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# National and Regional Self-Sufficiency Goals

Implications for  
International Agriculture

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edited by  
Fred J. Ruppel  
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1991

Lynne Rienner Publishers • Boulder & London

## Conceptual Issues in Analyzing the Economics of Agricultural and Food Self-Sufficiency

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Ever since Adam Smith wrote *The Wealth of Nations* in 1776 attacking mercantilist doctrines, economists have debated the wisdom of self-sufficiency versus "free trade." In spite of innumerable volumes written in favor of free trade by classical and neoclassical economists, countries throughout the world continue to push for self-sufficiency in key goods, particularly agricultural commodities. Often the debate over agricultural self-sufficiency becomes murky because proponents of self-sufficiency are not always clear about what they mean by the term, nor are they explicit about the actual objectives of the policies they advocate. The purpose of this chapter is to place the rest of the book in perspective by clarifying the definition of agricultural self-sufficiency, exploring possible reasons why countries might want to pursue self-sufficiency policies in spite of economic arguments in favor of free trade, and outlining mechanisms used to increase self-sufficiency. Many of the topics discussed and examples used in this chapter are discussed in greater detail later in this volume.

### DEFINING SELF-SUFFICIENCY

Economists usually define self-sufficiency as a situation in which a country or region's domestic production of a good, such as food, equals its domestic effective demand. The proportion of domestic effective demand for a good that is met by domestic production is commonly referred to as the "self-sufficiency ratio." There are a number of issues surrounding this definition of self-sufficiency, including commodity specification, location coverage, the relationship between self-sufficiency and nutritional need, and the period of coverage.

#### *Commodity Definition*

In order to define a country's degree of self-sufficiency with respect to a given commodity, we must first agree on how broadly to define the commodity.

Several possibilities exist. The first is full specification of the commodity with respect to species, variety, grade, and time and place of provision (e.g., U.S. number 2 soft red wheat, delivered on September 30 to Chicago). This is the most stringent method of specifying the commodity, and one that no country uses in defining its self-sufficiency policies, although a few may approach it.

An alternative is to specify the commodity with respect to species (e.g., rice), but not with respect to variety and grade, and only roughly with respect to time and location of provision. For example, from the mid-1950s through the late 1970s, South Korea, like many Asian countries, followed a policy to increase the country's degree of rice self-sufficiency. The policy did not distinguish among different varieties of rice and offered the same support price for all varieties. Consequently, by the late 1970s, the government found itself holding large stocks of rice from new high-yielding, low-quality varieties, which consumers disliked. At the same time, prices of "high-quality" varieties continued to rise in spite of the huge government stocks of "low-quality" rice (Lee 1988).

The demand-supply imbalance was partly brought about by changes in consumer demand resulting from rising incomes. (Real per capita gross national product [GNP] in South Korea rose sixfold between 1960 and 1980.) As Koreans became richer, they upgraded their diet, switching to more preferred varieties of rice, which made the government policy more problematic. Pursuing self-sufficiency in this sense may therefore still require some reliance on international trade to balance supply and demand for different grades of the commodity in question, particularly when consumption patterns are shifting due to increases in real income.

A third definition, very different from the first two, is specification of a broad category of goods, such as food grains, which contains several commodities that are substitutes for one another. Here, a self-sufficiency policy would aim for equating domestic supply and effective demand for the broad class of goods as a whole, but still permit exports and imports of individual commodities within the group, often based on relative prices. During the 1960s and 1970s, for example, China often engaged in "calorie arbitrage," exporting rice and importing wheat (and vice versa) depending on the relative price of the two grains in international markets, as part of a strategy aimed at assuring overall self-sufficiency in food grains (World Bank 1986, vol. II).

An even broader definition is sectoral self-sufficiency, in which the aim is to assure that the value of agricultural exports at least covers the value of imported inputs used by the agricultural sector, so that there is no net transfer of foreign exchange into agriculture from other sectors of the economy. This has been the policy followed, for example, by Rwanda, which has led to restriction on imports of fertilizer for domestic food production (Loveridge 1988). In a situation of fully convertible currencies, this policy is the same

as saying that imported inputs should pay for themselves. However, in situations in which there is rationing of foreign exchange and a large amount of unrecorded trade, such a policy may have undesirable consequences. In Rwanda the policy was based on the assumption that the country was self-sufficient in basic staples, such as sorghum and beans, and hence no foreign exchange was being "lost" to food imports. Hence, importing fertilizer for food crops could be justified only if the country could successfully export these crops, which was considered unlikely. Recent research has shown, however, that 20 percent of all the sorghum and 14 percent of all the beans used in rural Rwanda are imported, mainly in cross-border trade from Zaire and Uganda (Loveridge et al. 1988; République Rwandaise 1988). This puts the question of fertilizer imports in a different light, as the foreign exchange costs of the fertilizer must be weighed against the foreign exchange costs of the previously unrecorded food imports.

