

## V. Economics

### Wheat in the Tropics: Economic and Policy Issues

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#### Abstract

*Interest in wheat production in the warmer tropics stems from rapidly increasing wheat consumption and imports in many tropical countries. One billion people in the tropical belt (23°N to 23°S) now consume over 22 million tons of wheat, 83% of which is imported. In many tropical countries, wheat (usually bread) has become the staple food, especially of urban consumers. Wheat consumption has increased because of consumers' rising incomes and interest in convenience foods and a diversified diet. More importantly, governments have encouraged rapid increases in wheat consumption through favorable pricing policies for bread, including subsidies in many countries. Exporting countries have also promoted wheat consumption through export promotion and food aid. Large-scale investments in capital-intensive milling and baking industries have entrenched interest in continuing wheat imports. Governments concerned about rising wheat imports should consider policy alternatives as part of an integrated food policy analysis that includes consumer price policies for bread and competing staples, cereal import and food-aid policies, removal of incentives to the milling industry, promotion of nonwheat food staples, including composite flours, and increased domestic agricultural production. Domestic wheat production is only one alternative for increasing agricultural production. The comparative advantage framework enables an assessment of the real returns to the country of resources used in wheat production versus alternatives. These returns are likely to be highest where wheat enables an increase in cropping intensity, using available land, labor, water and mechanical services to a fuller capacity. The place of wheat in the farming system also needs to be carefully evaluated, with particular attention to the need for timely planting, which is critical for successful wheat production in the warmer tropics. These economic issues should be addressed at an early stage in any proposed wheat consumption/production program.*

Most people in the industrialized countries begin their day with a cup of tea or coffee, whose major ingredients originated on a small farm or plantation in one of the tropical countries, such as Brazil, Ivory Coast or Sri Lanka. At the same time, the people of these tropical countries, especially those in urban areas, are likely to begin their day with bread for breakfast, bread made from wheat grown on the farms of one of the industrialized countries. At first sight, this may appear to be a reasonable exchange, but closer examination raises a number of disturbing questions.

Unlike tea or coffee, bread has become a basic food staple to many people in the tropics, providing a significant proportion of their calories, not only for breakfast but also for lunch and, sometimes, dinner as well. Wheat imports by many tropical countries are growing very rapidly, and now constitute a significant proportion of foreign exchange expenditures. While people in the tropical countries may not be "addicted" to bread in the same way as are the coffee and tea drinkers, they are increasingly dependent on bread for

their daily food supply. The extent of wheat imports and their rapid increase underlie the current interest in producing wheat for the more tropical environments.

In this paper, a number of questions will be addressed. What are the major trends in wheat consumption in the tropical belt? How dependent are tropical countries on imported wheat? What are the major factors promoting these trends? How can we judge if these trends are in the economic interests of the country? What policy alternatives are available to governments whose objective is to reduce wheat imports? Finally, some of the major economic issues will be outlined which must be addressed in deciding on a domestic wheat production program.

### Overview of Trends in Wheat Consumption and Imports in the Tropical Belt

In this paper, the conventional definition of the tropics will be used, i.e., the area lying between the Tropic of Cancer (23°N) and the Tropic of Capricorn (23°S). To a remarkable extent, these latitudes define the areas of the world where wheat is not currently grown commercially at altitudes below 1,000 meters (Sudan is the only exception). A number of countries are dissected by these latitudinal delineations. Countries have been excluded from the analysis that have large wheat-producing areas above or below these lines (i.e., India, Saudi Arabia and China). Other countries which are largely tropical, such as Sudan and Burma, have been included. Brazil is a more difficult case; most of its wheat is now grown south of 23°S latitude, but future expansion will take place only in the more tropical zones.

Hence, Brazil has been arbitrarily included as a tropical country. With these definitions the tropical belt consists of the following countries:

- Africa—all Sub-Saharan Africa except Lesotho and South Africa
- Asia—the two Yemens, Sri Lanka and Southeast Asia, from Burma to the Pacific countries
- Latin America—Guatemala to Brazil and Paraguay, including the Caribbean countries

This group of tropical countries has a population of about one billion people, roughly equally divided between Africa, Asia and Latin America. In the period 1980 to 1982, they produced 4.3 million tons of wheat annually, most of it in Brazil and Ethiopia. This was only about 2% of total wheat production in the Third World and less than 1% of world wheat production. At the same time, these countries imported about 20 million tons of wheat, about one-third of all wheat imported by developing countries. That is, imports supplied about 83% of total wheat consumption in the tropical belt (Table 1).

