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Targeting Food Subsidies for the Needy
The Use of Cost-Benefit Analysis and Institutional Design

Abel Mateus

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ABSTRACT

The paper analyzes alternative schemes for targeting food subsidies to nutritionally needy groups that have been implemented in several countries and attempts to draw from their analyses lessons for the set-up or possible reforms in food policy systems. The types of experience reviewed range from ration shops targeted geographically (India, Brazil); self-targeting using an inferior-goods approach (Pakistan, Bangladesh); food-coupon systems targeted by income (Sri Lanka), and by health status (Colombia, Indonesia); and special intervention programs (such as those directed at pre-school children plus mothers), school feeding programs and most-vulnerable-group targeting, that have been followed in more than a dozen of developing countries.

One of the main contributions of the paper to the literature on this topic is the construction and actual implementation of a cost-benefit analysis to evaluate food policy systems. Starting from a concept of consumer surplus, a derived distribution scheme is applied to compute the social consumer surplus. The social producer surplus is also computed to measure the impact of the different schemes on domestic farmers. Finally, the different costs of running the system from food costs to administrative costs are considered. The second major contribution is a detailed description of the institutional design and a critical evaluation of the systems that have been implemented in several countries following a typology developed in the paper.

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ABSTRAIT

Le présent document analyse divers systèmes - mis en oeuvre dans plusieurs pays - de "ciblage" des subventions alimentaires destinées à des groupes souffrant de carences nutritionnelles, et tente d'en tirer des enseignements utiles en vue de réformes éventuelles des politiques alimentaires. Il passe en revue plusieurs types d'expériences ayant notamment pris les formes suivantes : magasins de rations implantés par zones géographiques (Inde, Brésil); système d'"autociblage" comportant l'utilisation de produits de qualité inférieure (Pakistan, Bangladesh); système de coupons distribués en fonction du revenu (Sri Lanka) et de l'état de santé (Colombie, Indonésie); programmes d'intervention spéciale visant, par exemple, les enfants d'âge préscolaire et leurs mères, programmes alimentaires au niveau des écoles et programmes réservés aux groupes les plus vulnérables, ces différents systèmes ayant été appliqués dans plus d'une douzaine de pays en développement.

Le présent document enrichit la documentation sur la question, notamment en élaborant et en réalisant concrètement une analyse coûts-avantages en vue d'évaluer les systèmes de subventions alimentaires. En partant du concept de surplus du consommateur, on applique une méthode de distribution dérivée afin de calculer le surplus social du consommateur. Le surplus social du producteur est également calculé pour mesurer l'incidence des différents systèmes sur les agriculteurs. Enfin, on étudie les différents coûts d'exploitation des systèmes, depuis les coûts des produits alimentaires jusqu'aux frais administratifs. Le présent document a un autre grand mérite, qui est de fournir une description détaillée de la structure institutionnelle, ainsi qu'une évaluation critique des systèmes mis en oeuvre dans plusieurs pays, suivant une classification originale.

EXTRACTO

En este documento se analizan diferentes programas de subsidios alimentarios para los grupos más necesitados de la población implantados en varios países y se trata de derivar enseñanzas para el establecimiento de sistemas de política alimentaria o para su posible reforma. Los tipos de programas examinados comprenden las tiendas de raciones destinadas a una determinada región (la India, el Brasil), los planes basados en la donación de productos de calidad inferior (Pakistán, Bangladesh), sistemas de cupones para alimentos asignados según el nivel de ingresos de los beneficiarios (Sri Lanka) o su estado de salud (Colombia, Indonesia), programas especiales de asistencia (como los dirigidos a los niños en edad preescolar y a las madres), los comedores escolares y la asignación de subsidios a los grupos más vulnerables, implantados en más de 12 países en desarrollo.

Una de las principales contribuciones de este documento a la literatura sobre esta materia es la elaboración de un análisis de costos-beneficios y su aplicación para evaluar los sistemas de política alimentaria existentes. Partiendo del concepto del excedente del consumidor, se aplica un método derivado de distribución a fin de calcular el excedente social del consumidor. Además, a fin de medir las repercusiones de los diferentes sistemas en los agricultores del país, se calcula el excedente social del productor. Por último, se examinan los diferentes costos de operación del sistema, que incluyen desde el costo de los alimentos para los gastos administrativos. La segunda contribución importante es la descripción detallada del diseño institucional y la evaluación crítica de los sistemas implantados en varios países, con arreglo a la tipología elaborada en el documento.

Contents

1. Introduction	1
<u>Nutrition Intervention and a Typology of Systems</u>	
2. The rationale for nutrition intervention	4
3. The trade-off between basic needs programs and economic growth.	7
4. A typology of food distribution programs: non-targeted versus targeted systems (by type of food, region, income health status) and special nutrition intervention systems.	9
<u>Some Case Studies of Targeted Systems</u>	
5. Case study of a targeted system: the food coupon system of Colombia and Brazil.	17
6. Case study of on-site-feeding programs: the cases of India and Indonesia.	25
7. Case study of a major policy reform: from a non-targeted to a targeted system (Sri Lanka).	31
<u>Lessons from Experience</u>	
8. Setting-up nutrition programs: (characteristics of an ideal system and political economy of a reform).	38
Appendices:	
A. The economics of basic needs: food distribution programs. ...	46
B. Cost-benefit analysis of alternative food distribution programs.	61
C. An optimization model for a food distribution system.	68
D. Deriving distribution weights from an income tax schedule. ...	71

1. Introduction

1. This paper summarizes the experience of several countries in setting-up food distribution programs: from untargeted food subsidies schemes to targeted systems like ration shops strategically located, self-targeting by commodity, food-stamp programs and to the highly targeted special intervention nutrition programs. Section 2 clarifies the objectives that are generally considered in untargeted systems and sets the trend for the rest of the work: the major objective of a non-targeted food subsidy system is improving the basic needs (nutrition) of the group of population below the poverty line. After considering the rationale for nutrition intervention, section 3 considers the complementarity aspect between basic needs and economic growth with well targeted systems and the depressive effect that an overspending in social untargeted programs can have on growth. It is also stressed that over the medium and long-term, growth can be accelerated if the untargeted expenditure is redirected to investments in agriculture (especially in small scale farms).

2. Section 4 discusses a typology of food distribution programs from a benefit/cost point of view, coverage, infrastructure required, leakages, improvement of nutrition habits, etc. The programs are then rated for each component. The most effective programs are the special intervention programs: on-site-feeding and take-home feeding for children and pregnant-lactating women. Next comes a food coupon system targeted by health status, targeted

food rations using regional targeting or self-targeting and a food coupon system targeted by income. The worst system, by far, is the untargeted food subsidy. The benefit-cost ratios computed in Appendix B also confirm and stress this view: the B/C ratio of a targeted food coupon system is more than 40 times (the Sri-Lanka system) the B/C ratio of a food subsidy scheme (the Moroccan case). The results also confirm the importance of choosing an optimal basket of food supplements to subsidize at appropriate subsidies, balance consumer surplus and producer incentives with the budgetary costs and use the private sector for distribution and community groups for participation.

4. Several case studies are presented in Chapter II. The food-coupon system of Colombia combined with regional targeting, that uses the private sector for distribution, has been directed to children and mothers. If nationally implemented, it would cost about 12.5 million dollars (1.3% of budget current expenditures). It has been combined with health services, water supply, food technology and small scale farming. It has proved very cost-effective and the well structured food coupon allocation system is an interesting institutional scheme (the leakage has not been above 2-3%). Several Latin American countries are interested in using a similar system. The pilot project of Brazil is also discussed.

5. India's project of Tamil Nadu shows how fine targeting can be achieved when financial resources are extremely scarce. This special intervention project is conducted in community nutrition centers by nutrition workers who through nutrition surveillance identify children (6-36 months) under high risk of malnutrition and administer food supplements using

healthy nutritious foods. The same type of project is run by communities in Indonesia, that covers also mothers. Both are very cost effective (they correspond in case of national coverage to 0.3% of GNP). Both projects have a component of food technology and nutrition education. Sri-Lanka constitutes an important example because it has reformed its food distribution system almost overnight from a non-targeted ration system that was spending 6% of GNP in 1979 to a food coupon system amounting to 3% of GNP in 1980, targeted by income, with an increase of about 30% in the transfer to the poor, covering roughly the lower income half of the population. The benefit/cost ratio has improved about 10 times with this simple policy reform.

6. Section 8 summarizes the lessons learned from all these and other projects and what are the elements of an efficient nutrition system: informational infrastructure, institutions that need to be built and the main implications. The link between nutrition programs and agricultural policies is stressed, as well as the need for an integrated approach: nutrition and health. Other components of basic needs like water supply and sewerage are also important. Finally, the political economy of reforming a food subsidy scheme is studied and three points are stressed: (i) the need of a phased approach in introducing nutrition systems; (ii) the principle of gradual adjustment in prices of basic foods when untargeted food subsidies are phased out; (iii) the need to introduce highly visible compensatory mechanisms for the vulnerable groups.

2. The Rationale for Nutrition Intervention

Food subsidy schemes are only one form among a dozen of alternative nutrition intervention schemes. However, the introduction of untargeted food subsidies has been an instrument used by governments to pursue such objectives as: (i) improve the nutrition status of the malnourished; (ii) stabilize food prices for the nutrition vulnerable groups; (iii) stabilize food prices in general in the context of large fluctuations in international prices; (iv) contain inflationary pressures by controlling foods prices; (v) give benefits to special politically vocal groups (like urban working class). Stabilization of prices has been shown to increase consumer and producer welfare, but this mechanism involves a special set up where subsidies given when prices are above the trend would be compensated by taxes when prices fare below trend, and the total budgetary effect over time would be nil. This is not what we observe in most of the countries that maintain large food subsidies (Egypt, Morocco, etc.)^{1/} Recent studies have also underlined that the benefit/cost ratio of such stabilization is rather low, when storage, interest and other administrative costs are taken into account. Besides, it should be remarked that sometimes the macroeconomic consequences are not fully analysed, e.g. the fluctuation in prices can be transfered to fluctuations in the budget or balance of payments deficits. Control food prices as an anti-inflationary measure does not seem to be appropriate because it introduces large distortions in relative prices and disincentives to production. Besides, it is only a temporary measure: the increase in expenditures would be translated in a larger and larger budget

^{1/} This topic would merit an independent study. See D. Newbery and J. Stiglitz (1981) for a good survey of the subject.

deficit that would cause inflationary pressure, before a new round of price increases. It would be better to use monetary, fiscal or incomes policies. The last objective is purely a political problem not addressed here and we only point out that the social benefits and costs should be carefully weighted by the decision makers.

The effectiveness of improved nutrition as a means of reducing mortality and severity of childhood infections and of preventing forms of retardation, blindness, anemia and other problems has been clearly established and is, in itself, sufficient justification for intervention in better nutrition.^{1/} Expenditure in improvement of nutrition levels of malnourished groups is thus, not a consumption expenditure, but an investment in human capital. Improvement in diet increases work output. Malnourished workers have been shown to lose 30% of their muscle strength and 15% of their precision movement, substantial elimination of innovation capabilities and with a large absenteeism rate. Because their average and expected life is reduced, there is a case for investments in education and training to be below the social optimum.

Investments in education are more effective when the students are adequately nourished. Malnutrition interferes with the child's motivation and his ability to concentrate and learn. School feeding programs originate a decrease in drop-out rates and absenteeism, sometimes as high as three times.

Because malnutrition during the fetal period and in early childhood impairs physical and mental development (80% of eventual brain weight is reached by the first 24 months of life), investment to prevent malnutrition

^{1/} See A. Berg (1981)

during this period is the most critical in terms of subsequent performance. Nutrition programs for children less than 3 years old have cut mortality rates by 30 to 50% in some cases, specially when combined with health services.

Investment in nutrition improvement of pregnant and lactating women influences heavily the nutrition status of the child at birth and during infancy. Other economic benefits accruing from improved nutrition are the reduced cost of medical care (or increased effectiveness of the current health care system since demand will be lessened); savings resulting from the lower incidence of communicable diseases; savings on the cost of caring for those malnourished who become permanently or temporarily impaired; and increased future productivity of the well-nourished worker's dependents because of his higher income and higher life expectancy of his dependents.

Malnutrition is also closely related to family planning through reduction in child mortality and increase in life expectancy.

Finally, and not least important, nutrition targeted programs are an excellent instrument for redistribution. As has been shown by Chenery, and others^{1/}, economic growth is not synonymous to reduction in poverty. Thus special schemes have to be implemented to improve the welfare of the groups of population below the poverty line. The fiscal system and supply of common public goods by the state does not improve significantly income distribution. However, almost all countries have shown a particular concern for the poorest and destitute.^{2/} For reasons of simple human dignity, this kind of program

^{1/} See Chenery, H. and others (1974)

^{2/} This seems in line with the Rawlsian criteria of the most to the neediest. See Sen, A. (1982).

is amply justified. Besides, it always easily drives external assistance from the international community. In fact, such programs are in general readily supported and funded by international donors.

