006. Parental heights are presumably also proxying for human capital investments in the parents, including the mother's nutritional status during pregnancy, which are not picked up in the income or education coefficients. These non–genetic factors are more important in the case of the mother. Furthermore, the difference between the impact of the mother and father's height is magnified when separate regressions by child age are considered. (See Table 6). The results that parental heights are important and that maternal height has the greater impact are consistent with a variety of other studies including studies of U.S. heights from the HANES survey (see Chernichovsky and Coate, 1983). Average mother's height ranges from 93.1 per cent of the U.S. median female adult height (163 cm) in the rural Northeast to 95.4 per cent in the urban South. Mothers living in the rural Northeast who are 163 cm would be expected to have children who are 94.6 per cent of U.S. standards, instead of 91.6 per cent as is the average Northeast rural child. For a mother of 163 cm in the urban South the equivalent numbers are 98.0 per cent instead of 97.0 per cent.

Age of the mother at birth of the child is significant in all four regions (with a p–value under .01). Its magnitude indicates that delaying childbirth five years would be associated with heights higher by roughly 0.5 per cent. While one would expect this impact to be nonlinear, a quadratic specification did not add significant explanatory power to the regressions.[12]

Coefficients on child age indicate how Brazilian children fare at different ages relative to U.S. children. The results indicate that heights lag significantly by 6 months with the difference increasing from 6 to 24 months. This period coincides with the supplementation of breastfeeding and weaning and is consistent with age patterns found elsewhere (e.g. Barerra, 1987, for the Philippines, or Svedberg, 1987, for a summary of African evidence). There seems to be a slight relative improvement at two years followed by a slight worsening at three or four years after which the age coefficients remain roughly constant.

The Northeast and South are both quite large, so state dummy variables are also included to capture effects of different food prices (and thus diets), different health and education infrastructure as well as underlying disease environment. In the urban Northeast children in Pernambuco (Recife) are taller than those in Bahia (Salvador) (the omitted state), after accounting for the influence of parental education, household income and parental height. Children residing in Ceara (Fortaleza) are smaller, with those living in Piaui and Maranhao being shortest. In rural areas of the Northeast all states seem to be very similar except for Maranhao and Piaui, where children are again smaller even after accounting for parental and household characteristics. In the urban South children in Parana and Santa Catarina tend to be 1.3 percent shorter than children in Rio de Janeiro, (the left out state), other factors held constant, followed by children in Rio Grande do Sol and Brasilia. In the rural South region also makes a big difference, with children surrounding Brasilia and in rural Parana being roughly 1 per cent shorter than children in rural areas surrounding Rio.

(a) **Regional Comparisons**

Regional differences might also occur in covariate coefficients, especially if the effectiveness of these variables depends on underlying community health levels and infrastructure. Comparing the rural and urban South and Northeast results, some major differences are apparent.

Non–mother's earned income coefficients are considerably higher in the Northeast than the South

[12] Using age of the mother at the time of the survey gives similar results.

and in rural rather than urban areas. This would be expected with a nonlinear income effect. Parental height coefficients are slightly higher in rural areas, although no differences emerge between the Northeast and South. This suggests that there may be factors in urban areas which substitute for the influence of height.

Mother's education seems to have roughly the same impact in the South as the Northeast, but coefficients are larger in urban than rural areas. If it were thought that mother's education, infrastructure and level of development are substitutes, then both these results would be surprising.

Father's education coefficients are about the same in the urban South and urban Northeast except for secondary or higher, for which coefficients are larger in the urban Northeast. They are smaller in the rural Northeast and smaller still in the rural South. The fact that both parents' education coefficients are larger in urban areas raises the possibility that selective migration of better endowed households to urban areas may be partly responsible. Had the sample been stratified by region of origin rather than region of current residence, which was not possible with these data, these differences might not have emerged (see Schultz, 1986, for a discussion of earnings equations using Colombian census data in which these patterns emerge).

The one other difference between regional results of note are the coefficient magnitudes on child age. Beginning at 6 months, the shortfall in height relative to U.S. standards, is much higher in the Northeast than the South and in rural versus urban areas. This heterogeneity probably reflects variation in levels of disease, health infrastructure, water supplies, or food prices (hence diet), which over and above household level factors, make the period beginning with food supplementation more risky to child growth.

(b) **Comparisons by Child Age Group**

Examining results by child age group (Table 6) several patterns appear. The impact of mother's education tends to decline with child's age, a pattern also found by Barrera (1987) for the Philippines. Non–mother's earned income and to a lesser extent father's education seems to have greatest influence on the 6–23 month old group, with a declining coefficient as the child ages beyond that. This may result from a cleaner, less disease ridden environment, increased food intake, as well as perhaps better quality foods.

Finally a very pronounced pattern emerges with the parental height coefficients. The magnitudes are considerably lower for the 0–5 month group in all four regions, a result often found in the medical literature (see, for example, Garn and Rohmann, 1966, or Mueller, 1986). Indeed father's height has a negligible influence for this group (again noted in the medical literature, e.g. Tanner, 1962), although the size of the impact rises for the 6–23 month group. This suggests a complex interaction between heights of parents and the nutritional and disease stresses which affect children of this age. Finally note that for the 0–5 month age–group maternal height has a larger effect in rural areas (as is the case for the pooled results), but this difference vanishes with the 6–23 month group.

(ii) Weight–for–height regression results

The weight–for–height results, reported in Table 7, are rather imprecise. Many short run factors such as disease or food intake and energy expenditure may lead to short–run variations in weight–for–height, though not height.

Of household and parental characteristics, non–mother earned income seems to have the largest impact. It is significant in urban areas, with a p–value of under .01, though not significant in rural areas. As for the height equations, its coefficient is higher in the Northeast than the South, and in rural over urban areas. Mother's education is significant only in the urban South (both jointly and individually for the highest category) and the rural Northeast (only for elementary school or higher). Father's education is positively related to weight for height only in the urban Northeast and, perversely, has a significant negative effect in the urban South.

5. CHILD SURVIVAL REGRESSION RESULTS

The child survival sample uses all women aged 14 and over who have had at least one live birth. Variable means can be found in Table A.2. In contrast with the anthropometric regressions we include women with no husbands in this analysis and so do not include a husband height variable. The reasons for this are two fold: the selectivity effects on education and income coefficients seem stronger in this case; secondly experimenting with a smaller sample for which husband height is available we find the magnitude of its effect is small (see page 23), consistent with its small impact on heights of 0–5 month olds. Husband's education is included in the covariates, although now we need to control for the existence of the husband by an additional dummy variable. Maximum likelihood estimates of the upper censored Tobit likelihood function are reported for all women and separately for women aged 25–34, 35–44 and 45 and over.[13] Splitting the sample by age of the mother at the time of the survey is intended to allow income, education and mother's height to have different impacts, since health and schooling infrastructure, as well as the disease environment may have differeed for different mother cohorts. If education and income interact with these changes then their coefficients should differ across age groups.

Some strong common patterns emerge from the pooled results. Mother's education coefficients are large in magnitude and significant. Looking at slopes of the expected value locus[14] (Table 8), being literate without having completed elementary education raises expected survival rates over nonliteracy by between 3.7 to 6.1 percent, depending on the region. Completion of elementary education has an impact of between 5.2 and 12.2 percent, while secondary or university education raises urban child survival by between 10.1 and 15 percent. These are very large proportionate impacts especially when one considers that mortality rates are falling from levels of .24 in the rural Northeast to .11 in the urban South (Table A.2). When non–mother's earned income is dropped from the analysis, the coefficients increase very little, the largest change being for the secondary and college education dummy in urban areas. Education is thus not simply a proxy for measured income, especially not at lower levels.

Husband's education also has an important influence but less than for mother's education. This result conforms with findings in the child survival literature (for example, the surveys of Cochrane, Leslie, and O'Hara, 1982, and Mensch, Lentzner and Preston, 1986 but see Trussell and Hammerslough, 1984, for an exception). While the impacts rise, especially for the higher education levels, when non–mother's earned income is dropped they are still substantially below mother's education coefficients. The one anomaly in

[13]Small sample size precluded separating the 14–24 year old group; this group is included in the pooled regression.

[14]That is the change in expected survivor rates resulting from a change in the independent variable, rather than the Tobit coefficient.

this pattern is in the rural Northeast where the husband completing elementary school has a negative effect. As pointed out for the height regressions, this may result partly from a selective migration pattern of higher skilled educated males out of the Northeast.

For the income coefficients, non–mother's earned income, its square and interaction term with unearned income are jointly significant with p–values less than .01 in all regions except the rural Northeast, where it is .03. The magnitudes of the impact of increasing non–mother earned income by one standard deviation region specific is .017 in the urban South, .019 in the rural South, .028 in the urban Northeast, and .016 in the rural Northeast. These effects, while positive are much smaller than for mother's education and are also smaller than for husband's education. Household unearned income coefficients are not jointly significant (except in the urban Northeast) and tend to be smaller in magnitude than for non–mother earned income as was true for the anthropometric regressions. Again this is consistent with husband's and mother's time being substitutes in child health activities.

Mother's nutritional status or genetic endowments, as proxied by her height, plays an important role in child survival holding education and income constant. When the logarithm of height as a proportion of median U.S. female adult height (an attempt to standardize for any teenage mothers) is used as a variable the slope of the expected value locus is approximately .32 in all regions except the rural Northeast where it is just over .50. This means a mother in the urban south whose height is at the median for the U.S. (163 cm) is associated with a child survival rate .014 higher than that of a mother at the mean height for the urban South (155.5 cm). Relative to the U.S. median mother's height is only 92.9 percent in the rural Northeast. A woman of 163 cm can expect a .037 higher child survival rate than a woman of average height there.

The mechanism through which mother's height is working is likely to be birthweight. This is consistent with the strong impact of mother's height on child height–for–age also reported in this paper. There exists abundant evidence (see, for instance, Chen, Chowdhury and Huffman, 1980, or the review, by Martorell and Ho, 1984) that such a relationship exists between low birthweight or low weight–for–age and subsequent child mortality. To our knowledge, however, most other multivariate analyses of child mortality or survival have not had controls available for mother's stature.

The impact of husband's height (not reported) is much less in magnitude and significance than mother's height, with expected value slopes of .104 for husband's height versus .237 for mother's height in the urban South and .137 versus .306 in the rural South. Standard errors are almost identical between husband's and mother's height so that t–statistics are correspondingly lower, though still significant at the .05 level. This result is consistent with the relative absence of an impact of husband's height on length of 0–5 month olds. Inclusion of husband's height in the regressions requires the exclusion of a large proportion of observations; 17% in the urban South, 8% in the rural South, 23% in the urban Northeast, and 15% in the rural Northeast. Mothers without husbands include unmarried mothers and older women whose husbands have died; they tend to be less well educated and have lower income than women with husbands present in the household. Dropping them from the analysis while omitting husband's height lowers the coefficients of mother's education and income, while slightly raising husband's education coefficients. For instance in the urban South the slope of the expected value locus is lowered roughly 8 percent, from .083 to .076 for mother's elementary education and from .101 to .094 for secondary and higher education. This may represent a selectivity effect, and since the impact of husband's height is small, these results are not reported.

Holding constant education and income, there are large effects of mother's age. While this partly represents older women having older children, who have consequently had more exposure to mortality, it also contains cohort effects related to more health and educational infrastructure investments, as well as possibly a reduction in underlying disease incidence. In general, the coefficients are increasingly negative with higher age, although some exceptions exist notably in the rural Northeast, where survival rates bottom out with 50–54 year olds. This may reflect less health mothers dying at younger ages in the rural Northeast compared to higher income regions. The differences in magnitude, especially between extreme ages, is large. For instance in the urban South a woman aged 60 or over is likely to have had a survival rate lowered by .14 compared to a 25–29 year old with the same education and household income. Even compared to a 40–44 year old the over 60 year old's child survival rate would be lower by .09. In the rural Northeast the same differences are estimated as .14 and .02.

Mothers having husbands with no education at the time of the survey tend to have lower child survival than those who do not have husbands at that time. This is, of course, controlling for mother's age, education, and household income variables, but is nevertheless surprising. The expected value loci slopes cluster near –.015. If the husband has some education then this effect is reversed since the coefficients on husband's education are positive and larger in absolute value than for the coefficient on the existence of a husband.

