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AGRICULTURAL RESTRUCTURING IN SOUTHERN AFRICA

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DYNAMICS OF FOOD SELF-SUFFICIENCY AND ECONOMIC GROWTH: A CHALLENGE TO SOUTHERN AFRICAN AGRICULTURE

N Rask

Prospects for initiating sustained economic development in much of Africa are not promising. With few exceptions, countries in Sub-Saharan Africa have experienced declining levels of per capita income for over 15 years (World Bank). High population growth, exceeding three percent per year, has diluted what meagre economic growth has occurred. Rising external debt, though not large in absolute terms, when expressed in relation to GNP for the region, is the highest in the world. Deteriorating social conditions, environmental degradation and decay of institutional capacity also contribute to a fragile environment for economic growth.

Agriculture also contributes to the malaise, as productivity levels are among the lowest in the world, with cereal productivity in Sub-Saharan Africa only 40 percent of world average. Agricultural neglect during the past 30 years has resulted in growth rates of only two percent per year for the region. Agricultural resources, however, are significant and capable of supporting substantially higher levels of productivity. Arable land per capita varies considerably across countries, but for the region as a whole is about at world average.

With predominantly rural populations and adequate land resources, many view agriculture as the primary foundation for accelerating economic growth in Africa during the coming years. Planners now see the need to double agricultural growth rates to four percent per year.

While agricultural growth rates of four percent per year are potentially achievable, efforts to maintain food self-sufficiency during periods of rapid economic growth in developing countries (including some in Africa), have generally not been successful. In most cases, food self-sufficiency has proven to be a transitory concept, especially in the context of economic development in low and middle income countries. This will be particularly true for many of the poor developing countries of Africa, where food self-sufficiency is now tragically declining in advance of the normal changes associated with economic development.

The central theme of this paper is that conditions of declining food self-sufficiency in Africa will continue even as agriculture becomes the engine that brings economic development to this continent. To develop this theme, we must look to the experiences of a number of countries in the world that are passing through or have completed the early stages of economic development. In this exercise, we find a significant level of consistency across countries in the relationship between economic development and changes in food consumption patterns. It is this consistency in consumer behaviour that leads to the projection that food self-sufficiency in Africa will continue to decline even if substantial increases in agricultural productivity are achieved.

A number of dynamic relationships cause food self-sufficiency for a country to change, sometimes radically, through time. These include: food consumption changes, primarily diet changes, as they relate to income level; production changes as affected by technology and limited by resource endowments; public policy, as it impacts on production and consumption

primarily through commodity prices; and population growth as it diminishes gains made in national income and agricultural output.

Paradoxically, as low income countries strive for self-sufficiency in food, the success they seek by increasing agricultural productivity, rather than closing the food production/consumption gap, instead creates a need for expanded food imports. This paradox is created when agriculturally generated income is multiplied throughout the economy. The resulting increase in food demand is greater than the agricultural supply increase that created the initial income growth, and greater than agriculture's ability to increase supply further in the short run.

Conversely, in the long run, as consumption growth slows, production may increase sufficiently to return some countries to a food self-sufficiency level. However, for other countries with production resource limitations, supply may never recover sufficiently to achieve self-sufficiency in food production. For others, some level of food imports will always be needed as diet changes dictate the need for food commodities not produced economically under local conditions.

The dynamic nature and magnitude of these consumption/production changes throughout the economic development process force the concept of food and agricultural self-sufficiency to be viewed as very transitory. As noted above, this is especially true in low and middle income countries undergoing rapid economic development; witness the cases of Taiwan and South Korea. In these countries, rapid growth in agricultural productivity cannot keep pace with continually rising food needs, which exhibit a dynamic growth path reflecting both population increase and changes in diet. These changes place demands on agriculture in terms of quantity and type of food commodities that cannot be met even under conditions of substantial technological change.

Among the dynamic factors, diet changes are the most important. They are linked closely to economic development, especially at low income levels, and can result in a several-fold per capita increase in basic food demands on agriculture, primarily more livestock products. Income growth is the factor that triggers diet changes and the concomitant increase in per capita food needs. This concept is developed in detail below and is followed by an empirical assessment of the dynamics of food needs and self-sufficiency as related to income changes over time for a selected group of countries.