3. The Trade-Off Between Basic Needs Programs and Economic Growth

The trade-off between basic needs programs of which nutrition intervention is one component and economic growth is extremely important. Food subsidies have reached in some countries like Morocco, Egypt and Sri-Lanka sometimes 10 to 20% of current expenditures which has been equivalent to 25 to 70% of capital expenditures by the Government and 3 to 6% of GNP. When 50 to 70% of these subsidies is leaked to well-nourished groups of population, there is clearly a depressive effect on investment and growth. Otherwise, for a well targeted nutrition program, section 1 has shown that there are clear complementarities between basic needs and growth. Let us assume that by targeting a food subsidy scheme it is possible to increase public and domestic savings by 2 to 4 percentage points relatively to GDP. Then, with an average capital/output ratio of 2, the GNP growth rate will increase by 1 to 2 percentage points. There have been very few studies modelling the effects of alternative approaches to basic needs and measuring the trade-off.^{1/} M. de Melo (1981) has studied these problems in the context of a simulation model of

^{1/} The World Bank report Zambia: A Basic Economic Report (1977) quantifies the macro effects of a consumer subsidies policy within a dual economy growth model. The results of such a policy (scenario A) is contrasted with one where the Government aligns consumer with world prices and invest the funds in the development budget to the rural sector (scenario B) for a 15 years period:

(see next page)

Sri Lanka and L. Taylor (1979 and 1980) for Egypt. The basic question addressed was: would a reallocation of government funds away from food subsidies and toward investment increase the growth rate sufficiently to permit a broadening of the benefits of growth to the poor, thus raising their standard of living over and above the level it would have reached with food subsidies? The answer to this question was given by using a general equilibrium model based on a social accounting matrix. The results of this and other studies show that cutting food subsidies in general will have a recessionary effect, decrease demand for food, and if a large proportion is produced domestically would decrease incomes of the farmers and rural workers. However, if the reduction in subsidies is accompanied by targeting those effects are minor and could be eliminated if investment expenditures in labor intensive agriculture are sufficiently increased. Over the medium to

Continuation of footnote on page 7

Scenario A

GDP grows at 4.4% p.a.
Urban sector g.r.: 6.6% p.a.
Agriculture g.r.: 1.5% p.a.
Explosion of food imports
(7% p.a.)

Large Government subsidies worsening
of income distribution between
traditional agricultural other sectors.

Rapid migration from rural to urban
areas

Rising urban unemployment

Scenario B

GDP grows at 5%
Urban sector g.r.: 6.5%
Agriculture g.r. 5%
Decline of food imports
until net exporter in 1980

Slower increase of
rural-urban gap.

Slower rate of rural-urban
migration

Lower urban unemployment

long-term the results would be impressive: in the case of a 2 percentage points increase in domestic savings and capital/output ratio of 2 GDP would be 10.5% higher after 10 years, the percent of population below poverty line would be reduced by 15 to 20%, and the effects on employment and balance of payments would also be appreciable and positive.

4. A Typology of Food Distribution Programs: non-targeted versus targeted systems (by type of food, region, income or health status) and special nutrition intervention systems.

There is a multitude of nutrition intervention schemes, ranging from food subsidies to special intervention programs. This work focus on the targeting element and on the benefit/cost analysis of such programs. A typology of food distribution programs is presented in Table 1.

Food subsidies to a basket of basic foods is the most untargeted of the systems, but it is also the most costly for the state budget.^{1/} Egypt, e.g. has spent as much as 15% of the total budget (1975), and between 9 and 12% in the 1976-81 period. Morocco, has spent as much as 18% of the total budget (1974), and in 1981 they were still 7.5% of total expenditures. Because it is an untargeted system, all income groups benefit from the system. For example, an analysis of the Moroccan system (Appendix B) shows that about 80% of the budgetary costs in the rural sector and 70% in the urban sector increase the food consumption of already well-nourished

^{1/} See Davis, J. (1978).

population. This is why, despite the large amount of the subsidy involved, the cost per calories delivered is extremely high (\$50-60 dollars per 100 calories). The scheme do not reach the poorest rural areas that do not use the market mechanism or buy the subsidize foods. But it is not only the impact on the consumer that must be taken into account. As Appendix A shows, disincentives to production can be important, if most of the products are imported, by decreasing demand to domestic produced food or by controlling producer prices at low levels. In Egypt, it has been estimated^{1/} that the food subsidy scheme imposes an implicit tax of about 20% on producers and subsidized foods constitute 22% of the import bill. In Morocco, the producer's loss is quite important for wheat, oils and dairy products. The impact of the subsidized foods on the balance of payments is also important (about 700 million dollars in 1982 or about 17% of the import bill). Besides, the impact on income distribution of these schemes is not generally understood. In fact, the system may be taxing poor farmers and transferring income to rich urban dwellers. Judging from the aspect of improvement in nutrition habits and participation (dictated by the buying power of the person), is also one of the worst schemes. The only clearly positive aspects are the low overhead costs (besides food) and no need of special human infrastructure to administer the scheme. The scheme can be improved somewhat by choosing foods that have very low income elasticity (staples like wheat or rice are the most important), high nutrition value per dollar cost (sugar, e.g., is not recommended) and that would have a positive impact on food

1/ IBRD, World Development Report, 1982.

Table 1

A Typology of Food Distribution Programs

	Benefit/ Cost Ratio	Consumer Surplus	Incentive to Production	Overall Budgetary Cost (% of total budget expenditures)	Dollars per beneficiary	Cost per beneficiary Dollars per 100 calories	Ratio of Overhead to Food Costs (% of total costs)
1. Untargeted food subsidies	1-2	3	Depends on level of imports and procurement prices (1-3)	1 As high as 16% of total budget expenditures	(25-29)	1 (50-60)	5
2. Untargeted food rations (using e.g. ration shops)	2-3	4	1-3	2 (3-6%)	(2-30)	2 (5-12)	3 (20-30%)
3. Targeted food rations Ration shops targeted geographically Self-targetting	4-5 4-5	5 5	2-3 2-3	2-3 2-3		3 3	3 (20-30%) 3 (20-30%)
4. Food-coupon systems Targeting by income Targeting by health status	5 5	5 5	2-3 2-3	2-3 (3-9%) 3-4 (3-9%)	(24-62) (24)	3 4 (6-18) (6-12)	3 (2-5%) 3 (2-5%)
5. Special intervention programs On-site-feeding Pre-school children plus mothers School-feeding programs Most vulnerable group targetting Take-home feedings	5 5 5 5	5 5 5 5	4 4 4 4	5 (1-2%) 5 (1-2%) 5 (below 1%) 5	(15-35) (10-30) (8-20)	3-4 3-4 3-4 5 5	2-3 (10-30%) 2-3 (10-30%) 2-3 (10-30%) 3
6. Food-for-work programs	5	5	5	5		2-3	2-3

Note: The scale used is 1 (worst) to 5 (best).

Table 1

A Typology of Food Distribution Programs									
	Special Human Infrastructure Required	Coverage Urban Rural		Partici- pation	Intra- family leakage	Inter-family leakage (% of total benefits)	Incentive to Work	Improvement Nutrition Habits	Countries with Experience
1. Untargeted food subsidies	5	4	3	3 (depends on buying power)	2	2 (60-70%)	3	1	Morocco, Egypt, Zambia, Korea, Portugal, etc.
2. Untargeted food rations (using e.g. ration shops)	5	4	2	4	2	2 (50-60%)	3	1-2	India, Sri Lanka(pre-1979) Pakistan, Bangladesh
3. Targeted food rations Ration shops targeted geographically	5	4	2	4	3	4 (5-10%)	4	2-3	India (presently), Brazil
Self-targetting	5	4	2	4	3	4 (10-20%)	4	2-3	Pakistan, Bangladesh
4. Food-coupon systems Targeting by income	4	4	2	4	2-3	3-4 (10-30%)	4	2-3	Sri-Lanka (post-1979), U.S., Colombia
Targeting by health status	3	4	2	3-4	4	4-5 (3-10%)	4	3-4	Colombia, Indonesia
5. Special intervention programs On-site-feeding Pre-school children plus mothers	3	4	2	4	5	5 (3-10%)	4-5	4-5	India, Indonesia, Colombia, Brazil, etc.
School-feeding programs	3	4	2	4	5	5 (3-10%)	4-5	4-5	India, Colombia, Brazil, etc
Most vulnerable group targetting	3	4	2	4	5	5 (3-10%)	4-5	4-5	India
Take-home feedings	3	4	2	4	3	4	4-5	4-5	India, Morocco
6. Food-for-work programs	4	4	2	2	2	5 (3-10%)	5	2-3	Morocco, India, Indonesia etc.

Note: The scale used is 1 (worst) to 5 (best).

production (choosing domestic rather than imported foods, and giving a net incentive to the producer). However, the large budgetary cost and the extremely low benefit/cost ratio will remain. Thus, targeted schemes must be chosen.

Several countries (esp. India, Pakistan and Bangladesh) have built a network of "ration shops" or "fair price shops" that distribute Government procured and imported food at below open market prices. The benefit/cost ratio of such scheme is comparable to the food subsidies scheme, except for three aspects. The first is that the scheme requires the construction of an infrastructure and the distribution costs, if substitutable for the private sector, are an additional cost. Second, sometimes ration cards or ration books, even if not targeted, introduce a redistributive element, since all the income groups receive the same amounts of the ration. Third, the existing schemes, like in India, seemed to have a more appropriate choice of commodities (lower income elasticity). The pre-1973 Sri-Lankan food distribution system was also untargeted, but had a ration card scheme. The infrastructure used, on the other hand, was the cooperative network. Recently, there has been a reorientation of these schemes towards two types of targeting. The first is the introduction of ration shops targeted geographically, the second is the self-targeting. The first has been tried in India, Pakistan and Brazil. There is also an element of targeting by region in the Colombia system. The main aspect here is to locate small shops on slums or poor rural areas that have been identified as having densely poor population. The self-targeting is one of the schemes in vogue and consists in subsidizing "inferior goods", i.e. goods that have a negative or very low

income elasticity, and that can figure high in the budget of the poor. It was introduced with success in Pakistan and to some extent in Bangladesh where the ration shops sell low quality wheat (which has a negative income elasticity) at a very low price, in contrast to the upper income classes that consume mainly rice. The problem in most countries is to identify commodities with this characteristic and since most of the times is a new food, it may imply change of behaviour. However, if the difference in relative prices is large enough, this change in nutrition habits may be forthcoming. The benefit/cost ratio of both these schemes is generally high and the overall budgetary costs depend on the amount of the food distributed. Overhead costs in terms of infrastructure and distribution costs that can be as high as 20 to 30% can be substantially reduced if the private wholesale and retail trade system is used.

When the private trade network is used, there is a need to identify the beneficiaries and to ration their access to subsidized foods. The food coupon system is a system through which coupons are printed and issued by a central department, distributed to beneficiaries by an official checkpoint (local administration, health center, etc.) and then presented by them to retailers as partial or total payment for a restricted or non-restricted amount and number of commodities. The retailer reimburses them with the wholesaler which reimburses them with the producer and the producer finally obtains the reimbursement with the Treasury. The system has proved to be very cost-effective, with overhead costs averaging 2 to 5% (Colombia, Sri-Lanka) and with very high benefit/cost ratios, when a redistribution of expenditure towards food for the malnourished is the objective. As theory shows, a basic

condition for implementing a cost-effective food stamp program is differential costing of the stamps for participants in accord with their expenditures on food (as a proxy of their income levels). Otherwise, those with income below-average in the target group will refuse to participate in the program and those with income above-average will use only a fraction of the subsidy for added food consumption. The system has also proved to allow large coverage, although the rural areas that do not use the market mechanism are impossible to reach. The leakage from the system has proved to be about 2-4% in the case of Colombia, that uses a well controlled and audited system but higher in Sri-Lanka that uses a loose control system. The case of Colombia when contrasted with Sri-Lanka shows that a better targeting can be accomplished with a health status identifier than with an income test, very difficult to administer in an underdeveloped country. Sri-Lanka is the only experience of a country that has changed from an untargeted to a targeted system in the space of several months, with a dramatic improvement in the benefit/cost ratio and a cut of 50% in the budgetary costs.

Most of the underdeveloped countries and some countries in combination with the previous schemes, have been using special intervention programs. Less costly in budgetary terms (1-2% at most of budget expenditures) these are highly targeted programs directed at the most malnourished and high risk individuals: children and expectant and lactating mothers. They can be distinguished by on-site-feeding if the food is taken under supervision, or take-home feeding. These programs are also in general combined with nutritional education and health care delivery systems. They can be curative or curative/preventive in nature. The most widely known program is the school-feeding program where children are distributed a certain

ration every school day. This has proved to increase nutrition levels, reduce mortality and increase dramatically attendance and efficiency of the primary school system. Since pre-schoolers and mothers are not reached, and they are generally considered more vulnerable to malnutrition, several programs have been designed to reach this group. On-site feeding programs have been set-up with heavy community involvement, using health centers or schools in order to administer the food supplement, give nutritional classes and to determine the health status of the children (weight-gain, weight-for-age, or weight-for-height methods). In order to cut down expenditures, the targeting can be even more strict as in India, where through a weight-gain method, only the most vulnerable group is identified for nutrition intervention. The take-home feeding economizes in infrastructure but is less targeted since some of the food will be leaked to other members of the family or to other families. The food distributed in these methods has been developed by Food Technology Institutes in several underdeveloped countries (more than 50 different types of food have been developed), with nutrition dense and locally available foods. It has also lead to the introduction of weaning foods, a most important habit to reduce child malnutrition. The overhead costs can be cut significantly through community involvement and volunteer organizations.

Finally, the food-for-work programs have been directed at low-income groups, generally temporary unemployed, that have a very positive aspect, besides the redistributive element - that is the incentive to work and the increase in labor productivity. However, they suffer from a drawback since they are not targeted to the most vulnerable group in terms of nutrition.

Some Case Studies of Targeted Systems

5. Case Study of a Targeted System:

The Food Coupon System of Colombia and Brazil

Despite being a middle income developing economy (\$1,180 dollars per capita, 1980), Colombia has recognized that income, production and employment increases alone are not sufficient to assure adequate nutrition for the rural and urban poor. The most acute nutrition problem is protein-calorie malnutrition (PCM), which affect approximately 4 million or an estimated 2/3 of all children under 7 years of age and 1.5 million women of child-bearing age. Although Colombia's aggregate availability of calories per capita appears to be adequate, almost 20% of the population consumes 60% or less of the recommended amount. The Colombia Integrated Nutrition Improvement Project, started in 1978, seeks to increase the productive capacity and well-being of the poorest 30% of the population through a combination of measures directed at low-income communities and groups within them at highest nutritional risk (children under 5 years of age, expectant mothers and lactant mothers). It includes several innovative features. First, it is an integrated approach, seeking to combat malnutrition through multi-sectoral programs. Second, it involves a new food distribution system directed specifically at the needs of the nutritionally most vulnerable groups. Third, it uses the primary level of the national health care system as a conduit for nutrition surveillance and delivery of integrated nutrition/health services

including nutrition education, food supplements, environmental sanitation, promotion of family gardens and family planning services.

