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# Food Gaps and Surpluses in Developing Countries

## Status, Trends, and Implications, 1967-88

Richard C. Taylor  
Mervin J. Yetley

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ABSTRACT

Comparisons of trends in food production and consumption in 106 developing countries during 1967-80 showed that deterioration in food calorie balances because of shrinking calorie surplus or widening calorie gaps was more than twice as common as were incidences of expanding calorie surpluses or narrowing calorie gaps. Continued growth in net food exports to these countries is highly probable during the rest of the eighties. Fifty net calorie importers with widening calorie gaps comprise the core of the world's current and prospective problems in food security and human malnutrition. Causes of intercountry differences in food self-sufficiency are identified.

Keywords: Non-Communist developing countries; food production/consumption imbalances; food self-sufficiencies; country classification criteria; agricultural sector characteristics; food sector performance.

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## SUMMARY

Continued growth in net food exports to 106 non-Communist developing countries is highly probable during the last half of the eighties. This report classifies these countries on the basis of food (calorie) self-sufficiency (that is, production/consumption imbalances) and by linear trend in per capita calorie surplus or deficiency (gap). During 1967-88, incidences of deterioration in food calorie balances because of shrinking calorie surpluses or widening calorie gaps were more than twice as common as were cases of expanding calorie surpluses or narrowing calorie gaps. Similarly, incidences of divergences in food calorie imbalances outnumbered convergences of such indigenous calorie production/calorie consumption trends more than seven to one during 1967-88.

Average values for selected factors underlying a country's agricultural production and food self-sufficiency classifications are compared. Differences are noted for countries with improving and worsening degrees of food self-sufficiencies for several characteristics, including agricultural resource use and food sector performance. Intercountry differences in degrees of food self-sufficiency probably can be explained more precisely in terms of the above characteristics and by national policies in a more comprehensive economic model.

Although worsening trends in food self-sufficiency are noted for 73 countries, accounting for 45 percent of the population and 58 percent of the gross national product of all 106 countries studied, this group seems extremely heterogeneous. Fifty of these net calorie importers with widening calorie gaps comprise the core of the world's current and prospective problems in food security and, to a large extent, in human malnutrition. These countries include most of the world's poorest and smallest economies and are scattered over three continents and three oceans. Preconceived notions that food-deficient countries are found primarily in Africa are not supported by this analysis.

A more comprehensive economic model would more adequately explain the intercountry differences found in food self-sufficiency trends. Such a model should include the characteristics investigated in this report as well as the national food and agricultural policies.

# Food Gaps and Surpluses in Developing Countries

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## INTRODUCTION

The numerous world food production and consumption projections published between the midsixties and the midseventies reached a broad consensus, according to Wortman and Cummings (19)<sup>1/</sup>: unless major efforts were quickly initiated, the food-population-poverty crisis would become much worse. The provisional document, Agriculture: Toward 2000, prepared for the 20th Food and Agriculture Organization Conference in 1979, concluded that agricultural sectors in developing countries have become increasingly disparate in structure and performance and have moved towards more traditional structures in poorer countries, while modernized subsectors have appeared in some developing countries (10, p. 4).

These worldwide studies used different commodity aggregations, and commodity coverage usually did not include all food commodities. Published production and supply projections were usually commodity-specific and seldom were aggregated beyond grains. Demand or consumption data were occasionally aggregated to include all food in nutritional (caloric) terms, but this was done for the base year only. Consequently, the data bases for these studies of food production trends were limited, and the consumption aggregations were usually incompatible with the production aggregations (3, 7, 14, 15, 16).

Projections in these studies do not enable indigenous food production and domestic food consumption to be compared either over time or across countries. Because of these inconsistencies, it is difficult to determine precisely from these studies what contribution domestic (indigenous) food production makes to domestic food consumption in most developing countries. Similarly, a comparison of key factors explaining total food production and consumption at different points in time or across countries has been very difficult. This report illustrates the feasibility of developing such comparisons from Food Balance Sheet data which has become much more comprehensive since the midseventies (8, 9).

A goal of this report is to document the diversity of food self-sufficiency problems, that is, production/consumption imbalances facing developing countries. The term "developing countries" has become so commonplace that there is a danger of assuming that these countries are homogeneous, all facing the same problem(s). This report will show that basic differences exist among their food economies. The food self-sufficiency classification scheme used permits the current and impending world

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<sup>1/</sup> Underscored numbers in parentheses refer to references at the end of this report.

food problem to be quantified in terms of the number of countries involved. Cross-classifications of trends in these food economies and various other country characteristics show why so many countries are classified as having worsening degrees of food self-sufficiency, while a minor but important number are categorized as having improving food production/consumption imbalances.<sup>2/</sup> Insights provided by these analyses may be useful to decisionmakers in international development agencies for policy/program planning and to those deliberating the allocation of scarce funds among various foreign assistance programs.

#### METHODOLOGY

Annual Food Balance Sheet data, on a computer tape compiled by the Food and Agriculture Organization of the United Nations (FAO), were used to fit linear trends to indigenous per capita food production and domestic per capita consumption for 106 developing market economy (non-Communist) countries. The use of Food Balance Sheets permitted all foods to be aggregated in order to obtain total calories consumed annually by the population and average per capita annual consumption of food energy (calories). Similarly, the data permitted calculating yearly indigenous production of food calories by adjusting the total domestic calorie consumption for imports, exports, and stock changes in calorie values (8, 9).