The principal conclusions drawn from this analysis are:

- Primary food demand on a per capita basis, measured in cereal equivalents, increases 5- to 7-fold as countries develop from very low to high income levels.
- At high income levels, primary food demand, in terms of its impact on farm level output, stabilises and is little affected by further changes in consumer income.
- Only 15 percent of the world's population has reached this high level of income.
- Fifty percent of the world's population including most of Sub-Saharan Africa is still at the very low income and food consumption levels.
- Food prices as determined by agricultural self-sufficiency or agricultural or food policies affect food consumption behavior through the income effect, especially at low income levels.
- The dynamics of self-sufficiency proceed through three distinct phases; first, at starting levels of development, countries are generally food self-sufficient but at a low level of consumption and production; in middle income countries, food self-sufficiency typically declines as consumption growth outstrips production increases; in high income countries,

- there is rising food self-sufficiency as production grows more rapidly than consumption.
- Tragically, because of low agricultural productivity and high population growth, many countries in Africa are experiencing declining levels of food self-sufficiency in advance of any significant positive change in level of economic development.

The income consumption link

Income growth provides the link between development and food consumption. At low levels of income, consumers allocate a major share of income to food, in some cases as much as 80 percent. In these situations, any increase in income results in a relatively large increase in food expenditure. Increased consumption may result directly from higher per capita income or indirectly from lower food prices.

The primary change in consumption is to improved diets that include greater proportions of higher quality foods such as livestock products, which in turn are much less efficient converters of agricultural resources to food. For example, to produce one pound of meat requires from 3-11 pounds of grain equivalent livestock feed. Thus, as more livestock products are included in the diet, feed grain requirements increase dramatically.

For a number of reasons, agriculture is often unable to increase productivity rapidly enough to meet increased food demands associated with rapid income growth. Further, domestic agriculture may not be an efficient producer of feed grains (as compared to food grains). These situations give rise to the need for feed grain and/or livestock product imports, and a greater level of international trade to finance imports.

There are, however, limits to the development/food consumption link. Two things generally occur. First, development eventually leads to slower population growth reducing this source of increased food demand. Secondly, at higher levels of income only a fraction of income (16 percent in the United States) is spent on food, and much of this is for convenience and quality factors little related to basic agriculture. Thus, as countries reach mature levels of development, the demands on agriculture are relatively stable, regardless of changes in income.

While consumption levels level off in developed countries, agricultural production does not. In most cases, application of new technologies continues to increase productivity, as do agricultural policies that provide production incentives, leading to increasing levels of food surpluses and the need to export.

Thus, economic development, as evidenced through rising incomes, exerts a dynamic influence on food needs. First, in early stages of development there is a dramatic increase in the demand for agricultural commodities, in part through population growth, but more importantly through diet changes to a higher proportion of livestock products. A country may or may not be able to meet this demand from domestic agriculture. In most cases, a combination of too slow a growth in agricultural productivity (or a lack of agricultural resources) and/or the inability to produce efficiently the newly required livestock feeds lead to a consumption/production gap that must be filled with imports.

At high income levels the consumption/production relationship is reversed as population growth slows, income-induced consumption changes cease, and agricultural productivity growth continues, either narrowing the consumption/production gap or creating exportable surpluses. Trade in agricultural products serves both surplus and deficit countries at various stages in the development process.

In the following, an assessment of the food consumption/income link for a selected

group of countries is presented. Annual consumption data for a twenty-five year period (1961-85) is converted to a single measure - cereal equivalents per capita - and compared with levels of income (GNP per capita) for each country and between countries. Based on these data, a generalized consumption/income relationship is presented.

Cereal equivalents

Diets vary, not only by income level but by available food resources, tastes and preferences. To measure adequately a general relationship between income and food consumption, a single measure of food demand is needed. Further, a simple counting of calories or units of protein is not sufficient, since livestock products require a much greater input of agricultural resources than plant products. Similarly, food expenditures as a measure of food consumption include costs for convenience and quality factors unrelated to agricultural production. Since cereals are the basic food building blocks, either consumed directly as food (i.e. rice, wheat) or converted to livestock products (wheat, corn), a concept of cereal equivalents was developed to serve as a measure of food consumption levels.

Grains are given a cereal equivalent factor value of 1.0. Meat products are scaled from 3.2 (poultry) to 11.7 (beef) to reflect the quantity of grain (or grain equivalents in other feeds), necessary to produce a unit of meat, including the feed necessary to maintain the breeding herd. Other crops are given cereal equivalent values that link them to grain, principally on a caloric basis. These factors are applied to FAO annual country level consumption data for the period 1961-85.