Even though the analysis is broken into two regions with urban–rural distinction within each, these regions are still large. Using state dummy variables allows for further distinction based on differences in health and food input prices, quality of infrastructure, and underlying disease incidence. Within the Northeast differences are especially large. For urban areas Bahia (Salvador), the omitted state, and Piaui have the highest survival rates after controlling for individual and household level factors, followed by Pernambuco (Recife), Maranhao (Sao Luis) and Ceara (Fortaleza). Rio Grande de Norte (Natal) and Paraiba (Joao Pessoa) register the lowest survival rates, some .07 lower than Bahia after controlling for observed household level influences. In the rural Northeast Piaui has the highest survival rates followed by Bahia and Ceara. Alagoas and once again Paraiba share the lowest rates. In the South, the state differentials are much smaller than in the Northeast except for Rio Grande Do Sul, which has markedly higher survival rates in rural and moderately higher rates in urban areas.

(a) **Regional Comparisons**

Regional price, infrastructure and healthiness factors may not only shift child survival rates, but also affect the impact of household level covariates. Better educated mothers may have less or more impact on child survival depending on whether her education is a substitute or a complement to health infrastructure and community healthiness. Likewise income may have more impact when incomes are low or under a more severe disease environment. These issues can be explored by examining differences in slopes of expected value loci across regions and rural and urban locations.[15] Important differences emerge from such a

[15]Note it is the expected value loci slopes, not the Tobit coefficients that should be compared. This is because the proportion of observations which are censored varies enormously between the four different groupings.

comparison.

For mother's education, effects are stronger in the Northeast than in the South, with proportionately larger differences with higher education levels. This is certainly consistent with mother's education being a substitute for health infrastructure and underlying healthiness, both of which are higher in the higher income South. Moreover, the degree of substitutability may be higher for more educated women. These regional differences may even be understated if women of the same education and income delay childbirth by longer in the South than in the Northeast, since then the education coefficients will be biased upwards by more in the South.

Contrasting urban and rural areas a different story emerges. In the South, mother's education has a larger impact in urban areas, while in the Northeast results are mixed, having a little education has a larger impact in urban areas but having completed elementary school or more has greater effect in rural areas. Thus these results are in partial agreement with the height regression results. Quality differences in urban and rural schools are unlikely to be responsible since the pattern on husband's education coefficients for child survival do not match. Here a qualification is in order. Since equivalently educated mothers probably delay childbirth by more in urban areas the differences may be overstated.

For non–mother earned income impacts on expected survival rates are higher in the Northeast than in South and in rural than in urban areas. This is consistent with a non–linear income effect, possibly resulting from substitutability between health inputs purchased with higher income and community health infrastructure or healthiness.

Husband's education coefficients have a less clear cut pattern. Completion of elementary school or high school and university education has more impact in the urban Northeast than the urban South, but the opposite is true for having literacy but not having completed elementary school. In rural areas meanwhile there is a slightly higher impact in the South. Between urban and rural areas impacts are higher in rural areas for small amounts of education, but higher in urban areas for elementary or higher. As mentioned in the discussion of the height regressions, this may reflect selective migration of more skilled higher educated males out of rural areas, particularly in the Northeast.

For mother's height the differences in coefficients between regions is small, except for the rural

Northeast. Impacts are higher in the Northeast and in rural areas, which may reflect substitutability between birthweight and health infrastructure resulting in fewer low birthweight children dying in the South and in urban areas.

Finally, examining the differential impacts of mother's age cohort reveals a number of patterns. The coefficient differentials which hold education and income constant, are larger for the oldest cohorts in the Northeast than in the South, and larger within rural areas in the South. The difference in coefficients between 40–44 year olds and over 60 year olds is largest in the urban South, .09, and smallest in the rural Northeast, .02. This is consistent with other evidence that mortality declines began earlier in the South (NRC, 1983), but suggests that recent — to 1974/75 —— advances may have been larger in the Northeast, again holding household factors constant.

(b) **Comparison by Mother's Age**

The results presented thus far have pooled mothers of different ages allowing for only an intercept shift effect. Results allowing for interactions with the other covariates are presented in Table 9. Sample sizes for the 14–24 age group are small, so they are omitted. For mother's education there is a tendency for a larger impact among older women in all regions except the rural Northeast. While part of this effect may result from less exposure to death of children of younger, more educated women, it is also consistent with increasing overtime infrastructure substituting for mother's education. Husband's education and non–mother's earned income shows an opposite pattern, having a slightly higher impact for mother's aged 25–34 than for older mothers. This may be an indication that current income of older women does not measure their past income well. Mother's height has a markedly lower impact on expected survival rates of younger mothers. This is further support for substitutability between child birthweight and general improvements in health and health infrastructure.

6. CONCLUSIONS

Large regional and urban–rural differences exist in Brazil in child survival and nutrition outcomes. Some of these differences can be explained by differences in parental education, household income, and parental stature. For child survival, maternal education dominates husband's, and maternal height dominates husband's height. The importance of maternal education on child height and survival duplicates studies in other countries. Effects of maternal stature on child survival, holding constant other factors, have rarely been documented. Income and husband's education independently affect height and survival outcomes. The effect of income on survival has not been much explored in previous work.

The impacts of these household level variables differ by region and urban or rural residence, particularly on child survival outcomes. These differences suggest that maternal education has a higher impact on child survival in the poorer Northeast than in the South. A similar pattern emerges for household income on both height and child survival. In addition the greater impact of maternal height in rural areas, and in the Northeast of child survival suggests that regional factors are playing both an important independent role, as well as modifying the impact of household level variables. The smaller role of maternal education and height among younger cohorts in explaining child survival outcomes suggests there may be substitution between community and household level factors. Which community factors are responsible is, however, unclear. This is an important avenue for future research.

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Table 1

Mean Income and Expenditure By Region[a/]

	No. Households	PCE[b]	Total HH income	Unearned Income mean	Unearned Income %non zero	Earned income	Non-mother's earned income mean	Non-mother's earned income %non zero
South Urban	**19 694**	**7.25**	**37.1**	**9.3**	**56**	**27.8**	**24.9**	**86**
Rio	5 104	7.18	35.0	9.9	59	25.1	22.6	84
Sao Paulo	5 987	7.47	37.7	9.0	54	28.7	25.9	88
South East	6 124	6.97	36.4	9.8	58	26.6	23.8	86
Brasilia	2 479	7.52	41.7	7.5	49	34.2	29.7	89
South Rural	**5 797**	**2.88**	**13.4**	**1.8**	**35**	**11.7**	**11.1**	**94**
Rio	1 080	2.49	10.3	1.9	47	8.3	7.9	90
Sao Paulo	1 150	3.04	17.6	2.0	34	15.6	14.9	96
South East	3 485	2.93	13.1	1.7	32	11.4	10.8	94
Brasilia	77	3.97	12.3	1.4	39	11.0	9.8	96
Northeast Urban	**9 405**	**4.08**	**21.1**	**4.3**	**57**	**16.8**	**15.1**	**83**
Northeast Rural	**6 337**	**1.41**	**5.4**	**0.6**	**48**	**4.8**	**4.4**	**90**

Notes:

a/ Income and expenditure in 1000 Cruzeiros.

b/ *per capita* expenditure.

Table 2

Child Nutrition Outcomes

Age of child in months	Height mean cm	Height Standardized mean	Height Standardized (sd)	Weight[a] mean Kg	Weight[a] Standardized mean	Weight[a] Standardized (sd)	Weight for height[a] Standardized mean	Weight for height[a] Standardized (sd)
South								
Urban	**100.9**	**97.2**	**(6.3)**	**18.5**	**94.8**	**(15.8)**	**100.5**	**(12.6)**
0-5	59.8	100.7	(6.6)					
6-23	75.8	97.5	(6.7)					
24-59	95.3	97.3	(6.4)	14.6	95.9	(14.8)	101.2	(12.3)
60-107	116.9	96.7	(5.9)	21.2	94.0	(16.5)	100.0	(12.8)
Rural	**99.8**	**95.2**	**(5.7)**	**17.7**	**90.7**	**(13.1)**	**100.0**	**(11.0)**
0-5	58.5	98.9	(6.9)					
6-23	74.0	95.0	(6.0)					
24-59	93.2	95.2	(5.8)	13.9	91.4	(12.7)	100.0	(11.7)
60-107	114.8	95.0	(5.4)	20.3	90.3	(13.3)	100.0	(10.5)
Northeast								
Urban	**96.6**	**94.1**	**(6.6)**	**16.9**	**87.8**	**(14.8)**	**98.9**	**(11.6)**
0-5	57.8	98.5	(6.6)					
6-23	72.9	94.2	(6.9)					
24-59	91.9	94.0	(6.9)	13.6	89.2	(14.9)	99.4	(12.1)
60-107	113.0	93.7	(6.1)	19.5	86.7	(14.7)	98.5	(11.2)
Rural	**93.1**	**91.8**	**(6.3)**	**16.1**	**83.8**	**(12.8)**	**98.9**	**(11.2)**
0-5	56.9	96.4	(6.9)					
6-23	70.3	91.3	(6.3)					
24-59	89.4	91.5	(6.2)	12.9	84.9	(12.9)	98.9	(11.5)
60-107	110.4	91.6	(5.9)	18.6	83.0	(12.6)	98.9	(10.9)

[a]Weight and weight for height and statistics are not reported for children under two years because of rounding error.

Table 3

Survival Rates, Standardized Heights and Weights-for-Height By Deciles of PCE and Parental Education

South

	URBAN			RURAL		
Decile of PCE	height for age % median	weight for height % median	Survival rate mean	height for age % median	weight for height % median	Survival rate mean
0-10	94.0	99.3	85.1	93.3	99.6	87.5
11-20	95.7	99.0	86.7	94.2	99.6	85.7
21-30	97.1	99.5	87.6	94.6	100.0	85.0
31-40	98.2	99.6	88.5	95.4	100.1	87.1
41-50	98.5	101.5	89.3	96.1	100.2	86.8
51-60	99.4	100.8	90.9	97.0	100.2	88.4
61-70	99.9	103.7	91.3	97.2	100.2	88.6
71-80	99.8	103.9	91.4	96.9	99.8	89.3
81-90	101.0	104.4	93.2	97.1	100.5	89.0
91-100	101.2	104.9	93.5	98.2	102.7	90.7
Mean	97.2	100.5	89.5	95.2	100.0	87.6
Std dev	6.3	12.6	19.3	5.7	11.0	18.9
Mother's education						
illiterate	94.6	99.7	79.5	94.2	99.5	82.6
literate	96.5	99.9	89.0	95.7	100.3	90.6
elementary school	98.4	100.8	93.3	96.7	100.8	93.5
secondary school	100.6	103.9	96.5	-	-	-
Father's education						
illiterate	94.3	100.6	80.8	94.4	99.6	82.6
literate	96.2	99.7	88.8	95.3	100.0	89.6
elementary school	98.1	100.5	92.8	96.5	101.1	93.2
secondary school	100.3	103.2	96.3	-	-	-

Notes:

Elementary School = completed elementary school in urban sector; completed elementary school or higher in rural sector.
Secondary school = completed secondary school or higher; applicable only in urban sector.
Survival rates are in percentages.

Table 3 (cont.)

Survival Rates, Stadardized Heights and Weights-for-Height
By Scales of PCE and Parental Education

Northeast

	URBAN			RURAL		
Decile of PCE	height for age % median	weight for height % median	Survival rate mean	height for age % median	weight for height % median	Survival rate mean
0-10	90.4	98.0	74.6	90.4	98.0	78.5
11-20	91.6	98.1	75.2	90.7	98.2	76.9
21-30	92.6	97.7	75.9	91.4	98.9	73.9
31-40	93.6	98.9	76.6	91.9	99.0	77.3
41-50	94.2	98.6	77.7	92.4	98.4	76.2
51-60	95.3	98.4	78.1	92.3	100.0	75.8
61-70	96.0	99.0	80.5	92.3	99.5	74.1
71-80	97.4	99.7	81.8	93.2	99.0	73.4
81-90	98.4	100.8	84.3	93.2	100.0	72.6
91-100	100.3	103.6	92.2	95.4	100.6	76.2
Mean	94.1	98.9	80.0	91.8	98.9	75.6
Std dev	6.6	11.6	25.2	6.3	11.2	24.9
Mother's education						
illiterate	92.1	99.0	69.8	91.4	98.9	73.3
literate	93.8	98.3	80.7	92.3	98.7	80.1
elementary school	96.0	99.3	89.5	93.8	101.3	88.5
secondary school	99.5	102.1	95.1	-	-	-
Father's education						
illiterate	92.0	99.0	72.6	91.4	98.9	74.3
literate	93.6	98.3	80.9	92.4	98.7	80.0
elementary school	95.9	99.0	89.1	93.6	100.1	82.5
secondary school	99.6	102.2	95.5	-	-	-

Notes:

Elementary School = completed elementary school in urban sector; completed elementary school or higher in rural sector.
Secondary school = completed secondary school or higher; applicable only in urban sector.
Survival rates are in percentages.

