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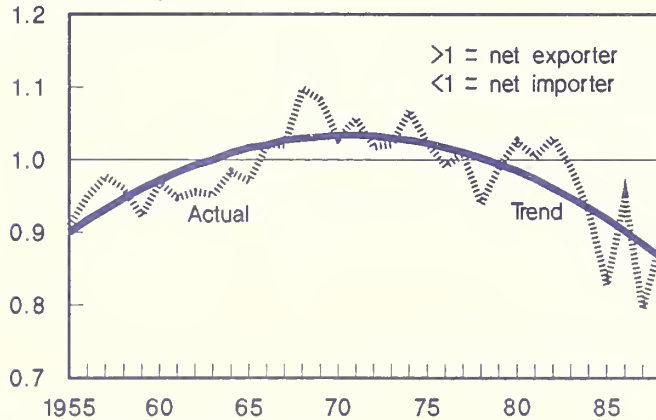
World Agriculture

Situation and Outlook Report

World Agriculture
September 1990

U.S. Dependence on Imported Nitrogen Increases

Self-sufficiency ratio¹



¹ Consumption + net imports/consumption.

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Economics Editor
Arthur J. Dommen

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World Agriculture Situation and Outlook Report will be published in a new format beginning this spring. **WORLD AGRICULTURE** will continue to report on significant issues and trends in global agriculture and trade and their implications for U.S. agriculture.

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Summary

The recent escalation in crude oil prices will cut the world's real output and slow production growth in most countries. Higher inflation and lower demand are likely to reinforce the divergent growth trends in the industrial bloc—raising the risk of a recession in North America but leaving East Asia and Western Europe with strong economic activity. Nevertheless, large petroleum stocks, generally stronger economies, and more energy-efficient industries will cushion the industrial economies' adjustment to higher oil prices.

In contrast, a longer period of recovery is expected for oil-importing developing countries and for Eastern Europe, particularly those with debt-service problems. The diversion of foreign exchange to higher oil-import costs will trim imports of other merchandise. Furthermore, earnings by oil exporters will not be completely transformed into import demand. As in the past, however, many "petrodollars" will be recycled through Eurocurrency markets.

The falling value of the U.S. dollar vis-a-vis the German mark and the Japanese yen will relieve cost-push pressures from higher oil prices and production-capacity constraints in Germany and Japan. Higher interest rates in these countries as well as continued strong real Gross Domestic Product (GDP) growth should maintain their currencies' recent significant gains against the dollar. The bearish sentiment toward the dollar mainly reflects the deteriorating U.S. economy and its intractable budget deficit.

During fiscal year 1991, the value of U.S. agricultural exports is expected to drop as increased foreign supplies lower U.S. export volume. U.S. corn exports are expected to fall 7 million tons as overseas customers replace U.S. corn with competitors' feed wheat. Wheat prices are expected to average lower in 1990/91 due to larger crops. But higher soybean prices will help offset some of this decline.

Fiscal year 1990 agricultural exports totaled about 148.5 million metric tons and about \$40 billion, respectively, both slightly above fiscal year 1989. Increased exports of high-value products and cotton offset lower prices for bulk products (other than cotton).

The Trade Negotiating Committee (TNC) that oversees the Uruguay Round of multilateral trade negotiations met July 23-26, 1990, for the important task of reviewing the status of agreement profiles for the Rounds's 15 negotiating groups and to provide the political-level resolve to overcome remaining obstacles. Arthur Dunkel, GATT Secretary-General and chairman of the TNC, noted at the conclusion of the meeting, however, that many of the agreement profiles represented "a compendium of positions, rather than draft agreements." With the concluding session of the Uruguay Round negotiations scheduled to convene in Brussels at the beginning of December, this state of affairs puts the negotiating groups "collectively behind schedule."

Agriculture remained one of the most contested areas at the meeting. Of particular concern was whether participants would accept the draft agreement text forwarded to the TNC by the Agriculture Negotiating Group chairman, Aart de Zeeuw. The countries did reach an agreement to intensify discussions by using the chairman's text. In accordance with the de Zeeuw text, they agreed to submit detailed country lists outlining current agricultural policies by October 1. This submission would be without prejudice to the participating countries' negotiating positions.

This issue contains four special articles. "Role of Imported Fertilizer Inputs in U.S. Agriculture" examines the increasing dependence of the U.S. fertilizer industry on imported inputs and the contribution of low-cost fertilizers to the competitiveness of U.S. agricultural exports. In the second article, Taiwan's agricultural reforms are analyzed and linked to that government's application to join the GATT. The authors of the third article associate countries having neutral trade regimes with more rapid economic growth than those following inward-oriented, import-substitution strategies. The fourth article looks at resource use and deforestation in Brazil's Amazon and shows how the problem is viewed differently by Brazilians and the rest of the world.

The World Economy And Exchange Rates

The recent escalation in crude oil prices will cut the world's real output and slow production growth in most countries. Higher inflation and lower demand are likely to reinforce the divergent growth trends in the industrial bloc—raising the risk of a recession in North America but leaving East Asia and Western Europe with strong economic activity. Nevertheless, large petroleum stocks, generally stronger economies, and more energy-efficient industries will cushion the industrial economies' adjustment to higher oil prices.