The consumption series for each country is an expression of aggregate food needs and food need changes over this time period, based on both population and diet changes. When converted to a per capita basis, it reflects the impact of diet changes only, and by implication, the impact of income changes on food needs.

Gross National Product (GNP)

Gross National Product is a global measure of development commonly used to rank countries of the world. It is a readily available measure for most countries, and is derived in a consistent manner. In this analysis, GNP/capita is used as the income proxy. To make cross country comparisons, GNP/capita values in each national currency are converted to a common value, 1985 US-dollar. To avoid sharp year-to-year fluctuations in prices and exchange rates, GNP per capita figures are calculated according to the World Bank Atlas method (World Development Report, 1985:230). This process involves three-year averages for both GNP and exchange rate values.

Several factors make GNP per capita only an approximate cross country measure of personal income available for food purchases. First, country differences in income-distribution are not accounted for. For example, a rise in GNP from oil revenues may not have the same impact as broadly-based income increases. Secondly, food prices vary between countries, often by a substantial amount. These differences may be policy-induced or may reflect relative resource scarcity. In either situation, a given level of income will not sustain comparable levels of food consumption across countries.

Income level and food consumption

One hundred and eight countries, representing various geographic, income and resource situations were selected to investigate the income/food consumption relationship. As noted

above, annual data on food consumption (metric tons of cereal equivalents per capita) and income (GNP per capita in 1985 US-dollars) were calculated for each country over the 25-year period 1961-1985. Data for the starting year (1961) and the ending year (1985) for both variables for subgroups of the countries studied are presented in Table 1.

At low income levels (under \$1 000 GNP per capita), annual per capita consumption of food is generally between 0.3 and 0.5 metric ton of cereal equivalents (Figure 1). Average consumption rises sharply to above 1.6 metric ton at \$6 000 and then rises more gradually to about 2.0 metric ton at \$10 000 GNP per capita income levels. Above the \$10 000 income level food consumption is relatively stable. Thus, between the very low and very high levels of income, there is, on average, at least a five-fold increase in consumption across the countries studied.

Cereal Equivalents (Tons/Capita)

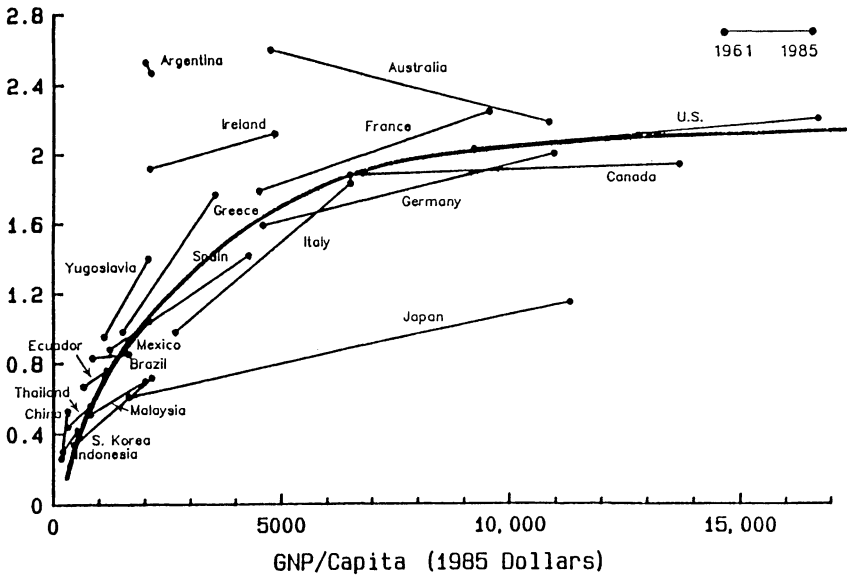


Figure 1: Per capita food consumption and income, 1961-85

Table 1
Per capita GNP and annual per capita food consumption in cereal
equivalents for selected countries, 1961 and 1985