Table 4

Survival Rates

Age of mother in years	Mean	(Sd)	%=1
South			
Urban	**89.5**	**(19.3)**	**69**
14-24	94.1	(17.9)	88
25-34	93.4	(15.9)	81
35-44	90.8	(16.8)	69
≥45	83.8	(22.4)	54
Rural	**87.6**	**(18.9)**	**58**
14-24	93.9	(17.9)	87
25-34	90.6	(17.3)	69
35-44	88.4	(17.3)	57
≥45	82.0	(20.4)	39
Northeast			
Urban	**80.0**	**(25.2)**	**49**
14-24	87.8	(25.1)	76
25-34	85.8	(21.8)	62
35-44	80.9	(23.3)	46
≥45	72.4	(27.1)	33
Rural	**75.6**	**(24.9)**	**34**
14-24	84.1	(28.4)	70
25-34	80.0	(23.0)	45
35-44	74.2	(23.7)	27
≥45	69.9	(24.2)	20

Notes:

Survival rates measured in percentages.

Table 5

Child Nutrition Regressions: All Ages

Log of Standardized Height for Age[a/]

	South				Northeast			
	Urban		Rural		Urban		Rural	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Constant	1.858	1.826	1.618	1.576	1.977	1.909	1.689	1.663
	(25.37)	(24.98)	(15.73)	(15.36)	(19.18)	(19.04)	(15.87)	(15.60)
Non-Mother's earned	0.111		0.398		0.401		0.937	
income[b]	(5.01)		(4.12)		(2.81)		(5.54)	
Non-Mother's earned	-0.119		-1.280		-0.776		-7.767	
income squared[b]	(3.89)		(2.11)		(1.10)		(3.81)	
Household Unearned	0.053	0.004	-0.067	-0.115	0.030	0.274	-0.399	-0.456
income[b]	(2.00)	(2.21)	(0.10)	(0.18)	(2.46)	(2.35)	(0.70)	(0.80)
Household Unearned	-0.013	-0.010	-4.444	0.292	-0.641	-1.134	-2.935	12.913
income squared[b]	(1.70)	(1.79)	(0.50)	(0.02)	(0.78)	(1.17)	(0.18)	(1.06)
Income Interaction[b]	-0.077		5.968		-2.416		15.924	
	(0.98)		(0.34)		(2.24)		(1.33)	
Number Adults[c]	0.337	0.351	-0.635	-0.586	-0.200	-0.140	0.313	0.333
	(1.60)	(1.66)	(2.14)	(1.96)	(0.90)	(0.63)	(1.01)	(1.08)
Number Adults	-0.068	-0.066	0.080	0.083	0.004	0.006	-0.035	-0.029
Squared[c]	(2.53)	(2.46)	(2.11)	(2.18)	(0.15)	(0.21)	(0.89)	(0.73)
Dummy (1) if child								
male	-.002	-.002	-.002	-.002	-.004	-.004	-.005	-.005
	(2.01)	(1.98)	(1.83)	(1.82)	(3.35)	(3.29)	(3.36)	(3.46)
age 6-11 months	-.026	-.026	-.036	-.036	-.045	-.045	-.044	-.044
	(7.77)	(7.78)	(6.18)	(6.15)	(11.10)	(11.12)	(10.99)	(10.86)
age 12-17 months	-.030	-.030	-.042	-.042	-.051	-.050	-.066	-.066
	(9.10)	(9.05)	(7.55)	(7.54)	(12.69)	(12.57)	(15.88)	(15.84)
age 18-23 months	-.034	-.034	-.047	-.047	-.060	-.059	-.067	-.067
	(10.18)	(10.16)	(8.32)	(8.23)	(14.94)	(14.82)	(15.63)	(15.52)
age 2 years	-.025	-.025	-.037	-.037	-.047	-.047	-.054	-.054
	(8.52)	(8.49)	(7.41)	(7.36)	(13.64)	(13.52)	(14.98)	(14.88)
age 3 years	-.032	-.031	-.038	-.038	-.055	-.054	-.059	-.058
	(11.35)	(11.24)	(7.64)	(7.56)	(15.78)	(15.63)	(16.11)	(16.08)
age 4-5 years	-.035	-.034	-.043	-.042	-.054	-.053	-.057	-.056
	(13.16)	(13.03)	(8.89)	(8.77)	(17.06)	(16.90)	(17.27)	(17.13)
age 6-8 years	-.034	-.033	-.042	-.041	-.052	-.051	-.056	-.055
	(13.17)	(13.01)	(8.94)	(8.81)	(17.22)	(17.08)	(17.79)	(17.64)
dummy (1) if mother								
is literate	.012	.013	.006	.007	.012	.013	.004	.005
	(8.03)	(8.25)	(3.77)	(4.30)	(7.35)	(7.82)	(2.93)	(3.54)
completed elementary	.020	.021	.010	.012	.016	.018	.014	.016
school	(11.01)	(11.44)	(4.05)	(4.79)	(6.76)	(7.63)	(3.20)	(3.60)
completed secondary	.024	.026			.024	.030		
school or higher	(10.24)	(11.44)			(7.07)	(9.50)		

Table 5 (cont.)

Child Nutrition Regressions: All Ages

Log of Standardized Height for Age

	South				Northeast			
	Urban		Rural		Urban		Rural	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
dummy (1) if husband								
is literate	.011	.011	.003	.004	.010	.011	.005	.007
	(5.77)	(6.00)	(1.58)	(2.12)	(6.06)	(6.67)	(3.55)	(4.79)
completed elementary	.019	.020	.004	.007	.021	.023	.007	.012
school	(8.99)	(9.42)	(1.57)	(2.58)	(8.31)	(9.63)	(1.37)	(2.59)
completed secondary	.024	.028			.030	.039		
school or higher	(9.70)	(11.37)			(8.07)	(12.89)		
log(standardized	.337	.340	.363	.369	.322	.328	.364	.364
mother's height)	(26.58)	(26.80)	(20.94)	(21.31)	(18.32)	(18.85)	(20.11)	(20.08)
log(standardized	.255	.259	.289	.292	.245	.254	.268	.274
husband's height)	(19.43)	(19.76)	(16.49)	(16.65)	(14.18)	(14.82)	(14.73)	(15.08)
mother's age at	0.073	0.075	0.053	0.055	0.081	0.082	0.032	0.032
birth[c]	(8.48)	(8.68)	(4.60)	(4.81)	(7.51)	(7.51)	(2.73)	(2.73)
dummy (1) if state								
Brasilia	-.004	-.003	-.013	-.012				
	(-2.30)	(2.01)	(2.49)	(2.41)				
Parana	-.015	-.015	-.011	-.010				
	(8.77)	(8.69)	(5.07)	(4.85)				
Santa Catarina	-.013	-.013	-.007	-.007				
	(-5.53)	(5.63)	(2.54)	(2.72)				
Rio G. do Sul	-.007	-.007	-.007	-.007				
	(-4.42)	(4.36)	(3.08)	(3.03)				
Sao Paulo	.001	.002	.002	.003				
	(0.94)	(1.27)	(1.01)	(1.42)				
Maranhcao					-.018	-.020	-.012	-.014
					(5.27)	(5.76)	(4.99)	(5.51)
Piaui					-.015	-.015	-.013	-.015
					(4.07)	(4.21)	(4.51)	(5.14)
Ceara					-.005	-.006	-.001	-.001
					(3.01)	(3.31)	(0.28)	(0.70)
Rio G. do Norte					.001	.0003	.002	.001
					(0.34)	(0.01)	(0.45)	(0.36)
Paraiba					-.008	-.009	.0001	-.0005
					(2.49)	(2.67)	(0.03)	(0.18)
Pernambuco					.006	.005	.002	.002
					(3.47)	(3.08)	(0.93)	(0.81)
Alagoas					.002	.002	.001	.002
					(0.43)	(0.32)	(0.44)	(0.52)
Sergipe					.002	.003	-.0004	.001
					(0.52)	(0.53)	(0.08)	(0.19)

Table 5 (cont.)

Child Nutrition Regressions: All Ages

Log of Standardized Height for Age

	South				Northeast			
	Urban		Rural		Urban		Rural	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
R^2	0.21	0.21	0.17	0.17	.25	.25	.16	.16
Std error[c]	5.713	5.718	5.429	5.441	6.091	6.115	6.230	6.242
F	132.2	146.1	53.8	58.9	96.4	10.30	54.8	59.3
LM Test	492.3	483.0	234.4	226.2	358.6	325.0	209.3	203.3
(dof)	(29)	(26)	(27)	(24)	(32)	(30)	(30)	(27)
Sample size	14713	14713	6913	6913	9233	9233	8592	8592

Notes:

a/ Heteroskedasticity consistent standard errors are computed using the jacknife.

b/ Non-mother earned income and household nonearned income are measured in Cr 1,000,000; the interaction term is the product of the two income measures; it and the squares are measured in $Cr10^{12}$.

c/ Coefficients are multiplied by 100 for number of adults, its square, age of mother at birth, and the equation standard error.

Table 6A

Child Nutrition Regressions by Age Groups

Standardized Height for Age[a]

	South							
	Urban				Rural			
Variable/Months	0–5	6–23	24–59	60–108	0–5	6–23	24–59	60–108
Constant	3.511 (10.32)	2.393 (11.73)	1.57 (13.26)	1.507 (15.38)	3.324 (5.32)	1.998 (7.11)	1.658 (8.26)	1.328 (10.28)
Non-mother earned income[b]	−0.055 (0.36)	0.319 (2.60)	0.116 (2.72)	0.145 (4.35)	−0.564 (0.41)	1.287 (2.85)	0.738 (4.91)	0.255 (2.57)
Non-mother earned income squared[b]	0.133 (0.32)	−1.747 (3.00)	−0.141 (2.13)	−0.142 (3.18)	9.439 (0.36)	−11.094 (1.59)	−2.941 (4.13)	−0.694 (1.25)
Household non-earned income[b]	−0.107 (0.47)	0.157 (0.61)	0.044 (0.52)	0.034 (0.80)	1.974 (0.39)	1.810 (1.40)	0.371 (0.65)	0.130 (0.32)
Household non-earned income squared[b]	0.188 (1.18)	−0.137 (0.10)	−0.012 (0.10)	−0.006 (0.53)	387.275 (0.97)	−34.386 (1.59)	−8.358 (0.81)	−5.103 (1.18)
Income interaction[b]	0.182 (0.12)	0.852 (0.30)	0.039 (0.10)	−0.129 (1.37)	−428.697 (1.72)	18.728 (0.49)	−13.253 (2.12)	8.371 (0.92)
Number of adults[c]	−1.130 (0.55)	−0.297 (−.52)	0.592 (1.46)	0.337 (1.21)	0.866 (0.30)	−2.832 (2.45)	−0.350 (0.61)	−0.718 (1.91)
Number of adults squared[c]	0.139 (0.45)	−0.001 (0.01)	−0.091 (1.74)	−0.072 (2.02)	0.030 (0.07)	0.359 (2.29)	0.060 (0.78)	0.075 (1.61)
Dummy (1) if child is male	−0.019 (3.87)	0.001 (0.20)	−0.0004 (0.22)	−0.003 (2.18)	0.005 (0.44)	−0.008 (2.09)	−0.002 (1.00)	−0.002 (0.93)
1–2 months	−0.001 (0.06)				−0.016 (0.97)			
2–3 months	−0.003 (0.42)				−0.005 (0.37)			
4–5 months	0.005 (0.70)				−0.040 (2.85)			
12–17 months		−0.004 (1.12)				−0.005 (1.01)		
18–23 months		−0.007 (2.04)				−0.011 (2.29)		
3 years			−0.007 (3.31)				−0.001 (0.40)	
4 years			−0.009 (4.19)				−0.005 (1.90)	
6 years				0.002 (1.05)				0.002 (0.62)
7 years				0.002 (1.28)				0.0002 (0.09)
8 years				0.001 (0.38)				0.001 (0.46)
Dummy (1) if mother is literate	0.024 (2.78)	0.017 (3.48)	0.014 (5.06)	0.008 (4.30)	−0.0002 (0.01)	0.009 (1.86)	0.003 (0.91)	0.007 (3.37)
completed elementary school	0.024 (2.52)	0.022 (3.84)	0.023 (6.85)	0.017 (7.06)	0.005 (0.28)	0.011 (1.36)	0.010 (2.15)	0.009 (2.81)
completed secondary school	0.031 (2.64)	0.025 (3.80)	0.027 (6.54)	0.020 (6.21)				