A final definition would be to specify the commodity simply as foreign exchange, which reduces the policy to one of avoiding a balance of payments deficit. In this broadest of all definitions, a "food self-sufficiency" policy is equivalent to a policy of "food self-reliance" or "food security"; that is, the country has the ability to feed itself either from its own production or from commercial imports. In this broadest sense, Japan is food self-sufficient because its exports of manufactured commodities provide more than enough foreign exchange to meet Japan's food needs through imports. The United States, on the other hand, as the world's largest debtor nation, is not self-sufficient in the sense that it meets current levels of consumption only by borrowing from abroad.

When politicians and economists speak of self-sufficiency, however, it is rarely in terms of this last definition. Most commonly, self-sufficiency policies are defined, explicitly or implicitly, in terms of either a single commodity or a group of closely related commodities. It is useful to recognize, however, that these definitions simply form part of a broader continuum of possible definitions. In examining options, policymakers may want to consider broader definitions, which are generally less costly to achieve because they give greater scope to specialization based on comparative advantage.

#### *Area Coverage*

A second implication of defining self-sufficiency as a situation in which domestic supply equals domestic effective demand is that in order to define self-sufficiency we need to be clear on whether we are talking about subnational, national, or supranational self-sufficiency. Most developing countries pursuing self-sufficiency do so on a national basis, although a few (e.g., China under Mao) have attempted to assure that each region of the country was self-sufficient in basic staples (Lardy 1984). From the 1950s through the 1970s, many African countries and a few Asian countries

restricted private movement of grain across district lines, usually to enforce an official state monopoly on the grain trade. Such restrictions had the effect of encouraging regional grain self-sufficiency, but at the cost to the country of high-cost production in areas not particularly suited to grain. A vision of state-wide self-sufficiency also often appears to motivate state directors of agriculture in the United States, although the U.S. Constitution prevents them from erecting trade barriers to achieve their goal.

Perhaps more important in terms of their effects on the pattern of international trade have been attempts, through the creation of common markets such as the European Community (EC), to increase the level of self-sufficiency on a supranational basis. Under policies aimed at increasing European self-sufficiency, for example, the EC has gone from a major importer of U.S. grain to a competitor in world wheat markets. The establishment of a common market involves both trade creation among member countries as the result of reduced trade barriers within the common market and trade diversion—the loss of trade from lower-cost suppliers who are not member countries. Weighing the economic benefits of a common market involves measuring the net effects of trade creation and trade diversion.

#### *Self-Sufficiency and Nutritional Need*

A third implication of this definition is that food self-sufficiency for a country does not imply that its entire population has an adequate diet. Our definition of self-sufficiency refers only to *effective* demand—that part of the demand for food that is backed up with either public or private purchasing power. India, for example, was a net exporter of wheat in the mid-1980s, and even sent 100,000 metric tons of food aid to Africa in 1984, a time when significant malnutrition still existed in that country (Eicher and Staatz 1986). Similarly, Ireland was exporting food at the time of the Great Potato Famine, because those who were starving (farmers whose potato crop had failed) did not have the income to purchase higher-priced grain, which was being exported to England (Sen 1980).

Some national leaders discuss self-sufficiency as though they mean “nutritional self-sufficiency,” that is, producing enough food domestically to assure that the entire population has an adequate diet. Assuring access to an adequate diet, however, is more a question of assuring adequate effective demand for food among the poor (via employment generation or income transfers or both) than of increasing overall levels of production, as testified to by the persistence of hunger among the homeless in the United States. Increasing the real income of lower-income consumers with high marginal propensities to consume food may turn a currently self-sufficient country into a substantial food importer, even if per capita production in the country increases.

