Using earlier estimates on the distribution of malnourished populations by income groups in conjunction with income specific demographic data, the differential incidence of malnutrition in children (as distinctive from adults) is derived. For some regions the difference is substantial: in Latin America 27.4 percent of individuals over age 10 suffer from calorie malnutrition; for children below age 10 this figure is 55.4 percent. An in-depth analysis for urban India shows a percentage of 65.9 and 47.2 for individuals below and above age 15. It becomes clear that the distributive dimension of malnutrition -- the association between malnutrition and poverty -- gives origin to a larger incidence of malnutrition among children.

A taxonomy of target-oriented food programs is constructed. Specific programs being compared -- with the objective of increasing calorie consumption in children -- are a subsidized food program for the household, a food stamp program and a direct site-feeding program for children. Programs are classified according to whether their effectiveness is different to an equivalent income transfer. The conditions determining this classification are examined, particularly the extent to which programs are inframarginal to present levels of consumption and whether they induce a substitution between food commodities. The conclusion is that many of today's programs are indeed inframarginal, with effects no larger than an equivalent income transfer. Second, programs inducing substitution can have a negative effect on calorie consumption to the extent they substitute more "calorie intensive" foods. Changes in the design of these programs so as to increase their effectiveness are suggested.

Prepared by: Marcelo Selowsky
Development Economics Department
Development Policy Staff

Copyright © 1978
The World Bank
1818 H Street, N.W.
Washington, D.C., 20433, U.S.A.
PREFACE

This paper was prepared for presentation at the Athens International Symposium on the CHILD IN THE WORLD OF TOMORROW, July 2-8, 1978, Athens, Greece. A summarized version of the paper is being published by the Symposium. Several of the ideas presented here are extensions of early work and discussions with Shlomo Reutlinger, to whom I am indebted. I also wish to thank Paul Isenman and Benjamin King for helpful comments.
# TABLE OF CONTENTS

**PREFACE**

**INTRODUCTION**

**I. THE MAGNITUDE OF THE PROBLEM**

A. THE GLOBAL PICTURE

B. THE INCIDENCE OF CALORIE MALNUTRITION IN YOUNG CHILDREN

C. A CASE STUDY: ESTIMATES FOR URBAN INDIA

**II. THE ECONOMIC JUSTIFICATION FOR INTERVENTION**

A. CHILDREN'S NUTRITION AS A "PUBLIC GOOD"

B. THE "RESOURCE SAVINGS" ARGUMENTS

C. THE "HUMAN CAPITAL" ARGUMENTS

**III. THE ECONOMICS OF INTERVENTION**

A. THE FUTURE UNDER THE NORMAL COURSE OF DEVELOPMENT

1. Perspectives for the Future

2. Identifying Points of Intervention

3. General and Target Oriented Programs

B. THE EFFECTIVENESS OF TARGET ORIENTED FOOD PROGRAMS

1. Programs Equivalent to An Income Transfer

   a. The strength of consumer sovereignty. Reselling

   b. Infra marginal food programs

2. Programs Different to An Equivalent Income Transfer

   a. Definition of programs and cost effectiveness

   b. Substitution between foods and effects on calorie consumption

3. Some Conclusions

**Technical Appendix** - Increasing Calorie Consumption in Children: Cost Effectiveness Comparisons Between General and Target Oriented Programs
INTRODUCTION

One billion people, half the population of the developing world, are suffering from calorie deficient diets. Four hundred million of them are children below age ten. What are the economic consequences of this? How can economists help to identify policy options to solve the problem?

The interest of economists in these issues is very recent. It explains why economics to date does not have much to contribute -- relative to other disciplines -- to the understanding of both the economic consequences and the economic determinants of malnutrition. The best example of this inability is the present state of the theory of consumption: a considerable effort has been devoted to identifying and testing hypotheses concerning the behavior of the mean per capita consumption of a household. This theory, however, does not provide information on the intrafamily distribution of consumption. To the extent young children are not homogenous to adults, present consumption theory fails to explain the allocation of consumption to one-third of the population in developing countries.

The involvement of economists has come through various fronts. First, an increasing disenchantment in the development literature concerning the use of gross national product as an indicator of welfare in comparisons across countries and over time.\(^1\) It results from the

\(^1\) See H. Chenery, et.al., *Redistribution With Growth*, Oxford University Press.
interest in the distributive dimensions of economic well-being as well as a consensus for the need of a wider definition of welfare. Health, low mortality and education have become indicators of welfare in their own right in the interpretation of economic performance.

The second front, explaining my original involvement with the subject, is the search of economists for wider definitions of capital (physical and human) able to explain the sources of growth of countries as well as the distribution of income between individuals. To the extent that malnutrition affects the economic productivity of the individual, nutritional status becomes part of that definition of capital.

The basic theme of the above two fronts is the economic justification for intervention. Regardless of these economic justifications, some countries have decided to devote fiscal resources to eliminate malnutrition. Economists have been asked to give advice on the most cost effective way of achieving this objective. This has been the third front of involvement by economists, i.e., the economics of intervention.

This paper consists of three sections. The first reviews briefly the global magnitude and distribution of the calorie deficit and derives figures on the differential incidence of malnutrition among children. The second section addresses what we have called the Economic Justification for Intervention. The third sections deals with the Economics of Intervention.
I. THE MAGNITUDE OF THE PROBLEM

A. **THE GLOBAL PICTURE**

i. Ideally, one would like to define children malnutrition in terms of its consequences and not in terms of the amount of food consumed by the individual. Mortality, health status, and indices of psychological achievements are some indicators of these consequences. In practice, however, it is difficult to precisely define underachievement in some of these measures, and to be able to trace them to malnutrition. Although this has been done for particular case studies and communities, the data is not available to provide a global picture of malnutrition on the basis of indices of nutrition-related achievements.

ii. If one has to settle for an index of food or nutrient for the purpose of measuring malnutrition, the best indicator is calorie consumption. Calorie deficits usually signal deficits in the intake of proteins and other nutrients; this is particularly true if one accepts the hypothesis that in these cases, part of the protein is used as energy. There is empirical evidence showing that, under very few cases, individuals suffer from protein deficit when their calorie consumption approaches their energy requirement.

iii. The number of people with a calorie deficit in a country can be estimated with household food consumption surveys of enough detail to provide per capita calorie consumption data for the household. In the absence of this data, the alternative is to allocate the known total consumption figure - derived from national aggregates - across income
groups in the population. This requires information on the distribution of income and some assumptions on the relationship between increases in calorie consumption and increases in the per capita income of households. This was the method used by my colleague, Shlomo Reutlinger, and me in an early attempt to derive an estimate of the distribution of the world calorie deficit.1/

iv. Table 1 presents these estimates. The first two columns show the number of people with calorie intake below physiological requirements; the last two columns show the cereal equivalent of that caloric deficit (on a yearly basis).

At the world level two factors are striking: first, the large number of people with deficit, 55 percent of the population of the developing world. They are concentrated in the poorest countries and in the lowest income groups within countries. Second, how small the deficit is, expressed as a fraction of the world production of cereals. The fact that this deficit is only two percent of the world's cereal production contradicts the widely held view that present malnutrition is the result of an imbalance between world population and world food supplies. At the global level, malnutrition is the result of the unequal distribution of world income and not the result of an insufficient availability of food. It is clearly a poverty problem and not a food problem.2/

---


2/ For a more extensive discussion of this issue see Shlomo Reutlinger, "Malnutrition: A Poverty or a Food Problem", World Development, Vol. 5, 1977.
### Table 1

AFFLICTED POPULATION AND SIZE OF THE CALORIE DEFICIT, 1975

<table>
<thead>
<tr>
<th>REGION</th>
<th>Population with consumption below calorie requirements</th>
<th>Cereal equivalent of the aggregate calorie deficit²/</th>
<th>Tons per year (millions)</th>
<th>As a % of total cereal consumption³/</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>million people</td>
<td>% population</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latin America</td>
<td>112</td>
<td>36</td>
<td>2.2</td>
<td>2.9</td>
</tr>
<tr>
<td>Asia</td>
<td>707</td>
<td>63</td>
<td>18.4</td>
<td>9.4</td>
</tr>
<tr>
<td>Middle East</td>
<td>61</td>
<td>33</td>
<td>1.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Africa</td>
<td>193</td>
<td>61</td>
<td>5.2</td>
<td>14.7</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1073</td>
<td>55</td>
<td>27.4</td>
<td>7.5</td>
</tr>
</tbody>
</table>

AS A FRACTION OF THE WORLD CEREAL PRODUCTION: 2.0%

---

1/ From Reutlinger and Selowsky, op.cit., Projection C.
2/ It is assumed a metric ton of cereals has 3.5 million calories.
3/ This consumption figure includes cereals used in animal feeding.
The same argument holding at the global level applies to particular regions, the Middle East and Latin America in particular. Approximately 35 percent of their population have calorie deficit yet this deficit amounts to less than 3 percent of their total cereal consumption. People consuming more than one-third of their requirements amount to 8.9 and 32.5 percent of the total population in the case of the Middle East and Latin America, respectively.

To a lesser degree, the distributive dimension is also important for the other regions. Within these regions, malnutrition is concentrated in the poorest 20 or 30 percent of the population. In the case of Asia, the per capita calorie deficit in the poorest quintile is twice the per capita deficit in the next two richest quintiles of the population.

B. THE INCIDENCE OF CALORIE MALNUTRITION IN YOUNG CHILDREN

i. Whatever the method used to estimate calorie consumption, we can only derive information on the mean per capita calorie intake of the household. Sample surveys do not provide information on the distribution of food within the family and it is not even clear if this possibility is technically feasible. It is therefore impossible, from the regular food surveys, to derive the extent of calorie deficiency in children as distinctly from the one in adults.

An alternative is to assume that when the per capita calorie intake of the family is below the (weighted) per capita requirement for the household, both children and adults experience a calorie deficit. Given this assumption, a difference in the global incidence of malnutrition
between children and adults (i.e., the fraction of the total number of children that are malnourished relative to the one for adults) can only be the result of "undernourished households" having a larger number of children than the typical household. This happens to be the case.

The empirical evidence shows that calorie intake is closely related to per capita income and that malnutrition characterizes the poorest segments of the population. Since the poorest income groups have a substantially larger family size (and number of children) the share of children that are malnourished becomes larger than the share of adults. *It is this distributive dimension of malnutrition - the association between malnutrition and poverty - that gives origin to a larger incidence of malnutrition among children.*

ii. By using this simplified method, we have derived the incidence of calorie malnutrition in young children in two regions, Asia and Latin America. The results are shown in Table 2.

The figures clearly show a higher incidence of malnutrition among children. In Asia, 69.2 percent of children aged below 10 experience calorie deficits; the figure for individuals aged above 10 is equal to 60.1 percent. For Latin America, the difference in the incidence is much stronger: 55.4 percent of children suffer calorie deficit whereas only 27.4 percent of the rest of the population is undernourished.

The difference in the incidence of malnutrition between children and adults depends on two factors: (a) how strong is the (inverse) relation between the number of young children per household and the
per capita income of the family; and (b) how small is the size of
the malnourished population as a fraction of the total population.
The smaller this fraction, i.e., the more important is the distributive
dimension of malnutrition, the larger will be the incidence of mal-
nutrition among children relative to the one in adults.

Table 2

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Asia, 1975</th>
<th>Latin America, 1975</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With Calorie Deficit</td>
<td>Without Calorie Deficit</td>
</tr>
<tr>
<td>Children (ages 0-9)</td>
<td>232 (69.2)</td>
<td>103</td>
</tr>
<tr>
<td>Adults (over age 9)</td>
<td>475 (60.1)</td>
<td>315</td>
</tr>
<tr>
<td>Total</td>
<td>707 (62.8)</td>
<td>418</td>
</tr>
<tr>
<td></td>
<td>112.0 (35.8)</td>
<td>201</td>
</tr>
</tbody>
</table>

1/ The figures are derived by using the estimates of undernourished individuals in each income group (as estimated by Reutlinger and Selowsky) together with the mean fraction of children per household figure specific to each of those income groups. See Table A-1 in Appendix A.
C. A CASE STUDY: ESTIMATES FOR URBAN INDIA

i. The earlier estimates assume that deficits in the per capita household calorie intake signal calorie deficits for adults and children. No possibility arises for particular children (defined by their age group) to be well nourished if they belong to "deficitarian" income groups (income groups where the mean per capita consumption is below weighted requirements). Conversely, there is no possibility of finding malnourished children in income groups without mean per capita deficits.

The second limitation is the inability to measure a different degree of malnutrition for adults and children within a "deficitarian" income group. Is the observed mean per capita deficit a result of food allocation across family members in proportion to their requirements, i.e., each family member has the same percentual deficit? Or are adults given priorities?