Table 6A (continued)

	South							
	Urban				Rural			
Variable/Months	0-5	6-23	24-59	60-108	0-5	6-23	24-59	60-108
Dummy (1) if husband								
is literate	-0.012	0.017	0.008	0.012	0.023	0.001	0.001	0.003
	(1.10)	(2.95)	(2.26)	(5.06)	(1.72)	(0.29)	(0.43)	(1.30)
completed elementary	0.002	0.027	0.018	0.018	0.006	-0.008	0.003	0.009
school	(0.19)	(4.14)	(4.47)	(6.73)	(0.34)	(1.11)	(0.58)	(2.76)
completed secondary	0.001	0.035	0.024	0.022				
school or higher	(0.05)	(4.68)	(5.34)	(6.57)				
log(standardized	0.171	0.333	0.326	0.365	0.240	0.296	0.364	0.388
height of mother)	(2.86)	(9.52)	(14.12)	(21.29)	(2.05)	(6.25)	(11.16)	(16.79)
log(standardized	0.067	0.134	0.282	0.297	0.045	0.275	0.271	0.316
height of father)	(1.05)	(3.48)	(11.71)	(17.55)	(0.38)	(5.44)	(8.58)	(13.85)
Mother's age								
at birth[c]	0.076	0.086	0.066	0.075	0.155	0.023	0.030	0.088
	(1.82)	(3.50)	(4.16)	(6.54)	(1.59)	(0.65)	(1.60)	(5.63)
Dummy (1) of state is								
Brasilia	0.013	0.007	-0.011	-0.004	-0.007	-0.020	-0.013	-0.010
	(1.82)	(1.50)	(4.17)	(1.76)	(0.24)	(1.57)	(1.47)	(1.38)
Parana	-0.001	-0.014	-0.017	-0.014	-0.011	-0.017	-0.015	-0.005
	(0.07)	(2.81)	(5.60)	(6.44)	(0.85)	(2.80)	(4.07)	(1.70)
Santa Catarina	-0.011	0.001	-0.021	-0.012	0.018	-0.016	-0.007	-0.004
	(0.75)	(0.20)	(5.08)	(3.75)	(0.79)	(1.96)	(1.55)	(1.24)
Rio G. do Sul	-0.001	-0.001	-0.011	-0.008	-0.002	-0.013	-0.010	-0.004
	(0.09)	(0.31)	(3.70)	(3.37)	(0.10)	(1.71)	(2.33)	(1.38)
Sao Paulo	0.009	-0.001	0.0004	0.002	-0.010	-0.003	-0.0002	0.007
	(1.59)	(0.38)	(0.17)	(1.07)	(0.67)	(0.52)	(0.06)	(2.19)
R^2	0.11	0.16	0.20	0.23	0.15	0.14	0.15	0.21
Standard error[c]	6.000	6.346	5.967	5.200	6.516	6.042	5.597	4.991
F	3.1	18.5	50.9	80.9	1.5	7.2	19.3	38.2
LM Test	25.8	72.2	110.8	189.1	21.4	58.3	61.5	108.6
(dof)	(25)	(24)	(24)	(25)	(23)	(22)	(22)	(23)
Sample size	661	2338	4918	6796	215	983	2381	3334

Notes:

See Table 5.

Table 6B

Child Nutrition Regressions by Age Groups

Standardized Height for Age[a/]

	Northeast							
	Urban				Rural			
Variable/Months	0–5	6–23	24–59	60–108	0–5	6–23	24–59	60–108
Constant	3.695	1.972	1.935	1.762	3.337	1.875	1.581	1.394
	(8.46)	(7.96)	(10.53)	(11.94)	(7.33)	(7.21)	(8.30)	(8.91)
Non-mother earned	0.100	0.436	0.678	0.349	−0.091	2.577	0.890	0.958
income[b]	(0.27)	(2.38)	(4.17)	(1.87)	(0.10)	(4.68)	(2.95)	(3.89)
Non-mother earned	−0.538	−1.051	−1.774	−0.684	11.479	−37.311	−1.998	−8.739
income squared[b]	(0.33)	(1.13)	(2.15)	(0.81)	(0.73)	(4.01)	(0.56)	(2.94)
Household non-earned	1.855	0.527	0.097	0.401	−0.653	−3.728	1.201	0.209
income[b]	(1.23)	(1.54)	(0.31)	(2.08)	(0.16)	(1.01)	(0.98)	(0.27)
Household non-earned	1.183	0.280	0.664	−1.188	209.615	204.688	−11.239	−2.550
income squared[b]	(0.03)	(0.16)	(0.20)	(0.44)	(1.34)	(0.80)	(0.30)	(0.19)
Income Interaction[b]	−12.915	−8.794	−1.584	−1.285	−261.890	−73.886	−93.414	16.246
	(0.50)	(2.45)	(0.52)	(0.89)	(1.34)	(0.81)	(2.95)	(1.90)
Number of adults[c]	−0.246	−0.372	−0.165	−0.208	2.792	0.652	0.403	−0.047
	(0.21)	(0.49)	(0.35)	(0.73)	(1.34)	(0.79)	(0.65)	(0.11)
Number of adults	−0.073	0.035	−0.006	0.012	−0.393	−0.041	−0.057	0.003
squared[c]	(0.52)	(0.35)	(0.11)	(−0.36)	(1.30)	(0.40)	(0.68)	(0.50)
Dummy (1) if child								
is male	−0.009	−0.002	−0.004	−0.005	−0.001	−0.011	0.002	−0.006
	(1.62)	(0.45)	(1.79)	(2.94)	(0.19)	(3.38)	(0.69)	(3.27)
1–2 months	0.005				0.005			
	(0.51)				(0.54)			
2–3 months	.005				−0.016			
	(0.69)				(2.05)			
4–5 months	−0.023				−0.040			
	(2.98)				(5.03)			
12–17 months		−0.006				−0.023		
		(1.50)				(5.81)		
18–23 months		−0.015				−0.024		
		(3.58)				(5.63)		
3 years			−0.008				−0.004	
			(2.68)				(1.45)	
4 years			−0.005				−0.003	
			(1.95)				(0.90)	
6 years				0.003				0.004
				(1.00)				(1.46)
7 years				0.003				0.001
				(1.12)				(0.45)
8 years				0.004				−0.003
				(1.39)				(1.18)
Dummy (1) if mother								
is literate	0.011	0.015	0.015	0.010	0.012	0.005	0.005	0.003
	(1.58)	(3.45)	(4.69)	(4.36)	(1.72)	(1.21)	(1.73)	(1.25)
completed elementary	0.020	0.022	0.018	0.012	0.035	0.020	0.010	0.014
school	(1.96)	(3.56)	(4.27)	(3.46)	(1.69)	(1.73)	(1.36)	(2.07)
completed secondary	0.035	0.026	0.023	0.021				
school or higher	(2.41)	(3.40)	(4.06)	(4.10)				

Table 6B (continued)

Variable/Months	Northeast Urban 0–5	6–23	24–59	60–108	Northeast Rural 0–5	6–23	24–59	60–108
Dummy (1) if husband is literate	0.013	0.013	0.017	0.004	0.005	0.012	0.005	0.002
	(1.91)	(2.79)	(5.26)	(1.90)	(0.71)	(3.05)	(2.03)	(0.77)
completed elementary school	0.014	0.027	0.025	0.015	−0.043	0.019	0.011	0.004
	(1.47)	(4.21)	(5.65)	(4.20)	(2.11)	(1.53)	(1.49)	(0.51)
completed secondary school or higher	0.018	0.044	0.035	0.021				
	(1.26)	(5.13)	(5.93)	(3.94)				
log(standardized height of mother)	0.011	0.331	0.325	0.342	0.234	0.288	0.390	0.381
	(0.15)	(7.60)	(10.38)	(13.53)	(2.97)	(6.27)	(11.85)	(15.00)
log(standardized height of father)	0.181	0.225	0.238	0.262	0.032	0.294	0.252	0.305
	(2.42)	(5.11)	(7.72)	(10.65)	(0.42)	(6.35)	(7.80)	(11.50)
Mother's age at birth[c]	0.072	0.093	0.083	0.078	−0.009	−0.007	0.034	0.050
	(1.55)	(3.40)	(4.30)	(5.03)	(0.17)	(0.25)	(1.65)	(2.91)
Dummy (1) of state is								
Maranhcao	−0.025	−0.023	−0.015	−0.018	−0.020	−0.016	−0.011	−0.011
	(1.62)	(2.24)	(2.26)	(4.17)	(2.07)	(2.47)	(2.43)	(3.06)
Piaui	0.002	−0.018	−0.007	−0.026	−0.008	−0.010	−0.013	−0.014
	(0.13)	(1.96)	(1.18)	(5.31)	(0.75)	(1.29)	(2.34)	(3.53)
Ceara	0.002	−0.007	−0.004	−0.008	0.016	−0.001	0.002	−0.004
	(0.35)	(1.49)	(1.21)	(3.08)	(1.75)	(0.28)	(0.49)	(1.30)
Rio G. do Norte	−0.026	0.0005	0.0005	0.001	0.015	0.007	0.003	0.002
	(1.61)	(0.07)	(0.78)	(0.36)	(0.71)	(0.66)	(0.43)	(0.30)
Paraiba	−0.030	−0.011	−0.003	−0.010	−0.009	−0.016	0.009	0.001
	(1.92)	(1.36)	(0.46)	(2.10)	(0.90)	(2.43)	(2.07)	(0.34)
Pernambuco	−0.003	0.0001	0.013	0.004	0.010	−0.002	0.004	0.0002
	0.40)	(0.02)	(4.17)	(1.49)	(0.90)	(0.31)	(1.03)	(0.06)
Alagoas	0.007	0.018	−0.0005	−0.003	−0.013	0.005	0.006	−0.001
	(0.37)	(1.37)	(0.06)	(0.49)	(0.97)	(0.65)	(0.99)	(0.28)
Sergipe	−0.010	−0.007	0.020	−0.004	0.032	−0.010	−0.0001	0.0001
	(0.47)	(0.50)	(2.38)	(0.54)	(1.22)	(0.81)	(0.01)	(0.02)
R^2	0.20	0.27	0.24	0.24	0.16	0.17	0.12	0.15
Standard error[c]	6.024	6.337	6.451	5.634	6.451	6.411	6.487	5.835
F	4.2	20.6	37.4	44.0	3.6	11.6	15.7	24.7
LM Test	17.5	70.1	101.1	173.3	27.5	42.9	63.4	143.9
(dof)	(28)	(27)	(27)	(28)	(26)	(25)	(25)	(26)
Sample size	510	1503	3179	4041	532	1477	2889	3694

Notes

See Table 5

Table 7

Child Nutrition Regressions: Ages 24-107 Months
Log of Standardized Weight for Height[a]