As a corollary to the preceding point, self-sufficiency can be defined only with reference to some price level. If a government wants to impose a high

enough level of protection for domestic agriculture, most countries could be self-sufficient in a particular commodity, albeit at a high cost to consumers (via high food prices) or to taxpayers (via agricultural subsidies). The United States, for example, could be self-sufficient in bananas if the country were willing to pay the enormous cost of greenhouse banana production.

#### *Time Coverage*

Where domestic production fluctuates substantially from year to year, self-sufficiency also must be defined with respect to some periods of time. When a government sets cereal self-sufficiency as a goal, for example, the aim may be never to import cereal, or to import only one year in five or one year in ten. If the country aims to import only rarely, and production fluctuates widely from year to year, then in some years the country will have to export. In the Sahelian countries of West Africa, grain production may fluctuate by more than 30 percent from year to year, requiring carryover stocks equivalent to 30 percent of “average” production to assure that these countries would never have to import. The carrying costs for such an inventory would place an enormous burden on these weak economies. Furthermore, only 15–20 percent of grain production in these countries is marketed, so carryover stocks would exceed total marketed volume. Because the stocks would have to be rotated every two years to keep the grain from going out of condition, and given the very limited size of the domestic market, maintaining such stocks would require these countries to become heavily involved in the import-export business for grain. It is not realistic to expect Burkina Faso or Mali to compete effectively with Cargill in this arena.

Another implication of this definition of self-sufficiency is that the level of self-sufficiency for a given commodity is likely to change over time, even if production per capita remains unchanged, because incomes and tastes (and hence effective demand) evolve over time. For example, as incomes increase, consumers typically demand a more diverse diet containing more animal protein, leading to increases in the demand for livestock products, feedgrains, fruits, and vegetables, and to decreases in the demand for basic starchy staples. Consequently, self-sufficiency policies must evolve with the changing demand-supply balance. Again, South Korea is an example: between 1970 and 1985 imports of rice fell from 500,000 metric tons to zero in response to a rice self-sufficiency program. However, total grain imports more than tripled, from 2.1 million metric tons to 7.3 million metric tons due to the rapidly increasing demand for feedgrains and wheat, fueled by rising consumer incomes and changing consumer preferences (Lee 1988).

Self-sufficiency is much more likely to be achieved quickly where the domestic market for the good in question is thin. If most of the domestic production of a commodity is consumed on the farm, a relatively small increase in production results in a proportionately much larger increase in marketed surplus, which, if not offset by a large increase in effective demand,

can quickly lead to market gluts. This is particularly relevant to the recent emergence of "surpluses" in some developing countries, particularly in Africa. Such "surpluses" typically are a reflection of modest increases in production due to good weather and, in some cases, improved technologies or more favorable prices, combined with little success in raising effective demand through policies to increase per capita incomes.

#### MOTIVATIONS FOR NATIONAL AGRICULTURAL SELF-SUFFICIENCY

Why do so many countries ignore generally accepted theories of specialization and exchange based on comparative advantage and persist in pursuing agricultural self-sufficiency? The most likely explanation is not that policymakers are uniformly irrational but that they are rationally pursuing goals other than narrowly defined economic efficiency. Attacks by economists on self-sufficiency policies as economically "irrational" are, in these cases, likely to carry little weight, as they do not address the real objective of the policies that policymakers may in fact be trying to obscure. Possible justifications for agricultural self-sufficiency policies include risk and stability considerations, protection of domestic agriculture, and pursuit of broader economic goals.

##### *Risk and Stability Considerations*

Agricultural markets are inherently risky. Stochastic fluctuations in production due to weather, combined with the generally inelastic demand for agricultural products, lead to large swings in prices. Economists often argue that international trade can help stabilize domestic prices because production in the world as a whole is less variable than that in a single country. Hence, a country can use trade as a shock absorber, importing in years of domestic shortage and exporting in periods of abundance.

Nonetheless, relying on international markets involves risks, particularly for commodities in which the world markets are volatile due to the residual nature (thinness) of these markets. For example, a very small proportion of total world production of rice and sugar passes through "free" international markets. Most rice is consumed in the country in which it is produced, and most sugar is traded under bilateral or multilateral trade agreements such as the U.S. sugar quota system. Because the international spot markets for these commodities handle only a small residual of total world production, small changes in world output can generate large percentage changes in the volumes handled by these markets and hence large fluctuations in price.

