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Notes and explanation of symbols

The following symbols are used in tables in the *Review:*
Three dots (...) indicate that data are not available or are not separately reported.
A dash (—) indicates that the amount is nil or negligible.
A blank space in a table means that the item in question is not applicable.
A minus sign (-) indicates a deficit or decrease, unless otherwise specified.
A point (.) is used to indicate decimals.
A slash (/) indicates a crop year or fiscal year, e.g., 1970/1971.
Use of a hyphen (-) between years, e.g., 1971-1973, indicates reference to the complete number of calendar years involved, including the beginning and end years.
Reference to "tons" mean metric tons, and to "dollars", United States dollars, unless otherwise stated.
Unless otherwise stated, references to annual rates of growth or variation signify compound annual rates.
Individual figures and percentages in tables do not necessarily add up to corresponding totals, because of rounding.

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Food security: trends and impact of the crisis

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The world food market has lost the noteworthy stability that characterized it in the 1950s and 1960s. The "shortage crisis" of the 1972-1974 period was followed by an "oversupply crisis", with strongly destabilizing effects on international prices. The first crisis aroused an intense interest in seeking formulas to cover the gap between effective domestic demand and domestic supply, so as to stabilize consumption. The transition to a market of abundant supply with falling prices relegated to second position the subject of food security, understood in traditional terms, and shifted priority to measures aimed at tackling the persistence of under-consumption and malnutrition in vast sectors of the population, even in countries with a sufficient aggregate supply.

As a result of the crisis affecting the countries of the region today and the recessive nature of the adjustment policies imposed, problems of both national availability and individual access must now be considered as constituent factors of food insecurity. Along with proposing a concept of food security that includes both types of problems, this article seeks to evaluate, in the light of a series of indicators, the degree of sufficiency, stability, autonomy, sustainability and equity that has characterized food systems in recent decades and during the crisis itself.

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Introduction

The spectacular increases in agricultural prices and the decline in the reserves/consumption ratio to unheard-of levels caused the 1972-1974 period to be labelled a "shortage crisis", and food security took over the top rank among international concerns. Given the type of phenomena that lie at the root of such concerns, food security was seen as being equivalent to the capacity of deficit countries to attain stable levels of domestic supply that were not significantly lower than the trend levels of effective demand (Valdés, 1981, p. 1).

In less than a decade, however, the world food market went from a shortage crisis to an oversupply crisis,[1] with a consequent replenishment of stocks and a drop in the real prices of the main tradeable foods. Thus, the problem lost the pre-eminent importance which it had had in international forums since the mid-1970s. At the same time, however, a healthy reconsideration of what should be understood by food security has taken place. There is now an awareness that aggregate supply, however generous and stable it may be, is not enough to assure *universal access* to basic foods to a population which lacks the purchasing power to buy them, and that this is one of the chief manifestations of food insecurity in most of the countries of the region.

The emphasis placed on the question of access does not imply that the problems of aggregate supply that emerged at the beginning of the 1970s have been surmounted, nor that the world food market has recovered the stability that it exhibited traditionally until the outbreak of the "shortage crisis". On the contrary, despite the decline in international prices the world market for the principal grains has become very volatile or, if preferred, extremely sensitive to small variations in supply. Moreover, the countries of the region have witnessed an increase in their degree of dependence and a serious deterioration in their import capacity, as a consequence of the size of their foreign debt servicing burden. The incorporation of problems of individual

[1] On the main causes for this change, see ECLAC (1988), pp. 20-32, and G. Miller (1986).

access and aggregate availability into more recent definitions of food security is therefore fully justified.

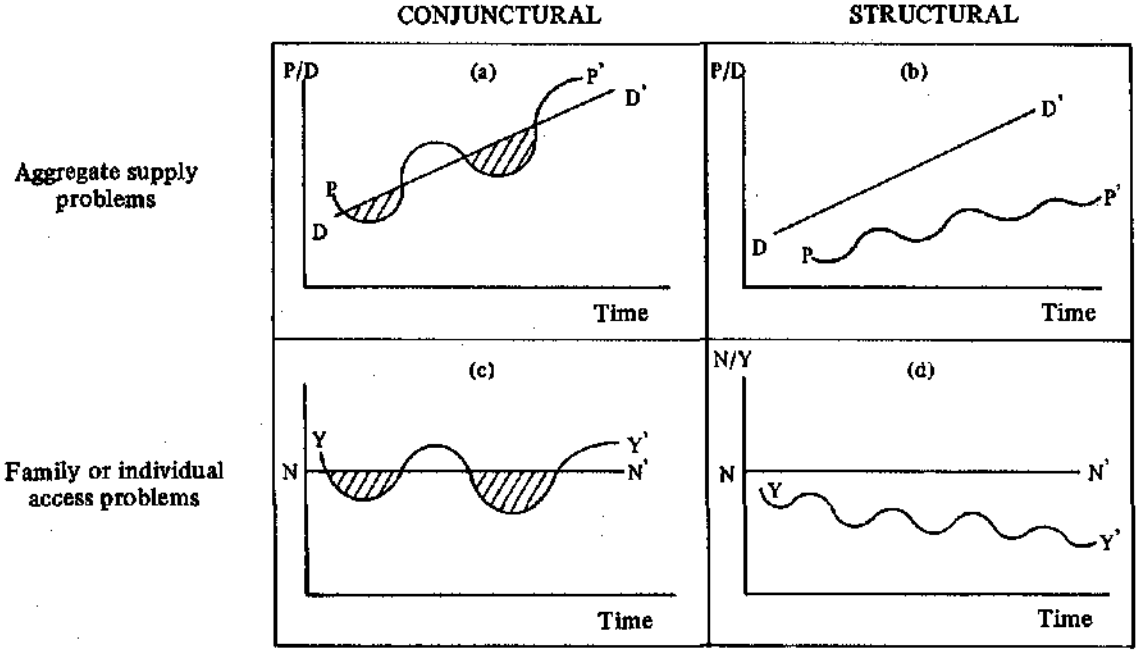
For analytical purposes, it would be convenient to distinguish four substantive ways in which the food security problem is manifested, two related to aggregate availability and two to food access: i) conjunctural maladjustments of aggregate availability, which refer to the presence of cyclical gaps between the levels of food production and demand; ii) structural imbalances of aggregate availability, which refer to the presence of persistent and increasingly frequent gaps between production and demand; iii) cyclical or seasonal problems of access, which refer to occasional difficulties, regular or not, encountered by given families in meeting their basic nutritional requirements, and iv) structural restrictions on access, which refer to the presence of a systematic gap between nutritional needs and the income available for food consumption in given social sectors (figure 1).

Although these problems can exhibit varying degrees of interdependence in each national situation, they are strictly speaking determined by distinct specific factors, so their solution demands the adoption of very different types of measures.

An examination of the problems affecting aggregate supply (national and/or regional and/or local) must take account of the following variables: i) the *degree of sufficiency* with which the supply meets predetermined levels of demand; ii) *seasonal factors* of domestic supply and of its main components; iii) the *autonomy* (or in contrast the external dependence) of food systems, and iv) the *sustainability* of the current patterns of supply and demand in the long run.