From 1980 to 1982, there were 40 tropical countries that consumed over 100,000 tons of wheat each. Only six of these countries (Ethiopia, Kenya, Sudan, Zimbabwe, Yemen Democratic Republic and Brazil) produced over 100,000 tons of wheat, mostly in highland areas (Table 1). Outside of this group, almost all were entirely dependent on imported wheat. By the early 1980s, nine of these countries were importing close to one million tons or more of wheat annually (Nigeria, Indonesia, Sri Lanka, Philippines, Vietnam, Cuba, Venezuela, Peru and Brazil).

Per capita consumption of wheat in the tropics varies substantially from less than 5 kg per year in Thailand to over 100 kg per year in Cuba. Per capita consumption is much higher in Latin American tropical countries (50 kg/year)

than in Asia and Africa (about 16 kg/year) (Table 2). In the Latin American tropics, wheat now accounts for over one-quarter of staple food calories compared to less than 10% for the Asian and African group; however, consumption is expanding much more rapidly in the latter group. Several countries have had an annual growth in per capita consumption of over 10% annually, e.g., Nigeria, Indonesia and Vietnam.

For the developing world as a whole, wheat consumption has expanded extremely rapidly over the last two decades as wheat and, to some extent, rice have substituted for coarse grains and roots and tubers (Table 2). This substitution has been greatest in the

Table 1. Summary of annual wheat production and imports in tropical countries, 1980 to 1982

Region	Population (millions)	Countries consuming over 100,000 t	Countries producing over 100,000 t	Production (million t)	Imports (million t)	Percent of consumption imported
Africa	360	15	4	.54	4.3	74
Asia	403	11	1	.19	5.7	100
Latin America	255	14	1	2.63	10.0	80
Total	1018	40	6	4.36	20.0	83

Source: FAO data tapes

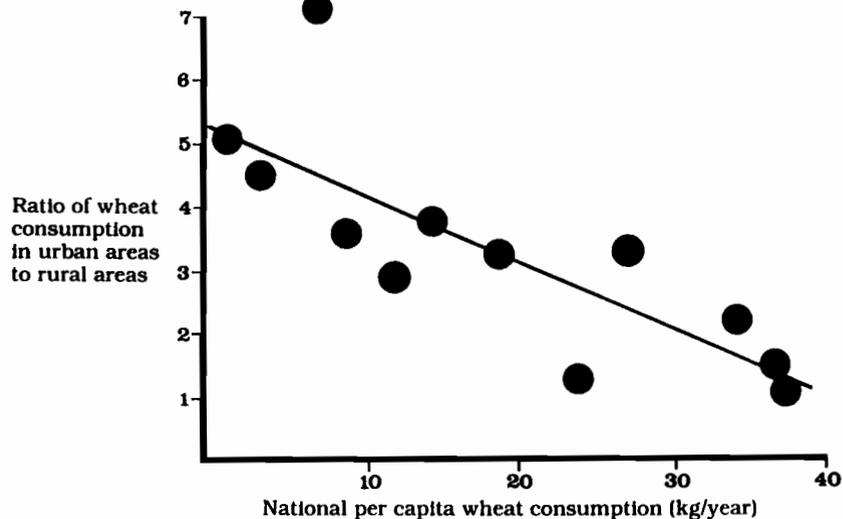
Table 2. Summary of trends in wheat consumption in the Third World, 1980-1982

Region	Per capita consumption (kg/yr)	Staple food <sup>a/</sup> calories from wheat (°/o)	Growth of per capita wheat consumption <sup>b/</sup> (°/o/ year)
Tropical Africa	19	6	4.2
Tropical Asia	14	6	4.2
Tropical Latin America	50	25	1.6
Average, tropical countries	25	15	2.8
Large mixed cereal economies:			
India, China, Mexico	65	28	3.2
Countries where wheat is the staple food	123	71	2.8