Country	GNP/capita		Food consumption in cereal equivalents		Agricultural self-sufficiency per capita	
	1961	1985	1961	1985	1961	1985
	(\$ 1985)		(Metric tons)		(Production/Consumption)	
Low income						
Malawi	130	170	0.33	0.42	1.04	0.98
India	240	270	0.32	0.35	0.98	1.02
China	170	310	0.26	0.53	0.98	0.98
Ghana	660	380	0.43	0.41	1.12	0.97
Pakistan	160	380	0.44	0.54	0.97	0.98
Lower middle income						
Indonesia	200	530	0.30	0.42	1.02	0.99
Domin. Repub.	711	790	0.50	0.70	1.84	1.04
Thailand	320	800	0.44	0.56	1.27	1.63
Nigeria	240	800	0.39	0.40	1.11	0.90
Turkey	1 200	1 080	0.85	0.88	1.03	1.03
Ecuador	650	1 160	0.67	0.76	1.11	1.06
Upper middle income						
Brazil	850	1 640	0.83	0.85	1.02	1.18
Portugal	980	1 970	0.84	1.12	0.91	0.65
Malaysia	800	2 000	0.51	0.70	0.72	0.75
Yugoslavia	1 100	2 070	0.95	1.40	1.02	0.96
Mexico	1 120	2 080	0.73	1.04	1.05	0.89
Argentina	2 000	2 130	2.53	2.47	1.40	1.40
S. Korea	460	2 150	0.34	0.72	0.96	0.62
Algeria	760	2 550	0.50	0.72	0.80	0.35
Greece	1 510	3 550	0.98	1.77	0.94	0.83
Spain	1 230	4 290	0.88	1.42	0.93	0.85
Ireland	2 100	4 850	1.92	2.12	1.30	1.70
Italy	2 660	6 520	0.98	1.83	0.89	0.75
High income						
France	4 510	9 540	1.79	2.24	1.06	1.20
Australia	4 760	10 830	2.60	2.18	1.50	1.80
Germany	4 600	10 940	1.59	2.00	0.83	0.92
Japan	1 650	11 300	0.61	1.15	0.76	0.56
Canada	6 500	13 680	1.88	1.94	1.25	1.44
USA	9 200	16 690	2.03	2.20	1.05	1.23

Several factors affect the consumption/income relationship for a specific country. For example, countries with high agricultural self-sufficiency (net exporters) generally have a higher consumption level of cereal equivalents per capita for given income levels. In these cases, consumption is above average. In contrast, countries with low self-sufficiency ratios fall below average. This typically represents higher food prices in food-deficit countries, where local prices reflect international prices plus transport, while in food-surplus countries, domestic prices would reflect international prices minus transport costs. Domestic food price policies also affect consumption levels.

Half of the world's population lives in countries with incomes of less than \$400 GNP per capita at starting development levels. This group includes many African countries. Another 35 percent lives in countries in the rapid food consumption growth stage with incomes of GNP per capita of \$400 - \$6 000 per year. Only 15 percent of the world's population has a per capita food demand that is largely satiated. In most other countries, a significant proportion of any increase in per capita income will be translated into increased demand for food.

Finally, countries with income levels in excess of \$6 000 GNP per capita are found principally in Europe and North America. These countries have adequate to surplus land resources and climates favorable to forage and feed grain production - factors that favor the production of beef, which in turn is the least efficient converter of cereals to meat products. Thus it is probable that, as developing countries in more tropical environments raise consumption levels, they will turn more to poultry and pork and less to beef. Many of these developing countries will need to import corn or other feed grains at costs significantly greater than those that presently exist in the exporting countries of North America and Europe. As more countries pass through the development phases, consumption will probably level off at a slightly lower level.

The pace of economic development in these countries, and the degree to which this development is translated into personal income for the populations will determine the extent of growth in food demand. If development efforts are successful, the increased food needs could be substantial and will require both agricultural production growth in developing societies as well as expanded world food trade.

The dynamics of self-sufficiency

The dynamics of agricultural self-sufficiency in countries experiencing rapid income growth demonstrate clearly the inability of agricultural production to accompany consumption increases in most low and middle income countries (Table 1). In these countries, self-sufficiency has declined significantly as income has grown. In contrast, high income countries show rising levels of self-sufficiency as the productivity of agriculture continues to grow, while consumption increases are limited largely to population growth, which has slowed.

Thus there are three general stages of agricultural self-sufficiency as countries pass through the development process. First, at low levels of development, countries are largely food self-sufficient. Low-income countries are often primarily agricultural economies where food production levels determine food consumption. Food production is the principal source of income and food consumption the principal use of the income. There is little surplus income to purchase food imports.

The second stage, as per capita incomes grow, is a period of relatively declining

agricultural self-sufficiency. While many developing middle income countries typically have significant technological change and growth in agriculture, it is often not sufficient to supply the rapidly rising demand for higher quality food. High population growth rates add to the aggregate demand for food.