At the community level, the project consisted in:

- (i) Incorporating delivery of nutrition interventions into the health system, using strengthened community health services as a conduit for: (a) nutrition education to improve food preparation and consumption habits; (b) food supplements to reduce the gap between dietary needs and intake of the nutritionally most vulnerable groups, through a program of coupons (representing part of the value of the supplements) delivered by health personnel; and (c) improved environmental sanitation through latrines for waste disposal;
- (ii) Install potable water supplies to prevent diarrheal diseases, as well as water-borne parasitic and other infections, which cause high infant mortality rates and produce significant nutrient losses, and;
- (iii) Increase production and consumption of home-grown nutritious foods.

At the national level, the project consisted in using the services of a National Nutrition Institute for Applied Food Technology and Quality Control to improve the use of available food in low-income areas and stimulate production of new varieties of low-cost enriched foods in the food manufacturers, while ensuring their conformity to prescribed quality standards. The nutrition program was tested first in pilot regions, extended to about half of the targeted regions in 1978 and is planned to be extended nationwide by 1985. It was also sought to have intensive testing of the regional nutrition delivery system and evaluation, in order to increase

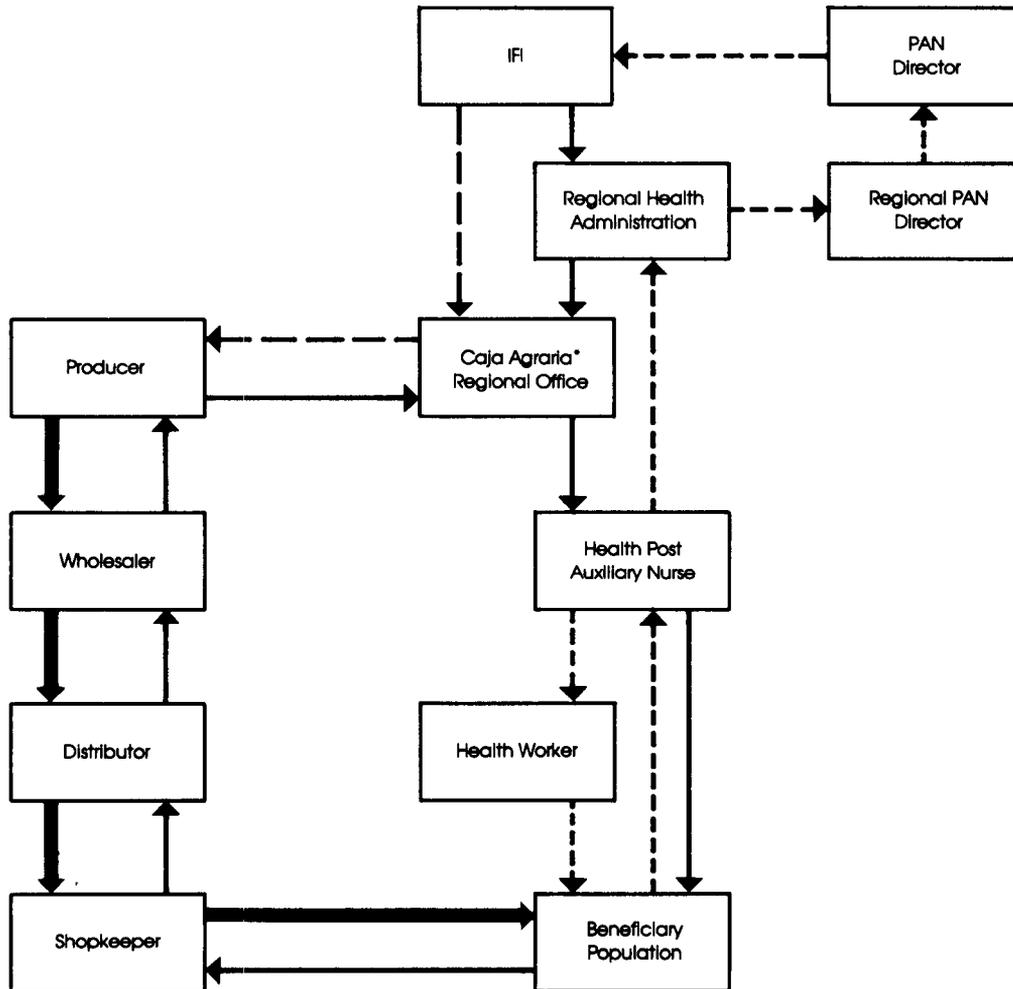
cost-effectiveness. The project was financed by the World Bank in cooperation with USAID, three United Nations Agencies and the Government of Netherlands.

The targeting of the nutrition system started with a regionalization plan designed to select specific localities in which nutrition activities should be concentrated. The analysis was applied at the "municipio" level and Colombia's 930 "municipios" were ranked according to three primary indicators of living standards: average family income (40%), educational status (30%) and access to public service utilities (30%), like water supply, electricity and sewerage. The poorest 30% of Colombia's "municipios" were thus identified. Then, a formula was applied to indicate the appropriate range of the population within a "municipio" which should be included in the nutrition program, varying from 18% of the urban population of the 4 largest cities to 100% of the populations of rural "municipios". Further analysis was undertaken in urban "municipios" based on locally secured data on income, health status, etc. which taken in conjunction with maximum coverage allowed under the formula mentioned above permitted a better identification. Finally, the process of identifying household beneficiaries was initiated. A population census was undertaken in each of the selected communities, so that the health promotor could later identify the targeted families of that area. The auxiliary nurse was responsible for checking the health status with the mother and measure child weight-and-height-for age and select the beneficiaries within children less than 5 years old, pregnant woman (for the last 6 months of pregnancy) and lactating mothers (for the first 12 months post partum).

The flow system for coupon distribution, delivery and redemption is shown in Diagram 1. Coupon programming is carried out at the national level by the National Food and Nutrition Organization (PAN) in consultation with the Ministry of Health, based on community and regional data, and then an annual estimate on quarterly program is submitted to the Industrial Development and Corporation (IFI). IFI prints the coupons and transmits them to the Agricultural, Industrial and Mining Credit Bank (Caja Agraria) which distributes them to its regional and community branches. The auditor of each Seccional de Salud would authorize withdrawals from Caja Agraria community branches and deliveries to the auxiliary nurse of each health post as required by the monthly distribution schedule. Distribution of coupons to beneficiaries would take place on fixed days each month at the health post. The auxiliary nurse would deliver to each registered mother those coupons to which she and her family were entitled. Family beneficiaries would exchange the coupons at retail food stores, paying the additional cash supplement appropriate for the foods selected. Retailers would transmit the coupons to their food suppliers, either through wholesalers or directly to manufacturers' representatives, and would receive their standard trading margin on the combined value of the coupons plus cash paid to their suppliers. Manufacturers would transmit the quantity of coupons received to the regional branch of Caja Agraria at which they have established a separate coupon account. Coupons are then redeemed by effecting a credit transfer to the manufacturer's account and then removed from circulation and destroyed.

Diagram 1

Colombia Integrated Nutrition Improvement Project



Flows of:

- 1. Coupons
- - - → 2. Information
- 3. Products
- - - → 4. Cash

*Acts as a "depository" for the coupons on behalf of the regional health administration. Health officials withdraw coupons from the regional Caja Agraria office to meet health post needs.

Coupon control and accounting is maintained at several levels, starting from a prespecified amount issued to each region and ending at the auxiliary nurse who is responsible for its security. Three forms are completed by her: (i) the registration ticket, which the beneficiary keeps as the ration card; (ii) a registration card for each beneficiary, retained by the auxiliary nurse, which beneficiaries sign each month for the quantity of coupons received and; (iii) a monthly inventory sheet of the coupons at the health center. The inventory sheets are checked by regional auditing staff of the Ministry of Health. For the firms, coupons are handled like cash.

All coupons have a fixed value, which has been set at Col. \$3.50 in 1977 and adjusted for the rate of inflation subsequently, and is valid for exchange against the purchase of the foods available through the program, representing about 60% subsidy of the retail price. Beneficiaries pay in cash the difference. Each coupon carries a serial number, and is valid for one purchase only. Two types of coupons are issued: green coupons for infants aged less than 2 years and pink coupons. The first may be exchanged only for approved infant food mixtures.

Government estimates of the quantities of coupons required by each beneficiary derive from sequential calculation of (i) the average daily deficit in proteins and calories occurring in each target group, respectively in urban and rural situations; (ii) the required daily/monthly intake of the selected foods to bridge this gap; and (iii) the monthly quantities which this represents. On an average, adult beneficiaries receives 28 coupons per month,

infants up to two years receives 12, and older pre-school children 14 per month. ^{1/} For a family of 5, this represents an income equivalent transfer of Col \$140 per household, per month, about 10% of the poverty threshold officially estimated.

One interesting aspect of the program was the development of food technology and the diffusion in the food industries of new more nutritious or enriched foods, like weaning foods, enriched pastas, rice-soy and fortified micro-nutrient based on domestic crops. At the same time a project component had as an objective to reduce food losses by concentrating on technologies for safe storage.

According to project estimates, the administrative costs of the nutrition program are about 3% of the total cost of food delivered. Based on present estimates, the nationwide program would cost about 875 million pesos (12.5 million dollars) to the Government, about 1.3% of current expenditures, and cover about 500 thousand beneficiaries. These rough numbers allow us to suggest a benefit/cost ratio very high and comparable to the food coupon system in Sri Lanka (see Appendix B).

The rate of participation is very high in urban areas (above 70%) but somewhat disappointing in rural areas (about 40%), which points out the difficulty in reaching rural families using market mechanisms and where new

^{1/} Colombia maintains a school feeding program.

types of food are being introduced. The results of the program also point out that nutrition intervention should build upon existing habits of the population and using traditional foods (although the case of whole wheat in Pakistan and Bangladesh is an interesting exception). Experience confirms that because relative prices play an important role in allocation of consumer's income, the cash contribution for the acquisition of foods under the scheme should be carefully studied.

Brazil has run some experiments with World Bank support as a preliminar to a nationwide nutrition program, including: (a) development of an information base; (b) testing of the effectiveness of alternative delivery systems (rural extension services, school feeding programs, urban and rural health delivery systems and the commercial market); (c) development and commercialization of nutritious foods. The experience of alternative nutrition delivery systems (PINS) has shown that an improved program would: (i) target geographic areas with high percentages of poor families rather than attempting to set an arbitrary income cut-off line for program participation; (ii) work through the retail system in these areas. The experiments have also confirmed that the income elasticity for consuming calories is very low (.3 - .4) even for very poor families and that the rate of participation by the families decreased substantially when the rate of implicit subsidy in food decreased (a decrease from 60 to 30% of subsidy increased dropout rate from 26 to 75%). The school feeding program (PROAPE) for pre-scholars (4 - 6 years old) combined informal education with food delivery and has been quite successful in terms of community involvement and cost effectiveness.

6. Case Study of On-Site-Feeding Programs: The Cases of India and Indonesia.

6.1. The food distribution scheme through ration shops

India has carried a food distribution policy since independence, largely based on a ban on private exports of foodgrains and distribution of grains domestically procured, imported or obtained from foreign aid, through a network of ration shops and fair-price shops. These shops have contributed with about 9 - 12.5% of grain consumption (rice and wheat)^{1/} at prices below the open market price. The system operated largely in big metropolitan and urban areas ^{2/}, but there has been a recent effort to locate ration shops in rural areas. Apart from location which favors urban and small-town consumers, there have been no attempts to target food towards low income consumers, although there is some self-targeting due to the lower quality of grains distributed than available in the open market. The quantity distributed was partly procured from farmers and millers at a price which is below the open market price. This was the case of the 70's, but more recently the procurement prices have been used to support prices as a producer incentive. An estimate of the benefits (consumer and producer surplus) and costs of such programs are presented in appendix B, which show a relatively modest social benefit/cost ratio, since it is a largely untargeted system and had a large producer loss in the early 70's.

1/ And limited quantities of vegetable cooking oil.

2/ See for a description G. Swamy (1979).

6.2. On-site feeding: the case of Tamil Nadu.

The most systematic effort yet undertaken in any developing country to analyze the nutrition aspects of food production, distribution and consumption was taken in Tamil Nadu (1970-73). Principal conclusions were: (a) around half the families consumed less than 80% of their calorie needs; (b) while some protein shortages occur, the most pressing need is for more calories; (c) generally increased food production is essential, but certain groups require special attention; (d) the highest priority target group for such specific intervention is the weaning child under 3 years of age, based on indications that malnourishment compounded by poor health is a major cause of pre-school mortality ^{1/}; (e) pregnant and nursing women constitute the next highest priority group; (f) food habits are major nutrition status determinants; and (g) these habits are amenable to change. These conclusions closely correlate with findings elsewhere in India - the country that has conducted the most extensive nutrition experiments ^{2/} - that: (a) infections diseases, diarrhea and unsatisfactory food habits are major contributors to

^{1/} 45% of the Tamil Nadu children died before 5 years of age and 50% of pre-school children in the state were malnourished. A study by the Institute of Child Health in Madras found that nutrition was a leading or associated cause of 41.8% of the death of pre-school children surveyed.

^{2/} For a recent revision of 14 of those special projects and experiments see R. Faruqee and E. Johnson (1982).

malnourishment, particularly young children; and (b) changes in many undesirable food habits are within the financial reach of most families, including timely supplementations of breast milk with satisfactory home-made weaning foods, better feeding during pregnancy and nutritionally more effective food preparation and purchasing habits.