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World Economic Activity

The Developed Economies

With the exception of the United States, Canada and the United Kingdom, the economies of the major Organization for Economic Cooperation and Development (OECD) countries should expand at about last year's pace—3.3 percent for the European Community EC, and at least 4.7 percent in Japan. Because these economies are working at virtually full capacity, higher oil prices and the extra demand from East Germany will add to inflationary pressures. Higher interest rates, however, are likely to crowd out domestic demand and divert output to exports, thereby attenuating inflation pressures.

Germany's unification is further boosting growth in neighboring countries such as France and Belgium. Despite the cushioning effect of Germany's sizable current account surplus, the strong demand for capital has raised interest rates there. The expected cost of modernizing East Germany's economy has risen from earlier estimates, thus increasing the risk premium charged against borrowed capital. The strong deutsche mark should, however, hold Germany's inflation down and keep needed capital flowing in.

If the United States escapes a recession, it will be because of the strong economies in Europe and the Pacific Basin—healthy markets for U.S. exports. The lower U.S. dollar can make up through export earnings part of what is lost in higher U.S. oil import costs.

Eastern Europe

The East European countries are now faced with even bleaker prospects of extricating themselves from old market rigidities. Their significant debt-service obligations are now exacerbated by the loss of inexpensive Soviet oil, and for some, trade contracts with Iraq. Higher interest rates will make trade financing more expensive, due to the lack of foreign exchange.

In general, negative real growth will remain, but increasingly qualified by improvements brought about by price reform and closer integration into the multilateral trading system. Positive growth rates should emerge over the medium term as industries become more competitive and as foreign direct investments accumulate and prosper.

The Developing Economies

Like the developed bloc, the developing countries (LDC's) are experiencing a growth slowdown this year but are expected to recover next year. This pattern reflects tighter financial policies in many LDC's, the slowing of world trade, and higher interest rates. Oil-importing LDC's in Africa and Latin America will be particularly hard hit by higher petroleum costs, given their already sluggish or recovering economies and their less energy-efficient industrial sectors. Additionally, LDC's lack the facilities to keep adequate inventories.

Economic activity in Latin America will barely escape negative growth this year as gains by oil-exporting Mexico and Venezuela are offset by setbacks in Argentina and Brazil. In Africa, oil exporters will benefit at the expense of debt-laden oil importers.

East Asia's rapidly expanding economies were poised for even more buoyant growth this year and next, but the impact of higher oil prices on world demand and trade will temper growth prospects in the region. However, less dependence on exports to the United States will limit the losses from lower U.S. import demand. Hence, these countries and those of South Asia will likely perform no worse than last year's overall economic growth advance of 5.1 percent. Prospects for Indonesia and Malaysia are now enhanced by higher earnings from crude oil exports.

Petroleum Picture

The short-run shortage of crude oil will apparently not disappear until late fall when excess production capacities from the Organization of Petroleum Exporting Countries (OPEC)

and elsewhere are in full operation. The extra output should meet the shortfalls resulting from the embargo on Iraqi and Kuwaiti oil and from increased seasonal demand, as some slowdown in overall demand due to higher oil prices is expected to occur by then. While crude inventories in OECD countries were high when the cutoff occurred, the supply of petroleum products is currently constrained by refining capacity. Moreover, the replacement of light Iraqi and Kuwaiti oil with heavier Saudi and Venezuelan crudes exacerbates already scarce refining capacity.

Oil imports by the United States have reached 8.3 million barrels per day (mbd), close to the year's peak in January when winter temperatures plunged below normal levels. At the same time, current U.S. domestic production of 7 mbd is at a record low, down by almost 1 mbd since January 1989.

Interest Rates

The new round of Eurocurrency rate acceleration that started over the summer has pushed short-term interest rates for German mark and Japanese yen deposits to new heights—this time above the Eurodollar rate, currently at 8 percent. Given domestic inflation rates running at about half the U.S. rate, real yields offered by the mark and yen deposits are substantially higher. These interest-rate premiums impose a further burden for the United States—they put a floor under U.S. long-term rates in order to secure financing for the U.S. budget and current account deficits. Short- and long-term interest rates between countries are inevitably linked in global capital markets.

Foreign Exchange Market

The U.S. dollar has entered new territory against the German mark—below 1.60 marks, and has fallen back to 1989's mid-year level of 140 yen. Higher short-term interest rates in Japan, combined with an expected 5-percent growth in real gross domestic product (GDP) this year, point toward a stronger yen, despite a weak stock market.