These questions can only be answered with data on the intra-family allocation of calories. To our knowledge, the only large survey providing this kind of data is the Calcutta Food Survey of 1969.\(^1\) We have tried to use this data to infer the magnitude of calorie deficiency in children and adults in urban areas. For this purpose, the Calcutta results are used in conjunction with new calorie estimates on urban mean per capita consumption out of the 1971-72 National Sample, 26th Round.

ii. The Calcutta Survey provides data on the calorie intake of children (of different age groups) and adults classified by the per

---

capita (income) expenditure of the household. This allows the (econometric) estimation of calorie-income functions for each age group, to be used thereafter for predictive purposes.

Consistency of data would require that the predicted mean per capita household consumption for a particular income group (equal to the predicted consumption of every age group weighted by the fraction of individuals of that age in the total population of that income group) should be similar to the per capita figures for that income group reported by the 1971-72 National Sample survey. The predicted values were substantially smaller than the reported values, not only for urban India but also for urban West Bengal. Hence, the predicted values for each income group were adjusted upward so as to make then consistent with the reported per capita values.1/

iii. Figure I shows calorie consumption as a percentage of requirements for children and adults for different levels of the per capita expenditure (income) of the household. With this figure we can test some of the assumptions made before in section B.

At very low levels of income, very young children experience a substantially larger deficit than adults and older children. However, the young children's consumption responds more rapidly to changes in income. The result is that young children reach their required levels of consumption at lower levels of per capita income than older children. Adults and young children reach their required levels at a

1/ For details see Appendix B.
FIGURE 1: URBAN INDIA: CALORIE CONSUMPTION BY AGE GROUPS

Daily calorie consumption as a percent of requirement (%)
similar income, between 43 and 48 rupees, while older children do so at around 60 rupees per month.

These results tend to show that within "deficitarian" income groups, children tend to have a larger calorie deficit than adults. Second, it shows that a particular age group of children could still be experiencing a deficit while the rest of the family members are already consuming above requirements. Obviously, these results are quite sensitive to the standards of calorie requirements set for each age group.\(^1\)

Figure 2 shows the percentage of children (in ages 1-4) and adults suffering different degrees of calorie deficit. It becomes clear that the incidence of strong degrees of calorie deficiency is substantially larger for these young children than for adults.

These results are also summarized in Table 3, where other age groups are also included. (For a more detailed presentation, the reader is referred to Appendix B.)

Eighteen percent of very young children have calorie intakes one-third below requirements; only 7.4 percent of adults suffer this degree of calorie deficiency. For milder cases of deficiency, older children are clearly worse off than adults: 42.5 percent of children ages 10-14 have calorie intakes below one-fifth of the requirements; for adults this figure is 19.3 percent.

\(^1\) The requirements being used are: children 1 - 4, 1150 calories; children 5 - 9, 1530 calories; children 10-14, 2200 calories; and adults, 2400 calories.
FIGURE 2: URBAN INDIA, 1971: PERCENTAGE OF CHILDREN AND ADULTS WITH DIFFERENT DAILY CALORIE INTAKE

Daily calorie consumption as a percent of requirement (%)
Table 3
Malnourished Individuals with Different Calorie Deficits
As A Fraction of the Total Number of Individuals in That Age Group

<table>
<thead>
<tr>
<th>Magnitude of the calorie deficit</th>
<th>CHILDREN Ages 1-4</th>
<th>Ages 5-9</th>
<th>Ages 10-14</th>
<th>ADULTS Individual</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than 33%</td>
<td>18.0</td>
<td>11.5</td>
<td>10.9</td>
<td>7.4</td>
</tr>
<tr>
<td>More than 20%</td>
<td>28.3</td>
<td>18.0</td>
<td>42.5</td>
<td>19.3</td>
</tr>
<tr>
<td>With positive deficit</td>
<td>61.7</td>
<td>61.6</td>
<td>74.4</td>
<td>47.2</td>
</tr>
<tr>
<td></td>
<td>65.9</td>
<td></td>
<td></td>
<td>47.2</td>
</tr>
</tbody>
</table>

1/ Fraction below requirements.

It is clear that the incidence of calorie malnutrition is substantially larger in children than in adults. Of interest is the last column in Table 3, given that the incidence for the mean individual (52.3 percent) is equal to the one found for developing countries as an aggregate: the findings that 52.3 percent of individuals suffer from calorie deficit is the result of having two-thirds of children being malnourished and only 47 percent of adults. Our hypothesis is that a similar result could be found for the developing world as a whole.
II. THE ECONOMIC JUSTIFICATION FOR INTERVENTION

i. What is the economic justification for nutrition intervention? What are the economic consequences for a country of having one-third of its young children with calorie deficit? Should social commitment and government intervention depend on the answers? Or are they simply of academic interest or, at most, relevant from a "tactical" point of view to the extent they influence such commitment?

There is some evidence that the mere hypothetical possibility of nutrition having economic effects has increased the sensitivity of governments and international organizations to broad intervention in this sector. There exists also an argument of substance: in the selection of specific types of nutrition intervention - particularly when they compete with interventions in closely nutrition-related sectors - some clear differential economic effects can appear, over and above the non-economic benefits. This differential effect should be taken into account in the proper selection of instruments.

ii. The economic justifications for improving children's nutrition can be classified into three types: (a) the ones based on the notion that children's nutrition is a "public good" or an "externality" to the rest of society, i.e., the rest of society derives a consumption benefit from eliminating malnutrition. Under this notion, the existence of malnutrition implies a distorted or non-Pareto optimal allocation of present economic resources; (b) the ones based on the
"resource savings" effect of better children's nutrition. If particular social objectives to which governments are already committed (infant mortality rates, incidence of infectious diseases, minimum standards of literacy in children, etc.) are the product of nutrition with other policy manipulable causal factors, better nutrition can, at the margin, be a cheaper intervention than these other interventions in achieving those objectives; and (c) the ones based on the notion that better infant nutrition can increase the future productivity of the individual, i.e., the "human" capital argument.

A. **CHILDREN'S NUTRITION AS A "PUBLIC GOOD"**

The recent literature emphasizing a "basic needs approach" to development is somehow related to this public good argument. In defining basic needs the question arises on (a) who will make the decisions of defining what is a basic need and (b) once decided, what is the appropriate level of that need to be provided.

The public good notion is, to some extent, an effort to define basic needs using the revealed preference of society as expressed by a voluntary choice of individuals to pay for a better nutrition of others. Society tends to behave that way; better off members of society would be voluntarily willing to tax themselves if they know the

---

1/ A large part of the basic needs literature has been the result of the concern of international development institutions on the inability of economic growth in reaching the poorest segments of the population. See ILO, "Employment, Growth and Basic Needs", Geneva 1976, and P. Streeten, "The Distinctive Feature of a Basic Needs Approach to Development", Policy Planning and Program Review Department, World Bank, August 1977.

proceeds would be used in better infant nutrition; they would try to correct a non-optimal Pareto initial condition. However, it is less likely they would voluntarily tax themselves to finance income transfers to poorer segments of the population.

The "public goods" notion can be used to define "basic needs" in terms of the interventions for which better off members of society would be willing to pay. The notion captures the relative nature of basic needs according to the particular country in question: non-malnourished individuals in India would be willing to pay to eliminate infant malnutrition of degree three; non-malnourished individuals in Latin America would be willing to pay to eliminate malnutrition of degree two. Similarly, the notion is consistent with the presumption that the first units of the need being provided are more valuable than additional units: within a country, non-malnourished individuals are willing to pay more for the first 100 calories to be provided to malnourished children than what they are willing to pay for the second 100 calories.

Although this argument provides a rigorous economic justification for policy intervention, it is not clear how it can be made operational. How can governments organize a system of institutions by which this willingness to pay for public goods can be captured? Should governments create semi-autonomous/semi-private agencies dealing with specific "basic needs" to be financed directly by tax deductible contributions?
B. THE "RESOURCE SAVINGS" ARGUMENTS

Governments are already devoting economic resources to achieve particular minimum social targets (which we may call "outputs") in sectors such as health and education. If infant nutrition is one of the several "inputs" determining these "outputs", the economic question becomes: what is the optimal combination of inputs that will minimize the cost of reaching these outputs or social targets? If the total cost of achieving a particular target goes down with improved children's nutrition, a "resource savings" benefits arises. Improved nutrition has released resources—spent previously in other inputs—of a higher value than the cost of the nutrition improvement. It will become clear that the evaluation of the resource benefits requires quite a bit of interdisciplinary cooperation inasmuch as the relation of these "outputs" and "inputs" is basically a biological or psychological phenomena.

Let us use some examples with the help of some graphical analysis. Assume governments are attempting to reach some minimum standards of health in young children defined by the frequency of diarrheal occurrences per year. Suppose diarrheal occurrences are affected by two factors:\(^1\): the quality of potable water and the quality of sewerage facilities in the dwelling (Q), and the level of nutrition of the child measured in terms of calorie intake (N).

---

Governments are presently achieving an average level of diarrheal occurrences per child per year equal to $\hat{D}$ by devoting resources only to water and sewerage in an amount $Q_o$ per household. Supplementary nutritional intake due to public programs, $N_s$, is zero. We now ask physicians and public health officials about the trade-offs between quality of water and sewerage against supplementary calorie intake from public programs for undernourished young children. Assume the index of diarrhea $\hat{D}$ could be achieved with lower standards of $Q$ and positive values of $N_s$ as reflected by the curve of figure 3.

![Figure 3. The Cost of an Index of Diarrheal Occurrences](image)

If the slope of the dotted line reflects the cost of one unit of $Q$ in terms of one unit of $N_s$, the optimal combination of both inputs is $P$. $Q_1$ and $N_o$ is the combination that minimizes the cost of achieving the index of diarrhea occurrences $\hat{D}$. The resources saved by introducing nutrition programs is equal to the monetary value of $(Q_o - Q_2)$. 
Figure 4 uses a somewhat different example, drawing from the present research on the effects of infant malnutrition on behavior and learning. Assume public policy attempts to achieve a minimum qualitative standard of literacy in young children, $\hat{L}$. If infant malnutrition—through whatever theoretical mechanism—affects learning, there will be a trade-off between nutrition and the amounts of (quantitative and qualitative) school inputs ($S$) in achieving a predetermined level of literacy achievement. The resources saved by introducing nutrition programs to the level $N_o^s$ is equal to the monetary value of $(S_o - S_2)$ educational inputs.

Figure 4. The Cost of an Index of Literacy Achievement
C. THE "HUMAN CAPITAL" ARGUMENTS

i. Human capital consists of those characteristics embodied in individuals that influence their productivities as labor inputs. From the point of view of policy, some are a datum, i.e., IQ at birth. Others can be more easily affected by policy such as the level of education of the individual.

Does infant malnutrition affect the future economic productivity of the individual? How do we test this hypothesis without waiting for data from long follow-ups of individuals from birth to adult age? How can economists complement the research that their colleagues in the medical profession are undertaking in determining the effect of early malnutrition on the mental development of children?

In theory, direct testing of this hypothesis could be carried out by multivariate analysis. In order to isolate the net effect of nutrition, indicators of productivity at adult age would have to be correlated with all the hypothetical variables – from birth on – affecting that productivity. It would include indicators of genetic endowment, nutrition and health status over time, education, home environment, etc. In practice these long longitudinal follow-ups of individuals do not exist in developing countries.¹/ What do we do in the meantime to take advantage of research based on shorter follow-ups of individuals (in different age groups) that several scientists are presently undertaking?

¹/ Even in developed countries, the availability of long follow-up studies is extremely scanty.
The starting point for economists is the identification of those specific attributes and abilities in adults which do have an economic (shadow price) value, i.e., those that seem to explain differences in the economic productivity of individuals. They will obviously be quite specific to the particular environment being studied (country, urban or rural, etc.). The next step is to identify those factors that determine the level of these abilities. It is at this point where, given the lack of data from long longitudinal studies, the research sequence must be broken down into smaller or shorter longitudinal studies.

Figure 5 suggests such a sequence. Let us define the A's as the abilities of adults. The economist's task is to identify which do have an economic value \((A_1, A_2, A_k)\). The levels of A's can be expressed in terms of initial levels of abilities at school age, the a's, and school and other environmental variables which the individual is exposed to between school age and adult age; this is research stage III. Stage II attempts to explore the determinants of a in terms of the a's and other variables. Finally, stage I explores the determinants of abilities in preschool age in terms of genetic endowment, nutrition and other environmental variables. This stage has perhaps received the most attention, particularly in the medical field.