Figure 1

TYPES OF FOOD SECURITY PROBLEMS



DD' : Effective demand
PP' : Production
NN' : Food needs
YY' : Income available for food purchases

An analysis of the problems of family food access —which are linked to the *equity* of the food systems— involves an evaluation of the degree to which the distribution of food "entitlements" leads to malnutrition and/underconsumption.[2]

I

Food security trends

In the following pages, an attempt is made to evaluate what has been happening in the field of food security since the early 1960s. The first stage covers the trends observed in the preceding decades and the second, what has been happening since 1980. Thus, an attempt is made to distinguish between structural trends of food systems and trends attributable to the current crisis.

1. *Levels of sufficiency*

The type of food system that can be considered sufficient is one that, through domestic production and net imports, generates an aggregate supply capable of covering not only the existing effective demand but also the basic food needs of the low income strata which are not manifested on the market. This must be achieved without affecting long-term sustainability, desirable degrees of autonomy, or the minimum conditions of equity of access.

The greater the prevailing inequality in income distribution, the greater the requirements that must be met in order to reach the level of sufficiency, *ceteris paribus*. Every time a segment of the population falls below the normative level adopted —whatever it may be—, the overall availability must be correspondingly higher than the average intake in order to ensure general satisfaction of calorie requirements.

A simple way of evaluating the levels of sufficiency consists of comparing the per capita supply of food energy available for human consumption (FES) —which assumes that it is taken to be representative of effective demand— with some estimate of requirements.

For the estimates presented here, the figures on availability (FES, measured in Kcal/per capita/day) published by FAO in its Food Balance Sheets have been used;[3] while for normative requirements, those established by the ECLAC Statistical Division in order to update estimates of poverty lines have been adopted.[4] In short, what we have called the base norm (BN) stipulates the calorie level required by a person whose weight, height and activity are representative of the population as a whole.

With this information, and for comparative purposes, we put together the following levels or degrees of sufficiency and/or insufficiency.

i) critical insufficiency: FES $<$ 0.95 BN
ii) insufficiency: 0.95 BN $<$ FES $<$ 1.0 BN
iii) precarious sufficiency: 1.00 BN $<$ FES $<$ 1.1 BN
iv) full sufficiency: FES $>$ 1.1 BN

The application of these criteria to the FES average during the 1960-1980 period leads to the conclusion that half of the 20 Latin American countries considered in our analysis showed levels of full sufficiency, while 20% were in a critical state (table 1). Among the first group of countries are Brazil, Argentina and Mexico, the largest countries in the region. At the other

[2]Sen (1982) presents an interesting conceptualization of the subject of the nature and sources of food entitlements.

[3]In these sheets it is assumed, with respect to almost all foods, that food energy supply for human consumption (FES) = Domestic production + Imports - Losses + Changes in stocks - Industrial use - Animal feed - Exports. Three-year averages of the variables indicated, expressed in Kcal/per capita/day, are presented.

[4]The following items were used for this purpose: the new recommendations on energy requirements prepared by a Joint FAO/WHO/UNU expert consultation (1985); the most recent census and occupational data (for determining requirements according to sex, age and type of activity), distinguishing between urban and rural areas, and, finally, income distribution and the composition of expenditure, with the aim of incorporating the consumption patterns of the lower-income population (see ECLAC, 1988).

Table 1

LATIN AMERICA AND THE CARIBBEAN: LEVEL AND TREND OF FOOD SUPPLIES, 1960-1980

Availability	Levels of sufficiency			
	Critical insufficiency	Insufficiency	Precarious sufficiency	Full sufficiency
Growing	Ecuador Bolivia	Dominican Republic	Venezuela Colombia	Trinidad and Tobago Cuba Jamaica Mexico Costa Rica Paraguay
Growing moderately	Guatemala	Honduras		Brazil
Constant			Panama	Chile Argentina
Decreasing	Haiti	Peru		Uruguay

Source: ECLAC/FAO Joint Agriculture Division.

extreme are Ecuador, Bolivia, Guatemala and Haiti. On the other hand, in the course of the period the degrees of sufficiency registered advances in the majority of the cases. Only in Haiti, Peru and Uruguay did this ratio deteriorate, while the stagnation experienced by Panama and Chile continued.

2. *Stability*

The concept of stability refers to the intensity of the fluctuations to which aggregate availability is subject over time. It was estimated by measuring the deviations of apparent consumption (production plus imports minus exports) with respect to the trend values in the 1970-1980 period, without taking account of the degree of sufficiency or insufficiency.[5]

As an indicator of the degree of stability/instability, the coefficient of variability of apparent consumption was used, expressed in terms of the standard deviation of the percentage differences with respect to the trend.[6] An identical procedure was followed with the variability of production, since in most countries this is the main component in consumption and shows, by comparison of coefficients, whether imports have performed the stabilizing role assigned them or not.

In order to visualize more directly the degree of instability, the coefficients were expressed in terms of probabilities (P) that the consumption or production in a given year would be less than 95% of the trend value. For operational purposes, the following categories were established:

i) stable	$P < 15\%$
ii) moderately unstable	$15\% < P < 25\%$
iii) unstable	$25\% < P < 33\%$
iv) critically unstable	$P > 33\%$

During the 1970s, that is to say, in the pre-crisis period, less than one-third of the countries attained reasonable levels of stability in basic food production (cereals, pulses and tubers), while the percentage rose to over 40% when considering the consumption of those goods

[5]Variations in stocks were not considered, since they do not appear in the sources employed for the other variables (FAO, *Production Yearbooks*). Although there are alternative sources for estimating this variable, it was decided not to use them for the sake of homogeneity and consistency. It is probable that this results in an overestimation of instability.

[6]This methodology corresponds to that suggested by Huddleston and others (1978) and Valdés (1981) (see the Methodological Appendix).

(table 2). In most cases, the consumption coefficients were lower than production coefficients. The high percentage of domestic demand that is met by imports in countries like Venezuela, Cuba, Jamaica and Panama helps to partially isolate consumption from the instability that major fluctuations in domestic production would otherwise cause. This situation contrasts with that observed during the period in question in Nicaragua and Mexico.

Table 2

LATIN AMERICA AND THE CARIBBEAN: LEVEL OF STABILITY IN THE THE PRODUCTION AND CONSUMPTION OF BASIC FOODS, 1970-1980

	Probability, less than 95% of the trend	
	Production	Consumption
Stable 0%-15%	Colombia Nicaragua Brazil	Colombia Brazil
Slightly unstable 15%-25%	Bolivia Suriname Mexico Peru Honduras	Panama Venezuela Cuba Trinidad and Tobago Honduras Bolivia Jamaica Peru
Unstable 25%-33%	El Salvador Costa Rica Venezuela Argentina Haiti Cuba Trinidad and Tobago	Mexico El Salvador Costa Rica Haiti Suriname Nicaragua
Critically unstable 33% or more	Guyana Uruguay Guatemala Dominican Republic Ecuador Paraguay Chile Jamaica Panama	Guyana Uruguay Argentina Dominican Republic Guatemala Ecuador Chile Paraguay

Source: ECLAC/FAO Joint Agriculture Division.