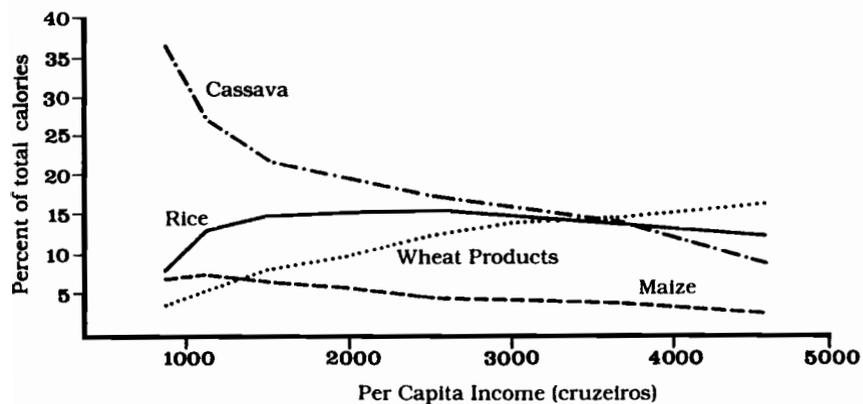
a/ Staple foods include coarse grains, roots and tubers

b/ 1961-65 to 1980-82





**Figure 2. Relationship between the ratio of urban to rural per capita wheat consumption and national per capita wheat consumption in tropical countries**



**Figure 3. Rice, cassava, wheat and maize as contributors to apparent per capita energy consumption according to income class, northeast Brazil, 1975-76**

Source: T.T. Poleman. 1981. Quantifying the nutrition situation in developing countries. Food Research Institute Studies 1:1-58.

These changing consumption patterns reflect the preference for bread as a convenience food in urban areas. Less time and cooking fuel is also required for the consumption of wheat-based foods (10, 12, 17).

On the supply side, urbanization also favors wheat consumption based on imports. With plentiful supplies of wheat in world markets, lagging domestic production of staple foods and poor infrastructure for transporting and marketing domestic food supplies in urban areas, there has been a natural tendency to import wheat to feed urban consumers, especially in countries where large cities are located on the coast.

#### Bread prices

Food pricing policy in many tropical countries favors low bread prices relative to competing staples. About one-quarter of the tropical countries for which we have price data subsidized bread prices in the 1970s. Sri Lanka, Sudan, Ivory Coast, Ecuador and Brazil are all countries where bread subsidies have led to rapid increases in wheat consumption (3, 12). Many other countries have imported wheat duty-free and at a significantly overvalued exchange rate. If bread prices are converted at the black market exchange rate, nearly half of the tropical countries, especially in Africa and Latin America, had declining real bread prices in the 1970s (3). In Africa, this largely reflects exchange rate policy while, in Latin America, a combination of overvalued exchange rates and increasing bread subsidies in a number of countries have led to declining real prices.

The result of these policies is that, in many countries, wheat flour and bread are cheap relative to locally produced food staples, such as rice, maize and cassava. In several countries, e.g., Nigeria, Ivory Coast, Sudan, Brazil and

Ecuador, wheat flour based on imported wheat was cheaper than locally produced coarse grains, such as maize or sorghum. Food pricing policy in these countries may explain half or more of the growth of wheat consumption. There are, of course, important exceptions. Southeast Asian countries such as Thailand, Burma and the Philippines maintain high bread prices. A number of countries, such as Colombia, Senegal and Sri Lanka, have phased out bread subsidies and per capita wheat consumption has fallen.

#### Food aid

Although food aid has declined in importance relative to commercial food imports, it has been and remains important to a number of tropical countries. Over 80% of food aid is provided as wheat, and this proportion is only slightly lower for the tropical countries. Food aid has encouraged wheat consumption in these countries by reducing the price of wheat products, establishing a milling and baking industry and developing consumer tastes and preferences for wheat (9, 19). The development of markets for commercial wheat is still an important objective of food aid and our cross-country regression analysis indicates that it has been relatively successful. Sudan, Sri Lanka, Somalia and Mauritania are examples of tropical countries that receive substantial amounts of food aid and have relatively high per capita consumption of wheat.