Under this framework the economic effect of infant nutrition, the net effect of \(N\) over \(E\), can be expressed in terms of the net

---

1/ This starting point is not only relevant in the study of the economic effects of malnutrition. It is fundamental in identifying the mechanism by which any "human capital" intervention affects future productivity. Education per se does not influence productivity: it does to the extent that it affects particular abilities of individuals, these abilities being the ones influencing individuals' productivity.
Figure 5. Hypothesis defining the Research Sequence
effect of N through the different stages.\footnote{1} What is promising about
the approach is its ability to make use of intermediate pieces of in-
formation that are presently coming out from research studies with
very different objectives.

ii. A practical, but quite simplified, application of this approach
was used in an earlier research we conducted in Chile with Lance Taylor.\footnote{2}
The framework used to trace the effect of N on E was:

$$\frac{\partial E}{\partial N} = \frac{\partial E}{\partial A} \frac{\partial A}{\partial a} \frac{\partial a}{\partial N}$$

where $\frac{\partial E}{\partial A}$ is the net effect (holding constant the effect of other
variables on E) of A over E, $\frac{\partial A}{\partial a}$ the net effect of a preschool
ability index, and $\frac{\partial a}{\partial N}$ the net effect of infant nutrition on an index
of ability at preschool age.

Empirical measurements were only obtained for $\frac{\partial a}{\partial N}$ and $\frac{\partial E}{\partial A}$;
"a" was defined by the Terman-Merril children's test (ages 3 to 4),
and nutrition, N, was measured in terms of height and weight for
age (relative to the IOWA Standard). E was measured in terms of wages
of unskilled workers (basically construction workers) and A was the
manual component of the Wechsler-Bellevue test for these same workers.
Being unable to derive information on $\frac{\partial A}{\partial a}$ (which requires longitu-
dinal data, equivalent to both stages II and III in figure 5), we used
U.S. estimates for this relationship. The final results showed that

\footnote{1}{The net effect of N over E can be derived by a partial differ-
entiation of E with respect to N.

\footnote{2}{Marcelo Selowsky and Lance Taylor, "The Economics of Malnourished
Children: An Example of Disinvestment in Human Capital", \textit{Economic
Development and Cultural Change}, October, 1973.}
a 10 percent increase in the weight of extremely malnourished children (before age 4) could increase the future productivity of these children as manual workers by approximately five percent.

iii. A more specific hypothesis about the way in which infant nutrition affects the productivity of the individual is the complementary hypothesis, where nutrition influences the impact of later investment in human capital, particularly education. If societies are already spending considerable amounts in education, improved nutrition has an important additional effect over and above the effect that it can have independently of these future investments. Given that we do have information on the resources that countries spend in education as well as its present economic productivity - the present rates of return to invest in schooling - we can use this information to estimate the additional productivity resulting from better nutrition.

The semilog earnings function (which reflects individuals productivities to the extent they are proportional to wage earnings), relating labor earnings to education and early abilities, has become a popular framework to analyze the effect of education. This function has the form:

(1) \[ \log W = \mu + bS + cA \]

where \( W \) is the yearly wage, \( S \) is an index of schooling (years of schooling and \( A \) a (standardized) score of ability of the child before he starts schooling. Let us assume \( A \) to be itself a function of several factors:
(2) \[ A = A(G, H, N) \]

where \( G \) is genetic endowment, \( H \) an index of the quality of the home environment, and \( N \) an index of nutrition. The present rate of return to one additional year of schooling, \( \rho \), can be written as the ratio between the additional wages resulting from that increase, \( \Delta W \), and the cost of schooling. Such cost is the foregone wage for a year, \( W \), plus other costs (teachers) per year, \( K \).

(3) \[ \rho = \frac{\Delta W}{W(A) + K} = \frac{\Delta W/W}{1 + K/W(A)} = \frac{b}{1 + K/W(A)} \]

It is clear from (3) that the rate of return to education is a function of the initial level of ability of the individual. The higher the level of \( A \) the higher the value for this rate of return. Given that \( A = f(G, H, N) \), we can rewrite (3) as:

(4) \[ \rho = \frac{b}{1 + K/W(A(G, H, N))} \]

The rate of return to education becomes a positive function of the level of nutrition of the child before he enters school. The effect of a change in the level of nutrition of the child on the rate of return becomes:

(5) \[ \frac{\partial \rho}{\partial N} = \frac{kbc}{(1+k)^2} \frac{\partial A}{\partial N} = \rho c \left( \frac{k}{1+k} \right) \frac{\partial A}{\partial N} \]

where \( \rho \) is the initial rate of return and \( k = K/W \) is the ratio of direct costs of schooling (teachers) to foregone income, i.e.,
the structure of the cost of schooling. We can define the *elasticity* of the rate of return to nutrition, the percentage change in $\rho$ when nutrition improves by certain percentage, as:

$$\eta(\rho, N) = \frac{N}{\rho} \frac{\partial \rho}{\partial N} = c \left( \frac{k}{1+k} \right) \left( \frac{\partial A}{\partial N} N \right)$$

The need for interdisciplinary cooperation in evaluating this elasticity becomes clear. Once $k$ and $c$ are known, the elasticity will depend on $(\partial A/\partial N)N$, the effect on early abilities of a percentage improvement in the level of nutrition of the child.
III. THE ECONOMICS OF INTERVENTION

A. THE FUTURE UNDER THE NORMAL COURSE OF DEVELOPMENT: 
THE NEED FOR SPECIFIC INTERVENTION

1. Perspectives for the Future

   1. Will the normal course of future events eliminate calorie malnutrition in the poorest segments of the population of developing countries? The answer depends on the future income growth of the malnourished groups, their preference toward consuming calorie-intensive foods (i.e., the calorie-income elasticity\(^1\)), and the future changes in the relative price of the main staples, basically cereals.

   At constant food prices, the increase in per capita calorie consumption can be expressed as the product of the per capita income growth and the calorie-income elasticity. Annual per capita income growth in the lowest income groups in India and Bangladesh (which accounts for two-thirds of the global number of people with calorie deficit) is not expected to exceed 1.5 percent per year.\(^2\) Growing empirical evidence shows that the calorie-income elasticity is substantially lower than one, even for poorest income groups. Values around 0.5 (a one percent change in per capita income increases calorie consumption by half of one percent), are consistent with almost all evidence to date.

---

\(^1\) This elasticity is defined as the percentage change in per capita calorie consumption resulting from a one percent increase in per capita income.

\(^2\) Per capita income in India grew at 1.3 percent per year in the 1960-75 period and at 0.5 percent in the 1970-75 period. The figures for Bangladesh were -0.6 and -2.3. World Bank Atlas, 1977.
By using the above two figures, it will take thirty years before the poorest twenty percent of the population of these countries -- presently experiencing a deficit of 450 calories per day -- will reach the required level of calorie consumption. During this period, marginally deficient and non-deficitarian income groups will also increase their consumption and reach levels that can be substantially higher than requirements. Thus, it could well be that during part of that period, malnutrition in the poorest groups will coexist with a calorie surplus at a country level.

This probable future situation of Asia will be equal to the present situation of Latin America; today in Latin America, the poorest twenty percent of the population has a per capita daily calorie deficit of at least 200 calories, while at the regional level, total calorie consumption exceeds requirements by at least ten percent. It is clear that the "market solution", to wait for the regular income growth in the malnourished groups to close their calorie gap, is not an acceptable solution.

An alternative and widely suggested solution -- to rely on accelerated food production -- while acceptable is, unfortunately, not feasible. Given the purchasing power of the poorest groups, accelerated food production over and above the rate at which food demand is expanding will tend to lower food prices. Given the cost of expanding food production, these lower prices to consumers can be consistent
with constant or increasing cost to food producers only if governments would be willing to finance the difference with general subsidies. In most cases this is an unfeasible solution from a fiscal point of view.

The solution can only rest in target oriented food programs concentrated in the most needed segments of the population. For countries having a calorie surplus at the aggregate level -- as in Latin America -- the problem can be solved by reshuffling food availabilities from the groups with calorie surplus to those in deficit.

ii. The future situation of young children belonging to these income groups will not be much better. On the other hand, since in the future malnutrition will be more concentrated (i.e., in the poorest 10 percent instead of the poorest 20 percent) and given the relation between family size and income, malnutrition will be much more of a "children problem" than in the present.

Why does the future not look much brighter for the representative child in the poorest income groups than it does for the representative adult? First, the scattered empirical evidence does not show significantly higher calorie-income elasticities for children than for adults. Second, to the extent development in general (and urbanization in particular) will increase women's participation in the labor force, infant nutrition could deteriorate due to further declines in breast feeding. If the additional purchased food for the infant (out of the additional earnings of the female now participating in the
labor force) does not compensate for the losses in breast milk consumption, the net effect is a deterioration in the infant's nutritional status. Higher incomes of the household due to women's participation in the labor force could be consistent with a deterioration in the level of nutrition of the child.

Other factors associated with urbanization -- and urbanization will be a distinctive feature of the future -- will tend to adversely affect young children. Other competing expenditures (transportation, clothing, housing) become more important in urban areas, affecting the share of income spent on food. Relative prices of food tend to rise. New commodities become available, such as entertainment and fashion, to be consumed basically by adults. The result is that the share of income spent on food for children can decline (a) because expenditures other than food become necessary and (b) new commodities, relevant basically to adults, become available.

The above considerations suggest that the future will not solve the problem with the desired speed. The need for specific nutrition interventions and programs becomes imperative.

2. **Identifying the Points of Intervention**

   1. To identify points of intervention to increase calorie consumption in young children, one needs a theory of family behavior. Only part of that behavior responds to economic stimuli and it is only in that realm where economists can operate.

---

1/ For specific estimates of this effect for Calcutta, see Reutlinger and Selowsky, *op.cit.*, pp. 35-38.
To better identify the economic points of intervention, we can think of calorie malnutrition in young children as (a) resulting from the fact that the family as a whole is malnourished; in this case, children malnutrition is not the result of a clear discrimination against children within the family, (b) the result of an allocation of calories within the family where children are, on the average, being discriminated relative to adults. The extreme case of this situation would be when adults consume an amount above requirements, where this excess could finance the calorie deficit of children in the family; a less extreme case is when adults reach calorie consumption levels that are clearly closer to their requirements than is the case for children, and (c) the result of a particular behavior of the family with respect to specific children in the household. In this case, malnutrition results from a discrimination among children according to some of their characteristics, i.e., intelligence, sex, birth order, who is the child's father, etc.1/

Clearly, the determinants of children malnutrition that operate via (a) and (b) above have more of an economic dimension than the ones that do via (c). The latter ones are more in the realm of other social scientists. The scope for economists becomes relevant to the extent (a) and (b) become important in the total explanation of today's infant malnutrition.

1/ Among poor families of Cali, Colombia it was found that the better-off children in the family were the ones belonging to the man presently cohabitating in the household. The results were part of the PRIMOP Research Project, U. del Valle. I am indebted to Dr. Isabel Valdes for pointing this out to me.
ii. Economic interventions operating via (a) are those increasing the household overall purchasing power of food -- either by increasing their disposable income or lowering the relative price of food -- or the ones that change the relative prices of certain foods, i.e., a decline in relative prices of calorie intensive foods. Via (b) are those specific food programs that have an effect on children's consumption larger than an equivalent income transfer to the household. They also include policies to change the relative prices of specific foods for which the price elasticity of demand in children is higher than in adults, i.e., the percentage increase in consumption by children resulting from that change in price is larger than the one induced in adults' consumption. Via (c) are those economic interventions that, given income and prices, influence the preferences of adults in allocating food to particular children. They become relevant if these allocations are the result of looking at specific children as partly an investment good. If there is a complementarity between nutrition and education, government interventions in education could affect the amount of food allocated to specific children in the household (i.e., the rate of return to invest in education is a function of the initial level of nutrition. See Section II-C of this paper.)

In this paper we will only address interventions that operate via (a) and (b). We will also address what might be called target-oriented programs, i.e., the ones which subsidize the poorest income groups without subsidizing the rest of society. This will become clear below.
3. General Programs and Target Oriented Programs

Interventions to increase calorie consumption in malnourished children range from general food subsidies at one extreme (i.e., subsidies on the imports of cereals), to specific programs for poor children at the other (i.e., breakfast in specific schools).

In order to reach children in the poorest group, the first type of program subsidizes all types of consumers, rich and poor, adults and children. The program has what might be called a large "leakage". The second has clearly less leakages, and only to the extent some food is diverted to the adults in the family as a result of the (breakfast) program. Nevertheless, target programs can be very expensive administratively; general food subsidies can be concentrated in foods consumed by low income groups and particularly by children.

The above becomes clearer if we divide the cost of a program whose objective is to increase children's food consumption by one dollar into (a) the cost of the *intra family leakage*, equivalent to the subsidy on adults' consumption in poor families that is necessary in order to achieve the objective; (b) the *income group leakage*, the subsidy received by non target families out of the program and (c) the *administrative costs* of the program.