The FAO Food Balance Sheets are available annually for 1966-80. The linear production and consumption trends were fitted for each developing market economy country in this study and were projected through 1988. These linear trends in indigenous food production and domestic food consumption, supplemented by statistics from unpublished FAO commodity supply-utilization accounts, and calculations of per capita food calorie production relative to food consumption in 1980, were used in a three-step classification process. The process distinguishes between all developing countries on the basis of six distinctive groupings denoting each country's classification in terms of food self-sufficiency.

First, net calorie exporters were distinguished from net calorie importers, and these initial classifications were then sorted according to converging or diverging trends in indigenous food production and domestic food consumption. Finally, three classifications were used for situations in which food self-sufficiency was improving, and three classifications were used for circumstances indicating declining (worsening) degrees of food self-sufficiencies. The distinctive characteristics of each classification are illustrated (hypothetically) in figure 1. Countries with worsening degrees of food self-sufficiency were characterized as: net exporters during 1966-80, projected to become net importers by 1988 (fig. 1a); consistent net calorie importers with widening per capita gaps (fig. 1b); or net calorie exporters with shrinking per capita surpluses (fig. 1c). Similarly, countries with improving degrees of food self-sufficiency were characterized as: net calorie importers during 1966-80, projected to become net exporters by 1988 (fig. 1d); net exporters with expanding per capita calorie surpluses (fig. 1e); or net calorie importers with narrowing per capita gaps (fig. 1f).

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<sup>2/</sup> Use of trends in food self-sufficiency as an analytical tool in this study does not imply that food self-sufficiency is a necessary condition for full economic development. Food self-reliance, however, is a logical and necessary condition. Self-reliance in food can be achieved in two basic ways: indigenous production or the exportation of sufficient quantities of goods to finance the commercial import of residual food needs. This initial report focuses on food self-sufficiency. Other works now in progress will focus on the potential for food self-reliance.



Figure 1. Typical indigenous food production and domestic food consumption levels and trends, six classifications of developing countries