The Tamil Nadu project^{1/} demonstrates how fine targeting can be achieved when financial resources are extremely scarce. The project was concentrated on the nutritionally most vulnerable group, children aged 6 - 36 months. Two innovative features were: (i) child beneficiaries would be identified and monitored through a nutrition surveillance system to be set up in project villages; and (ii) supplementation would continue only as long as required for a child to achieve adequate nutritional recovery and would be accompanied by intensive nutrition education of key family members to promote permanently-improved home feeding practices, within the financial reach of covered families.

The project consisted of linked programs of nutrition and health services delivery. The nutrition delivery system takes place through a network of community nutrition workers (CNW) and centers (CNC). Each CNC is an existing building, staffed by a CNW (chosen from the community) and helper,

and covers a village (approximately 1,500 persons). The average target population per CNW would be 250 pre-school children, including around 100 aged 6 - 36 months, and 45 pregnant or lactating women. The role of the CNW is to weigh the child, give nutrition education, distribute food supplements (a rice-pulse mixture, with added sugar, vitamins and minerals developed by a nutrition institute) and maintenance of village nutrition and health records. The weight gain criteria was preferred to a weight-for-age targeting since it permitted to sharpen the intervention. All child supplementation was given daily (2 times a day) for an initial period of 90 days. The rate of participation has been very high (about 90%) and there were about 55 thousand beneficiaries/year. The annual financial cost per beneficiary has been estimated at US \$12.03, which projected nationally would give about 0.3% of GNP in the case of India (51 million children). Overhead costs represent about one third of total costs.

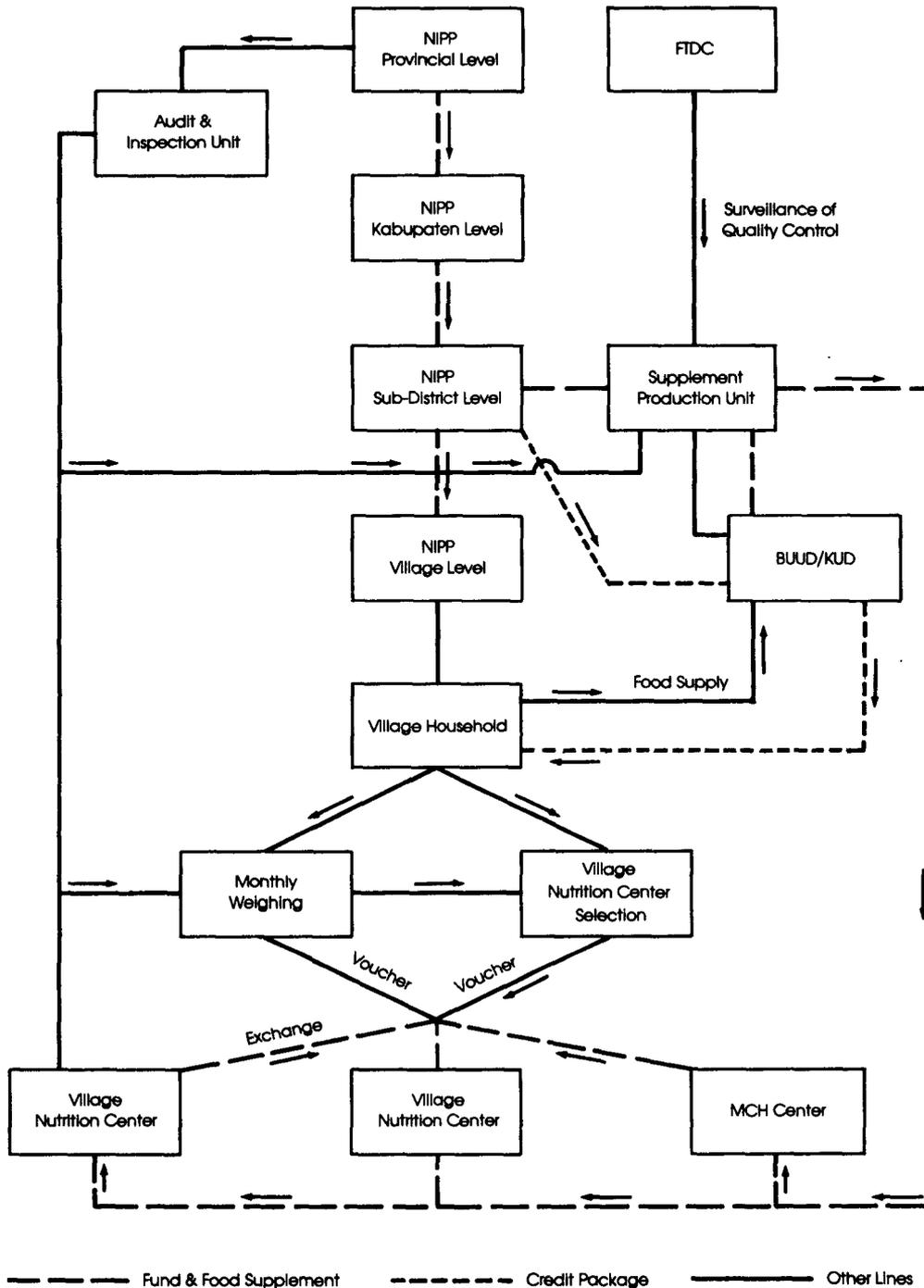
6.3 Community nutrition project in Indonesia

Indonesia launched a nutrition pilot project in 1978 to build the national institutions for a comprehensive nutrition program, to develop a cost-effective scheme of targeting food supplements and to test the efficiency of alternative methods of nutrition education. The institution building component had as an objective, besides improving planning, coordination and evaluation of nutrition activities at the Ministries of Health, Education and Agriculture, to establish a Center for Research and Development in Nutrition

and a Food Technology Development Center, both with research and teaching activities. The Nutrition Intervention Pilot Project (NIPP) proposes (i) to improve the nutritional status of children under 3 years old, pregnant women and lactating mothers in about 180 villages; (ii) to control related diseases through immunization and health care; and (iii) to conduct a nutrition education campaign. Food supplementation is supplied to malnourished children and pregnant/lactating mothers, screened through a health-income criteria. The food consisted of a cereal and legume mixture, made from locally available materials and processed at the sub-district level. The control is carried out by a technical institute. Raw materials are purchased and stored by the local cooperatives (BUVD/KVD) (see Diagram 2) and processing is carried out at cooperative depots in each sub-district. After processing the food is distributed to the village distribution points. Distribution to the beneficiaries is made weekly against the presentation of the vouchers distributed by the health center. This scheme has a strong community involvement and the Government is currently using volunteer organizations to carry out the scheme.

Diagram 2

Indonesia Nutrition Development Project
Production and Distribution of Food Supplement



7. Case Study of a Major Policy Reform: From a Non-Targeted to a Targeted System (Sri Lanka).

Sri Lanka is a prime example of a country that introduced a major policy reform for targeting its food distribution program, changing from a ration scheme to a food coupon system in 1979. The results were a decrease to one-half of budgetary costs, an increase of 30% of transfer to the poor and one of the most efficient food distribution systems in the world.

7.1. The Ration System (pre-1979)

Sri Lanka is often singled out as a poor country (\$270 dollars per capita in 1980), that has successfully followed a human needs development strategy. The ODC's Physical Quality Life Index, which combines literacy, infant mortality, and life expectancy rates, ranks Sri Lanka first among 42 low-income countries, although it ranks 31st for per capita income among these same countries.^{1/} This progress appears to be at least in part the result of a series of social policies that have been followed in the country, among which, food distribution programs are a major component. According to the Socio-Economic Survey of Sri Lanka 1969-70, not more than 5.4% of the population appears to consume a number of calories below 10% of the standard requirement. The Ration System initiated after 1942, involved the distribution of rice at subsidized prices through an extensive network of

^{1/} See e.g., P. Isenman (1980).

cooperatives and an active government program of price supports and procurement of agricultural commodities, particularly rice, to supply the public distribution system. Sri Lanka presents a case of a country where an important part of the food subsidy was in fact a producer subsidy. In fact, the Government has pursued a policy of maintaining rice prices through the Guaranteed Price Scheme, for some periods above the world price, and encouraging production mainly through irrigation, land settlement, and the subsidization of inputs. Rice production grew very rapidly between the 1940s and the early 1970s, and the cereal self-sufficiency ratio almost doubled in 20 years. According to ILO estimates, the subsidies were worth approximately 25 percent of the value of paddy production at farm gate, not including the subsidy element in procurement.

A large part of the paddy marketed in Sri Lanka has been handled through public sector procurement and ration operations. Under this scheme, the Government stipulates each year, in advance, the price at which it will purchase paddy from the farmers. There is no restriction on the amount of paddy that a farmer can sell to the procuring agents of the Paddy Marketing Board (PMB). These agents are the branch societies of the multi-purpose cooperative societies located in village areas (in 1978 there were about 3,100 branch cooperatives). They also distribute goods, mainly rice, to the public. The paddy is then transported to district warehouses and milled by PMB and authorized private and cooperative millers (1/3 and 2/3).

The Sri Lankan Government, through the Food Commissioner's Department, has a monopoly on the international trading of food commodities.

Distribution of rice under the ration system through wholesale and retail is carried out by the cooperative network and private authorized distributors. From 1954 to 1960 the ration of 2 quilos, per week and per person was distributed almost universally, at a price that contained a subsidy element of 30-60% subsidy. From 1960 to 1973 1 quilo was supplied free and the other at about 30% subsidy. From 1973 to 1979 ^{1/} the income-tax payers were no longer eligible for free ration rice, some wheat flour was also supplied at subsidized prices, as well as sugar (before 1973 sugar tax was a source of state revenue). The scheme was also used throughout as a consumer and producer price stabilization mechanism.

The budgetary costs of the food ration subsidies increased from about 8% of total government expenditures in 1966 to 17% in 1975 and in 1979 they were still about 14% of total government expenditures. As a percentage of GNP, they increased from 2% in 1967 to about 6% in 1979. These extremely high costs were the determinant factor of the reform of 1979 that introduced a food coupon system and targeted food subsidies to the lower income classes.

According to official estimates the ration scheme was equivalent to 20% of caloric consumption and 14% of income. Although largely untargeted, the ration mechanism allowed a more equalitarian distribution of the basic staple, thus the benefit cost ratio of 4.4 compares favourably with

^{1/} Weaning foods were also distributed to children and pregnant women in vulnerable families.

alternative programs. In 1970 the producer surplus was negative, but for some of the years, there was a positive producer surplus. An important lesson from the Sri-Lankan case is also the exchange rate policy, that was kept overvalued during most of the 70's (about 40%), needed for cheap food imports but that had a detrimental impact on agricultural production incentives.

7.2. The Food Stamp System (post-1979)

Under the new system food stamps were issued to households to enable them to purchase goods in the following basket: rice, paddy, flour, bread, sugar, locally produced pulses, lakspray, vitamilk, parakum condensed milk, dried fish and kerosene. Eligibility for the scheme was based on total household income. Those households consisting of five or less members receiving an income of Rs 300 or less per month were eligible to possess food stamps with Rs 60 for each additional member in excess of five. (This means test has been criticized and a per capita system proposed instead). The value of the food stamps distributed to each household depended on the age composition of each member of the household. Children below the age of 8 were given Rs 25 worth of food stamps per month. Children over 8 and below 12 were given Rs 20 and those over 12 were given Rs 15 worth of food stamps per month (equivalent to roughly 4 quilos of rice and 1 quilo of wheat flour).

The food stamp system covers roughly lower income half of population (about 7.4 million persons). Food stamps are issued and distributed every three months (in 1980, they were issued every 6 months). The Head Office of

the Food Commissioner is responsible for the printing and security of food stamps, that are distributed through the local officers. Food stamps with the consumers are valid only for one month. In the hands of the retail distributor the food stamps are valid for three months, so that they may have time to obtain reimbursements from the wholesale dealers. The wholesale dealers in their turn have three months in which to obtain their reimbursements from the Treasury. In the districts, the wholesale dealers may obtain the reimbursements from the Assistant Food Commissioners Office. Food stamps are accepted as full or part payment from the Multi-Purpose Co-operative Societies for the supplies of rice, paddy, flour and sugar by the Food Department. An interesting feature is that food stamps can be deposited and the cash equivalent saved in a savings account of the banking system.^{1/}

The overhead costs incurred in the administration of the scheme has been officially estimated at Rs 1.05 for each food stamp issued, divided almost equally between the operations of writing the stamps, distributing them, paying for the travelling and subsistence of officers, fuel costs, employment of casual clerks, payments of Grama Sevakas, stationary and destruction of used stamps. Total overhead costs are about 1.8% of effective food subsidy.

^{1/} The impact of this measure was, however, insignificant, since the marginal propensity to save of the poor classes is almost nil.

The dramatic reduction in budgetary costs achieved by the reform is illustrated by the following numbers: in 1979 total subsidies amounted to 14% of total government expenditures (6% of GNP); in 1980 the budgetary costs were halved (7% of total expenditures and 3% of GNP).

What were the changes in terms of benefits? A survey conducted in 1981 by the Food and Nutrition Policy Planning Division in Colombo^{1/} showed that the majority of the subsidy was being received by the needy. The main income of the food stamp recipient household was estimated at Rs 165 per month, and the average value of food stamps received amounted to Rs 90 per month (an increase of about 55% of average income). The importance of the scheme as a source of income supplement to the poor households is well illustrated by the fact that for a family earning less than Rs 100 a month, the income transfer is about 130%. In fact, the new scheme has increased by more than 30% the transfer per capita to the poorest when compared with the old system.^{2/} According to the survey, there were about 10% of needy not covered by the scheme and an upper limit of 30% covered not needy. Subsequent measures to control more tightly the entitlement have been devised. The pattern of utilization of food stamps reflected the relative prices of different foods, as the Government moved to full-cost producer pricing, which further increased benefits to farmers. The proportion of stamps spent on rice was quite high, ranging between 70-90%, followed by sugar and milk foods.