We will call general programs those where (b) becomes an important part of the fiscal cost of the program, i.e., nontarget groups must be subsidized in order to reach target families. Typical programs are general food production subsidies or subsidies on food imports, ration shops schemes for all the population, etc. Target oriented
programs are those where this component of the cost is relatively smaller: food stamp programs or ration shops for specified families, take home and on site feeding programs in specific schools and health centers.

A full comparison between the effectiveness of target and non target oriented programs, *where the objective is still to increase calorie consumption in poor children*, is presented in the Technical Appendix. Here we wish to concentrate on the effectiveness of target oriented programs, those aimed at families with malnourished children, with the objective of increasing the food and calorie consumption of those children.
B. THE EFFECTIVENESS OF TARGET ORIENTED FOOD PROGRAMS

Target oriented food programs are presently being implemented in several developing countries. Ration shops with free or subsidized rations for preselected families, take home and on site feeding programs for children in specific schools and health centers are some examples. Other countries are considering and experimenting with other interventions such as food stamps for specified populations.

What is the effectiveness of these programs in increasing children's food consumption? How much of a program's food simply replaces old consumption? How much of the intended food for children is diverted to adults? What are the magnitudes of these replacements and diversions that make these programs better, equal or worse than an income transfer to the family equivalent to the value of the food?

For the purpose of comparing programs, this chapter uses the effectiveness of an income transfer program as the yardstick (or reference program) of comparison. The first section discusses the conditions under which target food programs are equally effective as income transfers of a value equal to the food being distributed. In this case, the effectiveness of programs is determined by the household's marginal propensity to spend in children's food. The second section discusses

---

1/ For an excellent survey on the present experiences in supplementary feeding in different countries, see Simon Maxwell, "Food Aid and Supplementary Feeding: Impact and Policy Implications", Institute of Development Studies, University of Sussex, November, 1977.
programs can be of a larger or smaller effectiveness than an equivalent income transfer. Parameters other than the marginal propensity to spend in children's consumption also determine the effectiveness of these programs. The third section presents some conclusions in terms of policy decisions and suggestions for additional research.

1. **Programs Equivalent to An Income Transfer**

   a. **The strength of consumer's sovereignty: the possibility of reselling the concessionary element of the program**

   A well known principle in consumer's theory is that consumers receiving any transfer in kind will attempt to convert the transfer into income. This re-establishes the control of the consumer on the composition of his expenditure. Any transfer of a food commodity in excess of what the household voluntarily is willing to consume will be sold to households with different food preferences or households not reached by the program. If the resale price is similar to the cost of the food to the government, the household has received an income transfer equivalent to the fiscal cost of the program.¹/ ¹/ Under this case, and without exceptions, food programs will simply have an effect equal to an equivalent income transfer.²/ ²/

   The effectiveness of income transfers in increasing the consumption of food by children is proportioned to the marginal propensity to spend in children's food. The effect on calories will

---

¹/ We obviously exclude here the administrative costs.

²/ This also holds for food stamp programs to the extent the stamp can be sold.
depend on the calorie content of that additional food. A parameter that captures both elements is the calorie-income elasticity of children consumption; if that elasticity is 0.5, any food program equivalent to a per capita income transfer of ten percent will increase the calorie intake of children by five percent.

b. **The income transfer equivalency of infra marginal food programs: equivalency without the need of resale**

Several food programs operate like an income transfer even without the need of reselling the concessionary food. Here we specify the characteristics of these programs.

Programs that transfer free or subsidized food in magnitudes smaller, or infra-marginal amounts, than the amount previously consumed by the family will replace initial levels of consumption and release purchasing power of a value equal to the subsidy. When more than one food is involved in the program, two conditions are required: first, the foods being distributed must have been previously being consumed; second, the amount of any food being distributed cannot be larger than the amount initially being consumed. These conditions leave unaffected the marginal rate of substitution among foods, the condition for the program to act like an income effect. We believe these characteristics hold for most of the ration shops and take home programs presently being implemented in most countries. 

Under the same circumstances, a site feeding program for children (i.e., breakfast and lunches in schools) will have an effect

---

1/ At least this is the experience of the ration shop schemes in India and Sri Lanka.
on children's consumption - no larger than an equivalent income transfer. It will be true if the amount of each type of food being consumed on site is smaller than the amount of that food previously consumed by the child at home. In this case, the site food will partly replace the food eaten at home without changing the marginal rates of substitution among foods.

A food stamp program providing stamps of a smaller value than the initial (pre-program) food consumption level of the family will be also equivalent to an income transfer; this will be true without the need for reselling the stamps. The income transfer is equal to the concessionary component of the stamps, the difference between the value of the stamps and the price charged for them. Most of the food stamp programs provide stamps of a smaller value than the initial level of food consumption: the effectiveness of these programs have been equal to equivalent income transfers.

2. PROGRAMS DIFFERENT TO AN EQUIVALENT INCOME TRANSFER: PROGRAMS PROVIDING FOOD IN EXCESS OF INITIAL LEVELS OF CONSUMPTION UNDER CASES OF NO RESALE

a. Definition of programs and cost effectiveness comparisons

1. If programs provide free or subsidized food, on site feeding or food stamps in excess of initial consumption (non inframarginal programs), households will try to make use of the possibility of resale so as to increase their set of consumption choices. Food eaten on site cannot be resold, so for this program the option is not

1/ Actually, the threshold value where the scale of a program stops acting like an equivalent income transfer is beyond the initial level of consumption of the household.
open. Part of the concessionary food received in ration shops as well as a fraction of the food stamps can, however, be resold. As discussed before, this would simply convert the program in an income transfer. Assume, however, the food or stamps, due to heavy policing or high transaction costs, is not resold. What is then the cost effectiveness of these programs? Is that effectiveness still equal to an equivalent income transfer? How do these three different programs now compare in terms of the additional food consumed by children?

ii. Before we proceed to compare the cost effectiveness of programs, some definitions become necessary.

Cost effectiveness will be defined here as the fiscal cost of increasing by one dollar the aggregate food consumption of children not the per capita consumption by each child. The comparisons do not distinguish or capture the distribution of that additional dollar among children. For example, the comparisons do not distinguish between a situation where three-quarters of the additional dollar's worth of food benefit one child -- the other one-quarter being distributed among the other ones -- from a situation where all children benefit equally out of that additional dollar.

The second consideration to be kept in mind is that the effectiveness of an income transfer relative to the other programs is quite sensitive to the precise definition of "children". The effectiveness of an income transfer is proportional to the marginal propensity to spend in the food of these children, i.e., the increase in the
aggregate value of food consumption of that group of children. If
the group is defined rather widely, i.e., those below age 15, the
relevant marginal propensity is much larger and income transfers be-
come more effective. The reason is obvious: a smaller fraction of in-
dividuals is now considered as a non target age group, diminishing the
"leakage" of the program. It is always possible to define children
narrowly enough (i.e., those below age 5) so as to make income transfer
extremely inefficient: all the rest of children's consumption also
becomes a leakage.

In order to explicitly capture this last effect, we will
define the marginal propensity to spend in children's foods as \( \gamma m_T \),
where \( \gamma \) is the fraction of individuals defined as "children", and
\( m_T \) is the marginal propensity to spend in total households food con-
sumption. This proportionality assumption is a simplification insofar
as it assume that the individual marginal propensity is the same for
children as adults. However, we can predict the bias of the assumption:
if adults have a larger individual marginal propensity than children --
and we do have some evidence on it -- the earlier assumption will over-
estimate the marginal propensity to spend in children,\(^1\) i.e., our
estimates of the effectiveness of income transfer will be also over-
estimated. This will be important in interpreting the results of the
next section.

---

1/ As expected, data on individual's marginal propensity to consume
food (the increase in that individual's food consumption when the
income of the family increases by one dollar) is almost nonexis-
tant. Only the Calcutta Food Survey provides some estimates. The
individual propensity of children ages 3-5 was approximately 0.06
while that of adults was 0.08. These values correspond to the
poorest 50 percent of households.
iii. Table 4 shows expressions for the cost effectiveness of the three programs. When the programs are inframarginal, all have the same cost effectiveness and equal to an equivalent income transfer. In this case, the cost is inversely proportional to the marginal propensity to spend in children’s food consumption, $\gamma m_T$.

If the programs are "large enough" and resale is possible, the only program different to an equivalent income transfer is a site feeding program for children. For the program to operate differently than an equivalent income transfer, the required scale of the program (the food given on site to all the children of the household) must be at least $1/(1-\gamma m_T)$ times the food previously received at home. Under this type of program, the net increase in children's consumption -- even if families stop feeding children at home -- will be equal to the excess of the food given on site over the food previously eaten at home. Therefore, the cost effectiveness formula $\frac{1+\lambda}{\lambda}$ is relevant for all programs where $\lambda$, the fraction by which one wishes children's consumption to increase, is larger than $\gamma m_T / (1-\gamma m_T)$. For any objective $\lambda$ below this value, the effectiveness of the program will be equivalent to an income transfer.

Let us explore the effectiveness of a site feeding program under $\gamma m_T = 0.15$. In this case, any program whose objective is to increase children consumption by more than 17.6 percent ($0.176 = \frac{0.15}{0.85}$) can only do so by feeding children the full amount previously eaten at home plus an additional amount of food equal to the objective. If
Table 4: Cost Effectiveness Comparisons

Cost of Increasing By One Dollar the Value of Children's Aggregate Food Consumption

<table>
<thead>
<tr>
<th>Type of Program</th>
<th>INFRAMARGINAL PROGRAMS</th>
<th>PROGRAMS IN EXCESS OF INITIAL CONSUMPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Under resale</td>
<td>Under no resale</td>
</tr>
<tr>
<td>A subsidized food program for the household</td>
<td>$\frac{1}{\gamma m_T}$</td>
<td>$\frac{1}{\gamma m_T}$ $\frac{1 + \lambda}{\gamma m_T + \beta \eta^s}$ $^{1/}$</td>
</tr>
<tr>
<td>A food stamp program for the household</td>
<td>$\frac{1}{\gamma m_T}$</td>
<td>$\frac{1}{\gamma m_T}$ $\frac{1}{\gamma} \left[ 1 + \left( \frac{1-f}{\lambda} \right) \right]^{2/}$</td>
</tr>
<tr>
<td>Direct on site feeding of all children</td>
<td>$\frac{1}{\gamma m_T}$</td>
<td>$\frac{1 + \lambda}{\lambda}$ $\frac{1 + \lambda}{\lambda}$ $^{3/}$ (full feeding) (full feeding)</td>
</tr>
<tr>
<td>An income transfer to the household</td>
<td>$\frac{1}{\gamma m_T}$</td>
<td></td>
</tr>
</tbody>
</table>

Notation:
- $\gamma$ = children as a fraction of family size
- $m_T$ = marginal propensity to spend in household's food consumption
- $\lambda$ = desired increase in children's food consumption as a fraction of the initial consumption
- $\eta^s$ = "pure substitution" price elasticity of children's demand for food
- $\beta$ = share of food consumed by children
- $f$ = price charged for the food stamps, expressed as a fraction of the initial amount of food consumed by the family

$^{1/}$ Assumes that the total price elasticity of demand is equal for children and adults.

$^{2/}$ Holds for $f > 1 - \lambda \left( \frac{1-m_T}{m_T} \right)$.

$^{3/}$ Holds for $\lambda > \frac{\gamma m_T}{1-\gamma m_T}$; condition for "full feeding"
the program wishes to increase consumption by 20 percent, it has to feed children an amount 1.2 times the amount previously eaten at home. Thus, programs whose objective, $\lambda$, is larger than $\gamma m_T / (1 - \gamma m_T)$, can only be implemented by what might be called a "full feeding" program, i.e., the program must be able to compensate for the possibility of a 100 percent replacement at home.

iv. A food stamp program providing stamps in excess of the initial level of food consumption is illustrated in Figure 6. The cost effectiveness formula for the program is also presented in Table 4. Again, it is assumed that the stamps cannot be resold.

It can be shown that an increase in household's food consumption by a fraction $\lambda$ can be achieved by (a) providing the family with stamps equal to $(1+\lambda)$ times his previous consumption and (b) charging for the stamps a price that ranges between $1-\lambda(1-m_T)/m_T$ and one times the value of the food initially consumed. The higher the price charged -- within the above range -- the higher the effectiveness of the program, i.e., the cheaper the program. If either the price charged for this amount of stamps is below $1-\lambda(1-m_T)/m_T$ or the implicit subsidy of charging this price is maintained and less stamps are distributed, the program will be equal in its effectiveness to an equivalent income transfer.