Policymakers may also perceive the risks of relying on international markets as having increased since the early 1970s with the move toward flexible exchange rates, greater integration of commodity and financial

markets, and increased agricultural protection among industrialized countries, particularly the EC and Japan (Schuh 1987; Staatz 1988). The movement to floating exchange rates and the integration of financial and commodity markets have led world prices for agricultural commodities to fluctuate more in domestic currency terms than in the past, as fluctuations in volatile financial markets now spill over into commodity markets. Furthermore, high-income countries, such as the EC, Japan, and the Soviet Union, have increasingly tried to insulate their domestic agricultural economies from this increased volatility by shifting the burden of adjustment from supply and demand shocks onto international markets. Consequently, these markets have become more volatile, making them more risky for developing nations, which lack the financial resources to protect their domestic economies as much as the high-income nations do. Developing countries also often lack the technical expertise and liquidity to operate effectively in international markets through the use of risk management tools such as futures and options contracts. The perception of the riskiness of relying on international markets was reinforced by the experience of 1972-1973, when commodity prices shot up dramatically and the availability of food aid simultaneously declined.

The risks of relying on the international market are both political and economic and are frequently manifested in unexpected fluctuations in domestic food prices. Unexpected and uncontrolled increases in food prices often generate political unrest and may fuel domestic inflation, making the country less competitive in international markets. Political leaders often view large buffer stocks of grain as the only way of insuring against such disruption, particularly when the country lacks the expertise to deal effectively in international grain markets. Despite their high carrying costs, such stocks also have the advantage of allowing the government to influence domestic food prices at strategic moments, such as immediately before elections.

There are international as well as domestic political costs of relying on international trade, particularly where trade requires a country to rely on a politically more powerful trading power. For example, a primary motivation for the move to increase food self-sufficiency among the black-ruled countries of southern Africa during the 1980s was to reduce their economic dependence on South Africa. Similarly, one of the prime motivations leading to India's push for self-sufficiency beginning in the mid-1960s was the belief by Indian political leaders that the nation's political independence was being compromised through dependence on U.S. food aid.<sup>1</sup>

Food self-sufficiency may also be part of a broader national defense strategy. Mao's strategy of regional food self-sufficiency in China from the 1950s through the mid-1970s was in part inspired by military considerations. With such a policy, China could lose territory to invading armies from the north or south without great disruption to the rest of the economy.<sup>2</sup> South Korea's food self-sufficiency program was also part of a general preparation

of the country for war. South Korean planners felt that if North Korea invaded again, South Korea needed food stocks on hand in case international shipping was disrupted (Lee 1988). Strategic considerations, including the need to maintain a dispersed rural population to help discourage invasion, have also influenced the food self-sufficiency goals of the Nordic countries (Hojjati 1988; Kettunen 1988). Finland, for example, sets production and price targets based in part on the level of domestic production and stocks needed to sustain the country in case of a three-year total blockade.<sup>3</sup>

#### *Protection of Domestic Agriculture*

Promoting self-sufficiency may also be part of an attempt to protect a domestic agricultural sector that currently is not competitive internationally. The desire to protect domestic agriculture may arise either because of the political and social costs of forcing domestic farmers to face world market prices, or because policymakers believe that after an initial period of protection domestic agriculture will be able to produce certain products competitively.

Often agriculture may be seen as a declining industry, but one in which the process of adjusting to changing international comparative advantage needs to be tempered with government aid. Given the large number of fixed assets in agriculture, including human capital, that have low returns in alternative uses, it takes very low returns to those assets in agriculture to induce them to move to other sectors of the economy (Johnson and Quance 1972). In the meantime, if farmers were forced to face world market prices, their incomes would be severely depressed, which may not be politically or socially acceptable. If small-scale agriculture and rural communities are also perceived as the repository of the country's traditional social values (as was true in Japan and South Korea), people may view the social cost of allowing this sector to decline as very high. In such circumstances, a self-sufficiency policy is not so much an end in itself as a by-product of policies aimed at transferring income to farmers and preserving traditional values. For example, the United States does not have an explicit national policy to be self-sufficient in dairy products, yet the country had large dairy surpluses in the late 1980s as a result of national policies aimed at transferring income to dairy farmers. Some argue that such policies are made possible by a national ideology, based on Jeffersonian ideals, that views rural life as morally superior to urban life (Tweeten 1979; Browne and Bonnen 1988).