It is possible that the great variability observed in the production of basic crops is due to the fact that these goods are important elements in the "popular basket". The rigorous controls often imposed on their prices motivate those who produce them to change lines of activity as soon as they have more profitable alternatives. The fluctuations in wheat production in Chile, the shifts between grains and meat in Argentina and the sorghum/maize ratio in Mexico are illustrative of this type of phenomenon.

In several countries of the region, a significant portion of the supply of these products is generated by peasant agriculture, which is concentrated in non-irrigated land and is therefore exposed to rainfall variations which could very well be another source of variability. However, those countries in which peasant agriculture has the greatest weight are not necessarily those with the most acute levels of variability.[7]

In so far as instability in domestic supply can be checked by imports, a negative correlation between production and imports may be expected, as well as a relative inelasticity of the latter to price changes. The first of these phenomena was manifested clearly in only a few of the 24 countries considered in our analysis,[8] while in 11 of them some degree of inelasticity in the demand for imports was detected.

The lack of a (negative) correlation between production and imports and the relative insensitivity of import demand to price changes seem to explain why the differences between production instability and consumption instability are not substantial.[9]

[7] In the case of Mexico, which has a high level of instability, maize is the only cereal produced basically by peasants, while wheat and rice are markedly entrepreneurial crops. See ECLAC (1982), pp. 84 and 85.

[8] In the majority of the cases, the regressions were not statistically significant, while in many of them they were positive. Similar results were obtained by Valdés (1981), p. 33.

[9] Valdés (1981, p. 37) felt that in the 1961-1976 period fluctuations in volume had a significantly greater weight than those of prices in explaining the variations in spending on imports in five of the six countries considered, namely Brazil, Chile, Colombia, Guatemala and Mexico, with Peru being the exception. Although the relative position of the countries is the same as in our study, the values for the 1961-1976 period are higher than those of 1970-1980. This difference is attributable to greater instability in the international prices in the latter of the two periods, as well as the decline in food aid.

If the countries are grouped by geographical subregion and/or by integration agreements (the Caribbean, Central America, Andean Group, Southern Cone), it can be seen that the coefficients of variability of production for the groupings are considerably lower than those for the individual member countries. This suggests that both trade and the establishment of a common purchasing policy could help to alleviate instability in the products under consideration.

3. *Autonomy*

a) *Preliminary considerations*

A distinctive feature of the insertion of Latin America and the Caribbean in world food trade is its strongly asymmetrical nature. The agricultural exports of the majority of the region's countries are dominated by a small number of traditional items for which world demand shows little dynamism, or is even declining, and which are only marginal components of the "basic baskets" of both exporter and importer countries.[10] For their part, imports appear to be dominated by essential items (cereals, oilseeds, etc.) which come from an ever-smaller number of countries and firms.

The dynamics of food exports and imports show substantial changes between the two decades prior to the crisis. During the 1960s, the course of the values, volumes and prices of exports did not differ markedly from those of imports. In the 1970s, however, imports grew by 16% and exports by 9%; the volume of exports —a manifestation of the effort to win markets— grew slightly more than 1%, while that of imports rose by around 11%. This is the context in which the evolution of levels of food dependence must be examined.

The indicators of autonomy —or of its opposite, external dependence— attempt to measure the degree of external vulnerability of food systems. Frequently, these calculations must be based on the net food balance (exports minus imports) or on estimates on the weight of certain imported products (particularly cereals) in domestic consumption. However, these types of indicators reveal only partially —and in the case of the former, very mistakenly— what is really happening as regards the external vulnerability of food systems.

If what is desired is to measure the vulnerability of the food system as a whole, it would be necessary to include the inputs and means of production necessary for both agriculture and the food industry and also, to some extent, for commercial activities.

Examination of the trend in the weight of food system imports with respect to total overseas sales shows a very heterogeneous range of situations (table 3). There are cases in which the food and agriculture sector does not absorb more than 10% to 15% of export income, but there are other countries where that coefficient has exceeded 30% for several years. The relative weight of these imports reaches its maximum point in the middle of the decade under study, probably because of the rise in international grain prices.[11]

b) *Dependence on cereal imports*

With the exception of countries that are net exporters of wheat, the levels of dependence on cereal imports during the 1970s were quite high, since imports exceeded 10% of apparent consumption, in some cases by a considerable margin (table 4). If a level of dependence ranging between 10% and 20% of consumption is arbitrarily defined as average, around 30% of the countries fall into this category; another one-fifth exhibit a high level of dependence, with imports between 20% and 30% of consumption, and the rest (half of the cases, and especially the Caribbean nations) show a critical level of dependence.

If, moreover, we consider the trend followed by the import/consumption ratio during this period (i.e., the annual rate of growth of this quotient), it is possible to distinguish: i) a group made up of the Caribbean countries, which systematically import nearly all the cereals they consume; ii) a group formed by Chile, Peru and the Dominican Republic, with a high and growing

[10]Someone once said, not without some justification, that these exports merely supplied desserts for the industrialized nations.

[11]Until the mid-1970s, six items in the areas of cereals, dairy products and oilseeds accounted for 90% of imports —a coefficient that dropped to 56% in the 1980-1982 period.

Table 3

LATIN AMERICA: IMPORTS OF INPUTS AND MEANS OF PRODUCTION FOR THE FOOD AND AGRICULTURE SECTOR[a]

(Percentages)

	1970	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Argentina	8.3	9.7	8.5	7.6	9.9	5.9	6.2	5.4	8.2	11.3	7.7	5.2
Brazil	17.9	18.8	18.1	25.5	19.3	16.7	12.7	17.0	19.9	16.9	11.6	10.7
Colombia	16.0	13.5	17.5	22.7	15.8	14.8	14.2	14.2	12.9	17.6	22.1	24.6
Costa Rica	22.6	22.9	22.8	31.9	33.9	21.7	18.8	19.4	19.7	22.7	17.3	16.7
Chile	17.5	40.2	30.6	32.9	24.1	22.4	16.3	22.0	17.3	20.7	24.6	16.2
Ecuador	14.9	11.2	10.7	10.0	17.3	11.6	10.6	13.0	9.6	11.2	10.3	13.5
El Salvador	28.2	17.9	19.9	24.2	28.4	17.4	16.6	18.2	18.8	20.0	31.7	28.6
Guatemala	15.9	16.0	14.7	17.5	22.4	13.2	12.0	17.5	18.2	15.7	21.6	16.4
Honduras	23.2	17.6	19.0	21.4	28.2	20.3	19.6	21.3	33.3	23.7	25.8	17.2
Mexico	23.4	21.9	31.5	42.5	44.0	25.7	25.8	23.4	20.0	23.3	20.3	10.8
Nicaragua	16.3	16.3	23.1	21.7	22.4	13.5	17.6	17.4	10.3	47.6	41.9	35.8
Peru	13.9	20.5	25.1	20.3	37.7	26.6	20.9	17.6	11.2	18.5	30.5	22.1
Venezuela	7.9	7.9	7.2	5.5	10.2	10.4	16.8	17.4	10.4	10.4	13.2	12.2
Total	**14.5**	**16.1**	**16.2**	**18.1**	**19.4**	**15.1**	**14.9**	**16.5**	**15.0**	**16.5**	**15.6**	**12.2**

Source: "Cuadernos de la CEPAL" Series, No. 11, and FAO *Foreign Trade Yearbook.*

[a] Includes imports of food, means of production for agriculture (fertilizers, agricultural machinery and pesticides) and machines for the food industry.