Figure 1a. Net calorie exporters projected to become net importers

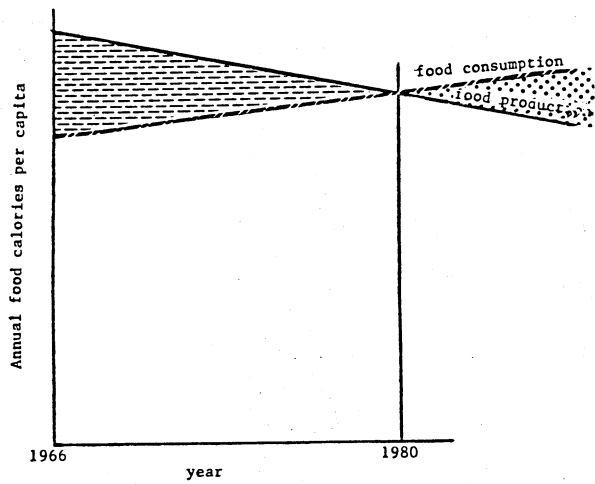


Figure 1d. Net calorie importers projected to become exporters

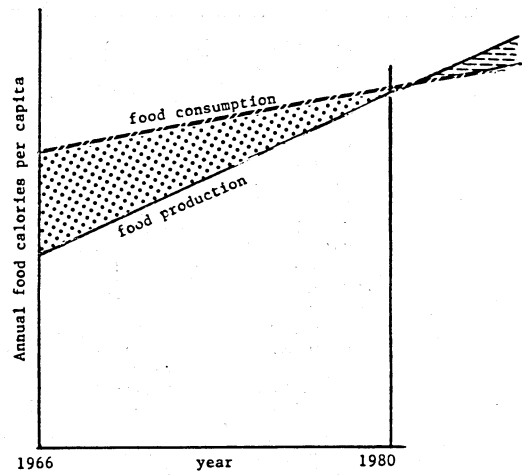


Figure 1b. Consistent net calorie importers with widening gaps

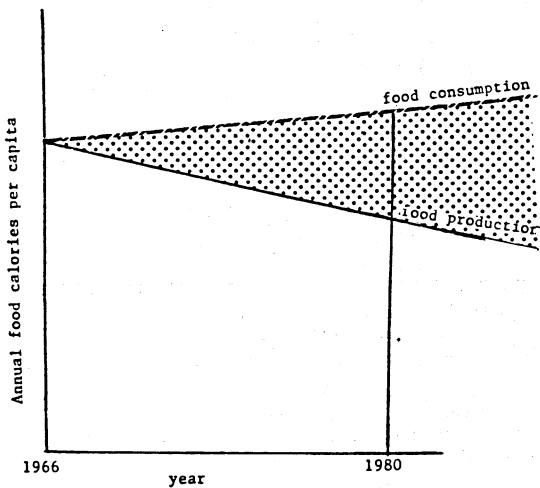


Figure 1e. Consistent net calorie exporters with expanding calorie surpluses

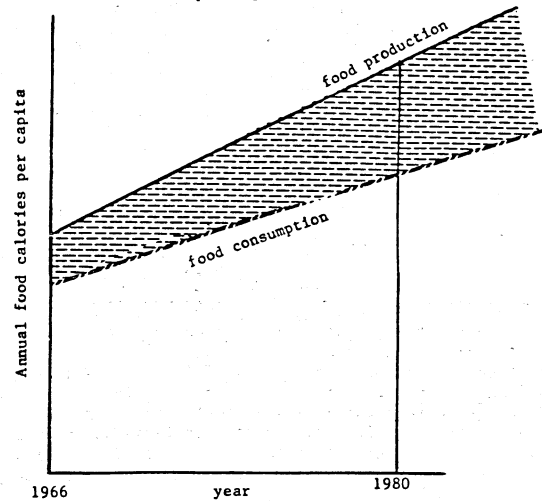


Figure 1c. Net calorie exporters with shrinking per capita surpluses

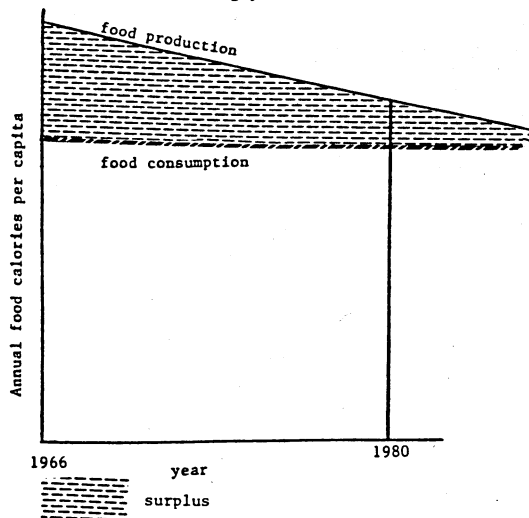


Figure 1f. Net calorie importers with narrowing per capita gaps

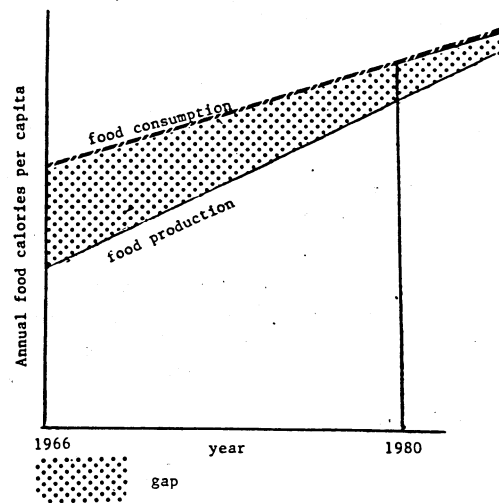


Table 1--Classifications of developing countries according to food calorie self-sufficiencies and trends

Countries with worsening food self-sufficiencies			Countries with improving food self-sufficiencies		
Calorie exporters during 1966-80, projected to become importers by 1988	: Consistent calorie importers with widening gaps	: Calorie exporters with shrinking surpluses	: Calorie importers during 1966-80, projected to become exporters by 1988	: Consistent calorie exporters with expanding surpluses	: Calorie importers with narrowing gaps
Cameroon	Afghanistan 2/5/	Liberia	Barbados 1/	Ghana	Argentina
Burma	Algeria 6/	Libya 6/	Columbia 3/	Honduras	Brazil
Gambia	Angola	Madagascar 4/	Ecuador 6/	Pakistan 2/4/	Burundi 3/
Niger	Bangladesh	Malawi	Guyana	Yemen (Aden)	Chad 3/
Zambia	Belize 1/	Martinique 1/	Mauritania		Costa Rica
	Bhutan 1/	Mexico 4/6/	Namibia 1/		El Salvador
	Bolivia	Morocco	Somalia		Guatemala
	Botswana 1/	Mozambique 4/	Sudan		India 4/
	Brunei 1/	Nepal 4/			Iraq 6/
	Cape Verde 1/	Netherlands-Antilles 1/			Kenya 3/
	Chile	Nigeria 6/			Malaysia
	Taiwan	Peru 4/			Mal 3/
	Congo	Guinea-Bissau 1/			Mauritius
	Cyprus	Reunion 5/1/			Panama
	Benin	Saudi Arabia 2/6/			Papua New Guinea 1/
	Dominican Rep.	Senegal			Paraguay
	Egypt	Sierra Leone 3/			Philippines
	Ethiopia 4/	Suriname			Zimbabwe
	Fiji 1/	Syria			Rwanda 3/
	Fr. Guiana 1/	Tanzania			Swaziland 1/
	Gabon 6/	Togo			Thailand
	Guadeloupe 1/	Tonga 4/ 1/			Turkey
	Guinea	Trinidad & Tobago 6/			Uruguay
	Haiti	Tunisia			
	Indonesia 4/6/	Uganda 3/			
	Iran 6/	Venezuela 6/			
	Jamaica 5/	Yemen (Sanaa)			
	Jordan	Zaire			
	Korea, Rep. of	Burkina Faso			
	Lebanon	(Upper Volta)5/			
	Lesotho 1/				

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Total number of countries in each classification					
5	60	8	4	23	6
percent of 106 countries in each classification					
4.7	56.6	7.5	3.8	21.7	5.7
percent of 86 countries in each classification 7/					
5.8	52.3	8.1	4.7	24.4	4.7

Designations as calorie exporters or importers are in terms of net food trade. Food self-sufficiencies are defined as indigenous food production relative to domestic food consumption, both terms being expressed in food calories per capita.

1/ These countries are small in both population and national product and many have unique characteristics which make their inclusion in intercountry comparisons of doubtful value. None were included by FAO in its recent report *Agriculture: Toward 2000*. These countries have not been included in several intercountry comparisons presented later in this report.

2/ Unique circumstances may distort food-calorie imbalances and trends in the mideighties, although these impacts may be transitory. Population transfer from Afghanistan to Pakistan and the sharp decline in food production in the former since the early eighties had significant, unmeasurable effects on the food economies of both countries. A different example involves the recent exploitation of ground-water resources in Saudi Arabia. This created surpluses of wheat and barley which, if sustained, could change that country's classification by 1988.

3/ The net change projected in per capita food self-sufficiency for the period 1981-88 was very small.

4/ This country's classification changed to the indicated column after 1975.

5/ This country's classification changed to the indicated column during 1972-75.

6/ Petroleum exporter by United Nations Organization classification.

7/ The 20 countries denoted by 1/ were not included in this distribution.