1/ Survey Report of the Food Stamp Scheme, Ministry of Plan Implementation, Colombo, 1981.

2/ Selowsky, M. (1980).

The nutritional impact of the new system has, thus, also improved. One of the main concerns of the recipient households was the erosion of real value of the food stamps in view of price inflation, and in 1981 there was, consequently, evidence of some deterioration in nutrition. An indexation of the food stamp value has been proposed to solve this problem, linked to the price of the rice.^{1/} Another limitation of the program is its more limited impact on children, which underlines the fact that special intervention programs have to be devised for such groups.

Overall, the improvement in the benefit/cost ratio of the system was spectacular. The targeting of the system, according to Appendix B, has allowed an increase from the B/C ratio of 4.4 in the ration scheme to 42.8 in the food stamp program. If allowance of 30% is made for wastage in benefits to non-needy, the B/C is still 37.6.

Lessons from Experience

8. Setting-up Nutrition Programs: Characteristics of an Ideal System and Political Economy of a Reform

8.1 Design of an ideal system and its phasing

The design of nutrition programs should be based on informational infrastructure and nutrition planning.^{1/} In order to identify the targeted groups, a population study (demographic and socio-economic characteristics by areas) and a basic needs survey need to be implemented.^{2/} Using several indicators is then possible to identify the areas and groups (since regional targeting has been proved superior in most developing countries) where nutrition intervention should be given priority. Next, a nutrition study should be conducted by sampling some of those areas: what is the type and severity of nutritional deficiencies affecting the target group? What are the basic causes of malnutrition? Who is affected? Simultaneously a study of economic behavior is advised: food habits, nature of the diet, beliefs about food, food-processing and distribution system, food demand, patterns of intra-family food distribution. All these studies should be focused to give answer to following question: what is the quantity and type of incremental nutrients or the behavioral or institutional change that the nutrition intervention needs to provide?

1/ See, e.g. A. Berg and al., Nutrition, National Development, and Planning, MIT Press, 1973.

2/ The World Bank through its study on LSMS is addressing this problem.

Institutional building should comprise two basic elements: a) a Nutrition Institute (linked to the Ministry of Health and Universities) primarily responsible for the studies indicated above and that would conduct applied research related to the nutrition delivery systems as well as teach nutrition intervention to the personnel of the nutritional system; b) a Food Technology Institute that would develop nutrient dense foods and control their quality, related to the special intervention programs.

Experience has shown that the design of nutrition policies should pursue an integrative approach, should increase production as well as improve standards of consumption and pursue several projects simultaneously. A phased approach is also advisable.

One of the most important lessons of the experience is the dramatic improvement in the benefit/cost ratio if nutrition is combined with health delivery system (and also possibly with family planning).^{1/} A review of the causes of mortality in several developing countries illustrates the dominant role of malnutrition, diarrheal disease, and pneumonia, which account for 36-65 percent of deaths among preschoolers. The synergy between infection and malnutrition has been well documented. Infectious disease can also increase the loss of essential nutrients as a result of subclinical

^{1/} The Narangwal Population and Nutrition Project has carried ample evidence of this conclusion. See, e.g. Taylor, E. and others, Malnutrition, Infection, Growth and Development: the Narangwal Experience, The Johns Hopkins U.P. (1983).

malabsorption, diarrhea, etc. By combining health care with nutrition intervention, it has been possible to reduce by 40-50% infant mortality and increase dramatically anthropomorphic measures of children. The integration of health and nutrition permits also a reduction in costs, since joint use of facilities capitalizes on fixed-cost investment, personnel and management. Another important aspect is that identification of beneficiaries by health status is more appropriate than family income, particularly in underdeveloped countries. Several projects (Indonesia, Morocco (USAID), India) show the importance of giving nutrition education combined with the food supplements, since a change in habits goes to the heart of the problem. The integration of nutrition with water supply and sewerage merits also serious consideration. In fact, water-borne diseases (e.g. infections hepatitis, cholera, typhoid) are contracted from contaminated water; water-washed diseases (e.g. trachoma, scabies) stem from poor hygienic practices; and water-based diseases depend on aquatic organisms for completion of their life cycles and water related insect vectors bite or breed near water.

An aspect of major concern in the design of nutrition programs is the impact on production, particularly in agriculture. A study of the cost effectiveness of food procurement and distribution policies^{1/} shows that in the period 1974/77, the loss of producer surplus caused by such policies averaged 43% of benefits (additional consumption of malnourished) in India,

^{1/} Scandizzo, P. and O. Bruce, Methodologies for Measuring Agricultural Price Intervention Effects, SWP no. 394, World Bank, 1980.

33% in Pakistan, 26% in Bangladesh and 82% in Indonesia. If the budgetary costs are added, those percentages rise to 48, 76, 49 and 92%. Interesting examples are the production of wheat in Egypt, that increased only 27% in the 1960-81 period, that had a large disincentive, resulting from price controls related to the food subsidy scheme and Morocco, where production wheat decreased by 14% between 1970 and 1978, while in Sri-Lanka, that had positive producer surplus for most of the 50's and 60's, production of rice tripled. The nutrition program should be based on domestic basic foods and accompanied by price support mechanisms with a net incentive to production. This also assures that there is no regressive distributive effects from poor farmers to above-average urban dwellers.

The first element to consider in the design of a nutrition program is the amount of budgetary resources earmarked for such projects. According to the analysis of alternative projects in section 4, the most efficient programs, most targeted and less costly are the special intervention programs designed for the malnourished and most vulnerable group: children and pregnant-lactant mothers. Those should be given priority. The remaining funds should be targeted to other most malnourished groups targeted by region (slums, poor rural areas) and using the food coupon system. Choosing between on-site feeding and a food coupon system depends on the available infrastructure (human and material). The food coupon system is by far less demanding and should use the traditional wholesale and retail trade system. Leakage from the system can be reduced at a maximum by using, e.g., the Colombian scheme. Other costs can be cut by using health personnel, community and volunteer groups. The Colombian control and audit of the food coupon system has proven to function quite efficiently.

Perhaps the single most important element in the design of a food coupon system is the choice of the optimal basket of goods and the prices to be charged for each of them by income group. Appendix C presents an algorithm for the solution of this problem. A successful solution of the problem must take into account a social welfare function, the consumer surplus and the producer surplus by income (or expenditure) group. The problem for the consumer is the minimization of costs subject to the "nutrition technology by commodity matrix" (nutrient content by commodity) and a "taste matrix" (the consumer prefers to take the nutrients in a certain composition of goods).^{1/} Based on those matrices, the consumer confronts the constraint of the minimum nutrition requirements. Taken the basket of goods actually consumed, the basket of food supplements can be computed, and from the dual the "optimal prices to charge". For the supply side, a competitive model of production-cum-imports is formulated, given the production function and international prices. The problem is then to maximize producer surplus. A tâtonnement procedure between demand and supply finds the optimal solution subject to an overall state budget constraint (the amount allocated to food subsidies).

^{1/} In Morocco, a large proportion of calories perhaps as much as 60% in poor rural areas is absorbed from durum wheat, in Sri Lanka, e.g. is in form of rice, etc.

8.2 The Political Economy of Reforming a Food Subsidy Scheme

Food subsidy schemes are very politically charged in all countries that have instituted them. Besides, the interest groups that most benefit from them and are the most politically vocal about any change on them (e.g. urban working class) are not always the most needy from a nutritionally point of view. These aspects make policy reform in food subsidy schemes particularly difficult for those countries and the action should be taken skillfully taking into account the cost and benefits of each constituency evaluated from a social point of view.

Experience has shown the importance of two basic principles:

- (i) The principle of gradual adjustment in prices of basic foods, according to opportunity costs of those commodities;
- (ii) the impact of those reforms in each income and regional group (urban and rural) should be studied in terms of cost of living and welfare, and highly visible compensatory mechanisms be introduced.

The importance of a gradual approach, i.e. the adjustment needs to be spread over time, using an indexation mechanism (with a quarterly adjustment) is illustrated by the case of Egypt and Morocco quite vividly. In Egypt, some of the basic food prices were adjusted in 1977 by about 100% overnight, in a package of other austerity measures. This occasioned the well-known episode of riots in the streets.

According to estimates for Egypt,^{1/} a cut in food subsidies (of about 5% of GNP) that is equivalent to a 30% increase in the price of food would originate a fall of 8% in real income of urban population and 3% in rural population, and in the first round would decrease GNP by about 5%, if no compensatory measures would be taken, without major improvement in the balance of payments in the short-run. However, these calculations are for the very short-run and presuppose very small elasticities of substitution between domestic and imported goods.

In Morocco, in the context of a drought and rapidly rising food prices, the prices of some basic foods (sugar, flour, edible oils, butter, milk and fertilizers) were increased, with growth rates ranging from 8 to 64% in May of 1981. These rises were equivalent to an increase of about 5% in the average food price index, and a 5-6% reduction in real income of urban middle-income classes, overnight (the annual inflation rate for food commodities would rise at 34.6%, contrasted with wages progressing at about 10%). This gave the pretext for the riots of Casablanca. These examples illustrate the need to choose the political opportune time for announcing changes in food prices, and the need to introduce a gradual indexation mechanism that would smooth those changes over time. The objective of such mechanisms would be to stabilize food prices in the occurrence of large fluctuations in world prices. This requires a separate analysis. The reduction of implicit subsidies in basic foods can be studied in a general equilibrium model, using a Social Accounting Matrix that desaggregates the population by income group. These would give the increase in cost of living (or reduction in real income) for each class.

^{1/} L. Taylor (1979)

When the reduction in food subsidies is sizeable, it should be announced in conjunction with the introduction of highly visible compensatory measures, consisting, in the introduction of special nutrition intervention schemes ("the subsidy in sugar reduced by 30% but from now on every child in school would have a glass of milk every day"), or partial adjustment in minimum wages, etc. The idea is to weight political costs and benefits by income group or political constituency pushing in the right direction of the reforms: the increase in social benefits and the search for cost effective programs.

Appendix A

The Economics of Basic Needs:

Food Distribution Programs

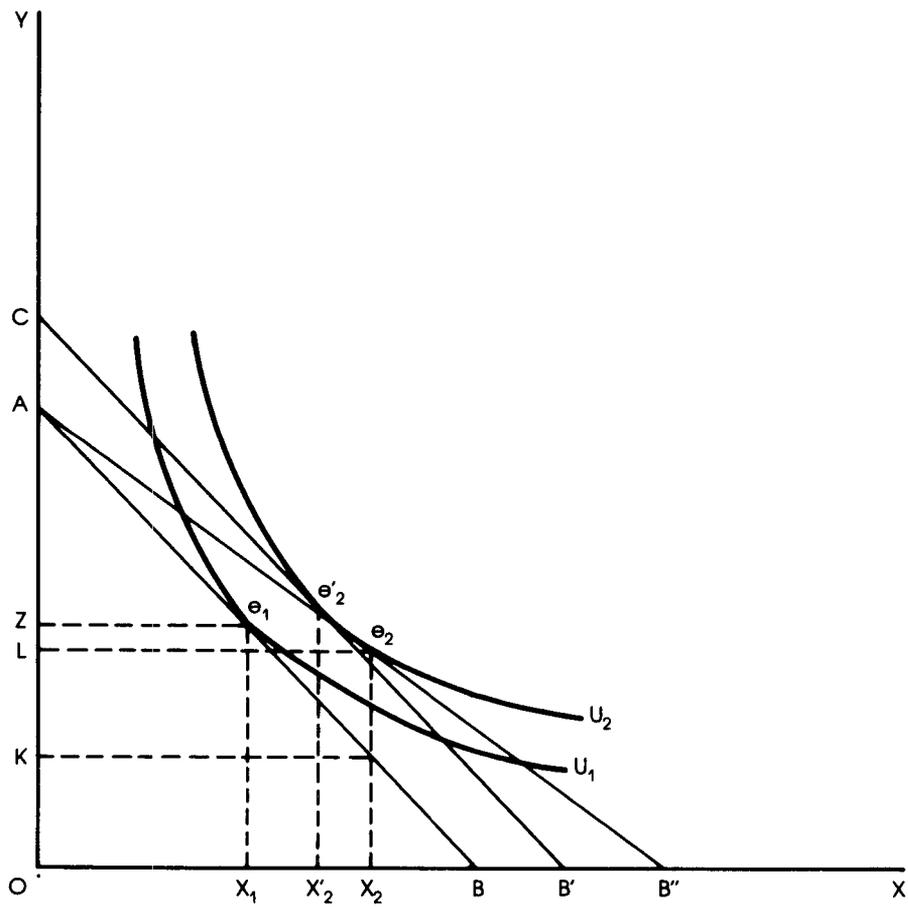
1. The Individual

In this section we study the impact of alternative welfare programs on the consumer equilibrium and the costs for the Government. Three alternative policies are frequently referred to: (i) introduction of a consumer subsidy targeted through food stamps; (ii) supplementary income to the poor; (iii) control of food prices.

Let us suppose the initial equilibrium of a consumer under the poverty level, that consumes X of food and Y of other goods (measured in "monetary income") (Figure A.1). The initial equilibrium is at e_1 , where the budget constraint, AB is tangent to the indifference curve, U_1 . He consumes OX_1 of food and OZ of other goods. Suppose that the aim of the Government is to increase the consumer's welfare to U_2 . The Government decides to subsidize food through a food stamp program, giving him the subsidy LK that can only be spent on food. The consumer, in response, changes his equilibrium to e_2 , consuming X_2 of food and L of other goods. If both goods are normal, notice that consumption of food increases from X_1 to X_2 and consumption of Y decreases from Z to L . Notice that in the case the Government wants to increase consumption of food above B , it has to supply all food free to the consumer.