Table 4

LATIN AMERICA AND THE CARIBBEAN: LEVEL AND TREND OF THE IMPORTED SEGMENT OF CEREAL CONSUMPTION, 1970-1980

Trend	Average level of imports			
	Low	Medium	High	Critical
Growing		Mexico Brazil Honduras	Haiti Ecuador	Dominican Republic Chile
Constant		El Salvador Colombia Guatemala	Nicaragua Bolivia	Cuba Barbados Venezuela Trinidad and Tobago Jamaica
Decreasing	Argentina	Paraguay	Panama Guyana	Costa Rica

Source: ECLAC/FAO Joint Agriculture Division.

level of dependence; iii) a small group where there is a downward trend, and iv) a large majority of the countries, where the level of dependence is in the medium range and rising.

c) *Calorie dependence*

An assessment along the same lines as the above, but referring this time to the imported content of energy supply (imported calories over calories consumed), provides very similar results in terms of the ranking of the countries. Although the levels of dependence are lower, several countries still display a critical situation. Moreover, there are few countries (among them, two basic grain exporters) which show downward trends in this variable (table 5).

4. *Sustainability*

By "sustainability", we mean the food system's capacity to ensure that the above attributes and equity (to which reference will be made further on) are not achieved in the short run at the cost of depleting renewable and non-renewable natural resources to such an extent as to make the process unsustainable in the long term.

Three major types of losses may be noted by way of illustration: loss of cultivable land, loss of phytogenetic varieties, and loss of energy efficiency of the food systems.

There are no recent and/or broad-ranging estimates on the damage that the processes of erosion, salinization, laterization, and desertification in general have caused to the agricultural potential. Judging by the data from studies on countries and/or regions, however, the loss of cultivable land is very significant. According to this information, in Mexico the land affected by accelerated or absolute erosion represents 51% of the surface area; in Colombia, 31%; in Central America, nearly all the highlands; in Chile, nearly 25% (Dourojeanni, 1980). One-fifth of the territory of Latin America, inhabited by 24 million people, is estimated to be affected by the presence or the imminence of desertification (Gligo, 1981).

Even though considerable new areas of land are also being opened up to cultivation and the potential of the existing land is being substantially increased, through the introduction of irrigation and other practices, the trend suggests that the losses are higher than the gains (Gligo, 1981).

Noteworthy among the processes that have given rise to what is generally known as "genetic erosion" are those that affect grazing lands. This is particularly so in the case of grazing by sheep and goats, which have annihilated the fodder species of greatest palatibility (Gligo, 1981). The penetration of the humid tropics, when carried out in the absence of genetic conservation programmes that safeguard these ecological fragile biosystems, is causing the rapid loss of whole populations of species. In the specific area of food systems, however, the trends which cause most concern are those tending towards accelerated genetic simplification, caused by the development of modern, high-yield seeds which has not been accompanied by equivalent concern for gathering and conserving the rich variety of pre-existing germoplasm (Barkin, 1983). In the case of Latin America, it has been possible to gather and maintain germoplasm reserves at a relatively acceptable level only in the cases of maize and, more recently, potatoes (Harlan, 1975).

Table 5

LATIN AMERICA AND THE CARIBBEAN: LEVEL AND TREND OF IMPORTED SEGMENT OF ENERGY SUPPLY, 1970-1980

Trend	Imported calories as a percentage of total calories consumed			
	Low	Medium	High	Critical
Growing	Mexico	Ecuador Haiti Jamaica	Dominican Republic	
Growing slightly	Colombia Brazil	Honduras	Peru Panama	Venezuela Chile Trinidad and Tobago
Constant	Guatemala		Costa Rica Bolivia	Cuba
Decreasing	Argentina Uruguay Paraguay			

Source: ECLAC/FAO Joint Agriculture Division.

Finally, there is the problem of energy subsidies posed by the fulfilment of a type of food pattern comparable to that of the United States, which is the dominant model in our region. According to estimates by Steinhart (1974), the ratio of commercial energy input per food calorie available on the consumer's table was around 9 to 1. The extension of that pattern to the whole of Latin America would have made it necessary —merely in order to meet food demand— to double the region's total consumption of crude oil (in 1980).[12] Thus, it is evident that generalizing that model is simply not viable.

5. *Equity: distribution of food entitlements*

The concept of equity is, by its very nature, a value concept. Although there may be broad consensus on the universality of the right to given minimum levels of nutrition, the range of the criteria on the "rules" for applying these in society is very wide. Very broadly, they range from the criterion that it is the unrestricted functioning of the market —by people exercising their purchasing power— which should determine each person's access to food, to the view that mechanisms should be established to ensure equal access (in proportion to nutritional needs, and in the light of national supplies), which in general means rationing. Although schemes approaching these two extremes have been attempted in the region, they have been tempered by policies of nutritional intervention and employment subsidies, in the first case, and by the increasing opening-up of spaces for market-influenced access and material stimuli that permit some degree of differentiation, in the second.

With the aim of defining a criterion for equity, let us assume, as a least common denominator, the consensual idea that malnutrition and/or under-consumption are clear expressions of inequality in the distribution of food entitlements. The magnitude of these phenomena can thus be considered an adequate indicator of the degree of equity of the region's food systems.

In order to estimate the percentage of the population affected, a level equivalent to 1.4 times the basal metabolic rate (BMR) was used as the threshold or "malnutrition line". The BMR corresponds to the energy expenditure of a person with an empty stomach at complete rest in a temperate environment. The experts of the FAO/WHO/UNU joint consultation felt that, until more precise data were available, the above-mentioned coefficient was a useful guide for estimating the extent of malnutrition. In turn, to define under-consumption, the so-called "base norm" (BN) used previously for calculating sufficiency has been used as a threshold or "under-consumption line".

It should be borne in mind that estimating the levels of malnutrition and under-consumption on the basis of national aggregate information necessarily leads, regardless of the source used, to very gross approximations as to the dimensions of the phenomenon, even in cases where studies are available on the structure and composition of food expenditure.[13]

It should also be borne in mind that —regardless of the undeniable conceptual advances achieved between the meeting of the FAO/WHO Special Joint Expert Committee on Energy and Protein Needs, in 1971, and the FAO/WHO/UNU joint consultation held 10 years later— even the determination of the minimum nutritional requirements is subject to a number of qualifications. An inadequate intake does not necessarily lead to malnutrition, since it can be circumvented by biological adaptation or changes in behaviour (reduction in the level of activity). These are the limitations that must be incorporated into the analysis when attempting to evaluate the levels of malnutrition and under-consumption on the basis of indirect information.

[12]Even the most moderate estimates made by Pimentel and others (1973) indicate that the amount of the energy subsidy required by the United States food consumption pattern would lead, in a period of 12 years, to the total depletion of the oil reserves. Implicitly, Pimentel assumes 1 246.8 kg/inhabitant/year of crude oil equivalent in the food system of the United States around 1975. In 1980, total world oil consumption was 643 kg/inhabitant/year (United Nations, 1982).