Protection of domestic agriculture may also be justified on the grounds that local agriculture will eventually be competitive internationally, given an initial period of protection. This thesis can take the form of the classic infant industry argument, in which a country developing a new industry such as soybeans needs an initial period of protection until farmers master the new production technology, and processing facilities large enough to capture economies of size are in place. Once these have been achieved, protection would be removed and the industry would be forced to compete internationally.

In recent years, however, this argument has been presented in different terms. Many policymakers, particularly in developing countries, contend that their countries' agricultural sector could compete internationally if world prices reflected "true costs of production." According to this view, current world market prices are poor indicators of international comparative advantage because they very likely reflect unsustainable levels of export subsidies from high-income countries such as Japan and the European Community. Therefore, to build a nation's food strategy based on current "artificially low" world prices is to mortgage the country's future to the whims of those making domestic agricultural policy in the high-income countries. Thus, the theory goes, it is necessary to encourage a certain level of domestic self-sufficiency in order to have enough domestic production capacity in place should the export subsidies from high-income countries evaporate and world prices rise to more "realistic" levels. Such arguments were behind the call in 1987 for a regional protected cereals market for the Sahel (Gabas et al. 1987).<sup>4</sup>

#### *By-Product of Other Economic Policies*

Promoting agricultural self-sufficiency may simply be a tool for, or an outcome of, pursuing other economic goals. For example, governments may restrict imports of agricultural products (particularly those considered luxuries) in order to deal with foreign exchange shortages when more direct means of dealing with the problem, such as devaluation, are considered unfeasible. Or the country may try to discourage consumption of particular products by restricting their importation, thereby making the country more self-sufficient, albeit at a low level of consumption. Such policies may be undertaken to discourage consumption of all consumer products, thereby increasing the proportion of income going to savings and hence investment. This was the policy in the Soviet Union until 1972 and in China until recently. Or imports of particular commodities may be restricted in order to divert consumption to other goods in which the country has more of a comparative advantage. For example, Japan places heavy import duties on beef, which raises the price of beef relative to fish.

In some cases, domestic agriculture may also be subsidized because of the positive externalities it generates for other important sectors of the economy. Some of the subsidies for Swiss agriculture, for example, come from the Ministry of Tourism, because Swiss officials believe that small, mountainside farms make the country more attractive to tourists.

#### INFLUENCING THE DEGREE OF NATIONAL SELF-SUFFICIENCY

Because food self-sufficiency is a function of both supply and effective demand, we can analyze the impact of policies to influence self-sufficiency by

decomposing them into the effects they have on domestic supply and the effects they have on effective demand. This, in turn, may suggest ways in which current agricultural exporters, such as the United States, can respond to increasing self-sufficiency in their traditional export markets. If, for example, U.S. policymakers are concerned that increasing agricultural production in developing countries may limit U.S. farm exports, these policymakers may want to push for foreign assistance policies that foster rapid, broad-based income growth in these countries in order to increase domestic demand more quickly than domestic supply, thereby generating demand for imports (Mellor 1983; Paarlberg 1986).

### *Supply-Side Policies*

Supply-side policies are those that attempt to boost domestic production, often by restricting competing imports. The most common example is a high support price for a domestically produced commodity, which is usually enforced and sometimes financed by import restrictions. The Common Agricultural Policy of the EC, for example, defends its target prices for EC farmers through a variable import levy, the receipts from which help finance agricultural subsidies. South Korea has used an import tax on beef to finance domestic pasture development (a subsidy to Korea's domestic beef industry), and Japan has used import taxes on wheat to subsidize domestic barley production.<sup>5</sup> In addition to import taxes, quotas and other nontariff barriers, such as health regulations and foreign exchange rationing, may be used to restrict imports or redirect import sources, as in the creation of a common market. A major portion of the higher prices to farmers, however, is paid not by importers but by domestic consumers. In most countries it is increasingly problematic that consumers will continue to accept such high levels of implicit taxation.