The ascent of the German mark is buttressed by Europe's ongoing economic integration and by Germany's emergent position as principal trading partner and primary source of capital for Eastern Europe and the Soviet Union. The European Monetary System further ensures the appreciation of other West European currencies against the dollar, given their fixed exchange-rate bands with the mark. [Alberto Jerardo (202) 786-1705]

World Trade and Agricultural Policy

U.S. Agricultural Trade

During fiscal year 1991, the value of U.S. agricultural exports is expected to drop as increased foreign supplies

lower U.S. export volume. U.S. corn exports are expected to fall 7 million tons as overseas customers replace U.S. corn with competitors' feed wheat. Wheat prices are expected to average lower in 1990/91 due to larger crops. But higher soybean prices will help offset some of this decline.

Fiscal year 1990 agricultural exports totaled about 148.5 million metric tons and about \$40 billion, respectively, both slightly above fiscal year 1989. Increased exports of high-value products and cotton offset lower prices for bulk products (other than cotton). However, the increase in high-value exports was largely due to corrections of previous underreporting available of exports to Canada.

Before January 1990, a significant portion of all U.S. goods exported to Canada were not reported in U.S. trade statistics. Unreported U.S. exports to Canada totaled \$16 billion in calendar year 1989, including both agricultural and nonagricultural products. This was equivalent to about 25 percent of the \$63 billion of exports originally reported by the Bureau of the Census. For agricultural products, it is estimated that underreporting represented about 50 percent of reported exports, with high-value products accounting for most of the unreported goods.

Under the terms of a 1987 memorandum of understanding, the United States and Canada agreed to officially exchange data regarding trade between the two countries, because each country's import data were unaffected by undercounting. Canada and the United States, like most countries, have traditionally monitored imports more closely than exports.

From January 1990 onward, U.S. data for exports to Canada will be based on Canadian statistics on imports from the United States. Canada will do the same using U.S. import data. Because data for previous years will not be revised, 1990's export value registered an apparent gain of about \$1 billion.

Wheat Exports Down in 1990

Bulk product volume in 1990 was little changed from the previous year, but export prices were generally lower, given the recovery of U.S. crop production from drought-reduced levels. During the first 10 months of fiscal year 1990, corn exports rose 8 million tons, soybean exports rose 2.5 million tons, and wheat exports fell 6 million tons.

Lagging wheat exports are the result of larger prospective crops in several major importing countries, increased competitor supplies (especially in Canada), and buyers' anticipation of even lower prices in the future.

Exports to China were forecast to fall more than 40 percent in fiscal year 1990, largely because of lower wheat exports. U.S. wheat shipments to China totaled 8.2 million tons in fiscal year 1989, but during the first 9 months of fiscal year

1990 China's imports from all sources fell nearly 10 percent, and U.S. market share fell from about 50 to 25 percent. Australia and Canada, especially the latter, have gained share at U.S. expense. Canada's sales were low in fiscal year 1989, due to poor production, but they have rebounded, returning Canada to its longstanding 40-45 percent market share.

Following an 18-percent rise to \$955 million in fiscal year 1989, U.S. agricultural exports to Egypt were forecast to decline to \$700 million in 1990, largely because of Egypt's credit problems. Egypt's imports of U.S. vegetable oil are forecast down, after increasing in 1989 under the U.S. Sunflowerseed Oil Assistance Program (SOAP). Wheat imports also fell, largely because of a bumper wheat harvest and Egypt's difficulties with past-due payments for GSM 102 credits received in earlier years.

Egypt's chronic shortage of foreign exchange also accounted for cuts in its purchases of U.S. tallow and poultry meat. However, U.S. cotton exports to Egypt rose 84 percent during the first 9 months of fiscal year 1990, as Egypt continued to increase textile exports and sell long-staple cotton overseas.

Shipments of U.S. agricultural products to Iraq were halted under U.N. sanctions in early August. Fiscal year 1990 shipments before the sanctions are believed to have totaled about \$590 million under USDA's GSM 102 and 103 credit guarantee programs. According to the Bureau of the Census, fiscal year 1989 exports to Iraq totaled a record \$790 million. Wheat and soybean meal are expected to account for most of the \$200-million decline from 1989, although sunflower oil exports will also be affected. Lower exports had already been forecast before the August sanctions were imposed.

Coarse Grain and Cotton Exports Rise

Stronger demand for U.S. coarse grains by the USSR, Taiwan, and Mexico probably drove exports almost 9 million tons higher in fiscal year 1990 to 69.2 million tons—their highest since 1981. Strong demand sustained coarse grain prices, and export value is estimated to have risen to \$8 billion, an increase of almost \$800 million.

Record corn sales to the USSR during the first 9 months of the 1990 fiscal year sustained grain exports to the Soviets at 1989 levels, despite a drop in wheat exports. The heavy Soviet presence in the world grain market over the past year, despite the rise in their 1989 production, primarily reflects the poor showing of farm sales of grain to the State. Soviet import demand for grain will likely remain relatively strong in 1990/91 even though tight hard-currency supplies and domestic opposition to importing grain continue to pose problems.

Despite growing domestic output of meat and dairy products, Soviet demand for livestock products continues to out-

pace supplies, due largely to the heavy State subsidization of retail prices and to increased wages. U.S. meat and dairy sales to the USSR—already at an all-time high—may benefit from any cutback in Soviet purchases from Eastern Europe.