The expression of cost effectiveness shown in Table 4 can be broken down into two components: $1+(1-f)/\lambda$ is the cost of inducing one extra dollar of food consumption in the household; $\gamma$ is the fraction of that extra dollar that will be consumed by children.
\[ \lambda = \frac{\Delta}{F_o} \quad \frac{P}{P_o} = f \]

Cost effectiveness = \[ \frac{S}{\gamma \Delta} = \frac{\Delta + F_o - P}{\gamma \Delta} = \left[ 1 + \frac{F_o (1 - f)}{\Delta} \right] \frac{1}{\gamma} \]

when \( f > 1 + \lambda \left( \frac{m_T - 1}{m_T} \right) \)

Figure 6. A Food Stamp Program
v. The subsidized food price program defined here is different from the typical ration shop scheme where the family does not have the freedom of buying as much as it wishes at the subsidized price. In the ration scheme, the family receives an infra marginal ration which, as discussed earlier, is equivalent to an income transfer. Here the family has the freedom to purchase at the subsidized price as much as it wishes; however, given that resale is not possible it will only purchase the amount demanded for own consumption, and the quantity purchased will be on the demand schedule of the household.

The cost effectiveness expression for this program (shown in Table 4) includes two new parameters other than \( \lambda \) and \( \gamma m_T \). One is \( \eta^s \), the (pure substitution) price elasticity of food demand of children, capturing the substitution in favor of food that takes place when the subsidy changes the relative price between food and non food. The program has changed the marginal rate of substitution between food and non food, an effect that was not present in programs equivalent to an income transfer. The larger the value of \( \eta^s \), the more cost effective will be the program. The parameter \( \beta \) corrects for the additional leakage -- being financed by the subsidy -- that takes place when part of the additional food demanded by the family is consumed by adults.

vi. Table 5 presents the cost of the programs in terms of the cost effectiveness of an equivalent income transfer, i.e., the numeraire. Table 6 presents results under alternative values of the parameters.
Table 5: Cost Effectiveness Comparisons

Relative Cost of Increasing by One Dollar the Value of Children's Aggregate Food Consumption, Cost Relative to an Income Transfer Program
(All figures of Table 4 are divided by \((1/\gamma m_T)\))

<table>
<thead>
<tr>
<th>Type of Program</th>
<th>INFRAMARGINAL PROGRAMS</th>
<th>PROGRAMS IN EXCESS OF INITIAL CONSUMPTION NO RESALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A subsidized food program</td>
<td>1</td>
<td>(\frac{1 + \lambda}{1 + \beta n_s \gamma m_T})</td>
</tr>
<tr>
<td>A food stamp program</td>
<td>1</td>
<td>(m_T \left[1 + \frac{(1 - f)}{\lambda}\right]^{1/2})</td>
</tr>
<tr>
<td>Direct on site feeding of all children</td>
<td>1</td>
<td>(\gamma m_T \left(\frac{1 + \lambda}{\lambda}\right)^{2/2})</td>
</tr>
</tbody>
</table>

1/ Holds for \(f > 1 - \lambda \left(\frac{1 - m_T}{m_T}\right)\)

2/ Holds for \(\lambda > \frac{\gamma m_T}{1 - \gamma m_T}\)
Table 6: Cost Effectiveness Comparisons in Terms of the Cost of an Income Transfer Program 1/

\( m_T = 0.5 \)

<table>
<thead>
<tr>
<th>Type of Program</th>
<th>INFRAMARGINAL PROGRAMS</th>
<th>PROGRAMS IN EXCESS OF INITIAL CONSUMPTION NO RESALE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( f )</td>
<td>( \gamma = 0.2 ) ( \lambda = 0.15 ) ( \lambda = 0.30 )</td>
</tr>
<tr>
<td></td>
<td>( \text{f}=0.25 )</td>
<td>( 1 ) ( 1 ) ( 1 ) ( 1 )</td>
</tr>
<tr>
<td></td>
<td>( \text{f}=0.50 )</td>
<td>( 1 ) ( 1 ) ( 1 ) ( 1 )</td>
</tr>
<tr>
<td></td>
<td>( \text{f}=0.75 )</td>
<td>( 1 ) ( 0.92 ) ( 1 ) ( 0.92 )</td>
</tr>
<tr>
<td></td>
<td>( \text{f}=0.9 )</td>
<td>( 0.83 ) ( 0.66 ) ( 0.83 ) ( 0.66 )</td>
</tr>
<tr>
<td></td>
<td>( \text{f}=1.0 )</td>
<td>( 0.50 ) ( 0.50 ) ( 0.50 ) ( 0.50 )</td>
</tr>
</tbody>
</table>

1/ The other parameter values are: \( \eta^g = 0.5; \beta = 0.1 \).
2/ The conditions for the program to operate like an income transfer are:
   For \( \lambda = 0.15 \), \( f < 0.85 \); for \( \lambda = 0.30 \), \( f < 0.70 \).
3/ The conditions for the program to operate like an income transfer are:
   For \( \gamma = 0.2 \), \( \lambda < 0.11 \); for \( \gamma = 0.33 \), \( \lambda < 0.197 \).
A value of \( m_T \) -- the households' marginal propensity to spend in food -- equal to 0.5 is used throughout the analysis. We believe this figure to be an upper limit.\(^1\) Thus, the effectiveness of an income transfer is being overestimated. It means the relative cost figures for the other programs shown in Table 6 represent maximum values.

The two assumed values of \( \gamma \), equal to 0.2 and 0.33, can be interpreted as two alternative definitions of "children". A value of 0.2 corresponds to children below age 5, and a value of 0.33 to children below age 10. Under the broader definition of children, the income transfer clearly becomes more effective due to a smaller leakage. The relative cost of the price subsidy and site feeding programs increases. The relative cost of the food stamp program remains the same since the food leakage resulting from redefining children affects proportionally the effectiveness of both programs.

As expected, a very narrow definition of children makes all programs more cost effective than an income transfer. The exception is "low" priced food stamp programs; \( f \) must be larger than 0.75 for these programs to be better than an income transfer. For objectives equal to \( \lambda = 0.3 \), stamps programs with a high price, and on site feeding programs become the best interventions.

\(^{1}\) Only for the poorest one-third of households in Calcutta have we found values of this magnitude. For most poor income groups in urban Latin America, the value of \( m_T \) fluctuates between 0.3 and 0.4. See C. Lluch, et.al., Patterns in Household Demand and Savings, Oxford University Press, 1977.
The above is also true in a wider definition of children; the difference is a different ranking between "high" priced stamps programs and on site feeding. Stamp programs become more effective than direct site feeding.

vii. For policy purposes the above figures must be adjusted by two factors: first, the difference in administrative costs of the different programs. Countries who already have an infrastructure of health centers, rural schools, etc., require less additional (non food) resources to carry out on site feeding programs. Second, the assumption of no resale is perhaps less realistic for some programs than for others, i.e., subsidized food price programs relative to food stamp programs. If resale is possible whatever the program, only one intervention will be more cost effective than an income transfer: a "full feeding" program on site.

b. Programs in terms of specific foods: substitution among foods and the effect on calorie consumption

i. The programs discussed earlier did not induce a change in the composition of food consumption. Therefore, the percentage change in food intake was equivalent to the percentage change in calorie consumption.

It was implicitly assumed that either one food provided most calories (i.e., cereals) - where all programs were designed in terms of that food or, in the case of several foods, that the program left unchanged the marginal rate of substitution among food commodities. For the specific case of the food subsidy program, this assumes all foods
are subsidized by the same percentage. For the site feeding program, it assumes the composition of the foods given on site to be equal to the composition of the foods previously eaten at home.

What happens if programs do change the composition of food consumption? How do we then predict the change in calorie consumption? A formal presentation of the effectiveness of specific food programs in terms of calories is presented in the Technical Appendix. In this section we discuss the extensions to the previous analysis that are required to take into account this intra food substitution.

ii. When substitution takes place, the increment in the consumption of a particular food (that is being subsidized or provided by the program) can induce a decline in the consumption of other foods, i.e., foods that are substitutes. If that substitution is strong and the foods being substituted account for an important share of the initial calorie consumption, the net effect on calorie intake could be negative.  

In order to predict these changes, cross-price elasticities of children's food consumption is needed. This information is extremely scanty even at the level of aggregate household consumption. For children it is absent. Thus, we can only speculate about how sensitive the effectiveness of particular programs is when these substitutions are present. It will become clear that many of the present nutrition interventions fall into this category.

1/ For a formal presentation of the relation between cross elasticities and calorie consumption, see Reutlinger and Selowsky, op.cit., pp. 44-45.

2/ For an interesting use of these elasticities in predicting the caloric effect of changes in the supply of particular foods, see Pinstrup-Andersen, et.al., "The Impact of Increasing Food Supply on Human Nutrition", American Journal of Agricultural Economics, May 1976.
iii. Milk price subsidies or free distribution (take home programs) of milk in amounts substantially above the previous consumption of the household are typical cases. If resale is not possible, these policies will induce a substitution among food commodities.

Assume children were consuming two basic foods, cereals and milk. The effect of those programs will be (a) to increase children's consumption of milk and (b) to increase or decrease children's consumption of cereals, depending if milk and cereals are complements or substitutes, respectively.1/

If milk and cereals are substitutes (the decline in milk's implicit price decreases children's cereal consumption), total calorie consumption could decline if, as it is usually the case, most of the calories are derived from cereals. It can be shown that, in this case, even a small degree of substitution between the two foods could induce a negative effect on caloric intake.

The percentage change in calorie consumption induced by a one percent decline in the price of milk, $K_M$, can be written as:

\[ K_M = \alpha_M \eta_{MM} - \alpha_C \eta_{CM} \quad \alpha_M + \alpha_C = 1 \]

where $\alpha_M$ and $\alpha_C$ are the initial shares of calories derived from milk (M) and cereals (C), respectively; $\eta_{MM}$ is the (own) price elasticity of demand of milk and $\eta_{CM}$ the (gross) cross elasticity between cereals and milk. $\eta_{CM}$ is assumed negative, both foods are (gross) substitutes.

1/ We define substitution including the corresponding income effect, i.e., gross substitution.
In order for $K_M$ to be negative, i.e., for the subsidy on milk to have a negative effect on calorie consumption, we need the condition:

$$\frac{\alpha_M}{\alpha_C} < \frac{\eta_{CM}}{\eta_{MM}}$$

If $\alpha_M/\alpha_C = 1/5$, initially four-fifths of the calorie intake came from cereals, any cross elasticity larger than one-fifth the value of the price elasticity for milk will induce a negative effect on calories.\(^1\)

If the price elasticity of milk is one, any (negative) cross elasticity larger than 0.20 will have this effect.

Milk subsidies and free distribution of milk programs are popular programs in the present. Perhaps they were basically conceived with the objective of increasing the consumption of "high quality" proteins. However, if calories are the major nutritional problem, a reevaluation of milk programs along the lines described earlier becomes of prime importance.

iv. The problem of predicting this substitution becomes even more difficult when a program introduces a food previously not being consumed by children. In this case, the notion of an inframarginal or non inframarginal program loses its meaning: any amount of the food being distributed could affect negatively the consumption of calories.

\(^1\) For children aged 2-5 in the poorest income groups, the Calcutta Food Survey, *op.cit.*, shows the following composition of sources of calories: out of cereals, 66%; out of milk, 13%, out of other foods, 21%.
When a program distributes an inframarginal amount of a food previously being consumed, the released purchasing power is used to expand the consumption of all food commodities, by both adults and children.\(^{1}\) If the new food being introduced by the program can only be consumed by children (specific baby foods), or is fed directly to children (milk programs in schools when children were not previously consuming milk), the only mechanism by which the rest of the family can also benefit from the transfer is by withdrawing some other food from the child in question.\(^{2}\) Substitution takes place automatically.

---

1/ We assume all foods are superior goods at low levels of income.

2/ Assume a utility function of the household equal to:

\[
U = F^\alpha R^{1-\alpha}_a
\]

where \( R \) is rice (or an index of cereals) consumed by adults and \( F^\alpha_a \) is an index of the food consumed by children. Suppose \( F \) is a CES index of milk (M) and cereal intake (Rd) consumed by children.

\[
F = \left[ \delta M^\rho + (1-\delta) R_d^\rho \right]^{\frac{1}{\rho}} \quad \rho = \frac{\sigma-1}{\sigma}
\]

where \( \sigma \) is the elasticity of substitution. If initially the child did not consume milk, first order conditions yield an allocation of cereals, \( A_o \), equal to:

\[
A_o = \frac{R_d}{R_a} = \left( \frac{\alpha}{1-\alpha} \right)
\]

When the child is fed at school an amount \( M_o \), the first order condition yields a new allocation of rice equal to:

\[
A_1 = \frac{A_o}{\left( \delta \frac{M_o}{R_d} \right) + 1}
\]

Clearly \( A_1 < A_o \), the relative allocation of rice to children declines. Since expenditure in rice (cereals) is always equal to total income, this decline involves a decline in the absolute amount of rice consumed by children.
The net effect on calorie consumption will again depend on the caloric content of the food being distributed relative to the caloric content of the foods whose consumption is being displaced.