#### Government Policy Alternatives with Respect to Wheat in the Tropics

Interest in wheat production in the tropical countries reflects a desire to promote greater self-sufficiency in food. Many governments have seen the rapid

increase in foreign exchange expenditures for wheat imports as an area where foreign exchange can be saved and, at the same time, domestic agricultural production be promoted. Food security is also sometimes an important objective, as governments seek to reduce exposure to fluctuations in world market prices. However, except for 1974-75, world market prices for wheat have been relatively stable over a long period.

The reasons for increasing wheat consumption are complex and need to be analyzed within the specific food policy environment in each country. Wheat consumption is bound to increase in most countries. As consumer incomes increase, there is a natural tendency to diversify diets. However, in many cases, the policies of governments, food-aid donors and exporting countries have reinforced and greatly accelerated this trend. This comes about as a result of food-pricing policies that favor bread and by an implicit policy of supplying urban consumers from food imports (in most cases, wheat). At the same time, policies have encouraged investments in marketing, storage and processing for imported wheat. These investments act like a "wheat trap" because, once established, it is very difficult to reverse the trend toward importing wheat (2,5).

The milling and baking industry has grown extremely rapidly over the last decade in tropical countries that do not produce wheat (for example, between 1975 and 1980 wheat flour production increased at an annual rate of 23.4% in Brazil, 7.6% in Indonesia, 11.1% in Kenya, 11.7% in Cuba, 14.4% in Guatemala and 7.2% in the Philippines) (5). This is a highly wheat-specific industry that cannot be converted into the processing of locally produced staples, even if they are in surplus supply. It is ironic that, in the last few years, the largest flour mills in the world

have been established in the nonwheat-producing countries of Indonesia, Sri Lanka and Nigeria. Investment and trade policies (such as high tariffs on wheat flour imports) have encouraged rapid expansion of flour milling in many tropical countries (5).

With this background, and given an objective of reducing wheat imports, a number of policy alternatives are available for tropical countries.

#### **Food pricing policy**

Undoubtedly the quickest way to reduce wheat imports is to raise consumer prices for wheat products. There is ample evidence that wheat consumption is quite sensitive to prices. Removal of consumer subsidies and, in some cases, imposing a tariff on wheat imports to compensate for overvalued exchange rates are the major instruments for adjusting bread prices. The objective should be to restore incentives to consume domestically produced food staples. It has been shown elsewhere that, based on world prices, the ratio of the price of wheat flour to rice and maize should be about 0.7 to 1.0 and 1.6, respectively (3). At these prices, bread will be considerably more expensive than rice and maize.

The political sensitivity of bread prices is recognized. However, it should also be recognized that the longer such a decision is delayed, the more difficult it is to correct the imbalance. Thailand is a country which has maintained high bread prices and, as a result, per capita consumption is low (4 kg/year); there it is still relatively easy to regulate bread prices. In the Sudan and Ecuador, bread subsidies have promoted per capita bread consumption of over 80 kg/year in the capital cities. It would now be very difficult to manipulate bread prices in these countries, since bread is such an important food staple to a politically powerful section of the population.

Finally, it should be clarified that, in many tropical countries, low bread prices have produced few benefits to the poor. Rather, the middle and upper income groups, which are the main bread consumers, have captured the benefit of these policies, while the farmer, especially the small farmer who produces local staples such as maize, has been the main loser (5,14,16).

#### **Policies toward the wheat processing sector**

An integrated wheat strategy should carefully rationalize investments in wheat processing, especially large-scale capital and foreign exchange-intensive milling and baking plants. Little justification is found for the establishment of a milling industry, given the need to efficiently use scarce capital and promote employment. Removal of tariff protection on flour imports should effectively arrest the growth of this industry, until such time as local wheat production might be established. Importing wheat as flour maintains much greater flexibility in future food-policy decisions and also reduces the power of one of the strongest voices, that of the millers, in food-import policy. Finally, most tropical countries produce white flour, milled at an extraction rate of 70 to 75%. Legally mandated higher extraction rates (e.g., in Sudan), which produce off-white flour and breads, would allow savings in wheat imports.