Growing feed consumption by Taiwan's pork and poultry industries has boosted U.S. agricultural exports to Taiwan to a forecast record \$1.8 billion in fiscal year 1990. While slower growth in Taiwan's exports of manufactured goods slowed its economy, the gross national product (GNP) has remained high by world standards. GNP probably increased 6 percent in 1990, and the wage gains and currency appreciation that slowed Taiwan's manufactured exports were encouraging for U.S. sales.

Like coarse grain exports, U.S. cotton exports probably rose \$850 million from fiscal year 1989, an increase largely attributable to competitive U.S. prices and strong foreign demand resulting from reduced supplies in major competing nations including China, Pakistan, and the USSR.

Larger cotton exports were mainly responsible for sustaining U.S. agricultural exports to the European Community (EC) in fiscal year 1990. At \$7 billion, U.S. agricultural exports to the EC were forecast to be unchanged in fiscal year 1990. Increased U.S. exports of cotton and some high-value products were expected, but meat exports continue to suffer from the EC's hormone ban.

One reason for strong U.S. exports is West Germany's economic growth associated with reunification, which is sustaining growth in other European countries. Although other EC countries are pursuing restrictive monetary and fiscal policies in 1990, Germany's economic and monetary union has required a rise in the money supply as ost marks were exchanged for deutsche marks and as larger budget outlays were required to pay for the additional social costs (pensions, unemployment, health insurance) of reunification.

U.S. cotton exports to the EC rose more than \$200 million during the first 9 months of the fiscal year. These exports are benefitting from low world stocks-to-use ratios—the lowest in 40 years. The tight market situation has kept prices high, making U.S. cotton more competitive. In addition, exports have benefitted from the appreciation of EC currencies, especially the deutsche mark, against the dollar. [Stephen A. MacDonald (202) 786-1821]

GATT Agriculture Negotiations and TNC Meeting

The Trade Negotiating Committee (TNC) that oversees the Uruguay Round of multilateral trade negotiations met July 23-26 for the important task of reviewing the state of agreement profiles for the 15 negotiating groups in the Round and to provide the political-level resolve to overcome remaining obstacles. Arthur Dunkel, GATT Secretary-General and

chairman of the TNC, noted at the conclusion of the meeting, however, that many of the agreement profiles represented “a compendium of positions, rather than draft agreements.” With the Uruguay Round negotiations set to hold their concluding session at the start of December in Brussels, this state of affairs put the negotiating groups “collectively behind schedule.”

Agriculture remained one of the most contested areas at the meeting. Of particular concern was whether or not participants would accept the draft agreement text forwarded to the TNC by the Agriculture Negotiating Group chairman, Aart de Zeeuw. The participating countries did reach an agreement to intensify discussions by using the chairman’s text. In accordance with the de Zeeuw text, the countries agreed to submit detailed country lists outlining current agricultural policies by Oct. 1. This submission would be without prejudice to the participating countries’ negotiating positions.

Agriculture Chairman’s Proposal

The de Zeeuw text proposes reforms in the often-discussed fields of internal support, border protection, export competition, and sanitary and phytosanitary regulations.

Internal support—The chairman’s text calls for reductions in internal support and protection beginning in 1991/92 for an agreed number of years and at an agreed rate, using a commodity-specific aggregate measure of support (AMS) that would use a 1988 base year and a fixed reference price based on 1986-88 data in order to calculate the total monetary value of supports for each commodity. All internal support policies would be reduced, with the exception of policies meeting certain agreed criteria.

This reduction would apply to price supports (including measures which help keep producer prices above those prevailing in international trade for the same or comparable products), direct payments to producers (including deficiency payments), and measures that reduce marketing costs (including credits and other financial inputs that are available only to agriculture). Some exceptions to this AMS reduction would be allowed. They include such broadly available programs as those for marketing and promotion, the environment and conservation, land retirement, regional development, and income safety-net programs. These exceptions, however, would still be subject to overall ceilings on support and to surveillance.

Exemptions would also have to conform to the following criteria: the support must come from government programs funded by taxpayers (rather than by consumers), the support must not be linked to production, the support must not be restricted to any specific agricultural product or sector, the support must not provide the effect of a price support for producers, and, for income safety-net programs, the support must not maintain producer income at more than an agreed percentage of the most recent 3-year average.

Border protection—To liberalize world agricultural trade and promote greater market orientation of agricultural policies (as agreed at the April 1989 GATT Midterm Review), border protection would be reduced by increasing market access opportunities in line with substantial and progressive cuts in internal support and protection. The chairman’s text calls for converting all nontariff trade barriers to tariff equivalents, a process commonly referred to as “tariffication.” Border measures, such as the EC’s variable levy and the United States’ sugar, dairy, and cotton import quotas, would be subject to tariffication. Minimum levels of access would be guaranteed by establishing tariff quotas at zero, or at levels low enough to assure import access—even without prior significant imports. Safeguard provisions are incorporated into the chairman’s paper to deal with import surges and excessive world price movements. The de Zeeuw text also includes the possibility of “specific solutions” to be negotiated where special situations arise for some products.