	Urban South		Rural South		Northeast Urban		Northeast Rural	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Constant	4.554	4.501	4.617	4.635	5.069	4.961	4.518	4.504
	(26.24)	(26.01)	(21.27)	(21.46)	(24.04)	(23.61)	(20.19)	(20.14)
Non-Mother's earned	0.200		-0.194		0.575		0.546	
income[b]	(3.67)		(1.21)		(5.56)		(1.58)	
Non-Mother's earned	-0.225		0.524		-0.854		-4.582	
income squared[b]	(2.52)		(0.99)		(2.27)		(1.04)	
Household unearned	0.113	0.082	0.494	0.221	0.473	0.535	0.053	-0.056
income[b]	(1.49)	(1.47)	(0.60)	(0.24)	(1.81)	(2.05)	(0.06)	(0.07)
Household unearned	-0.026	-0.019	-10.881	-0.195	-0.460	-0.972	-1.212	14.396
income squared[b]	(1.14)	(0.97)	(0.97)	(0.01)	(0.20)	(0.46)	(0.06)	(0.10)
Income Interaction[b]	-0.172		13.535		-1.716		14.804	
	(0.80)		(0.77)		(0.93)		(1.40)	
Number Adults[c]	-0.441	-0.407	0.105	0.095	0.260	0.343	-0.499	-0.493
	(1.08)	(0.99)	(0.19)	(0.17)	(0.54)	(0.71)	(0.91)	(0.90)
Number Adults	0.009	0.011	0.007	0.004	-0.043	-0.040	0.060	0.065
Squared[c]	(0.18)	(0.24)	(0.10)	(0.06)	(0.74)	(0.69)	(0.92)	(0.99)
Dummy (1) if child								
male	-.008	-.008	-.009	-.009	-.007	-.006	0.003	0.003
	(3.79)	(3.75)	(3.31)	(3.32)	(2.45)	(2.41)	(1.24)	(1.21)
age 3 years	-0.001	-0.003	0.001	0.001	0.008	0.008	0.011	0.011
	(0.17)	(0.06)	(0.20)	(0.19)	(1.47)	(1.52)	(2.18)	(2.16)
age 4-5 years	-0.007	-0.007	-0.004	-0.004	-0.003	-0.003	0.002	0.003
	(1.95)	(1.82)	(0.69)	(0.72)	(0.71)	(0.62)	(0.55)	(0.57)
age 6-8 years	-0.011	-0.011	0.001	0.0005	-0.006	-0.006	0.010	0.010
	(3.14)	(2.96)	(0.13)	(0.10)	(1.39)	(1.29)	(2.28)	(2.30)
Dummy (1) if mother								
is literate	0.003	0.003	0.005	0.005	-0.007	-0.006	-0.002	-0.001
	(0.81)	(1.02)	(1.57)	(1.52)	(1.99)	(1.71)	(0.67)	(0.48)
completed elementary	0.007	0.009	0.005	0.005	-0.008	-0.005	0.020	0.021
school	(1.77)	(2.10)	(0.95)	(0.86)	(1.61)	(1.08)	(1.94)	(2.07)
completed secondary	0.025	0.029			-0.002	0.009		
school or higher	(4.38)	(5.22)			(0.24)	(1.19)		

Table 7 (cont.)
Child Nutrition Regressions: Ages 24-107 Months
Log of Standardized Weight for Height

	Urban South		Rural South		Northeast Urban		Northeast Rural	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Dummy (1) if husband								
is literate	-0.014	-0.013	0.001	0.001	-0.002	-0.0005	-0.005	-0.004
	(3.31)	(3.12)	(0.36)	(0.22)	(0.57)	(0.13)	(1.66)	(1.34)
completed elementary	-0.012	-0.010	0.007	0.006	0.002	0.005	-0.007	-0.003
school	(2.49)	(2.17)	(1.22)	(1.12)	(0.31)	(1.00)	(0.63)	(0.32)
completed secondary	-0.004	0.002			0.016	0.030	0.007	0.066
school or higher	(0.63)	(0.39)			(2.28)	(4.33)	(1.83)	(1.82)
log (standardized	0.148	0.199	0.011	0.009	-0.078	-0.070	-0.005	-0.046
mother's height)	(0.49)	(0.67)	(0.30)	(0.23)	(2.17)	(1.96)	(1.29)	(1.19)
log (standardized	-0.146	0.005	-0.017	-0.018	-0.029	-0.013	-0.038	-0.039
father's height)	(0.05)	(0.16)	(0.44)	(0.47)	(0.81)	(0.35)	(1.64)	(1.67)
Mother's age at	0.001	0.003	-0.041	-0.042	-0.026	-0.026		
birth[c]	(0.05)	(0.16)	(1.59)	(1.63)	(1.11)	(1.13)		
dummy (1) if state is								
Brasilia	0.005	0.006	0.009	0.009				
	(1.40)	(1.65)	(0.91)	(0.89)				
Parana	0.013	0.013	0.021	0.021				
	(3.31)	(3.38)	(4.74)	(4.68)				
Santa Catarina	0.026	0.026	0.032	0.032				
	(4.98)	(4.92)	(5.72)	(5.76)				
Rio G. do Sul	0.027	0.027	0.021	0.021				
	(7.01)	(7.08)	(4.03)	(4.01)				
Sao Paulo	0.009	0.009	0.015	0.014				
	(2.72)	(3.00)	(2.94)	(2.87)				
Maranhcao					0.005	0.002	-0.007	-0.007
					(0.67)	(0.27)	(1.29)	(1.42)
Piaui					0.027	0.026	-0.007	-0.008
					(3.41)	(3.32)	(1.27)	(1.45)
Ceara					0.004	0.027	0.006	0.006
					(1.01)	(0.70)	(1.49)	(1.38)
Rio G. do Norte					0.032	0.031	0.009	0.009
					(4.58)	(4.35)	(1.18)	(1.18)
Paraiba					0.043	0.041	0.013	0.013
					(6.71)	(6.47)	(2.69)	(2.64)
Pernambuco					0.010	0.009	0.015	0.015
					(2.87)	(2.51)	(3.12)	(3.11)
Alagoas					-0.0003	-0.002	-0.007	0.006
					(0.03)	(0.14)	(0.98)	(0.95)
Sergipe					0.039	0.039	0.010	0.011
					(4.58)	(4.46)	(1.21)	(1.33)
R^2	0.02	0.02	0.01	0.01	0.03	0.02	0.01	0.01
Std error[c]	11.96	11.96	10.70	10.70	11.37	11.39	11.01	11.01
F	11.4	12.0	3.2	3.5	7.7	7.0	2.8	3.0
LM Test	258.7	236.7	158.4	152.1	214.7	212.4	150.8	145.8
(dof)	(25)	(22)	(23)	(20)	(28)	(25)	(26)	(23)
Sample size	11714	11714	5715	5715	7220	7220	6583	6583

Notes: See Table 5

TABLE 8A

Survival Rate Probability Tobits:
Coefficients, T-Statistics and Slopes of Expected Values

Covariate	South Urban I Coeff.	South Urban I Slope	South Urban II Coeff.	South Urban II Slope	South Rural I Coeff.	South Rural I Slope	South Rural II Coeff.	South Rural II Slope
Non-mother earned income[a]	1.212 (6.61)	0.351			2.179 (4.33)	0.908		
Non-mother earned income squared[a]	-0.551 (5.23)	-0.160			-3.894 (3.00)	-1.622		
Household non-earned income[a]	0.181 (1.04)	0.052	0.209 (1.26)	0.061	0.729 (.52)	0.304	2.062 (1.84)	0.861
Household non-earned income squared[a]	-0.009 (0.12)	-0.003	-0.025 (0.45)	-0.007	-3.096 (0.64)	-1.290	-6.747 (1.54)	-2.816
Interaction[a]	-0.433 (1.49)	-0.125			32.313 (0.95)	13.461		
Number of adults	0.011 (0.92)	0.003	0.017 (1.43)	0.005	-0.016 (0.98)	-0.007	-0.013 (0.79)	-0.006
Number of adults squared	-0.001 (1.08)	-0.0004	-0.002 (1.13)	-0.0004	0.003 (1.62)	0.001	0.001 (1.76)	0.001
Dummy (1) if mother is literate	0.145 (12.82)	0.054	0.149 (13.05)	0.056	0.087 (6.68)	0.037	0.092 (7.11)	0.040
completed elementary school	0.250 (17.11)	0.083	0.258 (17.46)	0.086	0.128 (5.25)	0.052	0.140 (5.75)	0.057
completed secondary school or higher	0.341 (15.86)	0.101	0.364 (16.79)	0.107				
Dummy (1) if husband exists	-0.049 (2.81)	-0.017	-0.047 (2.68)	-0.016	-0.043 (1.82)	-0.019	-0.036 (1.53)	-0.016
is literate	0.082 (5.34)	0.033	0.087 (5.66)	0.036	0.072 (5.35)	0.035	0.078 (5.75)	0.038
completed elementary school	0.125 (6.96)	0.048	0.136 (7.56)	0.053	0.080 (3.22)	0.039	0.098 (3.91)	0.047
completed seccondary school	0.189 (8.09)	0.067	0.231 (10.10)	0.081				
log (standardized height of mother)[b]	0.990 (9.33)	0.286	1.035 (9.73)	0.300	0.784 (5.64)	0.326	0.825 (5.91)	0.344

Table 8A (cont.)

Covariate	South Urban				South Rural			
	I		II		I		II	
	Coeff.	Slope	Coeff.	Slope	Coeff.	Slope	Coeff.	Slope
Dummy (1) if mother aged								
25-29 years	-0.073	-0.017	-0.070	-0.017	-0.132	-0.039	-0.130	-0.038
	(3.58)		(3.30)		(5.19)		(5.08)	
30-34 years	-0.106	-0.026	-0.101	-0.025	-0.215	-0.073	-0.211	-0.070
	(5.29)		(4.89)		(8.60)		(8.34)	
35-39 years	-0.175	-0.048	-0.171	-0.048	-0.201	-0.066	-0.197	-0.064
	(8.73)		(8.32)		(7.81)		(7.64)	
40-44 years	-0.219	-0.064	-0.217	-0.064	-0.297	-0.113	-0.292	-0.111
	(10.51)		(10.12)		(11.06)		(10.82)	
45-49 years	-0.263	-0.081	-0.257	-0.080	-0.309	-0.120	-0.304	-0.117
	(12.34)		(11.70)		(11.14)		(10.93)	
50-54 years	-0.287	-0.091	-0.284	-0.092	-0.359	-0.150	-0.356	-0.148
	(12.86)		(12.37)		(12.10)		(12.00)	
55-59 years	-0.355	-0.124	-0.352	-0.125	-0.405	-0.180	-0.402	-0.177
	(14.91)		(14.47)		(13.12)		(12.99)	
$\geq$ 60 years	-0.412	-0.154	-0.411	-0.156	-0.405	-0.180	-0.405	-0.179
	(19.39)		(18.78)		(14.64)		(14.59)	
Dummy (1) if state is								
Brasilia	-0.050	-0.019	-0.045	-0.017	0.039	0.016	0.040	0.016
	(3.29)		(2.98)		(0.67)		(0.69)	
Parana	-0.024	-0.009	-0.021	-0.008	-0.027	-0.012	-0.023	-0.010
	(1.68)		(1.47)		(1.63)		(1.36)	
Santa Catarina	-0.032	-0.012	-0.034	-0.013	0.017	0.007	0.014	0.006
	(1.35)		(1.40)		(0.79)		(0.64)	
Rio G. do Sul	0.079	0.026	0.080	0.027	0.099	0.037	0.103	0.038
	(5.52)		(5.52)		(5.26)		(5.29)	
Sao Paulo	0.003	0.001	0.009	0.003	-0.018	-0.008	-0.008	-0.003
	(0.29)		(0.83)		(1.01)		(0.43)	
Constant	-2.353		-2.572		-1.346		-1.548	
	(4.87)		(5.32)		(2.13)		(2.44)	
-2log likelihood	15474.9		15519.6		4631.3		4656.1	
% observations at limit	.693		.693		.581		.581	
Sample size	16280		16280		5065		5065	

Notes

[a]Non-mother earned income and household non-earned income are measured in Cr 1,000,000s; the interaction term is the product of the two income measures; it, and the squares, are measured in $Cr10^{12}$.

[b]Mother's height is standardized for age.