Figure A.1

Consumer Equilibrium under Alternative Policies



An alternative policy would be for the Government to give a supplementary income. For the same level of utility, U_2 , then the supplementary income would have to be AC. The new equilibrium for the consumer is e'_2 , and he demands now X'_2 of food (less than X_2) and increases also its consumption of other goods. If the Government sets as a target the level of food consumption X_2 (minimum standard) then the supplementary income to be given to the consumer is clearly above the food subsidy, i.e. the budgetary cost is higher, ceteris paribus.

Take the income constraint for the consumer

$$P_x X + P_y y = M$$

and differentiate it totally (maintaining P_y as constant):

$$X.dP_x + P_x dx + P_y dy = dM$$

now, a supplementary income would be represented by $dM > 0$ (with $dP_x = 0$) and is distributed between dX and dY (for normal goods). A subsidy to food, that can be spent only in food is $dp_x < 0$, that has to be compensated by $dX > 0$. (*)

(*) In the case of the subsidy to food, the cost of 1 unit of dx is:

$$\frac{dP_x}{dX} = - P_x - \frac{X}{dX}$$

and in the income transfer case:

$$\frac{dM}{dX} = P_x + \frac{P_y dy}{dX}$$

now $\frac{dM}{dX} > \frac{dP_x}{dx}$, or $P_x + \frac{P_y dY}{dx} > - P_x - \frac{X}{dx}$

is trivially true, if $dY > 0$ and $dX > 0$ (case of both normal goods).

A third policy is the price control of food prices, such that the income constraint of the consumer changes from AB to AB''. The budgetary costs to the Government in this case are null, since costs will be born out by the producers, and imports would grow.

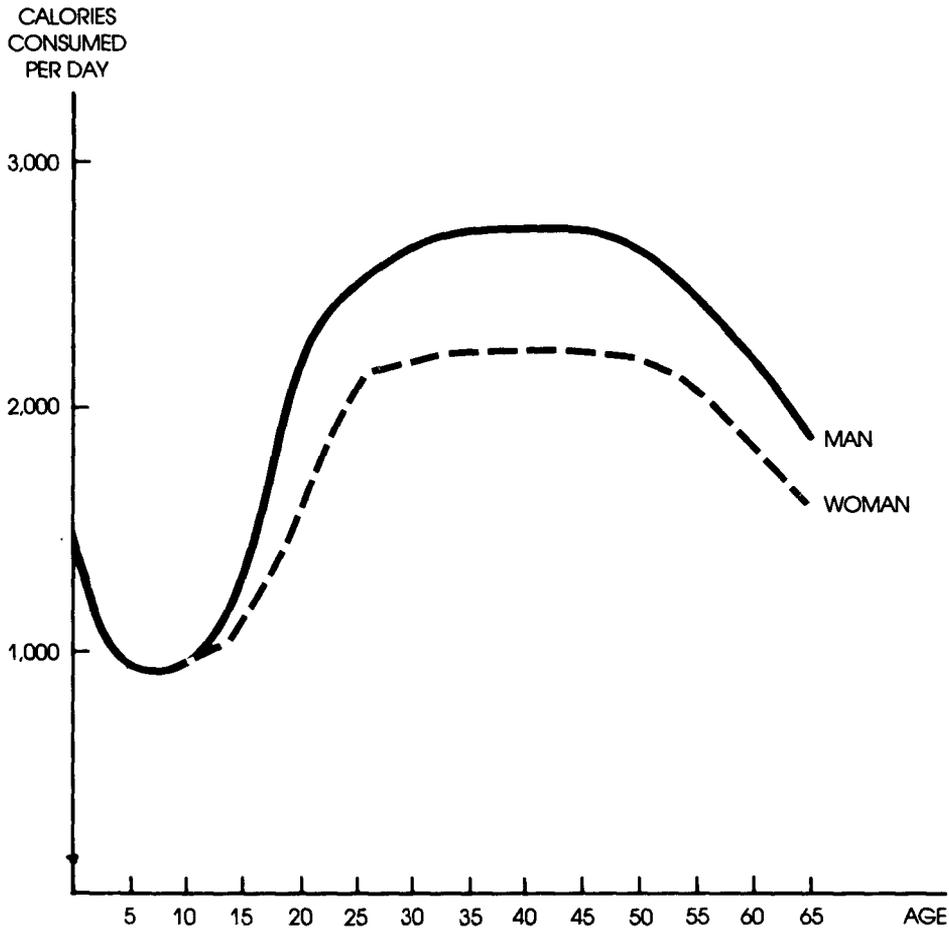
2. The Family

In the design of nutrition programs, it is not enough to study "the individual", because problems of intra-family food allocation cannot be ignored. For example, in Colombia, surveys of food distribution among family members show a typical U - curve for the calories consumed by age until the adult life, with women consuming less than men after a certain age (Figure A.2).

Although physiological studies have shown that the minimum requirements of calories are different according to the amount of energy spent by the human body, there are also economic reasons for the allocation of food between members. Some "beliefs" are also sometimes the reason for malnutrition, like the use only of the left breast by some asian cultures and the discontinuation of breast feeding by african women when they get pregnant again because they believe that the child can poison the fetus. Of course, the most obvious policy to change these habits is nutrition education. There are several problems that can be studied, and should be studied in a basic needs study. Here are some of them. If the mother has to spend a certain amount of time in the nutrition program, will she participate? That depends

Figure A.2

**Calories Consumed by Age in a
Typical Traditional Society**



on the value of the time and the implicit benefit of the program. What is the implication of different nutrition programs in children work? Child work is a major issue in most of the developing countries. What are the implications of incomes and price policies on food consumption and intra-family patterns of food distribution? A small model can be used to study these questions, in the Becker tradition. Assume a utility function for the household composed of a husband (h), wife (w) and child (c), indexed by superscripts:

$$U \left[Z_1^h, \dots, Z_n^h, Z_{n+1}^h, \dots, Z_m^h, \dots, Z_1^c, \dots, Z_m^c \right]$$

where the arguments, Z , are characteristics: food is measured by characteristics 1 to n (like calories, proteins, etc) and "non-food standard of living" is measured from $n + 1$ to m . In order to simplify the problem, we would need to specify a household utility function with individual utilities as variables (the problem is similar to a social welfare function):

$$\Psi \left[U^i (Z_1^i, \dots, Z_m^i) \right]$$

Those characteristics can be produced by using market or non-market goods X_i and time as inputs, through a kind of production functions:

$$Z_i = f (X_{k1}, \dots, X_{kn}; T_{cf}, T_{wf}, T_{hf}) \quad k = c, w, h$$

and

$$i = 1, \dots, n$$

$$Z_j = f (X_{k, n+1}, \dots, X_{km}; T_{cs}, T_{ws}, T_{hs}) \quad j = n + 1, \dots, m$$

The "total income" budget constraint is defined by

$$\begin{aligned} \sum_i \sum_k P_i X_{ki} + \sum_k T_{kf} \bar{W}_k + \sum_k T_{is} \bar{W} &= \\ &= V + T_{cw} \bar{W}_c + T_{ww} \bar{W}_w + T_{hw} \bar{W}_h \end{aligned}$$

where V is non-wage income, P_i are the prices of commodities, $T_{.w}$ are times allocated to work and \bar{W} are the wage rates for child (c), women (w) and man (h) labor.

There are certain minimum nutritional standards that have to be satisfied by each type of member of the family:

$$\begin{aligned} Z_{ki} &\geq \underline{Z}_{ki} && \text{for all } k = c, w, h \\ & && i = 1, \dots, n \end{aligned}$$

and time is bounded for each member:

$$\begin{aligned} \sum_l T_{kl} &= T && \text{for } k = c, w, h \\ & && = f, s, w \end{aligned}$$

An income transfer can be represented by ΔV . A food distribution program would be represented by $P_i \Delta X_i$ and some of the questions posed can be studied by simulating the basic problem and estimate demand functions for X_i 's, and allocation of time T_i 's.

3. The Targeted Group

Some very simple formulas can be deducted for the cost in food needed to increase consumption of a target group. Note that this measure of cost effectiveness does not include administrative or other overhead costs and does not weight benefits by income class.⁽¹⁾

The cost of an untargeted food price subsidy is given by area A (Figure A.3) (subsidy to consumers) plus area B (subsidy to producer), when the food is domestically produced, and we want to increase consumption from Q_0 to Q_1 .

An alternative would be to subsidize only the imported fraction of the commodity. Although this policy reduces the fiscal cost, it also induces a fall in farmers income and a production efficiency loss if they replace internationally competitive domestic production. The fiscal cost would be given by area C in the Figure A.4, where the difference between q^d and q^s represents imports.

The negative impact in production can be compensated by a producer subsidy equal to $(P_0 - P_1)$ times q^s , that would decrease imports by Δq_0^s . This is the policy followed here. Table A.1 shows the algebraic expressions for budgetary costs of these policies, and the cost in dollars for the values of parameters pre-specified, for price per unit. Three target group policies are considered: the food stamp program that provides

(1) See S. Reutlinger and M. Selowsky, Malnutrition and Poverty, World Bank, 1976.

Figure A.3

**Budgetary Costs of a Food Price Subsidy
(No Imports)**

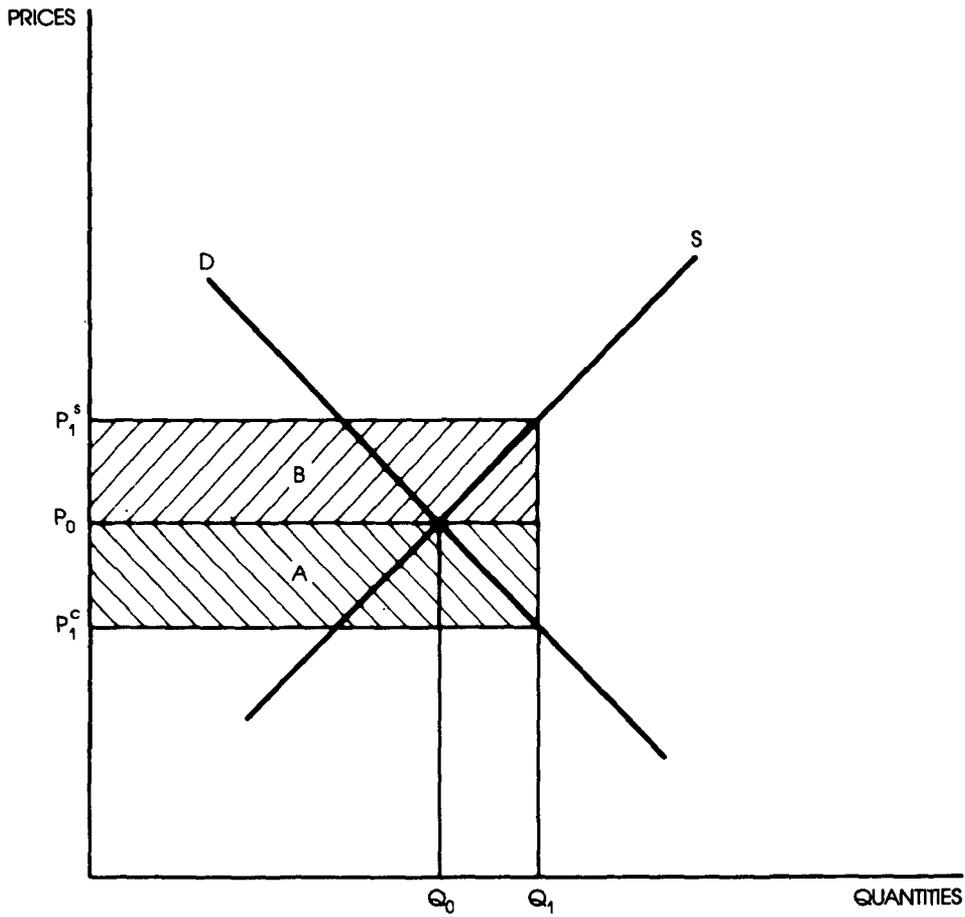
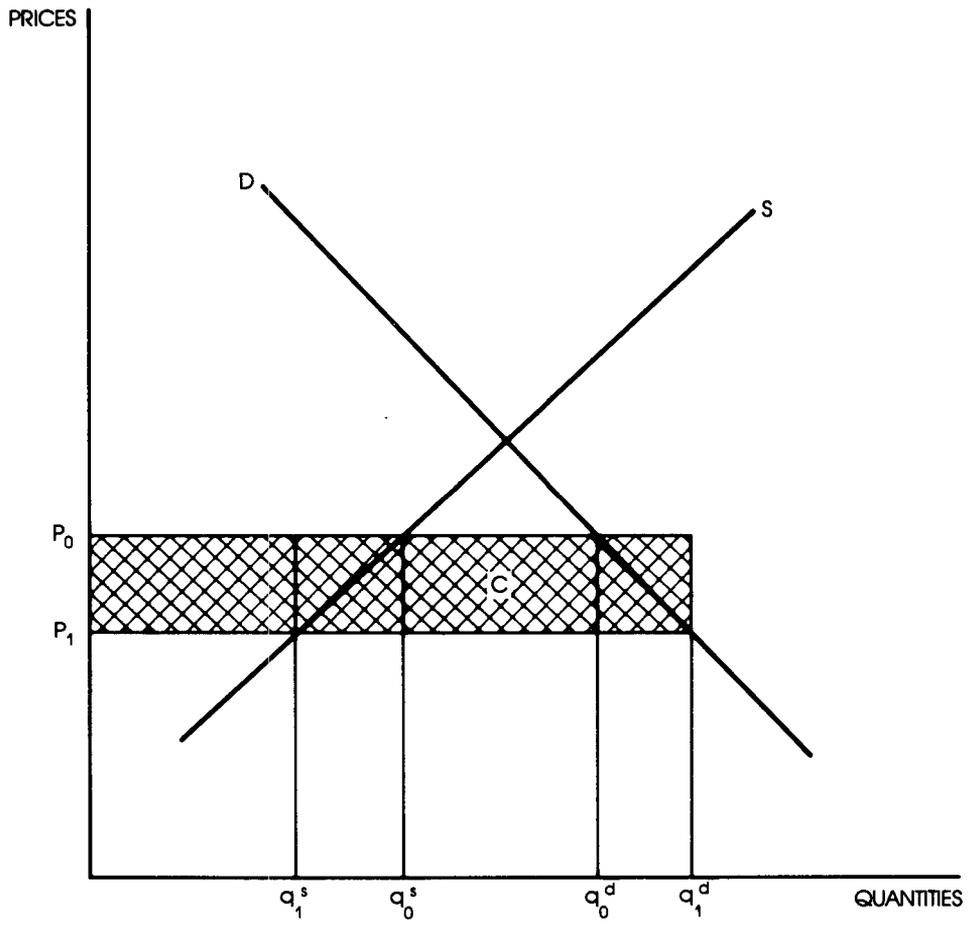


Figure A.4

**Budgetary Costs of a Food Price Subsidy
(With Imports)**



participants with the opportunity of purchasing a fixed amount of food at a lesser cost than market prices. The price subsidy allows members of the target group to buy food at subsidized prices. A third alternative is to make a straight income transfer required to induce a certain increase in food consumption. Cost comparisons show that a general consumption food subsidy is about four times more expensive than a food stamp program. Food coupons are the most efficient program. Among target group policies, a food stamp is preferable to an income transfer and this is preferable to a price subsidy restricted to the target group. However, we should emphasize again that these cost estimates do not include administrative costs and distribution weights by income class that can increase the disparity in benefit/cost comparisons between general and target group policies.