Export competition—The de Zeeuw text specifically proposes that export subsidies be reduced “effectively more than other forms of support and protection” as long as some participants insist on maintaining a dual-price system that requires export subsidies to bridge the difference between world and domestic price while others consider export subsidies to be the most trade-distorting support.

The United States considers export subsidies to be without redeeming quality, while the EC has steadfastly held that export subsidies are an essential component of its Common Agricultural Policy. The EC uses export subsidies to help clear its internal market of produce that costs more than the world market price to produce. Reductions in direct budgetary export assistance and other forms of export aid would be measured in terms of cuts in total budget export subsidies, per unit subsidies, total quantities subsidized, or some combination of these.

Remaining Negotiations

The GATT Agriculture Negotiating Group reconvened Aug. 27. It soon became apparent, however, that none of the major players was prepared to abandon its previously stated position until October, when countries have been called upon to table their final stated offers. The de Zeeuw proposal calls for detailed country lists in the negotiations on agriculture to be submitted by Oct. 1. Final stated offers for all negotiating groups, including Agriculture, are due Oct. 15 as decided at the July TNC.

The July TNC meeting established the week of Oct. 8 to begin work on drafting the final agreements for all negotiat-

ing groups. Final stated offers for all groups (such as Agriculture described above, or, for example, tariff and nontariff barrier offers in the market access negotiations) are to be submitted by Oct. 15. The Group on Negotiations on Goods (GNG) is expected to make its evaluation of the results of the negotiations with respect to special and differential treatment for developing countries in early November. Final documents could then be prepared by Nov. 23, according to the TNC chairman. This would allow ministers to convene the week of Dec. 3 to make the remaining policy decisions that would permit the adoption of legal agreements for presentation to the national legislatures. [Edward C. Wilson (202) 786-1693]

World real economic growth			
Calendar year	1989	1990	1991
Percent change			
World	2.6	2.5	3.1
World less U.S.	2.6	2.9	3.3
Developed countries	3.4	2.7	2.9
DC's less U.S.	3.9	3.5	3.2
United States	2.5	1.2	2.0
Canada	2.9	1.1	1.0
Japan	4.7	5.0	4.0
EC-12	3.3	3.3	2.9
Developing countries	4.1	3.3	5.3
Latin America	1.0	0.7	4.4
Mexico	2.9	3.3	4.1
Asia	5.1	5.4	5.7
South Korea	6.1	8.4	7.3
Taiwan	7.4	5.8	8.9
China	4.0	3.7	6.1
Middle East	3.9	3.2	3.4
Africa	2.8	3.0	3.8
Eastern Europe	-3.5	-4.9	-2.6
USSR	-4.3	-5.8	-3.7

Source: The WEFA Group (July 1990).

Role of Imported Fertilizer Inputs in U.S. Agriculture

by
Gary Vocke*

Abstract: Fertilizers are needed to maintain U.S. agricultural productivity. Imports, notably of potash and nitrogen, have played a key role in holding down costs. The United States became a net importer of potash in the 1960's, and of nitrogen in the 1980's. The U.S. Bureau of Mines projects that the United States may become a net phosphate importer sometime after 2000.

Keywords: Fertilizers, agricultural trade, cost of production, potash, nitrogen, phosphate.

Long-run U.S. competitiveness in agricultural export markets has been helped by relatively low-cost inputs for fertilizer manufacture. Fertilizers furnish nutrients to the soil, maintaining the productivity that allows U.S. agriculture to be a major player in world grain trade. Without these added nutrients, U.S. farmers would be mining their soils of nutrients essential for crop growth, eventually reducing productivity and raising unit production costs, thereby reducing the competitiveness of exports. USDA data show that while total U.S. fertilizer use on major crops has gone up over the last 20 years, imported fertilizers constitute a larger share of use today (fig. A-1).

Fertilizer manufacture begins with the basic materials of ammonia, phosphate rock, and potash, which are used to pre-