TABLE 8B

Survival Rate Probability Tobits:
Coefficients, T-Statistics and Slopes of Expected Values

Covariate	Northeast Urban				Northeast Rural			
	I		II		I		II	
	Coeff.	Slope	Coeff.	Slope	Coeff.	Slope	Coeff.	Slope
Non-mother earned	1.621	0.858			1.935	1.330		
income[a]	(4.79)				(2.25)			
Non-mother earned income	-1.549	-0.819			5.829	4.006		
squared[a]	(4.17)				(1.05)			
Household non-earned	2.339	1.238	1.972	1.044	0.198	0.136	0.544	0.374
income[a]	(3.37)		(3.10)		(0.05)		(0.13)	
Household non-earned income	-4.225	-2.236	-5.143	-2.724	303.100	208.290	156.354	107.493
squared[a]	(1.61)		(2.15)		(1.77)		(0.86)	
Interaction[a]	-11.971	-6.334			-187.934	-129.148		
	(2.56)				(1.79)			
Number of adults	0.040	0.021	0.045	0.024	0.006	0.004	0.009	0.006
	(3.45)		(3.81)		(0.46)		(0.68)	
Number of adults squared	-0.004	-0.002	-0.004	-0.002	0.002	0.001	0.002	0.001
	(2.81)		(2.81)		(1.30)		(1.22)	
Dummy (1) if mother								
is literate	0.104	0.061	0.107	0.063	0.061	0.042	0.064	0.044
	(8.99)		(9.26)		(5.20)		(5.48)	
completed elementary	0.203	0.109	0.213	0.114	0.206	0.122	0.216	0.128
school	(11.13)		(11.68)		(5.77)		(6.08)	
completed secondary	0.316	0.150	0.338	0.159				
school or higher	(11.65)		(12.61)					
Dummy (1) if husband								
exists	-0.024	-0.014	0.022	-0.012	-0.026	-0.018	-0.024	-0.017
	(1.55)		(1.38)		(1.57)		(1.46)	
is literate	0.035	0.021	0.041	0.025	0.039	0.028	0.044	0.031
	(2.56)		(2.99)		(3.31)		(3.71)	
completed elementary	0.107	0.061	0.119	0.069	-0.019	-0.014	-0.002	-0.002
school	(5.26)		(5.87)		(0.48)		(0.06)	
completed secondary	0.194	0.102	0.238	0.122				
school or higher	(6.74)		(8.72)					
log (standardized height	0.661	0.350	0.690	0.365	0.770	0.529	0.771	0.530
of mother)[b]	(5.51)		(5.75)		(6.45)		(6.45)	

Table 8B continued

Covariate	Northeast Urban				Northeast Rural			
	I		II		I		II	
	Coeff.	Slope	Coeff.	Slope	Coeff.	Slope	Coeff.	Slope
Dummy (1) if mother aged								
25–29 years	−0.071	−0.028	−0.069	−0.028	−0.110	−0.059	−0.108	−0.057
	(3.25)		(3.15)		(5.43)		(5.34)	
30–34 years	−0.146	−0.065	0.141	−0.063	−0.153	−0.086	−0.152	−0.085
	(6.83)		(6.59)		(7.62)		(7.53)	
35–39 years	−0.186	−0.086	−0.183	−0.056	−0.239	−0.146	−0.239	−0.145
	(8.75)		(8.60)		(11.86)		(11.81)	
40–44 years	−0.267	−0.135	−0.265	−0.135	−0.283	−0.179	−0.280	−0.177
	(11.94)		(11.82)		(12.96)		(12.84)	
45–49 years	−0.270	−0.137	−0.266	−0.135	−0.313	−0.203	−0.311	−0.201
	(11.60)		(11.40)		(13.89)		(13.78)	
50–54 years	−0.337	−0.182	−0.334	−0.182	−0.328	−0.215	−0.328	−0.215
	(13.42)		(13.27)		(13.25)		(13.23)	
55–59 years	−0.329	−0.176	−0.327	−0.177	−0.323	−0.211	−0.325	−0.212
	(12.24)		(12.15)		(12.58)		(12.62)	
≥ 60 years	−0.379	−0.213	0.374	−0.212	−0.310	−0.201	−0.311	−0.202
	(15.95)		(15.74)		(13.84)		(13.87)	
Dummy (1) if state is								
Maranhcao	−0.062	−0.034	−0.068	−0.038	−0.011	−0.007	−0.014	−0.009
	(2.25)		(2.49)		(0.67)		(0.84)	
Piaui	−0.002	−0.001	−0.006	−0.003	−0.082	0.050	0.078	0.048
	(0.07)		(0.19)		(3.97)		(3.78)	
Ceara	−0.085	−0.048	−0.088	−0.050	−0.021	−0.014	−0.023	−0.016
	(6.19)		(6.36)		(1.39)		(1.54)	
Rio G. de Norte	−0.139	−0.082	−0.143	−0.085	−0.080	−0.056	−0.081	−0.057
	(5.74)		(5.94)		(2.99)		(3.05)	
Paraiba	−0.150	−0.090	−0.154	−0.092	−0.108	−0.077	−0.109	−0.077
	(6.66)		(6.81)		(5.85)		(5.90)	
Pernambuco	−0.065	−0.036	−0.068	−0.038	−0.068	−0.047	−0.070	−0.048
	(5.01)		(5.22)		(4.32)		(4.42)	
Alagoas	−0.091	−0.051	−0.091	−0.052	−0.105	−0.074	−0.104	−0.074
	(2.70)		(2.72)		(4.69)		(4.65)	
Sergipe	−0.101	−0.058	−0.104	−0.060	−0.060	−0.041	−0.059	0.040
	(2.83)		(2.90)		(2.01)		(1.97)	
Constant	−1.015		−1.154		−1.469		−1.476	
	(1.86)		(2.11)		(2.70)		(2.71)	
−2 log likelihood	8015.0		8039.3		5096.2		5107.7	
% observations at limit	.488		.488		.346		.346	
Sample size	7688		7688		5320		5320	

Notes

[a]Non-mother earned income and household nonearned income are measured in $Cr 1,000,000s; the interaction term is the product of the two income measures; it, and the squares, are measured in $Cr10[12].

[b]Mother height is standardized for age.

Table 9A

Survival Rate Probabilities By Mother's Age:
Coefficients, T-statistics and Slopes of Expected Values

Covariates	SOUTH URBAN 25-34 Coeff	25-34 Slope	35-44 Coeff	35-44 Slope	>45 Coeff	>45 Slope	SOUTH RURAL 25-34 Coeff	25-34 Slope	35-44 Coeff	35-44 Slope	>45 Coeff	>45 Slope
Non-mother earned income[a]	1.40 (1.99)	0.22	2.18 (5.58)	0.64	1.55 (5.56)	0.73	3.62 (1.03)	1.08	2.47 (3.00)	1.04	2.27 (2.68)	1.44
Non-mother earned income squared[a]	-0.98 (0.63)	-0.15	-0.80 (4.38)	-0.23	-2.55 (4.89)	-1.20	29.38 (0.48)	8.78	-6.89 (2.91)	-2.89	-7.54 (1.69)	-4.77
Household non-earned income[a]	-2.48 (1.53)	-0.39	-0.56 (1.54)	-0.16	0.53 (2.14)	0.25	-3.16 (0.25)	-0.94	-6.55 (1.47)	-2.75	0.59 (0.44)	0.37
Household non-earned income squared[a]	10.27 (1.15)	1.60	0.72 (1.57)	0.21	0.07 (0.66)	-0.03	532.00 (0.90)	158.95	81.30 (1.37)	34.06	-5.50 (1.09)	-3.48
Interaction[a]	0.51 (0.04)	0.08	-1.47 (1.83)	-0.43	3.60 (2.76)	1.70	-247.07 (0.63)	-73.82	237.29 (2.42)	99.43	13.85 (0.71)	8.76
Number of adults	-0.18 (2.51)	-0.03	-0.00 (0.02)	-0.02	0.04 (2.75)	0.02	0.03 (0.23)	0.01	-0.06 (1.55)	-0.02	-0.00 (0.32)	-0.00
Number of adults squared	0.02 (2.17)	0.00	-0.00 (0.26)	-0.02	-0.00 (2.52)	-0.00	-0.01 (0.53)	-0.00	0.01 (1.88)	0.00	0.00 (1.00)	0.00
Dummy (1) if mother is literate	0.19 (5.46)	0.05	0.14 (7.16)	0.05	0.13 (8.87)	0.07	0.09 (2.85)	0.03	0.10 (4.46)	0.04	0.07 (4.21)	0.05
completed elementary school	0.33 (8.01)	0.07	0.23 (8.85)	0.08	0.21 (10.78)	0.10	0.12 (2.02)	0.04	0.14 (3.65)	0.06	0.12 (3.15)	0.07
completed secondary school or higher	0.48 (8.46)	0.08	0.30 (7.97)	0.09	0.30 (9.52)	0.13						
Dummy (1) if husband exists	-0.05 (0.74)	-0.01	-0.09 (2.64)	-0.03	-0.27 (1.32)	-0.01	-0.16 (2.25)	-0.06	-0.06 (1.27)	-0.03	-0.03 (1.06)	-0.02
is literate	0.16 (3.79)	0.05	0.06 (2.40)	0.03	0.06 (2.83)	0.03	0.10 (2.80)	0.05	0.09 (3.95)	0.05	0.05 (2.86)	0.03
completed elementary school	0.21 (4.23)	0.07	0.13 (4.36)	0.06	0.18 (3.38)	0.04	0.15 (2.54)	0.07	0.06 (1.42)	0.03	0.04 (0.94)	0.02
completed secondary school or higher	0.27 (4.42)	0.08	0.16 (3.72)	0.06	0.01 (5.07)	0.08						
log (standardized height of mother)[b]	1.00 (3.46)	0.16	1.17 (6.13)	0.34	0.87 (6.37)	0.41	0.90 (2.55)	0.27	0.91 (3.81)	0.38	0.63 (3.53)	0.40
Dummy (1) if mother is aged 30-34 years	-0.03 (1.50)	-0.01					-0.09 (3.32)	-0.04	-0.09 (4.42)	-0.05		
40-44 years			-0.04 (2.52)	-0.02								
> 55 years					-0.10 (8.38)	-0.05					-0.07 (4.38)	-0.05

Table 9A (Cont.)

Covariates	SOUTH URBAN						SOUTH RURAL					
	25-34		35-44		>45		25-34		35-44		>45	
	Coeff	Slope	Coeff	Slope	Coeff	Slope	Coeff	Slope	Coeff	Slope	Coeff	Slope
Dummy (1) if state is												
Brasilia	-0.04	-0.01	-0.07	-0.03	-0.06	-0.03	0.10	0.03	0.18	0.06	0.06	0.04
	(1.13)		(2.92)		(2.42)		(0.86)		(1.77)		(0.47)	
Parana	-0.01	-0.00	-0.06	-0.03	0.01	0.00	-0.06	-0.01	0.05	-0.02	0.01	0.00
	(0.35)		(2.44)		(0.42)		(1.37)		(1.72)		(0.23)	
Santa Catarina	-0.03	-0.01	-0.09	-0.04	0.00	0.00	-0.04	-0.01	-0.02	-0.01	0.06	0.04
	(0.53)		(2.12)		(0.03)		(0.69)		(0.51)		(2.14)	
Rio G. do Sul	0.16	0.03	0.03	0.11	0.08	0.04	0.06	0.02	0.10	0.04	0.10	0.07
	(3.96)		(1.16)		(4.12)		(1.21)		(3.02)		(4.53)	
Sao Paulo	0.03	0.07	-0.03	-0.12	0.01	0.00	-0.03	-0.01	-0.02	-0.01	-0.02	0.01
	(1.08)		(1.54)		(0.48)		(0.73)		(0.56)		(0.75)	
Constant	-2.20		-3.29		-2.18		-1.88		-2.06		-1.03	
	(1.68)		(3.79)		(3.49)		(1.16)		(1.90)		(1.27)	
2 log likelihood	3877.6		4096.4		5907.8		1397.1		1128.1		1366.9	
% observations at limit	.812		.696		.538		.690		.566		.394	
Sample Size	4679		4440		5586		1421		1327		1689	

Notes:

See Table 8

Table 9B

Survival Rate Probabilities By Mother's Age:
Coefficients, T-statistics and Slopes of Expected Values