The third stage displays a reversal of this trend and is characterised by rising rates of self-sufficiency, though it is probable that many countries may not return to full self-sufficiency because of agricultural resource constraints under current levels of technology. In this third stage, income-induced growth in food consumption is largely satiated. Further increases in food-related expenditures are for quality and convenience factors little related to agricultural production. Population growth slows, reducing its impact on food demand. At the same time the momentum of technological change in agriculture continues, closing the gap between domestic production and consumption.

This does not mean that all high income countries will eventually become food self-sufficient or net food exporters. Some, such as Japan, simply do not have sufficient land resources. But we must recognize that income and population growth impacts on food demand do reach relative limits at high income levels, while similar limits on technological growth in agricultural production are not yet apparent.

Agricultural self-sufficiency in Africa

Within Africa, most countries, especially in Sub-Saharan Africa, are experiencing declining levels of food self-sufficiency while still in the first stage of economic development (Table 2). For example, in 1965, countries in Sub-Saharan Africa (excluding South Africa) were more than self-sufficient in agriculture (107 percent), but since then self-sufficiency has declined precipitously to 103 percent in 1975 and to only 93 percent in 1985. Significantly this loss of self-sufficiency has occurred during a period of declining per capita incomes and stable per capita food consumption. In North Africa, the decline in food self-sufficiency is greater (from 92 to 60 percent) but expected, since it is associated with rising levels of income and per capita food consumption as these countries move into the second stage of economic development.

The agricultural land base in Africa varies by country, but is at world average at 0.27 hectares of arable land per capita. Cereal yields per hectare in Sub-Saharan Africa, however, are only 40 percent of world average. Increases in productivity of cereals or related livestock feed commodities will be critical to meeting food demands in Africa, especially the changing food demands associated with economic development.

In contrast, developing countries in Asia have experienced only modest declines in agricultural self-sufficiency. However, this decline has occurred on a much more restricted land base and has been associated with economic growth and per capita increases in income and food consumption for a number of countries. In Latin America some decline in self-sufficiency has occurred, but strong agricultural growth in land-rich Brazil and Argentina has kept this area at a positive agricultural self-sufficiency. In the developed regions of North America, Europe and Oceania, self-sufficiency has risen steadily as production increases driven by technology outpaced consumption growth that has been very moderate due to slow population growth and little change in per capita consumption levels.

Within the dynamics of economic development and agricultural self-sufficiency, Africa, and particularly Sub-Saharan Africa, faces a daunting challenge. Without appreciable economic development, most countries will be fighting a losing battle to supply the low level

of food needs associated with the present low levels of per capita food consumption. Significant income growth will depend heavily on growth in the agricultural sector. But even then, experience from the rest of the world demonstrates that only in cases of exceptional agricultural resource endowments can countries supply sufficient agricultural production to meet the rising food demands associated with the early and middle stages of economic development.

Table 2
Agricultural self-sufficiency, productivity, and food consumption
levels: world regions.

Region	Agricultural self-sufficiency			Food consumption in cereal equivalents			Arable land/ capita	Cereal yields
	1965	1975	1985	1965	1975	1985	1987	1987
	(percent)			(ton/capita)			hectare/capita	(kg/hectare)
World	100	101	101	0.79	0.83	0.87	0.27	2 483
Africa	105	99	86	0.55	0.55	0.58	0.27	1 171
North Africa	92	78	60	0.55	0.63	0.79	0.20	1 811
Sub-Sahara	107	103	92	0.51	0.49	0.49	0.28	995
Southern Africa*	112	106	94	0.48	0.52	0.50	0.28	1 175
South Africa	124	118	95	1.07	1.11	1.09	0.36	1 665
Asia	96	96	93	0.39	0.42	0.52	0.14	2 598
Europe	86	91	97	1.48	1.69	1.79	0.25	4 340
Latin America	125	114	115	0.96	1.03	1.02	0.35	2 075
North America	108	118	125	2.11	2.20	2.18	0.86	3 715
USA	106	118	123	2.12	2.23	2.20	0.76	1 604
Oceania	163	180	192	2.26	2.30	1.92	1.88	1 724
USSR	102	95	90	1.40	1.74	1.79	0.80	

*Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, Swaziland, Tanzania, Zambia, and Zimbabwe.

Source: Calculated from FAO Food Balance Sheet Data.

If agricultural productivity can be increased significantly in Africa, food self-sufficiency may rise marginally as cereal consumption increases for those populations now denied even minimal diets. However, as development proceeds beyond this early stage and income rise, food demand will outstrip production capabilities. Productivity growth in agriculture must be at the center of African development efforts, but food imports in most African countries will be necessary for the foreseeable future.