These considerations do apply to many nutritional interventions being carried out today. Milk programs, to be consumed in schools and health centers, are being implemented in environments where milk was not being previously consumed at home. What happens to children's calorie consumption if the family, as a reaction to the program, withdraws some cereal from the child, cereals being much more "calorie intensive" than milk?

As an illustrative case let us use the following example. Suppose the child gets fed twenty cents worth of milk at school and as a reaction the child receives at home five cents less worth of cereals: his total calorie consumption will go down as long as one dollar's worth of cereals has more than four times the calories of one dollar's worth of milk, a ratio of 4:1. In the Calcutta Food Survey this ratio was approximately 6:1.

As long as the rate of substitution between foods, as seen by the household, does not fully internalize the different calorie intensity of foods, the resulting substitution could adversely affect the calorie consumption of children. ¹/¹

¹/¹ For a discussion of the effectiveness of milk programs under extreme assumptions about the degree in which households internalize the different calorie intensity of foods, see the Technical Appendix.
3. Some Conclusions

i. Consumers' first reaction to a food program will be to convert the concessionary element of the program into an equivalent income transfer. The "force of consumers' sovereignty" or the effort of consumers of having full control on the composition of his expenditure will always be present. Thus, a logical way of starting the evaluation of any program is to ask the question, "why should this program be different to an equivalent income transfer? What are the specific characteristics of the program that prevent this to happen?

ii. What is wrong with having a program whose effect on food consumption is equal to an equivalent income transfer? Why not accept the results of households' own choices regarding the composition of their consumption?

The effect of an income transfer on calorie consumption is governed by the calorie-income elasticity. The limited empirical evidence shows rather small values for this elasticity in spite of the fact that most of these estimates are already upward biased. The challenge becomes to identify interventions that can have a calorie effect larger than an equivalent income transfer.

iii. Site feeding programs delivering foods in similar proportions to the ones eaten at home must be able to fully replace previous consumption so as to be more effective than an equivalent income transfer.

1/ Most studies do not control for the effect of variables positively correlated with income having an independent positive effect on consumption, i.e., education. This yields upward bias estimates for the calorie-income elasticity. There are some few exceptions; when controlling for other variables, Levinson found elasticities of less than 0.1 for young children in rural India. See F. James Levinson, Morinda: An Economic Analysis of Malnutrition Among Young Children in Rural India, Cornell-MIT Nutrition Policy Series, 1974.
If they are distributed in a lesser amount, the percentage increase in each child's food and calorie consumption will be equal to the product of (a) the food distributed to each child as a fraction of the food previously consumed at home and (b) the marginal propensity to spend in children's food, $\gamma m_T$. A propensity of 0.165 (the highest value of $\gamma m_T$ in Table 6) would imply that a program that feeds children half their previous consumption will increase calorie intake by 8.25 percent. Most present site feeding programs are distributing food in lesser amounts, so this will be an upper limit of their effectiveness in increasing children's consumption. Only full feeding programs will be able to increase consumption by amounts substantially above that figure.

In interpreting our conclusions on site feeding programs, it is important again to distinguish between the total cost of the program and its cost effectiveness. Full feeding programs, although having a larger total cost, are more cost effective than inframarginal programs.

iv. On site full feeding programs as recommended above are relevant for children of sufficient age to receive food in institutionalized centers. It is less clear an option for very young children (i.e., below age 4). It is for this group where perhaps programs based on new baby foods must be conceived. However, the success or failure of this type of program is extremely sensitive to the intra-food substitution issue discussed earlier. Unless we understand better this substitution -- and this is the main constraint of our present state of the arts -- we
run the risk of creating a new baby food that would adversely affect the calorie consumption of children.

v. To conclude a final point becomes important: if most of the food programs being implemented today do act like an income transfer, should we not simply -- in the absence of having more cost effective programs -- replace them by equivalent income transfers? Very possibly direct income transfer programs are cheaper administratively.

We believe this to be a dangerous line of thinking. Politically it is much easier to justify food programs -- even if they do not have a food effect better than an income transfer -- than direct income transfers. It is difficult to conceive a political scenario in which food programs could be easily replaced by income transfers of equivalent values.
APPENDIX A
### Table A-1

**FRACTION OF CHILDREN BELOW AGE 10 IN DIFFERENT INCOME GROUPS**

<table>
<thead>
<tr>
<th>Yearly Per Capita Expenditure (In US Dollars)</th>
<th>Asia&lt;sup&gt;1/&lt;/sup&gt;</th>
<th>Latin America&lt;sup&gt;2/&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 50</td>
<td>.35</td>
<td>.56</td>
</tr>
<tr>
<td>50-100</td>
<td>.32</td>
<td>.47</td>
</tr>
<tr>
<td>100-150</td>
<td></td>
<td>.40</td>
</tr>
<tr>
<td>In Total Population</td>
<td>.29</td>
<td>.30</td>
</tr>
</tbody>
</table>

<sup>1/</sup> Based on Indian data, See P. Visaria, "Living Standards, Employment and Education in Western India 1972-1973", World Bank mimeo 1977.

<sup>2/</sup> Based on Latin American urban households - The ECIEL Project, see P. Musgrove, "Consumer Behavior in Latin America", Brookings, 1978.
Estimates of Calorie Consumption
By Age Groups in Urban India

From the Calcutta Food Survey the following semilog function was estimated:

\[ C_{ij} = a_j + b_j \ln Y_i + c_{ij} \]

Where \( C_{ij} \) is the calorie intake of a typical individual in the age group \( j \) belonging to the \( i^{th} \) income group. \( Y_i \) is the mean per capita expenditure of the group.

The mean per capita consumption in any income group \( i \) is equal to weighted average of the predicted consumption for any age group, \( \hat{C}_{ij} \):

\[ \hat{C}_i = \frac{\sum f_{ij} \hat{C}_{ij}}{\sum f_{ij}} \]

where \( f_{ij} \) is the fraction of individuals in the \( i^{th} \) income group belonging to the \( j^{th} \) age group. The adjustment factor, so as to make the data consistent with the 1971 Sample Survey, was made equal to:

\[ \phi_i = \frac{C^0_i}{\hat{C}_i} \]

where \( C^0_i \) is the mean urban per capita calorie consumption for the \( i^{th} \) income group reported by the National Sample Survey.
The adjusted consumption for any individual $i_j$ becomes therefore

$$\hat{C}_{ij} = \phi_i \hat{C}_{ij} = \phi_i (a_j + b_j \ln Y_i)$$

Table A-1 shows the values of $f_{ij}$ for different age and per capita expenditure groups. Table A-2 shows the estimated values of $\hat{C}_{ij}$ and the fraction of individuals with a different level of consumption. Table A-3 shows the percentage of individuals with a different level of calorie consumption expressed as a fraction of the calorie requirement for each age group.
### Table B-1

**URBAN INDIA, 1971 FRACTION (f) OF INDIVIDUALS OF DIFFERENT AGE GROUP BY EXPENDITURE CLASS**

<table>
<thead>
<tr>
<th>Per Capita Monthly Expenditure (rupees)</th>
<th>Range</th>
<th>Midpoint</th>
<th>( f(0-4)^2 / )</th>
<th>( f(5-9)^2 / )</th>
<th>( f(10-14)^2 / )</th>
<th>( f(0-14) f(A) / )</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-15</td>
<td>10</td>
<td>.20</td>
<td>.18</td>
<td>.16</td>
<td>.54</td>
<td>.56</td>
</tr>
<tr>
<td></td>
<td>15-21</td>
<td>18</td>
<td>.19</td>
<td>.17</td>
<td>.14</td>
<td>.50</td>
<td>.50</td>
</tr>
<tr>
<td></td>
<td>21-24</td>
<td>22.5</td>
<td>.18</td>
<td>.16</td>
<td>.15</td>
<td>.49</td>
<td>.51</td>
</tr>
<tr>
<td></td>
<td>24-28</td>
<td>26</td>
<td>.18</td>
<td>.16</td>
<td>.13</td>
<td>.47</td>
<td>.53</td>
</tr>
<tr>
<td></td>
<td>28-34</td>
<td>31</td>
<td>.17</td>
<td>.15</td>
<td>.13</td>
<td>.45</td>
<td>.55</td>
</tr>
<tr>
<td></td>
<td>34-43</td>
<td>38.5</td>
<td>.16</td>
<td>.14</td>
<td>.12</td>
<td>.42</td>
<td>.58</td>
</tr>
<tr>
<td></td>
<td>43-55</td>
<td>49</td>
<td>.15</td>
<td>.13</td>
<td>.11</td>
<td>.39</td>
<td>.61</td>
</tr>
<tr>
<td></td>
<td>55-75</td>
<td>65</td>
<td>.12</td>
<td>.11</td>
<td>.10</td>
<td>.33</td>
<td>.67</td>
</tr>
<tr>
<td></td>
<td>75-100</td>
<td>87.5</td>
<td>.09</td>
<td>.08</td>
<td>.08</td>
<td>.25</td>
<td>.75</td>
</tr>
<tr>
<td></td>
<td>100+</td>
<td>100+</td>
<td>.09</td>
<td>.08</td>
<td>.08</td>
<td>.25</td>
<td>.75</td>
</tr>
</tbody>
</table>

---


2/ Derived by applying U.N. estimate of \( f(0-4) \), \( f(5-9) \), \( f(10-14) \) for total India (U.N. population projection).
### Table B-2

**URBAN INDIA, 1971, ESTIMATED DAILY CALORIE CONSUMPTION BY AGE GROUP AND PER CAPITA EXPENDITURE CLASS**

<table>
<thead>
<tr>
<th>Per Capita Monthly Expenditure (rupees)</th>
<th>1 - 4</th>
<th>5 - 9</th>
<th>10 - 14</th>
<th>Adults²/</th>
<th>Mean³/</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>Midpoint</td>
<td>Calorie Intake % Children</td>
<td>Calorie Intake % Children</td>
<td>Calorie Intake % Children</td>
<td>Calorie Intake % Adults</td>
</tr>
<tr>
<td>0-15</td>
<td>10</td>
<td>346</td>
<td>2.6</td>
<td>651</td>
<td>2.5</td>
</tr>
<tr>
<td>15-21</td>
<td>18</td>
<td>617</td>
<td>8.9</td>
<td>1000</td>
<td>9.0</td>
</tr>
<tr>
<td>21-24</td>
<td>22.5</td>
<td>750</td>
<td>6.5</td>
<td>1172</td>
<td>6.5</td>
</tr>
<tr>
<td>24-28</td>
<td>26</td>
<td>837</td>
<td>10.3</td>
<td>1284</td>
<td>10.4</td>
</tr>
<tr>
<td>28-34</td>
<td>31</td>
<td>932</td>
<td>15.8</td>
<td>1399</td>
<td>15.7</td>
</tr>
<tr>
<td>34-43</td>
<td>38.5</td>
<td>1056</td>
<td>17.6</td>
<td>1449</td>
<td>17.5</td>
</tr>
<tr>
<td>43-55</td>
<td>49</td>
<td>1218</td>
<td>16.5</td>
<td>1755</td>
<td>16.1</td>
</tr>
<tr>
<td>55-75</td>
<td>65</td>
<td>1359</td>
<td>11.4</td>
<td>1920</td>
<td>11.9</td>
</tr>
<tr>
<td>75-100</td>
<td>87.5</td>
<td>1567</td>
<td>4.7</td>
<td>2177</td>
<td>4.7</td>
</tr>
</tbody>
</table>

**CALORIE REQUIREMENTS:** 1150 | 1530 | 2200 | 2400

---

¹/ Data from 1971-1972 National Sample Survey, 26th Round.
²/ Estimate for adults ages 22-56.
Table B-3