Covariates	NORTHEAST URBAN						NORTHEAST RURAL					
	25–34		35–44		>45		25–34		35–44		>45	
	Coeff	Slope	Coeff	Slope	Coeff	Slope	Coeff	Slope	Coeff	Slope	Coeff	Slope
Non-mother earned income[a]	4.32	1.58	1.27	0.71	1.27	0.92	5.35	3.09	0.83	0.63	0.21	0.17
	(2.53)		(2.08)		(2.29)		(1.39)		(0.53)		(0.19)	
Non-mother earned income squared[a]	-2.40	-0.88	-1.13	0.64	-3.87	-2.88	31.29	18.09	1.57	1.19	6.18	5.17
	(0.15)		(2.13)		(2.35)		(0.39)		(0.27)		(1.09)	
Household non-earned income[a]	4.03	1.48	3.53	2.00	1.41	1.02	4.66	2.69	7.32	5.57	2.54	2.13
	(1.33)		(2.44)		(1.69)		(0.38)		(0.59)		(0.56)	
Household non-earned income squared[a]	-6.21	-2.27	-7.88	-4.46	-3.35	-2.43	150.77	87.17	-402.01	306.05	199.37	166.94
	(0.16)		(0.82)		(1.39)		(0.34)		(0.45)		(1.20)	
Interaction[a]	1.01	0.37	-17.54	-9.92	-2.69	-1.95	-193.68	-111.97	13.19	10.04	-109.53	91.71
	(0.01)		(2.21)		(0.50)		(0.25)		(0.03)		(1.09)	
Number of adults	-0.02	-0.01	0.04	0.02	0.08	0.06	-0.09	-0.05	0.05	0.03	0.02	0.02
	(0.29)		(1.74)		(5.48)		(1.20)		(1.59)		(1.50)	
Number of adults squared	-0.00	-0.00	-0.00	-0.00	-0.01	-0.00	0.01	0.01	-0.00	-0.00	0.00	0.00
	(0.31)		(1.61)		(4.07)		(1.01)		(0.92)		(0.59)	
Dummy (1) if mother is literate	0.10	0.04	0.12	0.08	0.09	0.07	0.10	0.06	0.05	0.04	0.05	0.04
	(3.70)		(6.04)		(5.79)		(4.34)		(2.71)		(2.55)	
completed elementary school	0.19	0.08	0.24	0.14	0.18	0.12	0.26	0.13	0.22	0.15	0.07	0.06
	(4.97)		(7.77)		(6.16)		(3.90)		(3.51)		(1.15)	
completed secondary school or higher	0.28	0.10	0.37	0.19	0.30	0.19						
	(4.79)		(8.19)		(7.29)							
Dummy (1) if husband exists	0.06	0.02	-0.04	-0.02	-0.04	-0.03	0.02	0.01	-0.06	-0.05	-0.03	-0.03
	(1.30)		(1.29)		(1.81)		(0.41)		(1.97)		(1.76)	
is literate	0.05	0.02	0.04	0.03	0.01	0.01	0.01	0.00	0.05	0.04	0.06	0.05
	(1.68)		(1.96)		(0.49)		(0.29)		(2.60)		(3.07)	
completed elementary school	0.19	0.06	0.07	0.05	0.08	0.06	-0.06	0.04	0.15	0.12	-0.08	-0.08
	(4.45)		(2.08)		(2.46)		(0.83)		(1.91)		(1.23)	
completed secondary school or higher	0.21	0.07	0.19	0.11	0.14	0.10						
	(3.46)		(3.63)		(2.95)							
log(standardized height of mother)[b]	0.44	0.16	0.49	0.28	0.89	0.64	0.69	0.40	0.64	0.49	0.72	0.60
	(1.60)		(2.37)		(5.31)		(2.61)		(3.02)		(4.63)	
Dummy (1) if mother is aged 30-34 years	-0.081	0.03					-0.04	-0.02				
	(3.68)						(2.02)					
40-44			-0.073	-0.05					-0.04	0.03		
			(4.25)						(2.34)			
> 55					-0.05	0.04					0.00	0.00
					(3.58)						(0.18)	

Table 9B (cont.)

Covariates	NORTHEAST URBAN						NORTHEAST RURAL					
	25-34		35-44		>45		25-34		35-44		>45	
	Coeff	Slope	Coeff	Slope	Coeff	Slope	Coeff	Slope	Coeff	Slope	Coeff	Slope
Dummy (1) if state is												
Maranhcao	-0.10	-0.04	-0.03	-0.01	-0.07	-0.05	-0.01	-0.00	0.01	0.01	-0.03	-0.02
	(1.83)		(0.53)		(1.62)		(0.19)		(0.49)		(1.20)	
Piaui	-0.08	-0.03	-0.05	-0.03	0.12	0.08	0.06	0.03	0.14	0.09	0.05	0.04
	(1.22)		(1.00)		(2.40)		(1.37)		(3.78)		(1.77)	
Ceara	-0.06	-0.02	-0.10	-0.06	-0.09	-0.07	0.00	0.00	-0.06	-0.04	-0.02	-0.02
	(1.84)		(4.02)		(4.54)		(0.00)		(2.14)		(0.99)	
Rio G de Norte	-0.09	-0.03	-0.17	-0.11	-0.16	-0.12	-0.10	-0.06	-0.07	-0.06	-0.10	-0.08
	(1.56)		(4.18)		(4.79)		(1.72)		(1.44)		(2.80)	
Paraiba	-0.14	-0.05	-0.17	-0.11	-0.14	-0.11	-0.09	-0.05	-0.07	-0.06	-0.13	-0.11
	(2.62)		(4.24)		(4.63)		(2.19)		(2.21)		(5.21)	
Pernambuco	-0.03	-0.01	-0.05	-0.03	-0.10	-0.08	-0.03	-0.02	-0.08	-0.06	-0.08	-0.07
	(0.98)		(2.28)		(5.43)		(0.78)		(3.00)		(3.92)	
Alagoas	-0.09	-0.03	-0.10	-0.06	-0.04	-0.03	-0.06	-0.03	-0.11	-0.09	-0.09	-0.07
	(1.24)		(1.67)		(0.90)		(1.25)		(2.94)		(2.65)	
Sergipe	-0.17	-0.06	-0.06	-0.04	-0.15	-0.12	-0.03	-0.01	-0.06	-0.04	-0.08	-0.06
	(1.93)		(1.05)		(2.87)		(0.39)		(1.08)		(1.87)	
Constant	-0.07		-0.432		-2.41		-1.12		-1.16		-1.59	
	(0.06)		(0.46)		(3.16)		(0.93)		(1.20)		(2.25)	
- 2 log likelihood	2232.0		1962.5		2529.2		1587.3		1026.7		1154.3	
% observations at limit	.617		.454		.327		.448		.272		1900	
Sample size	2152		2060		2653		1442		1317			

Notes:

See Table 8

Table A.1
Height for Age & Weight for Height Regressions
Means and (Standard Deviations) of variables

	South		Northeast	
	Urban	Rural	Urban	Rural
log (height for age)	4.57	4.55	4.54	4.51
	(0.06)	(0.06)	(0.07)	(0.07)
log (weight for height)[a]	4.60	4.60	4.59	4.59
	(0.12)	(0.11)	(0.12)	(0.11)
Non-mother earned income[b]	25.28	10.46	15.47	5.04
	(42.06)	(15.01)	(28.08)	(7.81)
Non-mother earned income squared[b]	240.78	334.74	1027.58	86.35
	(27071.08)	(3152.23)	(7923.71)	(594.58)
HH non-earned income[b]	5.45	0.96	2.39	0.43
	(54.57)	(4.90)	(9.85)	(2.45)
HH non-earned income squared[b]	3007.36	24.90	102.73	6.20
	(178840.11)	(445.74)	(1445.31)	(143.07)
Income interaction[b]	436.79	19.10	124.84	6.32
	(9165.04)	(323.02)	(1248.99)	(159.41)
# of adults	2.58	2.74	2.73	2.66
	(1.09)	(1.16)	(1.22)	(1.10)
# of adults squared	7.83	8.87	8.94	8.30
	(8.77)	(8.83)	(10.04)	(8.43)
dummy (1) if mother				
illiterate	0.16	0.39	0.30	0.64
literate	0.44	0.50	0.45	0.33
completed elem school[c]	0.27	0.11	0.16	0.03
completed secondary school/higher	0.13	-	0.09	-
dummy (1) if father				
illiterate	0.09	0.28	0.26	0.63
literate	0.46	0.59	0.47	0.35
completed elem school[c]	0.28	0.13	0.16	0.02
completed secondary school/higher	0.17	-	0.11	-
log (height of mother)	4.56	4.55	4.54	4.53
	(0.04)	(0.04)	(0.04)	(0.04)
log (height of father)	4.56	4.55	4.54	4.53
	(0.04)	(0.04)	(0.04)	(0.04)
mother's age at birth of child	27.12	27.87	28.42	28.66
	(6.41)	(6.97)	(6.82)	(7.02)

Table A.1 (cont.)
Height for Age & Weight for Height Regressions
Means and (Standard Deviations) of variables

	South		Northeast	
	Urban	Rural	Urban	Rural
dummy (1) if child				
male	0.51	0.51	0.50	0.52
if child aged				
0-6 months	0.05	0.05	0.07	0.06
6-12 "	0.05	0.04	0.05	0.06
12-18 "	0.05	0.05	0.05	0.06
18-24 "	0.06	0.05	0.05	0.05
2 years	0.11	0.11	0.12	0.12
3 "	0.11	0.12	0.11	0.11
4-5 "	0.23	0.23	0.23	0.22
6-8 "	0.34	0.36	0.33	0.32
dummy (1) if state is				
Rio de Janeiro	0.23	0.17		
Brasilia	0.19	0.02		
Parana	0.13	0.34		
Santa Catarina	0.04	0.11		
Rio Grande do Sol	0.12	0.17		
Sao Paulo	0.29	0.19		
Bahia			0.31	0.25
Maranhca			0.04	0.13
Piaui			0.03	0.07
Ceara			0.23	0.19
Rio Grande do Norte			0.04	0.03
Paraiba			0.05	0.09
Pernambuco			0.26	0.15
Alagoas			0.02	0.06
Sergipe			0.02	0.03
Number of observations	14713	6913	9233	8592

Notes:

[a]Weight-for-height calculated for children 24 months to 107 months. All other variables are calculated for children under 108 months.

[b]Income in $Cr1000. Income squared and interaction terms in $Cr10^6$

[c]In rural areas completed elementary school includes all higher education.

Table A.2

Survival Rate Probability Tobits - Descriptive Statistics

Covariates	Northeast Urban mean	Northeast Urban Std	Northeast Rural mean	Northeast Rural Std	South Urban mean	South Urban Std	South Rural mean	South Rural Std
Survival Rate	0.80	0.25	0.76	0.25	0.89	0.19	0.88	0.19
Non-mother earned income[a]	15.57	34.92	4.57	12.47	25.74	50.78	11.57	21.08
Non-mother earned income squared[a]	1461.93	21977.19	176.44	4834.40	3241.11	65445.38	578.21	7773.77
Household non-earned income[a]	4.43	15.39	0.60	2.39	9.44	64.58	1.86	10.49
Household non-earned income squared[a]	256.54	3820.04	6.08	126.89	4259.71	240008.63	113.41	2595.05
Interaction[a]	199.47	1858.85	9.13	216.12	773.81	23175.26	46.34	778.86
# adults	2.96	1.56	2.87	1.41	2.89	1.37	3.03	1.40
# adults squared	11.20	13.20	10.23	11.58	10.24	11.05	11.14	11.57
Dummy (1) if mother								
is literate	0.41		0.27		0.42		0.46	
completed elementary school	0.16		0.03		0.27		0.11	
completed secondary school or higher	0.11				0.13			
Dummy (1) if husband								
exists	0.79		0.87		0.85		0.93	
is literate	0.35		0.28		0.37		0.54	
completed elementary school	0.13		0.02		0.24		0.12	
completed secondary school or higher	0.11				0.16			
log(standardized height of mother)[b]	4.54	0.04	4.53	0.04	4.56	0.04	4.55	0.04

Table A.2 (cont.)

Survival Rate Probabilities - Descriptive Statistics

	Northeast Urban		Northeast Rural		South Urban		South Rural	
	mean	Std	mean	Std	mean	Std	mean	Std
Dummy (1) if mother is								
aged 25-29 years	0.14		0.14		0.14		0.14	
30-34 years	0.14		0.13		0.15		0.14	
35-39 years	0.15		0.14		0.14		0.14	
40-44 years	0.12		0.11		0.13		0.12	
45-49 years	0.12		0.10		0.11		0.11	
50-54 years	0.08		0.07		0.08		0.08	
55-59 years	0.06		0.06		0.06		0.06	
≥ 60 years	0.10		0.12		0.09		0.09	
Dummy (1) if state is								
Maranhcao	0.03		0.14					
Piaui	0.02		0.07					
Ceara	0.22		0.18					
Rio G. de Norte	0.04		0.04					
Paraiba	0.05		0.09					
Pernambuco	0.28		0.15					
Alagoas	0.02		0.03					
Sergipe	0.02		0.03					
Brasilia					0.12		0.01	
Parana					0.13		0.29	
Santa Catarina					0.04		0.11	
Rio G. do Sul					0.15		0.21	
Sao Paulo					0.31		0.20	
Number of Observations	7688		5320		16280		5065	

Notes:

a/ Non-mother earned income and household nonearned income are measured in $Cr 1,000s; the interaction term is the product of the two income measures; it, and the squares, are measured in $\$Cr10^6$.

b/ Mother height is standardized for age.