Countries classified as having either worsening or improving degrees of food self-sufficiency were then cross-classified by their selected agricultural sector, demographic, and macroeconomic characteristics. These informal analyses were used to explain the reason(s) or rationale(s) for incidences of worsening and improving food self-sufficiency among the countries studied.

The initial classification of 106 countries and the results of the several cross-classification exercises formed the basis for the implications presented in the last part of this report.

#### INCIDENCES AND TRENDS IN FOOD GAPS AND FOOD SURPLUSES

We classified 106 developing market economy countries into one of six categories of comparative levels and trends in per capita food-calorie production and consumption (table 1).

A distinct majority (69 percent) of the countries were characterized by decreasing (worsening) food self-sufficiency, attributable to decreasing trends in indigenous food production relative to domestic food consumption. The largest group of these countries, the consistent or prevailing (recent) net calorie importers with widening per capita gaps, accounted for all but 13 of these 73 countries, and constituted the core of the world's current and prospective food security and human malnutrition problems. The other two classifications denoted by worsening degrees of food self-sufficiency, net exporters during 1966-80 projected to become net importers by 1988 and net exporters with shrinking per capita surpluses, are much smaller in number, totaling only 13 countries, and account for prospective rather than current problems in food security.

Incidences of improving degrees of food self-sufficiency were less than half as frequent as occasions in which worsening degrees were noted. Seventy percent of the 33 countries denoted as having improving food self-sufficiency during 1966-80 were classified as net exporters with expanding per capita surpluses. The balance of 10 countries were net food calorie importers during the seventies, but trends show that per capita gaps were narrowing, and that four were projected to become net calorie exporters by 1988.

Changes in country classifications took place during 1972-80 in one out of nine cases. These changes in classification, which were particularly common in Asia and Africa, involved deteriorating calorie balances in all except two situations. These two exceptions, however, were the transformations of India and Pakistan, important food producing and consuming countries, into net calorie exporters.

Incidences of declines in food calorie self-sufficiency since 1966 were appreciably more common in Africa, in the Caribbean Basin, and in western South America, than in other South American countries and in Asia. More specifically, food calorie self-sufficiency deteriorated in 75 percent of the countries in the two former regions noted. In contrast, declining trends in food self-sufficiency occurred in slightly more than half of the remaining South American and Asian countries.

Subsequent sections of this study present key findings concerning how various agricultural, demographic, and macroeconomic indicators apparently differ among countries grouped by worsening or improving degrees of food self-sufficiency.

## THE RELATIONSHIP OF FOOD SELF-SUFFICIENCY TRENDS TO OTHER CLASSIFICATION CRITERIA

The classification methodology developed for analysis in this report is not as familiar to development economists as are terms employed by international agencies to differentiate between developing countries. The classification scheme used in this report and the categories commonly used by the World Bank and the United Nations Organization (UNO) are compared in table 2. The "middle-income and capital surplus oil exporting" countries of the World Bank are nearly twice as likely to fall under the category of "decreasing per capita food self-sufficiency" (62 percent), as compared with countries with "improving per capita self-sufficiency" (38 percent). The Bank's "low-income" countries are nearly three times more likely to fall into the "decreasing self-sufficiency" category (75 versus 25 percent) as defined in this study.

The UNO category of "petroleum exporter" is even more dramatic. Nearly all these countries (92 percent) are included in the "decreasing self-sufficiency" category. The distribution of the UNO's "least developed" countries is essentially the same as that of the Bank's "low-income" countries. Other developing countries not included in the two UNO categories just discussed are approximately evenly distributed between the decreasing and improving food self-sufficiency categories.

These findings are consistent with the relative growth rates in agricultural production and private consumption expenditures in middle- and low-income countries during the periods 1960-70 and 1971-78 (table 3). In real agricultural production, low-income countries had both lower and decreasing rates of growth, but had higher and increasing rates of growth in private consumption expenditures, of which food consumption was the predominant component. The increase in real agricultural product in low-income countries on balance was not sufficient to offset the increased food consumption in these economies.

## THE RELATIONSHIPS OF FOOD SELF-SUFFICIENCY TRENDS TO SELECTED AGRICULTURAL SECTOR CHARACTERISTICS

### Agroclimatic Factors

The physical environment is obviously important to agricultural production. To gain some insight into the possibility that developing countries in certain agroclimatic zones are more or less likely to be self-sufficient in food, seven such zones and their associated major staple food crop(s) were cross-classified with the food self-sufficiency criteria (table 4). Developing countries in the temperate/Mediterranean winter rainfall zone (wheat and barley) and lowland humid tropical zone (rice) were slightly less likely to be in the improving than in the decreasing self-sufficiency category.

In the semi-arid tropical summer rainfall zone (millet, sorghum, and peanuts), the situation was slightly different. If all these countries are compared, they are evenly split between the improving and worsening trends in food self-sufficiency. However, if consideration is limited to those countries with expanding calorie surpluses versus widening calorie gaps, countries in this agroclimatic zone are nearly twice as likely to have expanding calorie surpluses.

Countries in the subhumid tropical summer rainfall (corn) zone were approximately twice as likely to have improved their food self-sufficiency during 1967-80. In marked contrast, the humid-tropical African zone (starchy-root crops and rice) was noted for worsening trends in food self-sufficiency: these countries were nearly four times more likely to have a worsening rather than an improving trend.