4. The Market

The welfare costs and benefits of food distribution policies by fixing producer prices of some food products and then give a subsidy to domestic production and imports in order to sell the food at a certain price, can be depicted by Figure A.5:

If there was free trade at world prices, P_w , then domestic production would be q^s , imports $q^d - q^s$ and domestic consumption q^d . Now, the government fixes the producer prices at P_p , the consumer prices at P_c and covers the price differential $P_w - P_c$ through a subsidy to imports, that are now $q^d - q^s$ and covers the price differential $P_p - P_c$ through a subsidy to domestic production.

Table A.1

Cost Effectiveness (Budgetary Cost in Food) of Untargeted and Targeted Nutrition Programs, as a Ratio of the Price per Unit

<u>General</u>	Formulas	Cost in dollars
General consumption subsidy	$\frac{1}{\lambda \alpha} \frac{\lambda}{\mu_p} \left(1 + \frac{\mu_r}{\epsilon} \right) \left(1 + \lambda \frac{\mu_r}{\mu_p} \right)$	12.0
Subsidy on imports	$\frac{1}{\lambda \alpha} \frac{\lambda}{\mu_p} \left(1 + \lambda \frac{\mu_r}{\mu_p} \right)$	6.0

Target Group

Food Stamp	$1 + \frac{1 + \lambda}{\epsilon_p}$	3.4
Price subsidy	$(1 + \lambda) \left(\frac{1}{\epsilon_p} + \frac{1}{\mu_p} \right)$	4.8
Income transfer	$\frac{1}{m} \left[1 + (1 + \lambda) \frac{\mu_p}{\epsilon_p} \right]$	4.4

Parameters: $\epsilon = 0.5$; $\mu_p = 0.5$; $\lambda = 0.2$; $\mu_r = 0.5$; $\alpha = 0.4$; $m = 0.5$; $\epsilon_p = 0.5$

ϵ = domestic supply elasticity, μ_p = price demand elasticity of poor group;

λ = percentage increase in food consumption of the poor, μ_r = price elasticity of the rich; α = proportion of poor; m = marginal propensity to consume

food; ϵ_p = elasticity of supply faced by the poor

The benefits of such a program are equal to the consumer surplus plus the producer surplus. The first is the area under the demand curve from P_w to P_c and the second is the area above the supply curve between P_w and P_p :

$$\begin{aligned}
 \text{Benefits} &= \text{Consumer Surplus} + \text{Producer Surplus} \\
 &= (P_w - P_c) \left[q_w^d + \frac{1}{2} (q_c^d - q_w^d) \right] + \\
 &+ (P_p - P_w) \left[q_w^s + \frac{1}{2} (q_p^s - q_w^s) \right] \\
 &= (P_w - P_c) q_c^d \left[\frac{1 + 0.5 \mu_d}{1 + \mu_d} \right] \\
 &+ (P_p - P_w) q_p^s \frac{1 + 0.5 \mu_s}{1 + \mu_s}
 \end{aligned}$$

Where μ_d and μ_s are demand and supply price elasticities.

The costs will be equal to producer and consumer subsidies paid by the government, and will be equal to:

$$\begin{aligned}
 \text{Costs} &= \text{Consumer subsidy} + \text{Producer subsidy} \\
 &= (P_w - P_c) q_c^d + (P_p - P_w) q_p^s
 \end{aligned}$$

If the producer price is fixed at below the world price, or if the government imports a good that is a substitute of a domestically produced good, then we have Figure A.6. In this case, since $P_p < P_w$, the producer subsidy is negative.

Figure A.5

Welfare Costs of a Food Price Subsidy When $P_w < P_p$

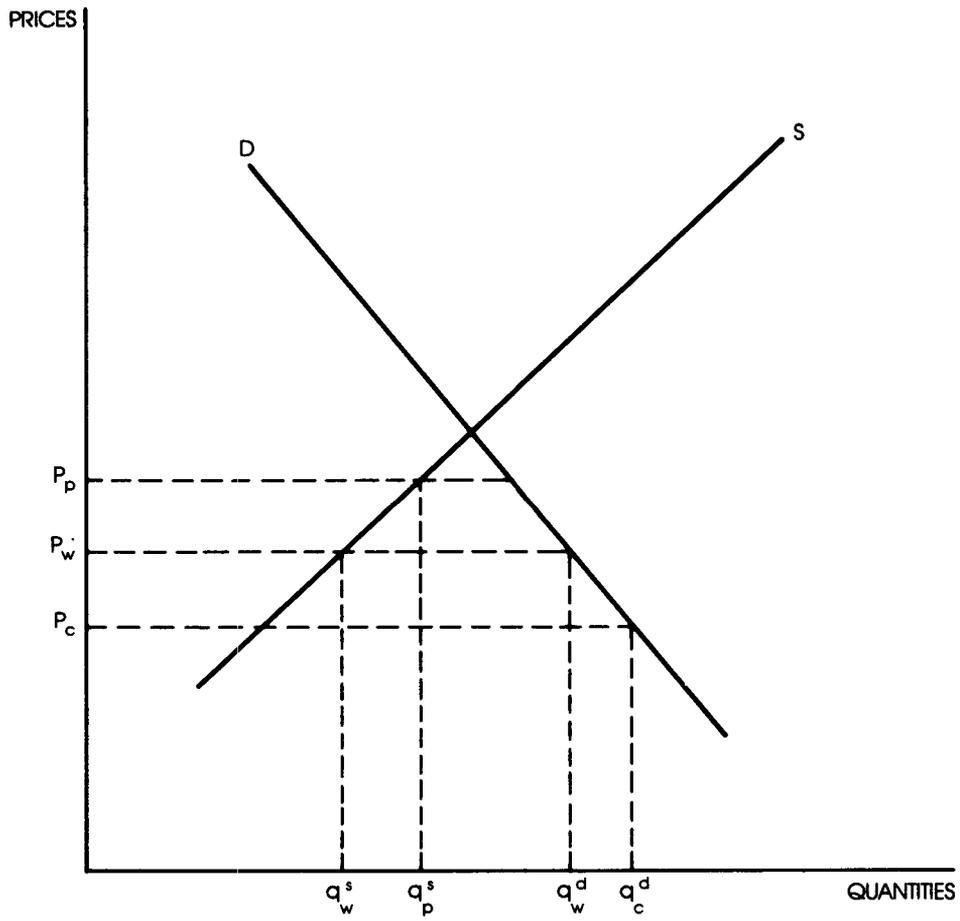
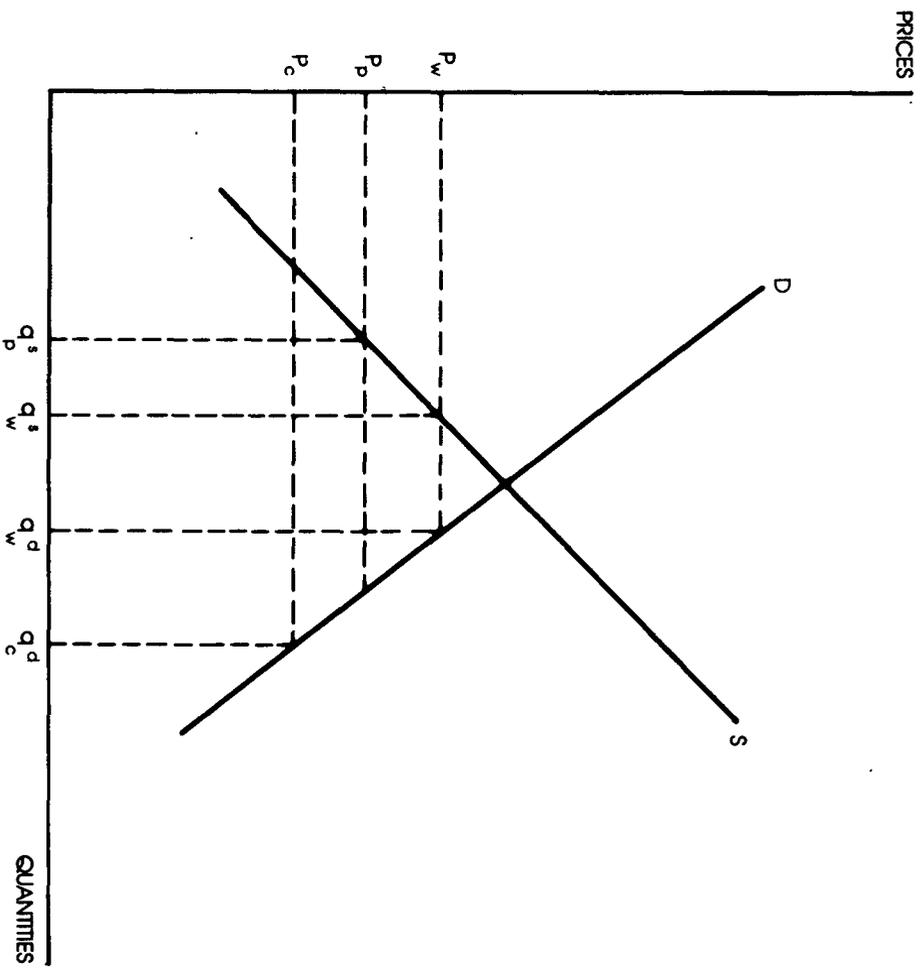


Figure A.6

Welfare Costs of a Food Price Subsidy When $P_w > P_p$



Appendix B

Cost-Benefit Analysis of Alternative Food Distribution Programs

This Appendix estimates cost/benefit ratios for the Moroccan food subsidy scheme, Sri-Lankan food ration scheme and targeted food stamp program. The methodology to estimate consumer and producer surplus is presented in Appendix A, section 4 and uses the distribution weights derived in Appendix D, implicit in a typical income tax schedule to evaluate social prices. Those were the only countries for which it was possible to obtain a decomposition of benefits by income classes. As a comparison, a table is also presented of the benefit/cost ratios for the India export ban on cereals and the procurement-distribution system, using the Scandizo-Knudsen methodology, that does not require knowledge of the distribution of actual benefits and costs.