FIGURE 1(a) : DISTRIBUTION OF STANDARDIZED HEIGHT FOR AGE

with cumulative %age of observations < 80, < 90 & <100% of median

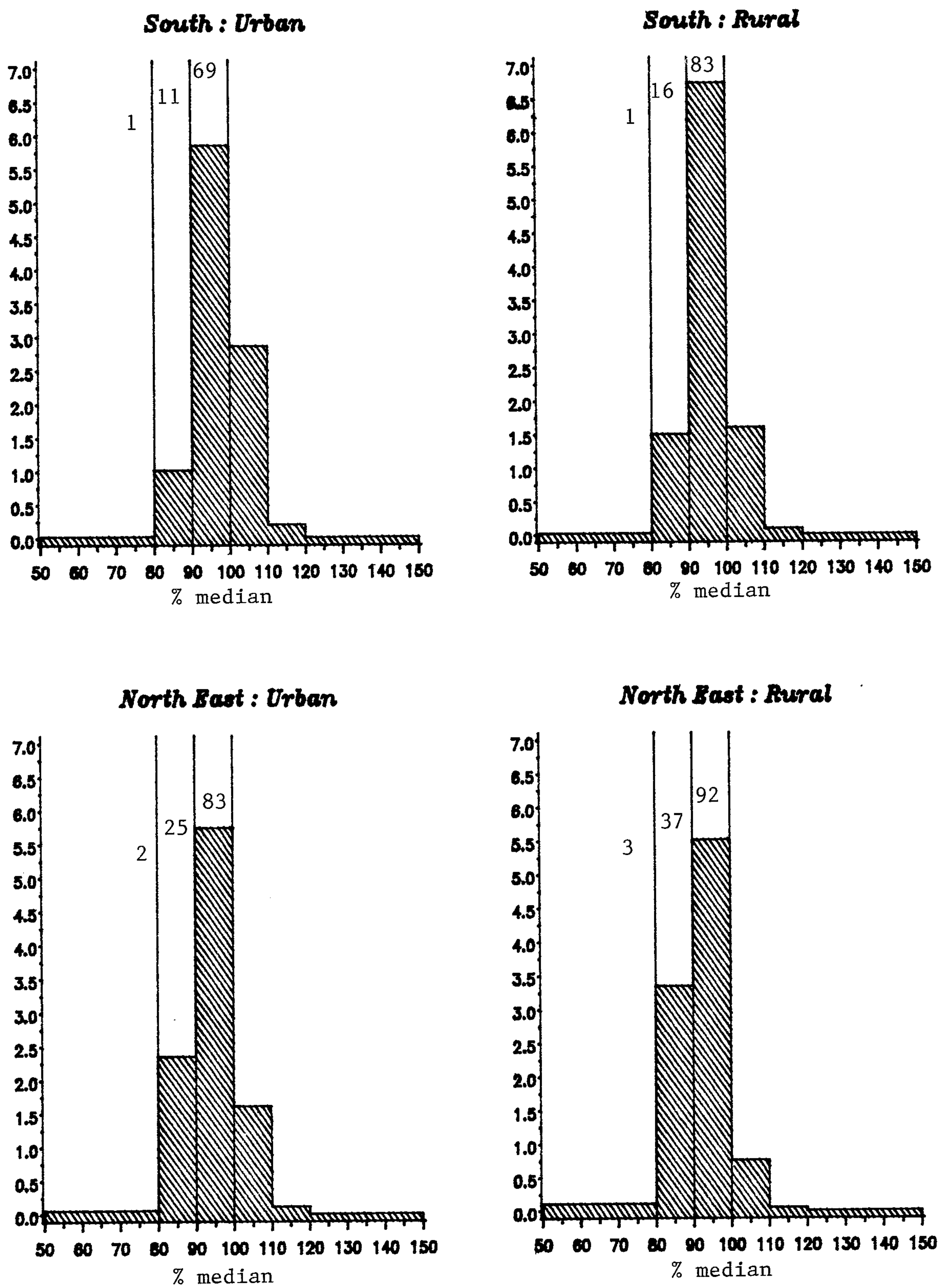

FIGURE 1(b) : DISTRIBUTION OF STANDARDIZED WEIGHT FOR HEIGHT

with cumulative %age of observations <80, <90 & <100% of median

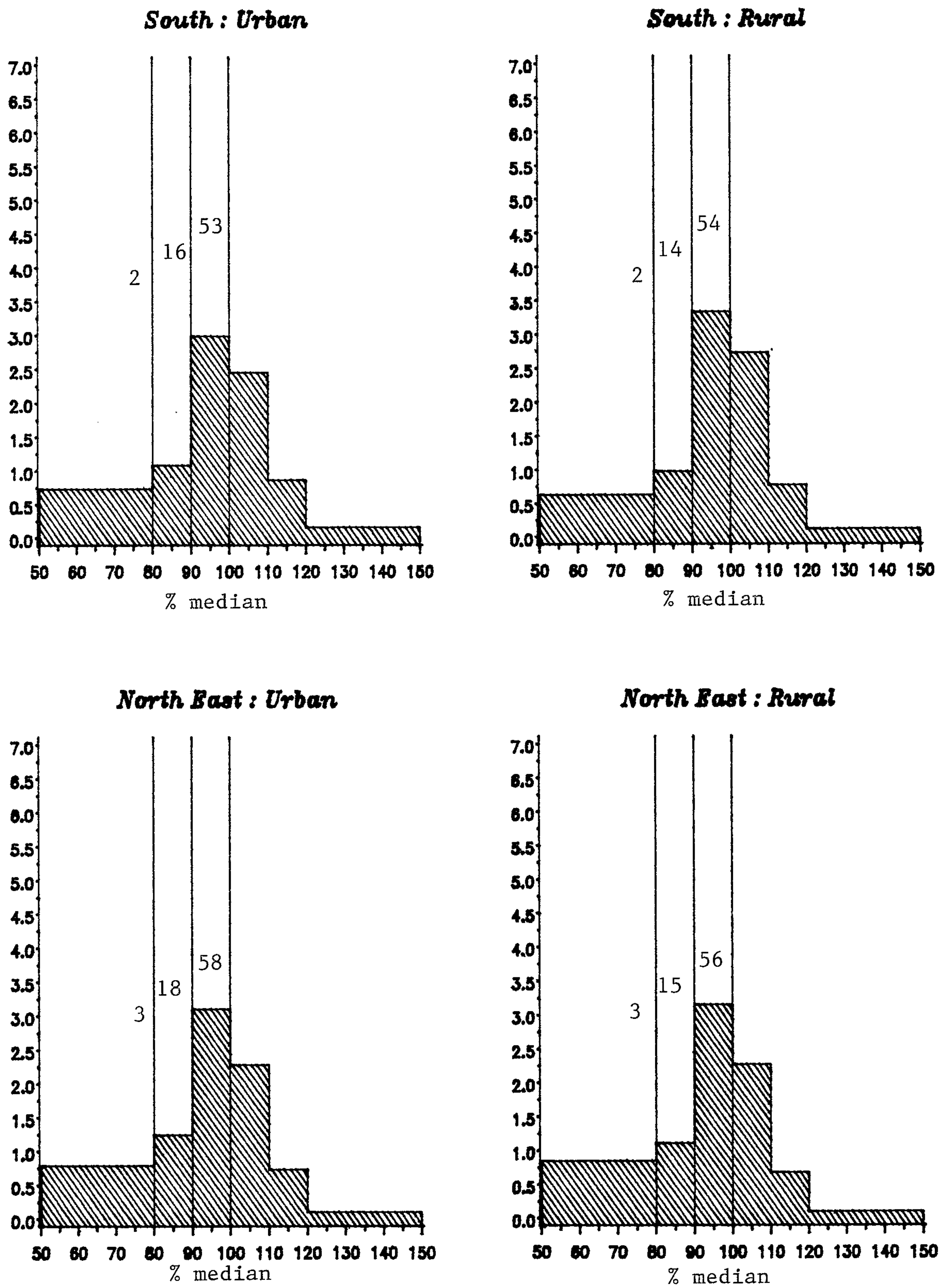

FIGURE 2 : DISTRIBUTION OF STANDARDIZED HEIGHT FOR AGE : URBAN NORTHEAST

with cumulative %age of observations <80, <90 & <100% of median

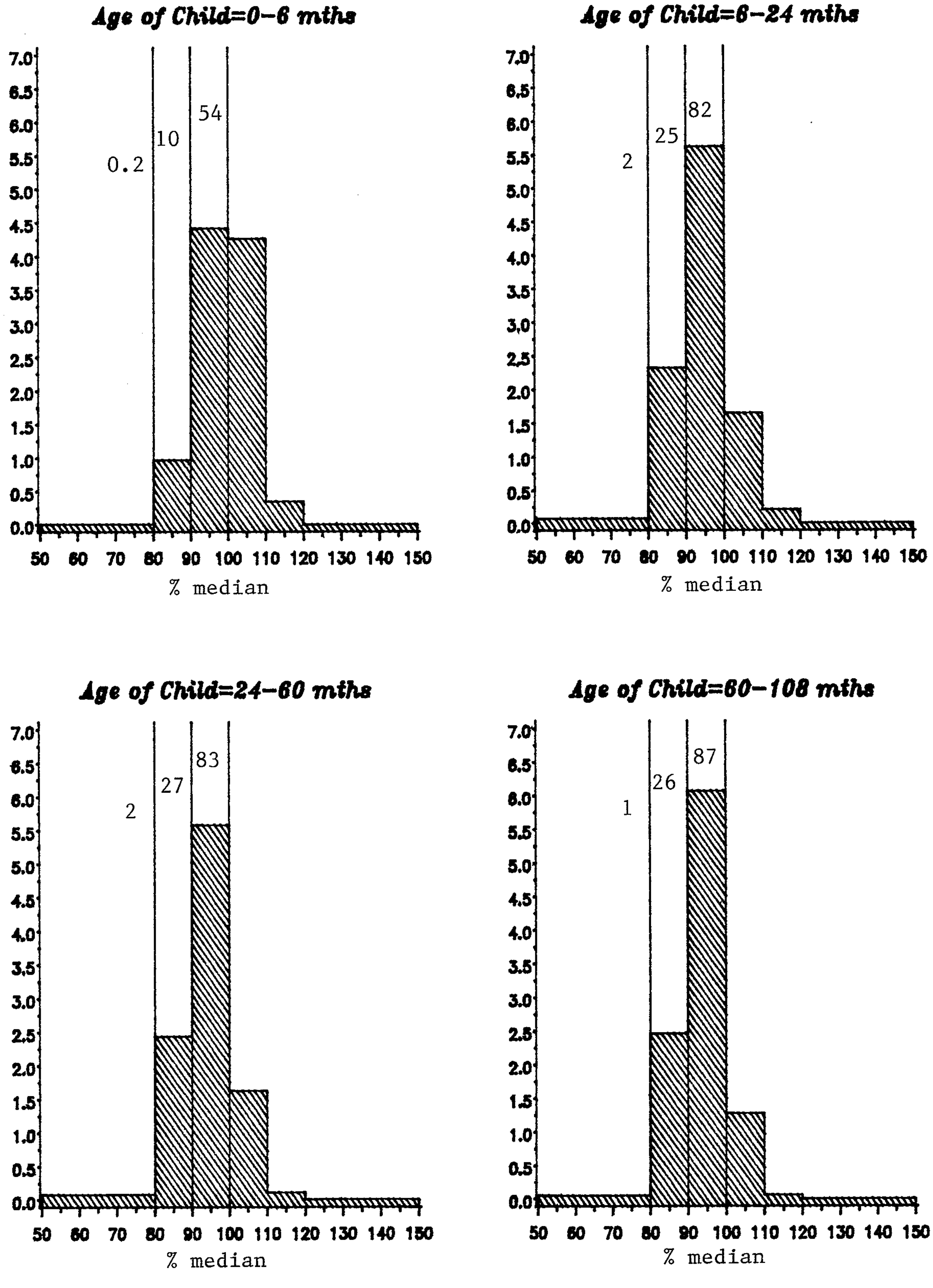

FIGURE 3 : MEAN STANDARDIZED HEIGHT FOR AGE AND WEIGHT FOR HEIGHT

by Deciles of Per Capita Expenditure