#### **Import policy and food aid**

We have noted that cereal imports by the tropical countries have emphasized wheat and, to a lesser extent, rice. Maize imports have largely been destined for feeding livestock. Yet maize is usually the cheapest cereal in world markets, and is a staple food of most tropical countries, especially for the poor. With consumer prices that reflect import prices, maize has considerable potential as a food import. Some difficulties arise because most countries

consume white maize, while yellow maize dominates world markets. Yet, with the favorable price incentives and export promotion seen for wheat, there should be no reason why maize cannot play an important role in world food trade. Donor agencies could help by targeting food aid to countries in accordance with their staple food. For tropical countries, this would mean more emphasis on food aid in rice and coarse grains.

#### **Promotion of convenience foods based on local food staples**

Bread-making technology has largely been imported from the industrialized countries. At the same time, until recently, little research has been conducted on the preparation of local foods to meet the preferences and convenience needs of urban consumers. There has been considerable research on composite flours which mix wheat flour with maize, millet or cassava flour for bread making (11,17). This appears to be technically feasible, but the greatest obstacle in most countries is that pricing policy favors wheat flour and provides no incentives to use mixtures.

Meanwhile, private and public agencies of wheat-exporting countries have conducted vigorous and apparently successful market-promotion programs for wheat products. Government policy should convert these efforts into the national interest, perhaps by requiring that these export interest groups conduct research and promotion that balances wheat with local food staples.

#### **Increasing domestic agricultural production**

In an integrated wheat strategy, increased agricultural production must receive high priority. Producing wheat domestically is only one option. Alternatives include 1) promotion of

export crops which will generate foreign exchange for importing food and 2) promoting the production of other food staples to substitute for wheat imports.

The comparative advantage framework is a useful way of assessing the economics of each of these alternatives. As an example, it can be assumed that one hectare of wheat yields 2 tons of grain. If imported wheat costs \$200/t in the capital city, and it costs \$20/t to transport domestically produced wheat to the capital, then the value of one hectare of domestic wheat would be equal to  $2 \times (200-20) = \$360/\text{ha}$ . Local wheat production will require imported fertilizer and other inputs; if these cost \$100/ha, the net gain would be \$260/ha. However, these same domestic resources of labor and land might be invested in export crops such as cotton. If one hectare of cotton yields 0.8 tons of lint per hectare at an export price of \$1,000/t, and requires \$200/ha of imported inputs, net gains would be \$600/ha, sufficient to import over 3 tons of wheat. In this case, cotton would have the comparative advantage. However, if wheat yields 4 t/ha (for the same inputs), wheat would have the comparative advantage. All of these calculations employ the world price equivalent of the commodity rather than the domestic price, since the world price reflects the real cost to the country.

The value of the comparative advantage analysis is that it demands a look at the alternatives. The above example shows that, in focusing on wheat alone, it might be concluded that there is a net gain from wheat production. However, with the country's welfare rather than wheat production as the objective, the alternative uses of the scarce domestic resources available and their contribution to national income must be taken into account.

### **Economic Issues in Establishing a Domestic Wheat Industry**

The economics of domestic wheat production must be examined at two levels, the comparative advantage or profitability to the country, and the profitability to the farmer. At the same time, there will be a number of marketing and milling issues to be resolved in establishing a new industry. Some of these issues will be mentioned only briefly, since they will be discussed in more detail in the papers that follow.

#### **Economic profitability**

Four issues will be dealt with that determine economic profitability to the country. First, the foreign exchange savings generated by domestic wheat production will be critically dependent on the technology employed. Highly mechanized wheat production schemes which have been tried in several African countries, with even harvesting being mechanized, are expensive from a foreign-exchange point of view and are unlikely to be efficient in a low-wage economy (6,13,17). One-third or more of the foreign exchange saved is spent on imported inputs and machinery. Investment in large-scale irrigation schemes is also extremely costly (over US\$ 10,000/ha) and foreign-exchange intensive. It is unlikely that it will pay to develop large-scale irrigation schemes in the tropics, specifically for wheat production (1,2,20). Even small-scale irrigation schemes for wheat have failed to generate satisfactory returns (8).