Table 2--Cross-classification of food self-sufficiency trends with country classification criteria used by international agencies 1/

Other classification criteria used by international agencies	: Developing countries with	
	: worsening per capita food self-sufficiencies, n = 57	: improving per capita food self-sufficiencies, n = 29
	Percent	
Middle-income and capital-surplus oil exporter countries <u>2/</u>	62	38
Low-income countries <u>2/</u>	73	27
Petroleum-exporter countries <u>3/</u>	92	8
Least developed countries <u>3/</u>	73	27
Other developing countries	57	43

1/ None of the countries in table 1 denoted by 1/ are included in this table.

2/ World Bank classification.

3/ United Nations Organization classification.

Sources: Classification criteria taken from (7) and (10), with food self-sufficiency trends from table 1.

Table 3--Trends in agricultural production and private consumption expenditures, developing countries, 1960-78

Recent average annual growth rates	: Low-income countries		: Middle-income countries	
	: 1960-70	: 1971-78	: 1960-70	: 1971-78
	Rate			
Agricultural production (median values, real gross domestic agricultural product)	2.5	2.0	3.4	3.1
Private consumption expenditures (median real values)	3.9	5.3	3.1	4.9
Memorandum item:				
	<u>1960</u>	<u>1978</u>	<u>1960</u>	<u>1978</u>
	Weighted average percentage			
Structure of production-- GNP generated by agriculture	50	38	22	16

Source: (17).

Table 4—Cross-classifications, food self-sufficiency trends, agroclimatic characteristics, and major basic food crop ecologies

Agroclimatic (ecological) grouping (main food crops)	: Countries with worsening trends in food self-sufficiency		: Countries with improving trends in food self-sufficiency	
	: All <u>1/</u>	: Calorie importers with widening gaps <u>1/</u>	: All	: Calorie exporters with widening surpluses
	<u>Percent <u>2/</u></u>			
Temperate/Mediterranean winter rainfall zone (wheat and barley)	15.4	19.1	12.9	14.3
Lowland humid tropical zone - mainly Asia (rice)	17.6	16.4	15.2	17.5
Semi-arid tropical summer rainfall zone <u>3/</u> (millet, sorghum, and peanuts)	12.5	7.3	12.7	13.9
Subhumid tropical summer rainfall zone (corn)	19.8	18.1	34.9	41.4
Humid tropical African zone - Africa (starchy root crops/rice)	28.0	31.8	15.1	8.6
Tropical export crop economy (land shortage precludes food crop production)	5.1	.55	6.2	4.3
Agroclimatic zone irrelevant (little agricultural production except vegetables)	1.6	1.8	— <u>4/</u>	— <u>4/</u>

1/ Includes all except five of the smallest countries enumerated in table 1. Agroclimatic classifications for omitted countries could not be determined. Country coverages in other columns include all countries in table 1.

2/ Includes all countries within this classification.

3/ Includes semi-arid parts of sub-Saharan Africa and India.

4/ No countries in this classification.

Source: Classifications of food calorie imbalances from table 1. Agroclimatic (ecological) groupings and associated main food crops adopted from (2) and (13), and supplemented by ERS files.

### Agronomic Research Expenditures

Relative agricultural performance in various ecological zones was generally consistent with relative investments in agronomic research during 1972-76. Incidences of improving degrees of food self-sufficiency were highest in the subhumid tropical summer rainfall zone, where corn yields benefited from the largest research expenditures. Declines in food self-sufficiency were relatively most common in the ecological zones in which the dominant food crops were starchy roots and rice, the crops for which relative research expenditures during 1976 were the lowest (table 5).

### Agricultural and General Economic Development

The intensity of agricultural resource use is an obvious factor in achieving food self-sufficiency. Factor use intensity is complementary to agroclimatic characteristics and to investment based on applied research: rational intensification of factor use often can reduce or essentially eliminate ecological constraints to agricultural production. These possibilities are clearly illustrated in table 6: developing countries with improving degrees of food self-sufficiencies harvested crops from 39 percent of their potential arable land (1974-76). This percentage was nearly twice the share of potential arable land from which crops were harvested in countries where degrees of food self-sufficiency were declining (worsening). Potential arable land, a key agricultural resource, had not yet been sufficiently developed to reverse declining trends in indigenous food production relative to domestic food consumption in the latter group of countries.

Similar relationships between the intensity of chemical fertilizer use, the principal land-augmenting input, and the trends in food self-sufficiency were apparent in Africa and in most of Asia (table 6). Average rates of fertilizer use per harvested hectare in the African countries classified as having improved degrees of food self-sufficiency were twice as high as average fertilization rates in the African countries with worsening trends in food self-sufficiency (table 6). Similar but less pronounced differences were noted in the Far East. In the Near East, much of which is semi-arid or arid, the optimum intensity of fertilizer use should be determined by the use of irrigation. Although irrigation incidence was much higher in developing countries experiencing worsening trends in food self-sufficiencies, irrigated areas in these countries apparently were fertilized at lower rates than irrigated lands in countries with improving trends in food self-sufficiencies. Farmers in the latter countries apparently used irrigation water more efficiently in combination with chemical fertilizer (that is, fertilized irrigated areas more intensively). Furthermore, population pressure, in terms of persons per hectare of cropland harvested, was 70 percent higher in developing countries in the Near East that were experiencing worsening trends in food self-sufficiencies. Finally, in Latin American countries with worsening trends in food self-sufficiency, the ratio of population to the harvested hectares was nearly 2.3 times higher than in countries with improving trends in food self-sufficiency (table 6). Although the intensity of fertilizer use in the former group of countries was actually 86 percent greater than in the improving self-sufficiency countries, this higher intensity of fertilizer use did not offset the greater pressures on arable land resources from correspondingly denser populations relative to such land. In neither the Near East nor Latin America, then, were fertilizers and other land-augmenting inputs used with sufficient intensity to offset marginal demands for food in countries with the highest ratios of population to areas of arable land which actually were harvested.