[13]As the manifestations of malnutrition are clinical, their measurement would call for sample studies, based on specific indicators, with respect to significant deviations of anthropometric parameters that could reflect this situation.

Taking account of the criteria and exceptions mentioned, and using the methodology proposed in the Fifth World Food Survey (FAO, 1987), which allows the distribution of calorie intake to be deduced from income distribution and other complementary parameters (see the Methodological Annex), the incidence of malnutrition and under-consumption in countries for which more or less recent data are available has been estimated.

Of the ten countries considered, only four show malnutrition indexes that (above all in the case of Argentina) could be remedied in the short run with conventional measures. In the others, the relative weight of malnutrition and under-consumption borders on or exceeds 25% (in many cases by a substantial margin),[14] which indicates that in order to address the food issue effectively, it would be necessary to reconsider more fully the place that it occupies in the design or basic conception of the development strategy (table 6).

The under-consumption indexes, for their part, show extremely high levels. Argentina is an exception, since it exhibits a high average level of calorie intake, but even so almost 18% of its population lies below the base norm. The weighted average indicates that around 44% of the Latin American population suffer from under-consumption: a figure that coincides with the 1980 ECLAC estimates on the magnitude of poverty in the region.

Table 6

LATIN AMERICA (SELECTED COUNTRIES): ESTIMATES OF MALNUTRITION AND UNSATISFIED DEMAND, AROUND 1980

(Percentages)

	Calorie intake below	
	1.4 BMR[a]	Base norm[b]
Argentina (1982)	5.6	17.9
Brazil (1984)[c]	24.2	46.0
Colombia (1982)	24.8	48.0
Chile (1982)[c]	12.5	35.2
Guatemala (1979-1981)	38.7	62.9
Honduras (1982)[c]	41.3	61.4
Mexico (1977)	25.5	43.3
Panama (1982)	13.1	48.4
Peru (1978)	40.5	61.8
Venezuela (1982)	12.7	37.5

Source: Prepared by the ECLAC/FAO Joint Agriculture Division on the basis of statistical data on income distribution from ECLAC, Income Distribution Series; for Brazil on the basis of figures supplied by República Federativa do Brasil, Programa de Acão Governamental.

[a] 1.4 times Basal Metabolic Rate.

[b] J.C. Peres and A. León, "Determinación de las necesidades de energía y proteínas para nueve países de América Latina", ECLAC (photocopy), Santiago, 1988.

[c] Base norm estimated on the basis of the ratio between the values of the study mentioned and those calculated by Altimir (1979) for countries with similar demographic characteristics.

II

The impact of the crisis on food security

There is no empirical information that permits an evaluation of the impact of the crisis on aggregate availability and the food access conditions of the low-income population, or that makes it possible to distinguish between the effects of the crisis *per se* and the adjustment policies adopted. However, based on figures on the growth of production, the trade balance and the prices of food, as well as an analysis of trends in employment and wages, it is possible to form a fairly crear qualitative idea of the effects of the crisis and the adjustment.

1. *Effects on aggregate supply*

In order to estimate what has happened as regards aggregate supply, a comparison has been made between the average rates of variation in the sufficiency, stability and autonomy of food systems in the period 1980-1985, when the

[14] The figure for Brazil is similar to that used by the 1987-1991 Government Action Programme (400 calories/day) to identify people with a food deficit.

effects of the crisis made themselves felt and the rates observed in each of the two previous decades.

a) *Levels of sufficiency*

In terms of per capita calorie supply, the overall rate of growth suffered a drastic drop, though this average figure concealed very dissimilar situations. While in Mexico, Central America and Cuba the growth rate was maintained or even increased, in the Southern Cone and in the Andean countries average supplies deteriorated. The fate of this latter subregion is particularly critical, since it was already affected by chronic insufficiency before the crisis (table 7).

Table 7

GROWTH RATE OF PER CAPITA CALORIE INTAKE FOR HUMAN CONSUMPTION,[a] 1960-1985

	1960-1970	1970-1980	1980-1985
Central America	0.8	0.5	0.6
Caribbean (except Cuba)	0.7	0.5	0.6
Cuba	1.5	1.0	2.1
Andean countries	0.3	0.8	-0.1
Southern Cone	0.6	-0.2	-0.4
Brazil	0.7	0.6	0.1
Mexico	0.6	1.2	0.8
Latin America and the Caribbean	0.6	0.6	0.2

Source: Prepared by the ECLAC/FAO Joint Agriculture Division on the basis of data from FAO, *Supply-Utilization Accounts*.

[a] Annual rates between the three-year periods 1961-1963, 1961-1971, 1979-1981 and 1983-1985.

The modest increase —even possibly attributable to problems of basic information— in the food energy supply (FES) was the result of improvements in the calorie content of domestic production.[15] This, along with the use of accumulated stocks, helped to offset the fall in imports and the increase in food exports (table 8).

[15] The volume of per capita production, however, underwent a slight decrease during this period.

The decline in calories of imported origin and the recourse to accumulated stocks were generalized phenomena. Moreover, domestic production contracted in the Andean countries, Central America and the Caribbean (excluding Cuba), though this was probably offset by cutbacks in food exports. On the other hand, the production and exports of Mexico, Brazil and the Southern Cone nations registered increases, which, in the case of this last group, led to a fall in per capita FES.

With regard to the destination of domestic supply, use for cattle feed rose more than use for human consumption in Mexico, the Southern Cone and Central America. In the Southern Cone, total supply expanded, but the per capita calory availability dropped, due to the much more rapid increase in production for other purposes. In the other subregions, the volume of calories used for animal feed and other purposes went down, but in the case of the Andean countries this was not enough to allow an increase in the calorie intake of the population.

The use of stocks (and, in some cases, the cutback in exports) as a means of sustaining intake levels would probably have been insufficient if not accompanied by shifts in consumption patterns towards products having a greater calorie content per expenditure unit. Thus, in the majority of the countries the consumption of calories from basic grains increased, while calories from meats and/or dairy products dropped. As a result, the average calorie content of each ton of food consumed by the Latin American population rose slightly more than 2% between 1980-1982 and 1983-1985 (table 9).

In sum, as far as sufficiency is concerned, the crisis was reflected in a reversal of the sustained trend toward a reasonable growth of aggregate supply. It is true that this supply maintained its level in some cases and even exhibited marginal increases in others; but this was achieved through the running-down of stocks, increases in the calorie content of the factors of both supply and demand, and a fall in use for cattle feed. The most critical situation affected the Andean countries, where the background of structural insufficiency was further aggravated, with a consequent increase in malnutrition and under-consumption.

Table 8

CHANGES IN THE SOURCE AND DESTINATION OF FOOD ENERGY SUPPLIES,[a] 1980-1985

	Source			Destination				
	Production	Imports	Stock variation	Exports	Food	Animal feed	Others	Total
Latin America and the Caribbean	135	-161	168	-47	18	-5	82	95
Mexico	143	-343	411	6	64	172	-19	217
Brazil	197	-119	50	-13	7	-140	247	115
Central America	-201	-117	124	225	85	13	-67	31
Andean countries	-240	-94	64	195	-22	-26	-27	-74
Southern Cone	581	-175	437	-667	-34	170	40	176
Caribbean (excluding Cuba)	-226	-62	64	199	24	-28	-21	-25
Total Caribbean	582	-113	-98	-261	291	-125	-56	110

Source: Prepared by the ECLAC/FAO Joint Agriculture Division, on the basis of FAO, *Supply-Utilization Accounts* for the corresponding years.