Table 2

Morocco - Distribution of Food subsidies by Expenditure Class
(Total Transfer by Class: Million of DH by Year, 1981)

	<u>-520</u>	<u>520-753</u>	<u>753-933</u>	<u>933-1132</u>	<u>1132-1317</u>	<u>1317-1524</u>	<u>1524-1779</u>	<u>1779-2100</u>
							Urban sector	
Distrib. weights	18.52	8.12	4.66	3.38	2.53	2.01	1.62	1.28
Flour	2.46	10.39	18.98	24.69	24.22	20.40	20.48	19.84
Bread	0.37	1.23	2.22	2.32	1.94	1.41	1.75	1.25
Pasta	0.06	0.12	0.32	0.35	0.36	0.48	0.54	0.51
Sugar	1.76	6.03	12.57	16.77	19.28	16.46	15.19	17.04
Butter	0.12	0.76	1.63	1.80	2.57	2.56	2.68	3.05
Edible oils	0.25	1.64	4.46	4.87	5.53	4.84	5.21	4.83
Total	5.02	20.17	40.18	50.80	53.90	46.15	45.85	46.52
							Rural sector	
Distrib. weights	9.20	4.03	2.31	1.68	1.26	1.00	0.80	0.64
Flour	0.61	2.60	4.75	6.17	6.05	5.10	5.12	4.96
Bread	0.08	0.17	0.17	0.33	0.23	0.18	0.25	0.15
Pasta	0.03	0.09	0.16	0.26	0.26	0.20	0.26	0.25
Sugar	8.75	23.63	35.53	45.26	38.74	38.23	40.74	32.90
Butter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Edible oils	1.77	4.91	7.82	9.44	7.92	7.20	7.71	7.55
Total	11.24	31.40	48.43	61.46	53.20	50.91	54.08	45.81
Total of Urban and Rural	16.26	51.57	88.61	112.26	107.10	97.06	99.93	92.33

- 62 -

Table 2

page 2

Morocco - Distribution of Food subsidies by Expenditure Class
(Total Transfer by Class: Million of DH by Year, 1981)

	<u>2100-2291</u>	<u>2291-2532</u>	<u>2532-2485</u>	<u>2845-3300</u>	<u>3300-3988</u>	<u>3988-4804</u>	<u>4804-6517</u>	<u>517-+</u>
strib. weights	1.00	0.88	0.75	0.63	0.51	0.38	0.29	0.11
Flour	18.11	20.01	14.06	15.38	11.28	8.20	31.30	85.90
Bread	0.74	1.07	1.24	0.79	1.27	0.79	2.35	19.31
Pasta	0.50	0.50	0.50	0.40	0.38	0.20	0.68	4.00
Sugar	14.47	12.75	15.24	14.49	14.11	8.59	23.34	176.71
Butter	2.04	2.67	3.37	2.93	2.91	1.66	6.24	40.89
Edible Oils	4.66	4.53	5.75	4.93	5.18	2.91	10.13	73.94
Total	40.52	41.53	40.16	38.92	35.13	22.35	74.04	400.75
strib.weights	0.50	0.44	0.38	0.31	0.25	0.19	0.14	0.05
Flour	4.53	2.63	3.51	3.85	2.82	2.05	7.82	21.48
Bread	0.10	0.11	0.14	0.09	0.18	0.05	0.38	1.30
Pasta	0.09	0.20	0.22	0.18	0.11	0.09	0.16	0.30
Sugar	33.41	30.47	26.16	19.70	15.78	11.72	36.07	75.32
Butter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80
Edible Oils	6.53	5.50	5.18	4.11	3.39	2.26	7.59	14.06
Total	44.66	38.91	35.21	27.93	22.28	16.17	52.02	113.26
Total of Urban and Rural	85.18	80.44	75.37	66.85	57.41	38.52	126.06	514.01

Table 3

Morocco: Consumer and Producer Surplus of Food Policies

	Price differential DH/ton	Quantity consumed or produced thous.of tons	Total subsidy million DH	Price demand elasticities	Price supply elasticities	Estimates million DH	Social shadow price	Social estimates million DH
<u>Benefits</u>								
<u>1. Consumer surplus</u>							<u>Consumer Surplus</u>	
Wheat	526	1734	912	-0.33		799	1.443 ⁽⁵⁾	1.153
Sugar	1149	617	709	-0.30		627	1.047	656
Butter	9950	18.6	185	-1.20		247	0.758	187
Edible oils	1368	199	272	-0.30		164	0.812	133
Total			2078			1837		2.129
<u>2. Producer surplus</u>							<u>Producer Surplus</u>	
Wheat	-369	840 ⁽¹⁾	-310		0.20	-284	1.3 ⁽⁶⁾	-369
Sugar	2118 ⁽²⁾	370	784		0.60	637	0.8	509
Butter	-9950	6 ⁽³⁾	-60		0.80	-47	0.8	-37
Edible oils	-2423	100 ⁽⁴⁾	-242		0.85	-186	1.0	-186
Total			172			120		-83
Total Benefits								2.046
<u>Costs</u>								
<u>3. Consumer subsidy</u>								
Wheat	526	1734	912					
Sugar	1149	617	709					
Butter	9950	18.6	185					
Edible oils	1368	199	272					
Total			2078					
<u>4. Producer subsidy</u>								
Wheat	-	-	-					
Sugar	2118	370	784					
Butter	-	-	-					
Edible oils	-	-	-					
Total			784					
Total Costs			2862					
<u>Benefit/cost ratio</u>			0.715					

- (1) Assuming that about one half of the production could be domestically substituted by increasing production of soft wheat or substituting by durum wheat.
- (2) Assuming that the cost of production in Morocco is double the world price.
- (3) Assuming that one third could be efficiently produced at home.
- (4) Assuming that half of the imports can be substituted.
- (5) Based on the distribution weights of Table 2.
- (6) Weights based on an assessment of the relative impact on poor or richer farmers.

Table 4

1970 Prices

Sri Lanka: Distribution of Food Ration and Food Coupons by Income Groups (million Re/year)

Household income:	<u>0-1200</u>	<u>1200-1800</u>	<u>1800-2388</u>	<u>2388-4788</u>	<u>4788-7188</u>	<u>7188-9588</u>	<u>9588-11988</u>	<u>11988-+</u>	Shadow Price
Ration System (1969-70)									
Rice ration	32.7	78.7	95.5	228.6	79.3	28.0	10.6	11.8	
Minus: sugar and flour tax	7.8	19.6	23.8	63.7	25.9	9.4	4.3	5.7	
Distribution weights	29.6	7.97	4.34	2.84	1.00	0.54	0.35	0.24	4.323
Food Stamps System (1980)									
(Rs/year)	<u>0-289</u>	<u>289-578</u>	<u>579-866</u>	<u>867-1,155</u>	<u>1,155-+</u>				
Value of food stamps (average per household)	187.8	257.1	291.8	268.7	176.2				
Total value of food stamps	48.6	170.8	162.4	15.6	2.8				
Distribution weights	117.1	67.4	23.8	12.98	8.44	53.2			

Table 5

Sri-Lanka: Cost-Benefit Analysis of Ration and Food Stamp Programs

	Price differential Rs/ton	Quantity consumed thous.tons	Total subsidy Million Rs	Price demand elasticities	Price supply elasticities	Estimates million Rs	Social shadow price	Social Estimates
A. <u>Ration Program (1970)</u>								
<u>Benefits</u>								
1. <u>Consumer surplus</u>								
Rice ration	1,320.0	580	766	-0.30		677	4.323	2,928
Minus: sugar tax	-	-	221	-0.30		196	1.0	196
TOTAL			545					2,732
2. <u>Producer surplus</u>								
Rice procurement	-352.0	369	130		0.20	-119	1.5	-179
Total benefits								2,553
<u>Costs¹</u>								
1. Consumer subsidy								598
2. Producer subsidy								-22
Total Costs								576
Benefit/cost Ratio								4.432
B. <u>Food Stamp Program (1980)</u>								
<u>Benefits</u>								
1. <u>Consumer surplus</u>			1595			1411	53.2	75,063
2. <u>Producer surplus</u>								-
<u>Costs</u>								
Food stamps								1,595
Administrative Costs (10% estimate)								160
Total costs								1,755
Benefit/cost ratio								42.771

Table 6

INDIA: Benefits and Costs of Intervention
(in million of US\$)

	Export Ban	Food Distribution System	Total
<hr/>			
Benefits			
Consumer surplus gain	2,828	9,200	12,028
Social gains	<u>1,126</u>	<u>963</u>	<u>2,089</u>
Total	3,954	10,163	14,117
Costs			
Producers' surplus loss	2,884	8,582	11,466
Government costs			
Imports valued at world prices	-0-	1,385	1,385
Net Benefits	1,070	196	1,266
Benefit/Cost Ratio	1.37	1.02	1.10
Net Private Benefits	-56	-767	-823
Private Benefit/Cost Ratio	0.98	0.92	0.94

Source: P. Scandizzo and G. Swamy., (1982)

Appendix C

An Optimizing Model for a Food Distribution Program

Two basic questions should be addressed: what is the optimal basket of supplementary food to be delivered to the nutritionally deficient populations, given a social welfare function and an overall state budget constraint as well as standards nutrition requirements and assuming that the consumer minimizes costs and is subject to certain types of habits? As a dual response we should be able to compute the optimal subsidies to be given to those commodities. the second question is from the producer side in what is the optimal basket, since given "world prices", the increase in demand for domestically supplied good will increase incomes, while if the good is imported, it most certainly will decrease producer surplus. Since incomes enter the problem of the consumer we have a general equilibrium framework to model.

C.1 Problem for the Individual Consumer

The problem for the individual consumer, h, is to minimize the cost of the diet, $P(s + z)$, where s are the food supplements and z the pre-subsidy basket of goods consumer by the individual:

$$\begin{aligned} \min \quad & P(s_h + z_h) = P s_h + P z_h \\ \text{s.t.} \quad & B.(s_h + z_h) \geq \underline{n} \\ & U(\bar{p}, M_h) \geq \underline{U}(\bar{p}, \underline{M}_h) \\ & M_h = w^{ns} l^{ns} + w^s l^s \\ & s_h, z_h \geq 0 \end{aligned}$$

where B is the "technological matrix" of goods-nutrients, \underline{n} is the minimum nutrient requirements and U is the indirect utility function that reflects "tastes" in the space of nutrients. Income is obtained only from the supply of non-skilled and skilled labor, demanded by firms.

C.2 Problem for the Individual Producer

For traded goods, we make the small country assumption where the prices are fixed in the international market (possibly augmented by the tariff or the equivalent of a quantitative restriction). Then, given output, p_w , and input prices w , profit maximization subject to the technology can be formulated as follows (for the firm f that produces good i):

$$\begin{aligned} \max (P_w + r_i) y_f^i - w^s l_f^s - w^{ns} l_f^{ns} \\ \text{s.t. } f(y_f^i, l_f^s, l_f^{ns}) \geq 0 \\ y_f^i, l_f^s, l_f^{ns} \geq 0 \end{aligned}$$

where r_i is the producer subsidy to good i , l^s is skilled labor and l^{ns} is non-skilled labor.

Given the amount produced and an exogenous estimate of exports, then imports can be estimated

$$m_i = d_i + e_i - \sum_f Y_f^i (\bar{P}_w, r_i, w^s, w^{ns})$$

where d_i is the total amount consumed by each household i :

$$d_i = \sum_h s_h^i + z_h^i$$

For nontraded goods, we assume that prices are given and consumer and producer subsidies, Θ_i and r_i , are adjusted to balance total demand and total supply for each market:

$$d_i (P_i - \Theta_i) = \sum y_f^i (P_i + r_i)$$

Since consumer subsidy, Θ_i , is given by the solution of the dual problem to the consumer, this equation determines r_i , once the supply equation y^i is known.

C.3 Problem for the government

The problem for the government is to maximize a social welfare function Ψ , given the distribution of income, F , subject to a budget constraint, B :

$$\begin{aligned} \max \quad & \int_w^\infty \Psi [U (s_h)] dF \\ \text{s.t.} \quad & \sum_i \sum_h \Theta_h^i s_h^i + \sum_i \sum_f r^i y_f^i \leq B \end{aligned}$$

The problem can be simplified if we assume only a small number of household groups and characterize the household's utility by the income transfer given to each group.

Appendix D

Deriving distribution weights from an income tax schedule

In the analysis of benefits derived from income transfer policies or equivalent welfare programs, we are in the realm of income distribution problems. Harberger has underlined the importance of distribution weights for such kind of analysis, and despite the reference to its use in current project evaluation manuals (Little and Mirrless), Squire, van der Tak, and UNIDO not too much attention has been devoted to its derivation. This note proposes a method to deduct such weights assuming that governments choose an income tax schedule from an underlying optimization model à la Mirrless. This "revealed preference approach" pervades most of the modern consumer demand theory, so to assume that the Fiscal Authority follows some rational approach^{1/} is only a natural way to deduct the implicit parameters of the social welfare function.

The formulation of the optimal income tax problem follows that of Mirrless. Let us assume that the population is characterized by its earning ability, w . Thus, a person of type w chooses the amount of labor to

^{1/} The problems of paradox in social choice have been demonstrated not to be very severe, since single-peakedness or other similar restrictions will likely hold in this case.

maximize utility, $U(\cdot)$, derived from income net of taxes, $Y(w)$, and Labor (L). The gross income is $Z = w \cdot L(w)$. We assume a general tax rule, $T(Z)$, differentiable, and such that $T' < 1$. The problem of each individual consumer, (type w) is thus:

$$\begin{aligned} \max U [Y(w), L(w)] &= \\ = U [Z - T(Z), L(w)] &= \\ = U [w \cdot L(w) - T(w \cdot L(w)), L(w)] \end{aligned}$$

and there is a value w_0 (minimum wage) for which $L(w) > 0$.

The government chooses the income tax schedule, $T(Z)$, to maximize the social welfare function:

$$\int_{\underline{w}}^{\infty} \Psi(U) dF$$

where Ψ is the social welfare function, w is the minimum ability level and F is the distribution function of abilities across the population. The government is subject to the production constraint of the economy:

$$\int_{\underline{w}}^{\infty} Y dF + R_0 = \int_{w_0}^{\infty} w \cdot L dF$$

where R_0 is the government revenue requirement.

Using optimal control theory the following optimal income schedule can be arrived at:

$$\frac{T'}{1 - T'} = U_{Y(w)} \left[\int_{\underline{w}}^{\infty} \left(\frac{1}{U_y} - \frac{\Psi'}{\lambda} \right) dF \right] \left(\frac{\epsilon}{w f} \right)^*$$

under the assumption that U_L is independent of Y , where λ is the multiplier associated with the production constraint and that measures the social marginal cost of public revenue (1), ϵ^* a measure of the elasticity of labor supply, and f is the density function associated with F .

Following the tradition, the social welfare function is taken from the isoelastic form:

$$\Psi = \frac{U^{1-\nu}}{1-\nu} \quad \text{for } \nu \neq 1 \text{ and}$$

$$= \log_e U \quad \text{for } \nu = 1$$

and the individual utility function of a constant elasticity form:

$$U = \left[\zeta^{1-\rho} Y + (1-\zeta)^{1-\rho} (1-L)^\rho \right]^{\frac{1}{\rho}} \quad \text{for } \rho \leq 1$$

where the elasticity of substitution $\zeta = 1/(1-\rho)$.

The distribution of earnings abilities, $F(w)$, is assumed to be equal to income distribution, and of the Pareto type:

$$F(w) = \left[\frac{w}{\bar{w}} \right]^{-\eta}$$

which is linked to the Gini coefficient (G) by the expression

$$\eta = (1 + G/2G).$$

Using the T' "revealed" in the country income tax schedule, the distribution parameter for the social welfare function can be estimated.

(1) See Mirrlees for the computation of λ based on a plausible distribution of consumption and labor.

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