Table 5--Cross-classifications of trends in food self-sufficiencies, major basic food crop ecologies, and efficiencies in agronomic research expenditures: Selected comparisons, 1972-76

Country classification	Incidence of high yielding variety (HYV) wheat and rice planting, 1972/73		
	Area comparisons		
	Distribution of total area planted to HYV wheat and rice	HYV planted areas relative to Total harvested area 1/	Total irri- gated area harvested 1/
<u>Countries characterized by improving trends in:</u>			
<u>Food self-sufficiencies 1/</u>			
		<u>Percent</u>	
India and Pakistan	73	12.1	43.4
Six others 2/	11	6.9	38.8
<u>Countries characterized by worsening trends</u>			
<u>in food self-sufficiencies 1/</u>			
Twelve countries 3/	16	6.4	29.6
All 86 developing countries 6/	100	5.9	32.0
<u>Food crop specific research expenditures, 1976, and food</u>			
<u>sector performances</u>			
Food-crop combination	Research expenditures (crop value)4/	Improving situations (33 countries)6/	Worsening situations (68 countries)6/
		<u>Percent</u>	
Corn	0.96	34.9	19.8
Wheat, barley	.73	12.9	15.4
Sorghum, peanuts	.72	12.7	12.5
Rice	.33	12.7	17.6
Starchy root crops, rice 5/	.23	15.1	28.0

1/ Country coverage limited to countries in temperate/Mediterranean winter rainfall zone, India, and lowland humid tropical zone, mainly Asia, but including several South American countries.

2/ Sri Lanka, Iraq, Malaysia, Philippines, Thailand, and Turkey.

3/ Afghanistan, Algeria, Bangladesh, Burma, Indonesia, Republic of Korea, Nepal, Iran, Syria, Lebanon, Morocco, and Tunisia.

4/ International and national research expenditures as a percentage of the value of the specified commodities in all developing countries. Crop combination weighted by respective crop values.

5/ Pertains to humid tropical African zone. Expenditures for starchy root crops and rice weighted by harvested areas in 16 Western Africa countries for which roots and tubers accounted for 14.6 percent of harvested areas.

6/ Country coverage was identical with corresponding classifications in table 2.

Sources: Classifications of trends in food self-sufficiency from table 1. Incidence of HYV planting, 1972/73, from (4). Food crop-specific research expenditures, 1976, from (5).



Table 6--Cross-classifications of trends in food self-sufficiencies, intensities of use of potential arable land and other inputs, and population pressures, 1974-76 averages

Item	: Developing countries : with worsening food : self-sufficiencies	: Developing countries : with improving food : self-sufficiencies
		<u>Percent</u>
Share of potential arable land, 86 developing countries	53.5	46.5
Potential arable land harvested, 1974-76	20.5	39.1
		<u>Index numbers</u>
Potential arable land per person	151	100
Additional regional comparisons:		
Africa--		<u>Kg nutrients/hectare harvested</u>
Fertilization intensity	7.6	14.4
Near East--		
Fertilization intensity on irrigated land <sup>1/</sup>	79.0	214.2
		<u>Percent of harvested area irrigated</u>
Irrigation incidence	40.3	15.1
		<u>Persons/hectare harvested</u>
Population pressure	3.6	2.1
Far East--		<u>Kg nutrients/hectare harvested</u>
Fertilization intensity	15.6 <sup>1/</sup>	19.5
Latin America--		
Fertilization intensity	60.1	32.4
		<u>Persons/hectare harvested</u>
Population pressure	5.8	2.5

<sup>1/</sup> Ninety percent of total regional consumption of fertilizer was assumed to be applied on irrigated land.

Source: Table 1 and (6). Country coverages are identical to those in table 2.

JOINT IMPACTS OF FOOD SECTOR PERFORMANCE, DEMOGRAPHICS,  
AND MACROECONOMICS ON TRENDS IN FOOD SELF-SUFFICIENCY

Bachman and Paulino (1) studied basic trends in staple food production in most of the countries included in this report.<sup>3/</sup> Comparisons between the growth rates of staple food production (rapid, medium, and slow), contemporary relative population growth rates, and the trends in food self-sufficiency used in this study are presented in table 7. Countries classified by Bachman and Paulino as having slow basic growth trends of staple food production were more than three times as likely to have worsening food self-sufficiency trends than improving trends. The additional characteristic of having relative population growth faster than LDC average population growth increased this likelihood to nearly 4.2 times. Conversely, as basic trends in staple food production accelerated from slow to medium, and from medium to fast, countries attaining these growth rates in staple food production had increasing likelihoods of improving trends in food self-sufficiency: 1.7 and 1.8 times, respectively. However, incidences of rapid food production increases apparently had only slight marginal impacts on further improving food self-sufficiency trends, for reasons suggested in the following paragraphs.

Food self-sufficiencies in petroleum exporting countries were highly likely to have worsened during 1967-80 (table 2). Most of these countries also achieved moderate or rapid growth rates in staple food production, according to Bachman's and Paulino's analysis. Thus, roughly one-fourth of the countries with worsening trends in food self-sufficiency and increasing (medium and rapid rates) growth in staple food production were petroleum exporters, compared with less than a tenth of all countries in the classifications of slow trends in basic food production. Consequently, food self-sufficiencies deteriorated in significant numbers, because of the rapid transformation of these petroleum-led growth economies, and the slow growth trends in staple food production.