Note: The increases in stocks and exports during the base period appear with a minus sign, since they reduce domestic supply.

[a] Measured in daily per capita calories; correpond to the differences between the values registered in 1985 and those for 1980.

b) *The impact on levels of stability*

In order to evaluate the incidence of the crisis on levels of stability, a comparison was made between the coefficients of variability corresponding to the 1970-1980 series and the coefficients for the longer 1970-1987 series, on the assumption that any changes would be attributable to the incorporation of the five years of the crisis.[16]

In theory, food imports attenuate the effects of fluctuations in domestic production. Their generalized fall should therefore have accentuated the instability of domestic supply. However, this was observed in only 13 of the 24 countries considered (table 10).

The Andean subregion is once again a special case, since it is the only area in which the instability grew in all the member countries. Neither the use of accumulated stocks nor the decline in food exports allowed them to offset the instability caused by the fluctuations in production, coupled with the fall in the levels of sufficiency and the high indexes of malnutrition and under-consumption.

[16] This overlapping of the two series was carried out in order to have the degrees of freedom necessary to be able to calculate the coefficients of variability.

c) *The impact on the levels of autonomy*

For the region as a whole, the supply of imported calories dropped by slightly more than 18% between 1979-1981 and 1984-1985, so that their weight within domestic supply fell from 12% to 10%. The decrease reached as much as 20% in Mexico and 27% in Brazil (table 11). A

Table 9

LATIN AMERICA: TREND OF AMOUNT OF CALORIES PER TON OF FOOD CONSUMED

Subregions	Millions of kilocalories per metric ton	
	1980-1982	1983-1985
Mexico	1 960	2 007
Brazil	1 700	1 717
Central America	2 023	2 546
Andean countries	1 597	1 653
Southern Cone	1 407	1 443
Caribbean	1 823	1 843
Caribbean (excluding Cuba)	1 727	1 733
Cuba	1 983	2 027
Total	1 687	1 723

Source: FAO, *Supply-Utilization Accounts*, January 1987.

Table 10

COEFFICIENT OF VARIABILITY OF THE CONSUMPTION OF BASIC FOODS, 1970-1980 AND 1970-1985[a]

Countries	Coefficient of variability	
	1970-1980	1970-1985
Argentina	21.4	26.2
Bolivia	5.9	11.8
Brazil	1.9	3.5
Colombia	4.1	8.7
Costa Rica	10.2	9.8
Cuba	6.8	5.2
Chile	13.4	12.7
Ecuador	14.6	12.6
El Salvador	10.6	9.9
Guatemala	15.9	13.8
Guyana	24.8	23.2
Haiti	7.9	7.0
Honduras	6.3	8.8
Jamaica	5.7	7.9
Mexico	10.5	12.2
Nicaragua	8.1	11.6
Panama	7.3	6.6
Paraguay	13.3	11.1
Peru	5.7	6.4
Dominican Republic	16.1	15.4
Suriname	8.0	8.9
Trinidad and Tobago	6.5	1.5
Uruguay	19.3	16.4
Venezuela	7.0	8.2

Source: Prepared by the ECLAC/FAO Joint Agriculture Division, on the basis of FAO *Production Yearbooks*.

[a] Corresponds to apparent consumption and does not include stock variations.

similar trend may be observed when examining the annual rate of variation in the physical volume of imports per capita, which rose in only three of the 22 countries for which estimates were made.

However, the decline in the imported component of food consumption cannot be considered equivalent to an improvement in the levels of autonomy, since this was largely achieved at the cost of a virtual stagnation in the levels of sufficiency and the use of stocks accumulated in previous periods. Only in a few cases did the decline in the imported component seem to be attributable to import substitution (table 12).

2. *The impact on equity*

The lack of information about the evolution of food consumption, income distribution and the nutritional situation of vulnerable sectors impedes a direct evaluation of the impact of the crisis and of the adjustment policies on the conditions of access to food, and it is even more

Table 11

LATIN AMERICA AND THE CARIBBEAN: VARIATIONS IN THE IMPORTED COMPONENT OF CALORIE INTAKE, 1980-1985

(Percentages)

	1979-1981	1984-1985
Latin America	12.2	10.0
Mexico	15.9	12.7
Brazil	6.6	4.8
Central America	15.3	14.0
Andean countries	16.8	15.7
Southern Cone	6.1	3.0
Caribbean	30.1	29.0

Source: FAO, *Supply-Utilization Accounts*, January 1987.

Table 12

RATE OF VARIATION OF PER CAPITA PRODUCTION, IMPORTS AND EXPORTS OF FOODS, 1980-1985

Country	Production	Imports	Exports
Bolivia	-2.1	-4.1	-23.3
Brazil	1.0	-7.5	4.3
Colombia	-1.0	-1.0	-4.5
Costa Rica	-1.4	-8.2	-5.3
Cuba	2.5	0.8	1.1
Chile	-0.4	-17.6	8.4
Ecuador	-1.2	-3.4	-7.7
El Salvador	-1.3	-2.8	1.9
Guatemala	-0.6	-8.1	-5.8
Guyana	-4.6	-21.0	-7.8
Haiti	-0.8	-1.1	-6.7
Honduras	-4.6	-13.7	-5.5
Jamaica	1.5	0.3	2.2
Mexico	-0.6	-6.9	2.2
Nicaragua	-2.7	-10.5	-13.2
Panama	0.2	-1.6	-1.8
Paraguay	-	-6.7	17.7
Peru	1.0	-8.7	3.8
Dominican Republic	0.8	-6.4	-1.3
Trinidad and Tobago	-1.0	2.6	-7.1
Uruguay	-0.1	-8.4	2.1
Venezuela	-1.5	-4.9	3.5
Latin America	**-0.02**	**-5.8**	**1.8**

Source: Based on FAO data.

difficult to establish how much of the deterioration is due to the crisis and how much is due to the policies used to cope with it. Moreover, the causal relations between crisis and malnutrition —or, inversely, between growth and a high nutritional level— are neither simple nor direct,[17] while furthermore there is the question of the time gap existing between the deterioration in the factors that affect the level and quality of consumption, on the one hand, and its nutritional manifestations, on the other.

a) *Deterioration of the rights of access to food*

Without prejudice to the above reservations, the generalized nature and rapidity of the deterioration in the various factors that have an impact on the rights of access to food suggest a severe intensification of under-consumption. Among these factors are the following:

i) The generalized increase in open unemployment and underemployment, which reached unprecedented levels in the 1985-1986 period in eight of the 16 countries for which official information was available. The simple average of the number of unemployed in 17 countries registered an increase of nearly 50% between 1980 and 1985. Moreover, unemployment has had a much stronger impact on lower-income families (IDB, 1987), and, within urban unemployment, the percentage of heads of household thus affected has tended to rise (PREALC, 1987b).