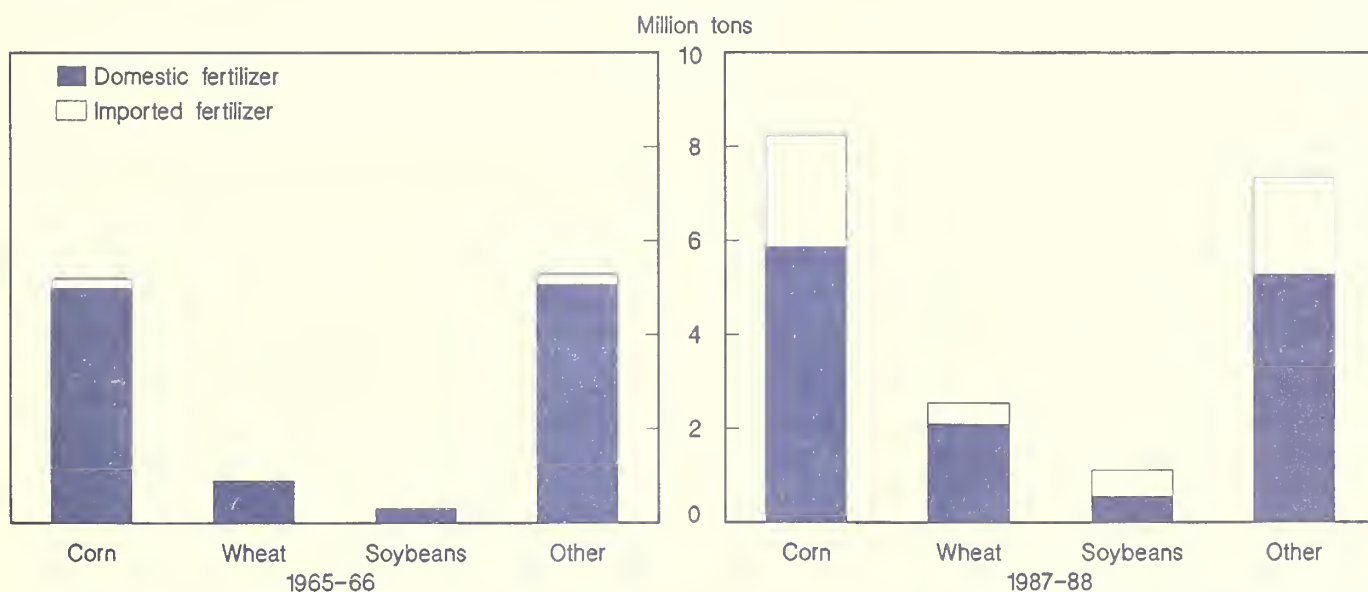
pare intermediate and finished fertilizer materials (fig. A-2). The basic materials are prepared from natural gas and phosphate and potash ores. The availability and relative costs of these resources determine whether fertilizer raw materials are obtained domestically or imported.

Canadian Imports Affect Fertilizer Prices to U.S. Farmers

Potash fertilizer production started in Germany in the 1860's, and until the 1940's that country was the world's principal potash supplier. Then during World War I, the blockade of Germany cut off exports to the United States, encouraging the U.S. Government to explore for domestic sources (10). Deposits were found in New Mexico, and mining started in 1931. This competing source of potash low-

Figure A-1

U.S. Fertilizer Consumption Becoming More Dependent on Imports

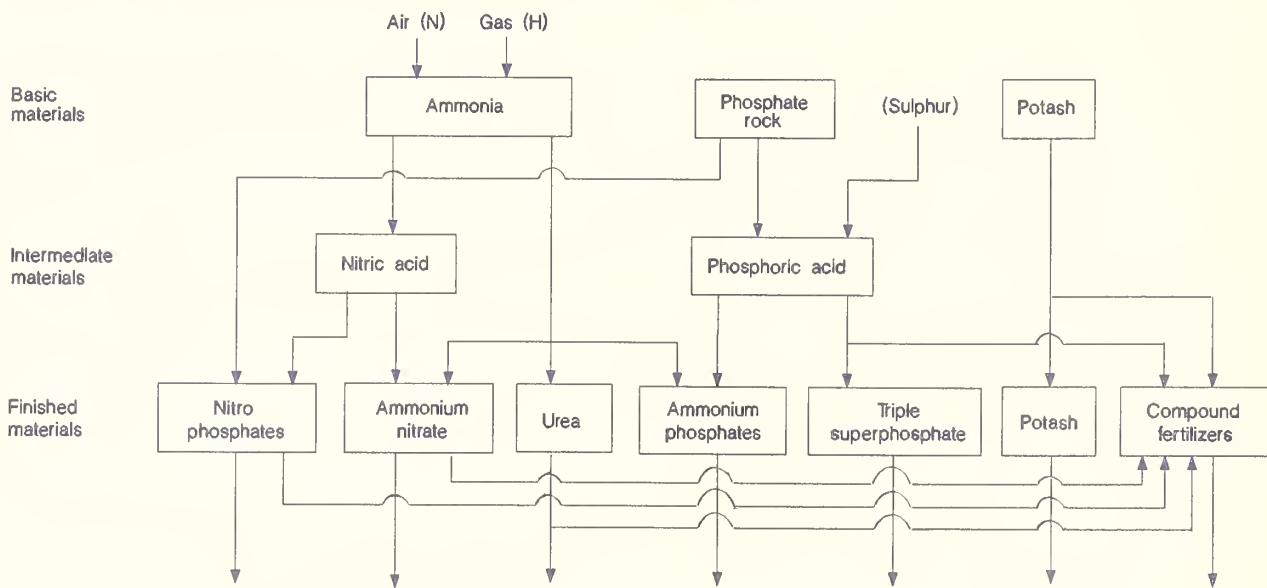


Sources: (21, 22)

*Agricultural economist, Economic Research Service, USDA.