Comparisons of major demographic and macroeconomic characteristics and trends presented in table 8 confirm the preceding analyses. Among nonpetroleum exporters, average population was smaller and population growth rates were significantly higher for those countries with worsening food self-sufficiencies. Incremental demand attributable to population growth was a major factor in explaining worsening degrees of food self-sufficiency among these calorie importers. Conversely, increased per capita incomes and changes in the structure of production were the major causes of deteriorating food production/consumption balances among petroleum exporters. The food economies of petroleum exporters caused the percentages of countries cross-classified as attaining medium to rapid trends in staple food production and having worsening food self-sufficiencies (table 7) to be inordinately large. Trends in total indigenous food production and domestic food consumption in petroleum exporting countries were uniquely different from contemporary developments in other food-deficient developing countries during the seventies.

The Bachman and Paulino study's conclusions have much in common with selected findings reported in this study. They found that the incidence of rapid growth in staple food production was highest in higher income countries and countries attaining faster growth in real per capita incomes. Rapid growth in staple food production was associated with diverse patterns of resource endowments and technological changes, including wide ranges in food commodities contributing to this growth (1).

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<sup>3/</sup> Basic staple foods—cereals, roots and tubers, pulses including peanuts, bananas and plantains—comprise 3/4 of food-caloric intake in developing countries, but only 3/5 for the world as a whole.

Table 7--Cross-classifications of trends in food self-sufficiency, basic food sector performance, and demographic trends 1/

Basic trend in staple food production and relative population growth	: Developing countries with worsening food self-sufficiencies	: Developing countries with improving food self-sufficiencies
	<u>Percent</u>	
Slow trend with relative population growth faster than developing countries average	26.7	6.4
Slow trend with relative population growth slower or equal to developing countries average	25.0	9.7
Medium trend <u>2/</u>	26.7	45.2
Rapid trend <u>2/</u>	21.6	38.7

1/ Includes essentially all developing countries in table 1 and in the sample countries studied in (1), except the smallest economies and countries that imported most of their food. Thirteen countries in table 1 with worsening food self-sufficiency trends were not included. Two countries in table 1 with improving food self-sufficiency trends were not included.

2/ No differentiations were made regarding relative population growth rates.

Source: Food self-sufficiency classifications from table 1. Staple food production trends from (1). Population growth rates from ERS files.

Table 8—Major demographic and macroeconomic characteristics of developing countries: Trends in per capita food self-sufficiencies, 1966-80 <sup>1/</sup>

Trends	: Countries with worsening per capita food self-sufficiencies			: Countries with improving per capita food self-sufficiencies	
	: All	: Calorie importers with widening gaps	: 10 petroleum exporters	: Other	: All : Consistent calorie exporters with expanding surpluses
			<u>Group averages, 1981</u>		
Population (million)	: 16.6	: 39.8	: 9.5	: 36.8	: 47.1
Gross national product (million U.S. dollars)	: 18,631.2	: 13,885.0	: 5,974.8	: 24,733.0	: 32,604.0
Gross national product per capita (U.S. dollars)	: 1,122.4	: 1,856.4	: 628.9	: 672.1	: 692.7
			<u>Group ranges, 1981</u>		
Population (million)	: 0.26-149.5	: 0.6-149.5	: 0.3-90.7	: 1.0-690.2	: 1.0-690.2
Gross national product (million U.S. dollars)	: 41-238,960	: 3,000-238,960	: 41-65,750	: 90-142,010	: 313-142,010
Gross national product per capita (U.S. dollars)	: 80-12,600	: 530-12,600	: 80-2,680	: 110-8,280	: 110-2,820
Growth rates, 1970-81:			<u>Compound rates of change, weighted</u>		
Population	: 2.6	: 2.1	: 3.1	: 2.3	: 2.2
Gross national product	: 6.1	: 6.3	: 5.7	: 5.1	: 5.3
Gross national product per capita	: 3.5	: 4.2	: 2.7	: 2.8	: 3.0
Proportional distribution, 1981:			<u>Percent of all countries in sample</u>		
Population	: 45.1	: 18.0	: 21.8	: 54.9	: 49.0
Gross national product	: 57.8	: 38.2	: 15.7	: 42.2	: 38.8

<sup>1/</sup> Country coverages were essentially identical with corresponding groups in table 1, except that consistent calorie importers with widening gaps were subdivided into 10 petroleum exporters and other countries in this classification.

Sources: Table 1 and (18), supplemented by ERS files. Growth rates for gross national product per capita derived from weighted growth rates for population and gross national products.

## IMPLICATIONS

The analysis of this study was based upon the categorization of developing countries into six classifications; three having worsened and three having improved food self-sufficiencies (fig. 1). An alternative grouping of these categories provides additional insight into the commonalities and differences among these countries.

Incidences of divergences in food-caloric production/consumption balances during 1966-80 among countries included in this study outnumbered convergences by more than seven to one. Only 14 countries were found to have convergent balances, six countries classified as net importers with narrowing per capita gaps and eight as net exporters with shrinking per capita surpluses. All other countries studied fell into one of four classifications which may be denoted as constituting differing trends within divergent food balances: net importers with widening per capita calorie gaps, net exporters with expanding per capita surpluses, exporters projected to become importers, and exporters projected to become importers by 1988. Consequently, continued growth in net food exports to these countries during the eighties is highly probable.<sup>4/</sup> In terms of the 106 countries classified in table 1, convergent trends mean that 6 net importers with narrowing gaps will import less food on a per capita basis, and that 8 net exporters with shrinking surpluses will export less; all other 92 countries listed in the table will either export more, import less and eventually export food on balance, import more or export less and eventually import food on balance.<sup>5/</sup>

Most countries classified as improving their degrees of national food self-sufficiency were consistent net calorie exporters with expanding per capita surpluses. This correlation between export performance and increased indigenous food production relative to domestic food consumption was not spurious. Countries with improved food self-sufficiencies were twice as likely to be economies which exported more than 25 percent of gross agricultural products and/or earned more than 50 percent of the total merchandise export earnings from agricultural products than were countries with declining food self-sufficiencies.<sup>6/</sup> Furthermore, countries classified as calorie exporters with expanding per capita surpluses were, on the average, larger in population and, except for petroleum exporters, were larger in gross national product (GNP) than other classification averages (table 8). In fact, countries in this classification accounted for nearly half of total population and 39 percent of GNP among all 106 developing countries included in this study.