ii) The deterioration in real wages, which was observed in virtually all types of jobs, but was particularly severe in the activities preferentially engaged in by poor groups, such as agriculture and construction (PREALC, 1986).

iii) Inflation and the disproportionate rise in the prices of food or of the items in the "basket of the poor". When automatic or semi-automatic indexation mechanisms which were characteristics of the wage policies of several of the countries of the region were eliminated, the resurgence of inflationary processes led —with few exceptions (Argentina, Brazil and Colombia)— to a slump in the real average wages of those who depend on wages and salaries. Furthermore, food prices rose more than the general index in the periods and countries where the inflation was most virulent (ECLAC, 1986).[18]

iv) The deterioration in the share of the poorest 40% of the population in total income,

Table 13

EVOLUTION OF PER CAPITA HEALTH EXPENDITURE BY THE CENTRAL GOVERNMENT

(1980 = 100)

	1981	1982	1983	1984	1985[a]
Argentina	75.2	53.0	72.7	86.1	81.1
Barbados	97.3	76.4	75.2	78.7	73.3
Bolivia	54.0	22.3	31.2[b]	45.8[b]	
Brazil	100.8	114.4	126.8[b]	140.6[b]	
Costa Rica	62.0	57.5	54.2	83.5	27.7
Chile	105.2	96.0	78.0	76.2	117.4
Ecuador	126.6	115.8	94.2	103.7	60.3
El Salvador	98.4	83.8	71.5	67.6	62.5
Guatemala	69.9	81.6	39.6	41.7	35.9
Guyana	104.5	101.8	73.1	70.2	79.6
Haiti	97.0	141.1	110.4		
Honduras	98.9	101.9	103.6	84.8	124.4
Jamaica	100.7	99.2	92.1	81.5	65.0
Mexico	100.0[b]	73.8	49.2	36.4	57.4
Nicaragua	113.6	96.0	99.9		
Panama	98.2	104.5	112.7		
Paraguay	135.7	212.4	212.6	170.3	169.4
Peru	119.3	118.5	169.5	160.4	80.3
Dominican Republic	105.7	58.5	57.1	53.5	48.2
Trinidad and Tobago	114.6	192.8	196.2	169.3	156.4
Uruguay	87.5	83.8	86.6	103.0[b]	66.7
Venezuela	108.6[b]	96.2	88.8	78.0	93.2

Source: P. Musgrove, "The economic crisis and its impact on health and health care in Latin America and the Caribbean", *International Journal of Health Services*, vol. 17, No. 3, 1987.

[a] IDB, *Progreso Económico y Social en América Latina*, 1987, and national accounts data supplied by ECLAC.

[b] IMF, *Government Finance Statistics Yearbook*.

[17] Although economic growth may be expected to lead to a decline in malnutrition, a per capita wage increase does not always mean a rise in the income of the poor; a rise in the income of the poor does not always mean greater spending on food; increased spending on food does not necessarily lead to improvements in nutrition, and advances in family nutrition do not necessarily improve the condition of the most vulnerable members of those families (Berg, 1973, p. 42).

[18] In the case of Chile, where since 1984 a non-governmental organization has been conducting a systematic review of the ratio between the consumer price index for the low-wage section of the community and the general consumer price index, it can be seen that the first-named index was 1% higher in 1984 and 6% higher in 1985, 1986 and 1987 (PET, 1988).

as shown by what happened in the few countries with systematic information. Even in the cases where that 40% achieved a slight improvement, the share of the poorest decile declined still further (see annex).

v) The cutback in public spending, which has an impact on food and nutrition. As part of the adjustment policies, total per capita public spending contracted in approximately 80% of the countries. Spending on health, which is among the items of expenditure most closely linked to access to food, shrank everywhere except in Brazil, Paraguay and Trinidad and Tobago, although in several countries it later showed a trend towards recovery (table 13). Moreover, the food subsidies applied by several countries, including Mexico, Brazil and Colombia, suffered drastic cuts. In contrast, per capita military expenditures were reduced in only six countries (Arms Control and Disarmament Agency, 1986).

b) *The impact on levels of consumption and nutrition*

There is no direct information on the evolution of the consumption of the poor. However, the stagnation in average intake and the shifts in consumption patterns towards foods with a greater calorie content per unit of weight and cost are powerful indexes of a deterioration in the consumption levels of the poorest strata. Obviously, it is their situation which has largely determined the changes observed in the average values.[19]

The data on the impact on nutrition are not only scant, but also in many cases ambiguous, to the point that several works aimed specifically at evaluating them have had to put more emphasis on the factors than the results. Among the few cases where information is available, the following are worthy of special note: the doubling of severe malnutrition in Costa Rica between 1981 and 1982; the increase from 34% to 63% in infant mortality attributable to nutritional factors in Bolivia (Musgrove, 1987); the rise from 5% to 5.5% in the rate of infant mortality and in the number of infant deaths due to malnutrition in Mexico between 1981 and 1983; the rise from 66 to 74 per thousand in infant mortality in Brazil between 1962 and 1984, with significantly greater increases in the already high rates prevailing in the regions of the Northeast (from 93 to 116 per thousand live births) and North (from 81 to nearly 99) (World Bank, 1986, p. 21); the rise from 28.6 to 31.8 per thousand in the rate of infant mortality in Uruguay among children born during the three-year period 1983-1985; the aggravation from 38.3% to 40.8% between 1978 and 1985 of the incidence of malnutrition among children from 0 to 4 years of age in Jamaica (Cornia and others, 1987, p. 29); and the increases in the size of the indigent population from 12% in 1979 to 23% in 1984 in Chile and from 2.5% in 1978 to 7.1% in 1982 in Venezuela.

[19]This is revealed, for example, by the decline in consumption of protein sources in contrast with the constant level of consumption of carbohydrates observed in Costa Rica (CMA, 1987), and the severe decreases in the consumption of meat, milk and fish in the poorest strata of Mexico City in 1983 (World Bank, 1986).

Methodological Annex

A. *Calculations of the coefficients of variation (Stability)*

The method used was taken from Huddleston (1978) and Valdés (1981).

The coefficient of variation (c.v.) was defined as the standard deviation of the percentage fluctuations with respect to the trends, that is:

$$\text{STD}\left(\frac{Y_t - \hat{Y}_t}{\hat{Y}_t} \times 100\right)$$

where Y_t corresponds to the observed values of the four variables considered: production and apparent consumption of cereals and basics.

Apparent consumption was defined as production + imports − exports.

In order to calculate the trend, a semilogarithmic time-regression function of the following type was adjusted:

$$LN(Y_t) = a_0 + a_1 * t \qquad \begin{matrix} t = 1970 \ldots 1980 \\ t = 1970 \ldots 1985 \end{matrix}$$

The production and consumption of cereals were expressed in physical units, while production and consumption of staples (cereals + tubers + pulses) were expressed in values, using the implicit prices of the corresponding country's imports for 1980 (value of imports/volume of imports in 1980), taken from the FAO *Production Yearbooks*.

The rate of variation corresponds to the coefficient (b_1) of the following regression equation

$$LN(Z) = b_0 + b_1 \times t$$

where Z is equal to the absolute values of $Y_t - \hat{Y}_t$.