**URBAN INDIA, 1971. CALORIE INTAKE AS A PERCENTAGE OF REQUIREMENTS FOR DIFFERENT AGE GROUPS**

<table>
<thead>
<tr>
<th>Per Capita Monthly Expenditure (rupees)</th>
<th>1-4 years</th>
<th>5-9 years</th>
<th>10-14 years</th>
<th>Adults</th>
<th>Mean</th>
<th>Percentage of Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-15</td>
<td>30.1</td>
<td>2.6</td>
<td>2.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-21</td>
<td>53.7</td>
<td>8.9</td>
<td>11.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-24</td>
<td>65.2</td>
<td>6.5</td>
<td>18.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24-28</td>
<td>72.8</td>
<td>10.3</td>
<td>28.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28-34</td>
<td>81.0</td>
<td>15.8</td>
<td>44.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34-43</td>
<td>91.8</td>
<td>17.6</td>
<td>61.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43-55</td>
<td>105.9</td>
<td>16.5</td>
<td>78.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55-75</td>
<td>118.2</td>
<td>11.4</td>
<td>89.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75-100</td>
<td>136.3</td>
<td>4.7</td>
<td>94.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100+</td>
<td>5.7</td>
<td>100</td>
<td>5.7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Per Capita Monthly Expenditure (rupees)</th>
<th>1-4 years</th>
<th>5-9 years</th>
<th>10-14 years</th>
<th>Adults</th>
<th>Mean</th>
<th>Percentage of Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calorie Intake</td>
<td>% Children</td>
<td>Cumulative</td>
<td>Calorie Intake</td>
<td>% Children</td>
<td>Cumulative</td>
<td>Calorie Intake</td>
</tr>
<tr>
<td>0-15</td>
<td>30.1</td>
<td>2.6</td>
<td>2.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-21</td>
<td>53.7</td>
<td>8.9</td>
<td>11.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-24</td>
<td>65.2</td>
<td>6.5</td>
<td>18.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24-28</td>
<td>72.8</td>
<td>10.3</td>
<td>28.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28-34</td>
<td>81.0</td>
<td>15.8</td>
<td>44.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34-43</td>
<td>91.8</td>
<td>17.6</td>
<td>61.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43-55</td>
<td>105.9</td>
<td>16.5</td>
<td>78.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55-75</td>
<td>118.2</td>
<td>11.4</td>
<td>89.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75-100</td>
<td>136.3</td>
<td>4.7</td>
<td>94.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100+</td>
<td>5.7</td>
<td>100</td>
<td>5.7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TECHNICAL APPENDIX

Increasing Calorie Consumption in Children: Cost Effectiveness Comparisons Between General and Target Oriented Programs

1/ This is part of Shlomo Reutlinger and Marcelo Selowsky, "Policies to Increase Calorie Consumption in Children: Cost Effectiveness Comparisons", paper presented at the Bellagio Workshop on the Economics of Nutrition Oriented Policies and Programs, August, 1977.
Table C-1 shows expressions for the cost effectiveness of alternative programs. It is defined as the fiscal cost of providing one extra calorie to children in those households being defined as target households. Table C-2 presents definitions of the symbols being used.

A general price subsidy benefits all urban consumers. A price subsidy to target households entails these households to purchase as much as they want at the subsidized price.\(^1\) A direct site feeding program for children provides food that must be consumed on the same spot where it is delivered, e.g., schools, health centers or other delivery centers. Income transfers cover all programs with an effect equivalent to a cash income transfer in the sense that the program maintains the household on the income-consumption path of food. They include free delivery of food, food stamp programs where the price of the stamp is "low" and ration shops schemes where the legal ration is smaller than the desired ration.

For each program (except the income transfer), two situations are analyzed: one where the program is concentrated on a particular food (or basket of foods) that is different in caloric "intensity" to the typical diet received by children at home. This "caloric intensity" is defined as the calories per dollar out of that food or diet. The second scenario is where the program is concentrated on the same basket of food received by

\(^1\) A ration shop scheme, where usually the quantity demanded (at the subsidized price) is larger than the legal ration, cannot be classified as a price subsidy program. Such a scheme is analogous to an income transfer equal to the ration multiplied by the per unit subsidy.
Table C-1
COST PER CALORIE INCREMENT IN CHILDREN'S CONSUMPTION IN TARGET HOUSEHOLDS
(Cost is expressed as a fraction of the mean cost per calorie of the typical diet consumed at home, 1/\(\Phi_H\))

<table>
<thead>
<tr>
<th>POLICY INSTRUMENT</th>
<th>FOOD 1</th>
<th>ALL FOOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. GENERAL PRICE SUBSIDY</td>
<td>((L_1)) ((L_2)) ((A)) ((B)) ((1 + C))</td>
<td>((L_1)) ((L_2)) ((B)) ((1 + C))</td>
</tr>
<tr>
<td>(= \frac{1}{\alpha_1} \frac{1}{\beta_1} \frac{1}{\mu_1} \frac{n_{\lambda}}{K_{\lambda}} \left(1 + \lambda \frac{n_{\lambda}}{K_{\lambda}}\right))</td>
<td>(= \frac{1}{\alpha} \frac{1}{\beta} \frac{1}{\mu} \left(1 + \lambda \frac{n_{\lambda}}{\eta}\right))</td>
<td></td>
</tr>
<tr>
<td>II. PRICE SUBSIDY TO TARGET HOUSEHOLDS</td>
<td>((L_2)) ((A)) ((B)) ((1 + C))</td>
<td>((L_2)) ((B)) ((1 + C))</td>
</tr>
<tr>
<td>(= \frac{1}{\beta_1} \frac{1}{\mu_1} \frac{n_{\lambda}}{K_{\lambda}} \left(1 + \lambda \frac{n_{\lambda}}{K_{\lambda}}\right))</td>
<td>(= \frac{1}{\beta} \frac{1}{\mu} \left(1 + \lambda \frac{n_{\lambda}}{\eta}\right))</td>
<td></td>
</tr>
<tr>
<td>(= \frac{1 + \lambda}{\beta n_{\lambda}} = \frac{1 + \lambda}{\beta (n_{\lambda} + \frac{1}{\beta})} = \frac{1 + \lambda}{\beta n_{\lambda} + 1}) if (\frac{n_{\lambda}}{\eta} = 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III. DIRECT SITE FEEDING PROGRAMS FOR CHILDREN (As a function of the scale, (\lambda), of the program)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Behavior A (food valued at market prices) (\begin{cases} \lambda &lt; \frac{m + (\mu - 1)}{1 - m} \ \lambda &gt; \frac{m + (\mu - 1)}{1 - m} \end{cases})</td>
<td>(= \frac{1}{m - (1 - \mu_1)})</td>
<td>(= \frac{1}{m})</td>
</tr>
<tr>
<td>(= \frac{1 + \lambda}{\mu_1 \lambda})</td>
<td>(= \frac{1 + \lambda}{\lambda})</td>
<td></td>
</tr>
<tr>
<td>2. Behavior B (food valued in equivalent calorie content) (\begin{cases} \lambda &lt; \frac{m}{1 - m} \ \lambda &gt; \frac{m}{1 - m} \end{cases})</td>
<td>(= \frac{1}{m \mu_1})</td>
<td>(= \frac{1}{m})</td>
</tr>
<tr>
<td>(= \frac{1 + \lambda}{\mu_1 \lambda})</td>
<td>(= \frac{1 + \lambda}{\lambda})</td>
<td></td>
</tr>
</tbody>
</table>
Table C-2: **DEFINITION OF SYMBOLS**

1. \( \frac{\phi_i}{\phi_H} = \mu_i \) = ratio of calories per dollar in food \( i \) (\( \phi_i \)) over calories per dollar in the typical diet consumed by children at home (\( \phi_H \)).

2. \( n_i \) = fraction of children's calorie intake out of food \( i \)

3. \( \delta_i \) = consumption of food \( i \) by the child as a fraction of an adult consumption of that food

4. \( \beta_i \) = share of total consumption of food \( i \) in the family consumed by children

5. \( \alpha_i \) = share of target households consumption in the total market consumption of food \( i \)

6. \( K_i \) = calorie elasticity of children with respect to the price of food \( i \)

7. \( \eta_d \) = price elasticity of demand for food \( i \) by the children in the target households

8. \( n_i^T, n_i^{NT}, n_i^M \) = price elasticity of demand for food \( i \) by target households, non-target households and total market demand

9. \( \gamma \) = fraction of children (2-5) in the family

10. \( A, a \) = share of family income spent in total food consumption (\( A \)) and in children's food consumption (\( a \))

11. \( m \) = marginal propensity to spend in children's food out of family income

12. \( d \) = income elasticity to spend in children's food

13. \( \eta_d \) = "pure substitution term" of the price elasticity of demand for food by children
the children at home, i.e., the types of food selected by the program have, on the average, the same calories per dollar as the food received at home.

ii. The expression for the cost effectiveness of the general price subsidy consists of the following multiplicative terms: \( L \), or the leakages, where \( L_1 \) is the leakage to non-target households and \( L_2 \) the leakage to adults in the target households. \( A \), which corrects for the difference in calorie intensity between the food having been selected and the food received at home. This correction is required given that the cost is expressed as a fraction of the cost per calorie of the home diet.

The value of \( B \) shows the increase in children's caloric consumption (as a percent of the calorie consumption out of food 1) induced by a change in the price of food 1. It is inversely related to \( K_1 \), the calorie elasticity of children with respect to the price of 1. The smaller this elasticity, the larger becomes \( B \), i.e., a smaller elasticity requires a stronger change in the price to induce a given increase in caloric consumption.

\[ (1 + C) \] term is a correction factor which is a function of \( \lambda \), the scale of the program, and \( \frac{\eta^M}{\eta^L} \), representing the ratio of the total market demand price elasticity and the calorie price elasticity for children. This ratio captures the adjustment to the total fiscal cost resulting from non-target groups (non-target families plus adults in the target households) having different demand price elasticities than the target group.

iii. The expression for the cost effectiveness of the subsidy to target households obviously does not include the leakage to non-target households, \( L_1 \). The correction factor \( (1 + C) \) is now expressed in terms
of the ratio \( \frac{\eta_1^T}{K_1} \), the ratio between the target households demand elasticity and the children's calorie elasticity.

iv. The cost effectiveness of direct site feeding programs depends basically on (a) the scale of the program and (b) the value placed on that food by the family -- relative to the food provided at home -- when the calorie intensity of both foods differ.

The scale of the program \( \lambda \) determines to what extent the family stops feeding the child at home. If the scale is not large enough so as to stop the feeding at home, the program acts like an income transfer or income effect; in this case the marginal propensity to spend in the child becomes relevant. If the scale is large enough so as to stop the feeding at home, the marginal propensity becomes irrelevant, i.e., the cost effectiveness expressions are independent of this propensity (see Table C-1).

If the site food has a different caloric intensity (calories per dollar) than the home food, the reaction of the household to the program will depend on the "perceived substitution" or "terms of trade" between both foods. Two extreme scenarios can be defined: one where only market values matter, one dollar's worth of site food is equivalent to one dollar's worth of home food independent of their different caloric intensity; we call this Behavior A. The second behavior is when the family fully corrects for the difference in caloric intensity; if the site food has only half the calories per dollar than the home food (i.e., the site food is milk), then 10 dollars worth of site food is equivalent to 5 dollars worth of home food. We call this Behavior B.
The specification of the above behavior becomes important only when the program acts like an income transfer; hence, the concept of equivalent income transfer to which the marginal propensity applies must be defined. It is only in this case when the expression of cost effectiveness changes with the specification of household behavior. If Behavior A holds and the market value of the site food is "small" (in the sense that the program acts like an income transfer), the expression of cost effectiveness could become negative if \( \mu \) is small enough (\( \mu < 1-m \)). In this case, the net effect of the program is to reduce the total calorie consumption of the child.

v. Table C-3 shows the value of the parameters being used to evaluate the cost effectiveness expressions of Table C-1. The target group is defined as children of ages 2-5 in a subgroup of the population classified according to income. In this case, this group is defined as the bottom one-third of families -- classified according to per capita income -- in Calcutta, India. Most of the parameters of Table C-3, except for the price elasticities which are assumed values, are derived from data out of these families.\(^1\)

The 2-5 age group was selected so as to explicitly leave out children in school age and for whom school feeding is clearly the solution. In this analysis we want a target group for which a clear delivery system for site feeding does not presently exist and therefore becomes a policy option to be compared with price subsidies. The difference between the cost

\(^1\)/ A Study of Food Habits in Calcutta (USAID - Hindustan Thompson, Nov. 1972).
Table C-3
VALUE OF PARAMETERS (CHILDREN 2-5)
(except for the price elasticity values which are assumed, the parameters correspond to the bottom 1/3 of families reported in the Calcutta Food Survey, 1969)