Declining degrees of food self-sufficiency were noted for countries accounting for 45 percent of the population and 58 percent of GNP of the sample of countries studied (table 8). Countries which were consistent net importers with widening per capita calorie gaps constituted by far the largest single group (table 1), but countries comprising this classification were usually heterogeneous. It included petroleum exporters, accounting for 38 percent of the total sample GNP, and 50 other countries including the smallest and poorest economies (table 8). Nonpetroleum exporters

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<sup>4/</sup>FAO's alternate projections in Agriculture: Toward 2000 of net cereal imports by 90 developing countries vary from average growth rates of 2.7 to 6.3 percent yearly, during 1979-2000 (5). These projections are substantially below recent actual growth in this trade (9.5 percent per year during 1964-78). Similarly, FAO projects that self-sufficiency in basic foods for 90 developing countries will stabilize or decline only slightly by the year 2000. This measure declined slightly during the seventies.

<sup>5/</sup> These projections of larger net imports are contingent upon continuing ability to pay for this food and/or access to food aid on concessional terms.

<sup>6/</sup> These comparisons pertain to 1974-76 averages (9).

among these net calorie importers with widening gaps accounted for 22 percent of the total sample population and only 16 percent of the sample GNP. Consequently, these countries, comprising 47 percent of all countries studied, defined the nature and scope of the world's current and prospective problems in food security, and to an important extent, related problems in human malnutrition. More specifically, 14 of the 20 countries denoted in table 1 (by 1/) are classified in the category of net calorie importers with widening gaps. This raises the question of whether the majority of these countries can ever achieve food self-sufficiency. Perhaps most have little choice other than seeking other solutions for their food needs.

The geographic distribution of these countries is also an indicator of the dynamic nature of these food problems; 15 years ago, most recipients of food aid lived in South and East Asia and in a few of the largest countries in South America and the Near East. In 1980 however, food-deficient countries were widely scattered among the Caribbean Basin, western South America, sub-Saharan Africa, Central Asia, and Oceania (table 1). The problems of effectively identifying food aid needs and administering such programs under these diverse circumstances probably far exceed the corresponding difficulties faced by program planners and administrators in the midsixties and early seventies.

Because of such heterogeneities among countries with declining degrees of food self-sufficiency, such a classification was not indicative of deteriorating diets or increasing incidences of malnutrition. For example, food calorie supplies relative to average nutritional requirements in nine oil exporting countries increased from 93 percent during 1969-71 to 109 percent during 1978-80, although degrees of food self-sufficiency declined in each case (11, 12). Similarly, food supplies increased relative to nutritional requirements in Latin America and South and East Asia, despite incidences of declining food self-sufficiency. These dietary gains were made possible by food imports, adequately financed by foreign exchange reserves, foreign exchange earnings, and net inflows of foreign capital.

Conversely, improvements in average nutritional statuses (increases in food calorie supplies relative to average nutritional requirements) are indicative of declines in the incidence of malnutrition or hunger, only if food consumption patterns among different income groups within a country become more equitable, or remain basically unchanged. Evidence presented in table 1, for example, suggests that per capita food self-sufficiencies in Brazil, India, and Pakistan did improve during 1967-80, while food self-sufficiency in Indonesia, Mexico, and Nigeria declined. Collectively, these six countries contain more than 1 billion people, roughly one-third of all persons living in non-Communist developing countries. Because of regional and subregional disparities among such huge populations, national averages of food self-sufficiency ratios and average nutritional statuses may mask incidences of malnutrition or hunger which would be more apparent in smaller, more homogeneous economies. Consequently, estimates that per capita food (caloric) energy supplies in relation to nutritional requirements increased impressively in these countries from nearly 90 percent in 1966-68 to nearly 97 percent in 1978-80, do not necessarily mean that a corresponding reduction in malnutrition or hunger occurred.<sup>7/</sup>

Trends in food self-sufficiencies were mixed in the countries in the temperate/Mediterranean winter rainfall zone (wheat-barley) and in the lowland humid tropics (rice) zones (table 4); yet these Asian and North African countries were the principal beneficiaries of the induced technologies involving fertilizer-responsive

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<sup>7/</sup> The State of Food and Agriculture, 1981. FAO, Rome, 1982. Country measures were weighted by population.

improved varieties of wheat and rice developed at international research institutes. By 1972, however, these improved varieties were still not common in many agricultures, and plantings represented negligible percentages of total planted areas and irrigated cropland in most of these countries (table 5). Subsequent research efforts at international and national research centers were focused on corn, as well as wheat and grain sorghum, while rice and other food crops tended to be neglected (table 5). Finally, it should be emphasized that all these crop-specific research expenditures were very small relative to the total value of these basic foods in developing countries.

Annual measures of national and regional indigenous food production relative to domestic food consumption describe or define an initial food supply-demand imbalance, quantify subsequent changes in the initial situation, and/or monitor progress towards explicit policy objectives. These indicators also are uniquely suitable for making intercountry comparisons pertaining to specific years. Intercountry differences in food self-sufficiency probably can be explained with satisfactory precision in terms of national macro- and microeconomic characteristics and national policies and government programs.

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