Figure A-2

Production Flow Chart for Principal Fertilizer Materials

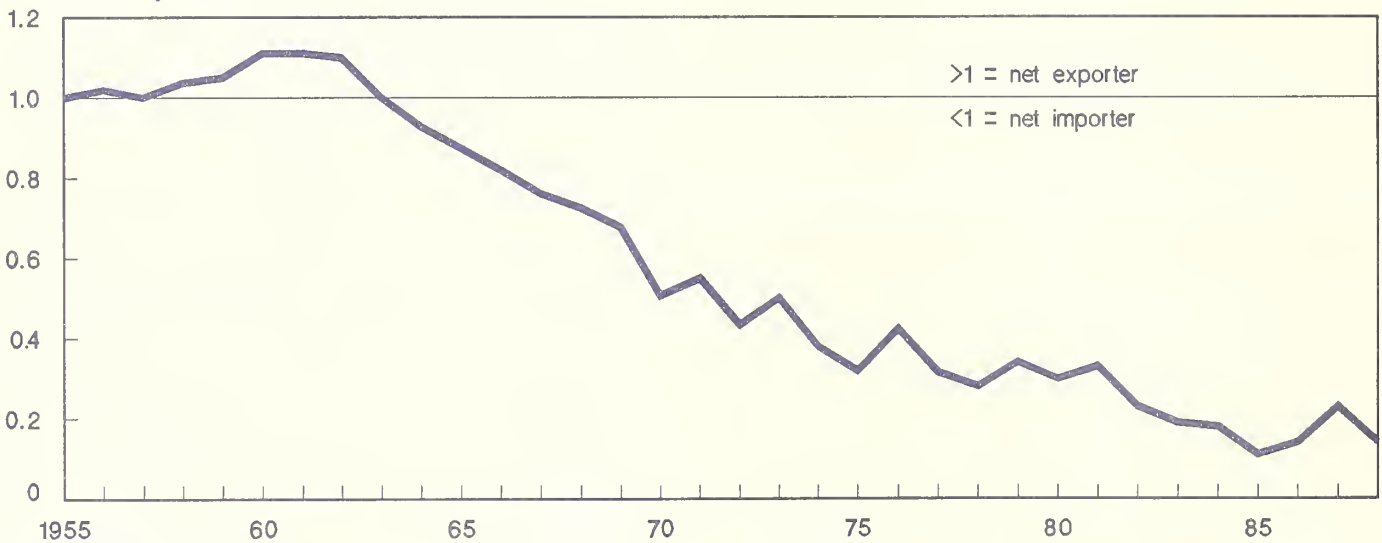


Source: (5).

Figure A-3

U.S. Dependence on Potash Imports Increases

Self-sufficiency ratio*



* Consumption + net imports/consumption.
Sources: (4, 21, 22)

ered prices for U.S. farmers. By 1933 production had expanded enough for the United States to begin exporting potash.

At the same time, however, the eastern United States continued to import potash from Europe because transportation costs were lower than from New Mexico (14). Elsewhere, New Mexico had the advantage. This division of the country's fertilizer market occurred because potash is a bulky, low-value commodity whose transportation costs give naturally protected markets.

The impact of transportation costs was shown after potash mining began in Canada in 1958. By 1963 Canadian exports had started to replace New Mexico potash in the upper Midwest because transportation costs favored Canadian potash (4). Growth in domestic consumption beyond the capacity of U.S. producers, plus the large reserves of high-grade Canadian potash ore, led to a rapid expansion of Canadian potash production and U.S. dependence on imports (fig. A-3). Imports lowered the cost of fertilizer in the Midwest. However, because of their transportation edge, New Mexico mines continued to supply the southeastern United States and some export markets through West Coast and Gulf ports (13).

Recently, however, administrative action raised potash prices, and therefore fertilizer costs to U.S. farmers. In response to a petition by two New Mexico-based potash companies, the Department of Commerce issued a preliminary finding in August 1987 that Canadian potash had been sold in the United States at less than fair market value. Following the finding, the Government of Saskatchewan and private firms raised potash prices to the United States (20). Consequently, wholesale potash prices increased from \$57 per ton in August to \$91 by December 1987.

In January 1988, the antidumping case was suspended when Canadian potash producers and the U.S. Department of Commerce signed an agreement restricting Canadian producers from dumping potash in the United States. Wholesale potash prices fell somewhat after the agreement, but remained significantly above pre-trade-case levels, averaging \$80 by February. U.S. farmers also faced record potash prices as the increase at the wholesale level was passed on. The retail price of potash reached \$157 per ton by April 1988, up 37 percent from a year earlier, and rose to \$163 by April 1989.

Reversal of Nitrogen Trade Trend Holds Down U.S. Fertilizer Costs

The U.S. shift to a net importer of nitrogen during the 1980's is a new trend (fig. A-4). The earlier trend toward net exports in the 1960's and early 1970's followed rapid expansion of U.S. manufacturing capacity. Rising natural gas prices forced a reversal of this trend.

U.S. nitrogen imports began with guano from Peru and nitrates from Chile. These nitrogen sources were replaced by nitrogen fertilizers made with ammonia from coke-oven gas, and later ammonia from the Haber-Bosch synthetic nitrogen process developed in Germany.