Second, areas with high yield potential and irrigation or adequate moisture will also usually have high-value alternative crops such as rice, cotton or other cash crops that are adapted to tropical areas. While it seems logical to emphasize areas where wheat gives the highest yields, it may well be that wheat's greatest comparative advantage will be

in areas where wheat yields are relatively low, but where there are few alternatives. (The rapid expansion of wheat in Bangladesh on residual moisture after rice illustrates this point). A similar issue arises in those tropical countries with limited highland areas suitable for wheat, but where there are a number of alternative land uses with high returns (4).

Third, the greatest potential for wheat in the tropics is likely to be as a second or third crop after a main crop, such as rice or cotton. An early variety of wheat that fills a gap in the cropping calendar and enables increased cropping intensity may also allow more efficient use of farmers' labor, land and water resources.

Fourth, the economic profitability of wheat in many countries is critically dependent on transportation costs from the producing region to the consumption center. For example, in 1979, it was estimated that transport costs for wheat from the north of Nigeria to Lagos were about US\$ 65/ton at the real exchange rate. Assuming a CIF price of wheat of about \$200/t, the cost of imported wheat in the north would have been about \$265/ton ( $200 + 65$ ), while the real value of domestically produced wheat at Lagos would be about \$135/ton ( $200-65$ ), or only half of its value in the north. Given these wide margins, it may have been profitable to produce wheat for local consumption in the north, but quite unprofitable to substitute it for wheat imports in Lagos. In some countries, this issue is further complicated by the location of flour mills on the coast for imported wheat. If wheat is to be produced in the interior for local consumption, there may be a need to establish small-scale wheat mills in the producing area (6).

#### **Farmer compatibility**

The key issues in the acceptance of wheat production by farmers are profitability, risk and compatibility with

their current farming systems. The last two are related; one of the most critical determinants of wheat yields in the tropics will be timely planting. Hence, it is essential to examine the current farming system and the extent to which the farming calendar and available resources will allow planting during the optimal period. Expected yields under farmers' conditions must be carefully evaluated through extensive field testing within the cropping system and resources available to farmers. Several wheat development projects have been wildly optimistic about expected farmer yields. Even where wheat fits well into the cropping system, there is always a learning curve for the adoption of a new crop.

Profitability depends on both the input and output prices facing farmers. It is not difficult to make wheat production profitable. The phenomenal expansion of wheat production from a very small base in Saudi Arabia reflects high subsidies on water, machinery and fertilizer, and the highest producer price in the world, over US\$ 1,000/ton. The issue is to find that combination of price incentives which promotes an efficient industry. The basic guidelines for setting a domestic wheat price will be the price of imported wheat (adjusted for exchange rate overvaluation) and the price of competing agricultural products.

Once a domestic producer price has been set, a mechanism will be needed to ensure that this price is actually received by farmers. In most countries, wheat millers enjoy a degree of monopoly power. They also prefer the *status quo* of using only imported wheat, whose supply and quality is predictable and which can be handled in volume. In the initial stages, the government food procurement agency will probably have to act as a wheat buyer, since it will be in a much better position to negotiate with the millers.

## Conclusions

Wheat consumption will undoubtedly continue to expand in tropical countries. However, if governments pursue policies that remove incentives to consume wheat, this expansion will be relatively slow and will reflect a natural tendency by consumers to diversify diets as their incomes increase.

Governments that wish to reduce dependence on imported wheat should consider domestic production of wheat as only one among a set of policy alternatives. A decision to produce wheat domestically should be taken in the context of the wider food policy environment, and after a careful assessment of the comparative advantage of wheat. It is impossible to make general statements about the economics of wheat production in the tropics. However, it appears that the best prospects for efficient wheat production in the warmer tropics are where wheat will enable two or even three crops a year, where moisture limits production of other crops or where small-scale irrigation is available, and where wheat can be produced using the labor and machinery already utilized by farmers in the production of other crops.

These economic issues should be analyzed at an early stage, before the commitment of a large amount of resources to a domestic wheat research and production program.

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