In addition to raising output prices, governments attempt to increase domestic production through improving input and output marketing systems and by taking other actions aimed at reducing input prices. Improved output marketing arrangements increase incentives for domestic production by reducing marketing margins (for a given level of marketing services), thereby raising farm-gate prices, and by lowering the transaction costs to farmers of orienting their production toward the domestic market. Input policies may take the form of direct market subsidies on inputs; subsidized government production of inputs, such as land development, irrigation schemes, and reclamation projects; and institutional changes, such as land and credit reforms, aimed at improving certain farmers' access to inputs and creating improved incentives to use inputs more efficiently. In addition, governments attempt to increase domestic production by investment in transportation infrastructure and in training and research, which aims at fostering the domestic development of new, lower-cost agricultural technologies or their more efficient importation and adaptation from abroad. In making these

investments, the key question facing the country is whether the return on the investment is competitive with alternative investments. The problem is that for some types of investment, particularly research and institutional changes, rates of return are very difficult to judge *ex ante*, although *ex post* studies have tended to show a high rate of return to agricultural research (Judd et al. 1986).

### *Demand-Side Policies*

The level of self-sufficiency can also be increased by restricting domestic demand, thereby increasing the supply-demand balance. This may be achieved by taxes on specific products, such as beef in Japan; subsidized production of domestically produced alternatives; persuasion, such as advertising ("Buy American!") and extension efforts; or coercion. South Korea included both exhortation and coercion as part of its rice self-sufficiency program during the 1960s. The government periodically declared "no rice days" and assigned Ministry of Agriculture employees to check restaurants and students' lunch boxes to enforce the ban (Lee 1988). Such coercion is sometimes formalized into nonprice rationing systems, such as China and Cuba followed for basic staples until recently. In addition to restricting the level of demand for specific products, a country may follow monetary and fiscal policies aimed at restricting overall levels of aggregate demand, with the aim of restricting overall levels of consumption. Other policies, such as subsidies on imported capital, which have the effect of limiting employment growth by making capital artificially cheaper than labor, may also have the unintentional consequence of limiting income growth, and hence the demand for food, thereby raising the self-sufficiency index.

Much of the concern among U.S. farmers over increasing agricultural self-sufficiency in the Third World has focused on the supply side of the equation. Calls for reducing U.S. foreign aid to countries that compete with the United States in agricultural export markets (e.g., the Bumpers Amendment) ignore the potential impact of U.S. aid in increasing demand for imports into Third World countries by stimulating income growth. For countries that are primarily agrarian, broad-based income growth must begin in most cases with agricultural growth. Hence there is a strong justification, in terms of U.S. self-interest, in promoting agricultural growth in these countries. Indeed, countries that have been most successful in stimulating broad-based agricultural growth during the past twenty years, such as South Korea, have also experienced very rapid increases in agricultural imports, as effective demand (particularly for livestock and hence feedgrains) has outstripped the countries' rapidly growing agricultural supply (Mellor 1983; Paarlberg 1986). Therefore, promoting income growth in these countries, although it may initially involve growth in exports that compete with the United States, may in the longer run stimulate U.S. agricultural trade.

## CONCLUSION

Pursuing agricultural self-sufficiency involves trying to bring domestic agricultural production into balance with domestic effective demand. Motivations to do so vary widely, with self-sufficiency sometimes sought as an end in itself and sometimes pursued simply as a means of achieving some other objective. Not surprisingly, given the divergence of objectives, specific policies used to attain self-sufficiency vary widely, as do the tradeoffs countries face between increasing self-sufficiency and achieving other objectives. The following chapter elaborates on these issues.

## NOTES

1. This is according to Uma Lele, Division Chief, Development Strategy Division, Economics and Research Staff, World Bank (personal comm., January 1988). The ability of a country to use food as a political weapon, however, is often overestimated. See Paarlberg (1985) for details.

2. China's self-sufficiency policy also reflected the ideological opposition of certain factions of the Communist party to trade, as well as a recognition of the poorly developed transportation infrastructure within the country. For details, see Lardy (1984).

3. This is according to Lauri Kettunen, Director, Agricultural Economics Research Institute, Finnish Ministry of Agriculture (personal comm., January 1988).

4. There is an inconsistency between this argument for protecting domestic agriculture and the one discussed previously. The "declining industry" justification for protection argues that resources will move out of agriculture very slowly, even in the face of lower prices, leading to very low incomes for farmers. The thesis regarding the export subsidies of high-income countries argues that without higher prices, resources will move quickly out of agriculture, leading to a lack of national production capacity, which, proponents contend, would be costly to re-establish if world prices rose.

5. This is according to Sang-Mu Lee, former agricultural advisor at the President's Office, Republic of Korea (personal comm., February 1988).

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