B. *Estimation of the incidence of values and prices on the variation of spending on imports (based on Valdés, 1981)*

In order to estimate the relative influence of the fluctuations in prices or volumes on the variability of the spending on imports, the equation Spending (S) = Quantity (Q) × Price (P) was expanded as a first-order Taylor series in which the variability of spending (V) would be:

$$V(G) = P^2 \times V(Q) + Q^2 \times V(P) + 2P \times M \times Cov(P,M)$$

and the incidence of the variation on the quantities imported would correspond to:

$$P^2 \times V(Q)/P^2 \times V(Q) + Q^2 \times V(P)$$

C. *Estimation of malnutrition and under-consumption (corrected sufficiency and equity)*

The basis of the model adopted and the source of the data used to define the intervening functions are described in detail in the FAO Fifth World Food Survey. Here, only the equations used to arrive at the estimates presented are reproduced.

The FAO methodology was applied in order to deduce the distribution of calorie intake from the income or expenditure distributions and, on this basis, to calculate the percentage of the population that falls below a certain level Z = 1.4 BMR or a BN, both for malnutrition and for under-consumption. For the first of these, a figure of 1.4 times the BMR was used as the break point; for the second, provisional estimates made by ECLAC were used (see section E of this annex).

Using a log-normal as a theoretical model of adjustment to the calorie intake, we have the following:

$$1)\ U = P(X<Z) = 1\text{-}f\left[\frac{LN(Z) - \mu}{\sigma}\right] \qquad [8]^a$$

and

$$2)\ SC = P(X<NB) = 1\text{-}f\left[\frac{LN(NB) - \mu}{\sigma}\right]$$

[a] The numbers in square brackets correspond to the equations of the methodological appendix of the *Fifth World Food Survey*.

where

U = proportion of population under break point Z.
$\overline{SC}$ = proportion of population under break point $\overline{BN}$, both expressed in kcal/person/day.
The values of Z are those calculated by FAO (see table).
The values of BN are those calculated by ECLAC (see text).

3) $\mu = 2LN(X) - 0.5LN\ (\sigma_x + \bar{x}^2)$ x = average calories of the HBA

4) $\sigma = LN\ (\sigma x^2 + \bar{X}^2) - 2LN\ (\bar{X})$

5) $\sigma x = \frac{1}{r}\ (\bar{X} \times Ex \times \sigma\ LN(V)$ [14] LN(V) = standard deviation of the log-base of income.

6) $r = \sqrt{0.04 + 1.09 \cdot Ex}$ [16]

Corresponds to the estimate of the coefficient of determination of regression between calorie intake and income, when data linking intake to income are not available.

7) $Ex = K \times E_f$ [20]

8) $K = 8.4 - 43.98F + 76.98F^2 - 42.17F^3$ [19]

9) F = Food expenditure/total expenditure

10)a $E_F = 0.2339 + 0.0033P + 0.5054 \cdot F^b$ [21] for Argentina, Brazil, Chile, Colombia, Panama and Venezuela

10)b $E_F = a_1$ in $LN(G_i) = a_0 + a_1(Y_i)^c$ for Guatemala, Honduras, Mexico and Peru.

where G_i = spending on food of strata i
Y_i = average income of strata *i*

D. *Calories needed to reach the level of 1.4 times the basal metabolic rate*

Countries	Per capita calories/day
Argentina	1783
Brazil	1683
Chile	1720
Colombia	1586
Guatemala	1576
Honduras	1573
Mexico	1663
Panama	1608
Peru	1577
Venezuela	1635

[b]For countries in respect of which only income distribution was available.
[c]For countries in respect of which both income distribution and the corresponding food expenditure were available.

Sufficiency corrected by income distribution

The type of function used to deduce the calorie intake from the income distribution (log-normal), has the disadvantage that it does not establish the upper and lower limits on intake levels, overestimating the magnitude of the deficit of the very low income sectors and overestimating the surplus of the very high income sectors. In order to reduce the effect of this characteristic on the estimates of overconsumption and under-consumption, the lowest daily limit was set at 1 300 calories and the highest at 4 300 calories per person.

With the values of X, σ and μ obtained from equations 1 to 10, the calorie deficits and surpluses of the population were estimated on the basis of the adjusted log-normal as follows:

1) $\log (D_1) = \sigma \times P(X < 1.4\ BMR) + \mu$
2) $\log (D_2) = \sigma \times P(X < BN) + \mu$
3) $\log (S) = \sigma \times P(X > 1.1\ BN) + \mu$

where D_1 = deficit for Z = 1.4 BMR
D_2 = deficit for base norm = 1
S = surplus for 1.1 (BN)
P(x) = values of the normal table associated with differing probabilities.

E. *Estimates of the base norm*

The per capita daily calorie intake used as a base norm in the estimates of under-consumption and in the definition of the goals for the year 2000 corresponds to that of the ECLAC/UNDP project on the dimension and characteristics of poverty in Latin America around 1985.

These are a series of new estimates compared with that employed by Altimir (1979), based on the recommendations of the Joint FAO/WHO/UNU Expert Consultation held in 1981.

The latest population censuses were used for the estimates, taking the urban and rural socio-demographic structures separately. For estimating energy and protein requirements, an average height specific to each of the countries was assumed, using body weight averages for both sexes in accordance with the procedures indicated in the FAO/WHO/UNU Report.

The authors went on to make a series of simulation exercises, subsequently adopting the one that came closest to the available indirect complementary information.

F. *Indexes of linkage*

The method adopted was that proposed by the Department of Planning and the Budget of Mexico in *Bases informáticas para la utilización del modelo de insumo-producto*, volume III, pp. 35-48 and 81-118.

The input-product matrixes available were reduced to five sectors: agriculture, food industry (ISIC 310 and 311), commerce, fuels and lubricants, and others.

For estimating the "linkages", the inverse matrix of the open static input-product model was calculated for the five activities, using the elements of the inverse matrix:

$$S_{ij}\ (i, j = 1...5), \text{ defined as}$$

$$S_j = \sum_{i=1}^{5} S_{ij}\ \ (j = 1...5)$$

where S_j is the sum of the elements of column j, whose elements measure the direct and indirect impact on the corresponding branch in terms of gross production, of an increase of one unit of final demand. S_j would correspond to the gross production of the entire economy generated by an increase

of one unit in the final demand of branch j.

The estimated values correspond to the expression

$$E_j = \frac{1}{n} S_j \Big/ \frac{1}{n^2} \sum S_{ij}$$

The denominator would correspond to the average of all the elements of the inverse matrix, so that a value of $E_j > 1$ indicates backward effects greater than the average of the other branches.

G. *Estimates of the relation between composition of consumption and per capita income*

The information corresponds to a 1980 cross-section of per capita income in dollars for 15 countries of the region, with Haiti and Uruguay representing the extremes. The data come from the ECLAC, *Statistical Yearbook*, while the data on intake composition (in calories per capita per day) were taken from the *Food Balance Sheets* for 1979-1981. Separate regressions were made for each group (oils, sugar, stables and meat products), using the following type of equation:

$$LN\ (C_i) = a + b\ LN\ (Y_j)$$

where i corresponds to calories from the groups of products and j to the countries.

The sum total of calories for each of the countries was made equal to 100, proportionally dividing the share of the different items.

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