<table>
<thead>
<tr>
<th></th>
<th>CEREALS</th>
<th>MILK</th>
<th>TYPICAL DIET</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ( \frac{\phi_1}{\phi_H} = \mu_1 )</td>
<td>1.96</td>
<td>.37</td>
<td>1.0</td>
</tr>
<tr>
<td>2. ( n_1 )</td>
<td>.67</td>
<td>.11</td>
<td>1.0</td>
</tr>
<tr>
<td>3. ( \delta_1 )</td>
<td>.44</td>
<td>2.92</td>
<td>.56(^1/)</td>
</tr>
<tr>
<td>4. ( \beta_1 = \frac{\delta_Y}{\gamma(\delta-1)+1} )</td>
<td>.072 (( \gamma = .15 ))</td>
<td>.34 (( \gamma = .15 ))</td>
<td>.09 (( \gamma = .15 ))</td>
</tr>
<tr>
<td>5. ( \alpha_1 )</td>
<td>.37</td>
<td>.12</td>
<td>.33</td>
</tr>
<tr>
<td>6. ( K_1 )</td>
<td>.33 (( n^d = n^T = .5 ))</td>
<td>.16 (( n^d = n^T = 1.5 ))</td>
<td>( K = n^d = n^T = 1.00 )</td>
</tr>
<tr>
<td>7. ( n^M_1 )</td>
<td>.35 (( n^M_1 = .25 ))</td>
<td>.84 (( n^M_1 = .75 ))</td>
<td>( n^M = a n^T + (1-a)n^N )</td>
</tr>
</tbody>
</table>

\( \gamma \) .15 (ages 2-5; = 1 child per family)
\( \Lambda \) .66
\( a = \beta \Lambda \) .06
\( m \) Range = .08 - .06 (value used = .7)
\( E^d = \frac{m}{a} \) Range = 1.33 - 1.00
\( \eta^d = \eta^s + \frac{1}{\beta m} = \eta^s + AE^d \) Range = (\( \eta^s + .88 \)) - (\( \eta^s + .66 \)) (value used = 1.00)
\( \lambda \) .2

\(^1/\) Derived given the values of \( \gamma \) and \( a \); the value is derived by solving for \( \delta \) in the expression:

\[
a = \frac{1}{1 + \frac{1-\gamma}{\delta \Lambda}}
\]
of a subsidy program and site food programs (as defined in Table C-1) would provide the bound for the maximum administrative cost that could be associated with the latter.

vi. The programs have been included for three types of foods: cereals, milk and a basket representing the typical diet of the child. As can be seen from Table C-3, the type of food selected has a strong influence on the value of the parameters.

Cereals have double as much calories per dollar than the typical diet ($u = 1.96$) while milk has less than one half ($u = .37$). The child's consumption of cereals is .44 times the consumption of an adult while for milk this figure is 2.92; this difference has a crucial effect on the $L_2$ leakage. The share of total market consumption accounted by the bottom one-third of families is .33 for cereals and .12 for milk; this difference is fundamental for the $L_1$ leakage.

vii. Table C-4 shows numerical results for the cost effectiveness of programs when the objective is to increase the consumption by children by twenty percent ($\lambda = .20$, or the scale of the program). For most subsidies, $\lambda$ enters as a second order effect in the expression for the unit cost. It is only in the direct feeding program and when the program is large enough (consumption at home stops) that $\lambda$ enters as a first order parameters; for this case the cost has also been computed for $\lambda = .3$ and $\lambda = .4$.

viii. Direct site feeding with a high calorie intensive food is the most cost effective option. By using cereals, the cost is around 1 under Behavior A and 3.1 under Behavior B.
### Table C-4

**COST PER CALORIE INCREMENT IN CHILDREN'S CONSUMPTION IN TARGET HOUSEHOLDS**

(Cost is expressed as a fraction of the mean cost per calorie of the typical diet consumed at home, $1/\phi_H$)

**NUMERICAL RESULTS**

<table>
<thead>
<tr>
<th>POLICY INSTRUMENT</th>
<th>CEREALS; $\mu = 1.96$</th>
<th>MILK; $\mu = .37$</th>
<th>ALL FOOD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. GENERAL PRICE SUBSIDY</strong></td>
<td>$(L_1) \cdot (L_2) \cdot (A) \cdot (B) \cdot (1+C)$</td>
<td>$(L_1) \cdot (L_2) \cdot (A) \cdot (B) \cdot (1+C)$</td>
<td>$(L_1) \cdot (L_2) \cdot (B) \cdot (1+C)$</td>
</tr>
<tr>
<td></td>
<td>$(2.7) \cdot (13.9) \cdot (.5) \cdot (2.0) \cdot (1.2)$</td>
<td>$(8.3) \cdot (2.9) \cdot (2.7) \cdot (.7) \cdot (2)$</td>
<td>$(3.0) \cdot (11.1) \cdot (1) \cdot (1.1)$</td>
</tr>
<tr>
<td></td>
<td>= 45.4</td>
<td>= 90.9</td>
<td>= 36.6</td>
</tr>
</tbody>
</table>

| II. PRICE SUBSIDY TO TARGET HOUSEHOLDS | $(L_2) \cdot (A) \cdot (B) \cdot (1+C)$ | $(L_2) \cdot (A) \cdot (B) \cdot (1+C)$ | $(L_2) \cdot (B) \cdot (1+C)$ |
| | $(13.9) \cdot (.5) \cdot (2.0) \cdot (1.3)$ | $(2.9) \cdot (2.7) \cdot (.7) \cdot (2.9)$ | $(11.1) \cdot (1) \cdot (1.2)$ |
| | = 18.1 | = 15.8 | = 13.3 |

| III. INCOME TRANSFER | 1. Behavior A | for all $\lambda < 1.1$ | for all $\lambda > 0$
| | $= \frac{1 + \lambda}{\nu_1 \lambda}$ | $\rightarrow$ | $= \frac{1 + \lambda}{\nu_1 \lambda}$ |
| | $(for \ all \ \lambda < .07)$ | $\downarrow$ | $(for \ all \ \lambda > .07)$ |
| | $= 3.1$ | $\lambda = .2$ | $\lambda = .2$ |
| | | $\lambda = .3$ | $\lambda = .3$ |
| | | $= 2.2$ | $= 4.3$ |
| | | | $= 3.5$

| 2. Behavior B | $\rightarrow$ for all $\lambda > .07$
| | $= \frac{1 + \lambda}{\nu_1 \lambda}$ |
| | $(for \ all \ \lambda > .07)$ |
| | $= 16.2$ | $\lambda = .2$ | $6.0$ | $\lambda = .2$
| | $= 11.7$ | $\lambda = .3$ | $4.3$ | $\lambda = .3$
| | $= 9.5$ | $\lambda = .4$ | $3.5$ | $\lambda = .4$

| IV. INCOME TRANSFER | **14.3** |
General price subsidies as a means of reaching children in poor families are obviously extremely inefficient; this is particularly true in the case of milk: in addition to having a low value of $\mu$ a large part of milk consumption is accounted by non-target households who also must be subsidized (e.g., a large value of $L_1$).

When the subsidy is designed to reach only the target households, the subsidy on milk becomes slightly cheaper, 15.8 instead of 18.1; the reason is the low leakage to adults within the target households ($L_2$) since in the case of milk a much larger share of consumption is accounted for by children.

ix. For small values of $\lambda$ the cost effectiveness of an all food subsidy to the target households tends to become equal to the cost of an income transfer, except for the influence of the pure (price) substitution term, $\eta_s^d 1/$. The cost of this subsidy is 13.3 while the cost effectiveness of an income transfer is 14.3.

x. The conclusions to be drawn from Table C-4 is that direct site feeding with a food as calorie intensive as cereals is, even in the worst circumstances (Behavior B), one-sixth the cost of a price subsidy of that food to the target households (3.1 instead of 18.1) and almost one-fifth the cost of an income transfer (3.1 instead of 14.3).

---

If the price elasticity of food for adults and children are the same ($\eta^T = \eta^D$), the cost effectiveness of this subsidy becomes

$$\frac{1 + \lambda}{\beta \eta_s^d + m}$$
<table>
<thead>
<tr>
<th>No.</th>
<th>Title of Paper</th>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>265</td>
<td>India's Population Policy: History and Future</td>
<td>R. Gulhati</td>
</tr>
<tr>
<td>266</td>
<td>Radio for Education and Development: Case Studies (Vols. I &amp; II)</td>
<td>P. Spain, D. Jamison</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E. McAnany</td>
</tr>
<tr>
<td>267</td>
<td>Food Insecurity: Magnitude and Remedies</td>
<td>S. Reutlinger</td>
</tr>
<tr>
<td>268</td>
<td>Basic Education and Income Inequality in Brazil: The Long-Term View</td>
<td>J. Jallade</td>
</tr>
<tr>
<td>269</td>
<td>A Planning Study of the Fertilizer Sector in Egypt</td>
<td>A. Choksi, A Meeraus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A. Stoutjesdijk</td>
</tr>
<tr>
<td>270</td>
<td>Economic Fluctuations and Speed of Urbanization: A Case Study of Korea 1955-1975</td>
<td>B. Renaud</td>
</tr>
<tr>
<td>271</td>
<td>The Nutritional and Economic Implications of Ascaris Infection in Kenya</td>
<td>L. Latham, M. Latham</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. Basta</td>
</tr>
<tr>
<td>272</td>
<td>A System of Monitoring and Evaluation of Agricultural Projects</td>
<td>M. Cernea, B. Tepping</td>
</tr>
<tr>
<td>273</td>
<td>The Measurement of Poverty Across Space: The Case of Peru</td>
<td>V. Thomas</td>
</tr>
<tr>
<td>274</td>
<td>Economic Growth, Foreign Loans and Debt Servicing Capacity of Developing Countries</td>
<td>G. Feder</td>
</tr>
<tr>
<td>275</td>
<td>Land Reform in Latin America: Bolivia, Chile, Mexico, Peru and Venezuela</td>
<td>S. Eckstein, G. Donald</td>
</tr>
<tr>
<td></td>
<td></td>
<td>D. Horton, T. Carrol</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(consultants)</td>
</tr>
<tr>
<td>276</td>
<td>A Model of Agricultural Production and Trade in Central America</td>
<td>R. Norton, C. Cappi, L. Fletcher, C. Pomareda, M. Wainer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(consultants)</td>
</tr>
<tr>
<td>277</td>
<td>The Impact of Agricultural Price Policies on Demand and Supply, Incomes and Imports: An Experimental Model for South Asia</td>
<td>M. Osterrieth, E. Verrydt, J. Waelbroeck</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(consultants)</td>
</tr>
<tr>
<td>278</td>
<td>Labor Market Segmentation and the Determination of Earnings: A case Study</td>
<td>D. Mazumdar</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M. Ahmed</td>
</tr>
<tr>
<td>279</td>
<td>India - Occasional Papers</td>
<td>M. Ahluwalia, J. Wall</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S. Reutlinger, M. Wolf</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R. Cassen (consultant)</td>
</tr>
<tr>
<td>No.</td>
<td>TITLE OF PAPER</td>
<td>AUTHOR</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>280</td>
<td>Educational Effects of Class Size</td>
<td>W.D. Haddad</td>
</tr>
<tr>
<td>281</td>
<td>Relieving Traffic Congestion: The Singapore Area License Scheme</td>
<td>P.L. Watson, E.P. Holland</td>
</tr>
<tr>
<td>282</td>
<td>World Trade and the International Economy: Trends, Prospects and Policies</td>
<td>B. Balassa</td>
</tr>
<tr>
<td>284</td>
<td>Pakistan: Forestry Sector Survey</td>
<td>S.A. Draper, A.J. Ewing, J. Burley, G. Grayum (consultants)</td>
</tr>
<tr>
<td>285</td>
<td>The Leisure Cost of Electric Power Failures</td>
<td>M. Munasinghe</td>
</tr>
<tr>
<td>286</td>
<td>Shadow Pricing and Power Tariff Policy</td>
<td>M. Munasinghe, J. Warford</td>
</tr>
<tr>
<td>287</td>
<td>Wages, Capital Rental Values and Relative Factor Prices in Pakistan</td>
<td>S. Guisinger (consultant)</td>
</tr>
<tr>
<td>288</td>
<td>Educational Reform in the Soviet Union: Implications for Developing Countries</td>
<td>I. Blumenthal, C. Benson (consultants)</td>
</tr>
<tr>
<td>289</td>
<td>Petroleum and Gas in Non-OPEC Developing Countries: 1976-1985</td>
<td>R. Vedavalli</td>
</tr>
<tr>
<td>290</td>
<td>Major Reforms of the Swedish Education System</td>
<td>A. Heidenheimer (consultant)</td>
</tr>
<tr>
<td>291</td>
<td>Industrialization, Technology and Employment - China</td>
<td>T.G. Rawski (consultant)</td>
</tr>
<tr>
<td>292</td>
<td>Development and Income Distribution - Zambia</td>
<td>C. Blitzer</td>
</tr>
<tr>
<td>293</td>
<td>World Potash Survey</td>
<td>W.F. Sheldrick, H. Stier</td>
</tr>
</tbody>
</table>
Selowsky, Marcelo. 
The economic dimensions of malnutrition in young children: a survey of the