Ammonia Production Dependent On Low-Cost Natural Gas

Coal was the main input in synthetic nitrogen production until the 1940's, when it was displaced by naphtha (a petroleum product), which in turn was replaced by natural gas in the late 1950's. Low-cost natural gas and improved manufacturing technology allowed the United States to trend toward net exports of nitrogen.

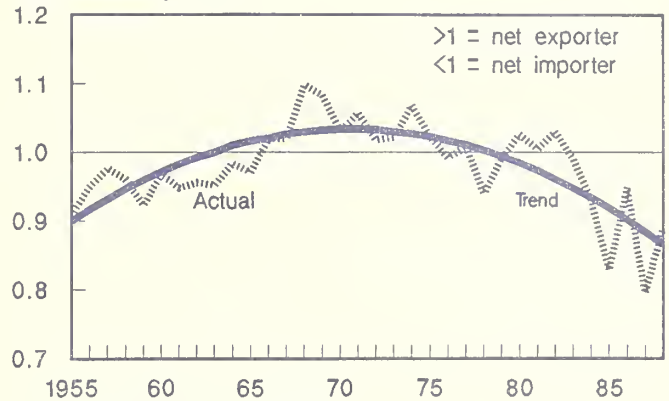
However, when the United States deregulated natural gas prices during the 1970's, U.S. ammonia producers lost markets to foreign producers. U.S. natural gas prices are now higher than the price of gas in those countries where there are no economic alternative uses for the natural gas, as in the USSR and the Middle East where much natural gas is flared. Competing sources of ammonia can reduce the cost of nitrogen fertilizer to U.S. farmers.

Before 1960, most of the world's ammonia production was in the industrial countries of the United States, Western

Figure A-4

U.S. Dependence on Imported Nitrogen Increases

Self-sufficiency ratio*



* Consumption + net imports/consumption.
Sources: (2, 7, 8, 9, 21, 22).

Table A-1--Regional breakdown of ammonia capacity under construction and planned through 1995

High natural gas prices are restructuring the ammonia industry as new plants are constructed outside North America

Region	Under construction	Planned
	1,000 tons N	
North America	-	366
Western Europe	410	493
Eastern Europe	-	58
USSR	369	2,029
Oceania	-	407
Africa	381	544
North Africa	381	-
Sub-Saharan Africa	-	544
Latin America	811	1,048
Central America	738	-
South America	73	1,048
Asia	1,617	3,815
East Asia	979	1,563
South Asia	366	2,252
West Asia	272	-
World	3,588	8,760

- = None reported.

Source: (2).

Europe, and Japan. Now, ammonia manufacture is increasing elsewhere as new plants using the latest technology are constructed elsewhere, especially in those countries possessing low-cost sources of natural gas (table A-1) (19). Older, less efficient plants have been closed in the industrial countries.

Phosphate Imports May Reduce Industry's Environmental Impact

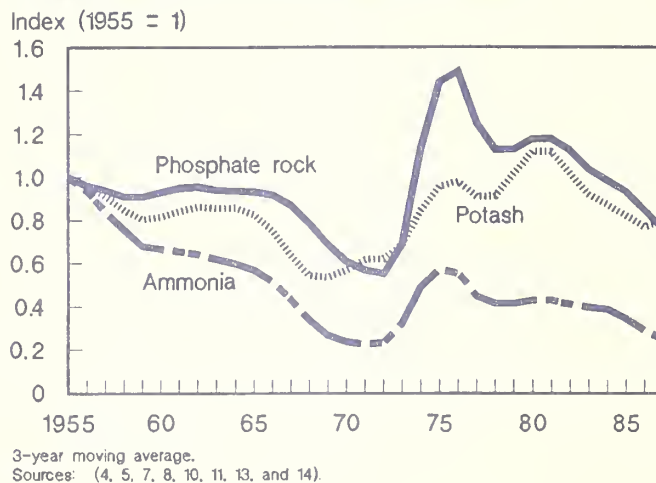
Large, high-quality phosphate ore reserves in the southeastern United States, principally Florida and North Carolina, have allowed the country to be a leading producer and exporter of phosphate rock and phosphate products. Now, however, U.S. exporters are looking at higher production costs with the exhaustion of high-quality ore reserves and the higher costs associated with opening new mines. The rising costs would come at a time when U.S. exporters face strong competition from North Africa (1).

Phosphate Rock Processing Shifts to Mines

Phosphate rock producers are increasingly exporting their phosphate ore as phosphoric acid or finished fertilizer products because transportation costs for higher-grade products are cheaper. This value-added processing at the mine is restructuring the world fertilizer industry and trading patterns, especially in Western Europe.

Western Europe's phosphate industry has traditionally imported phosphate rock for processing. Now, these companies face competition from imports of phosphoric acid and phosphate fertilizers from Morocco and the southeastern United States. But rising costs due to environmental restrictions and lower-grade ore could limit opening of new mines in Florida and, thus, exports to Western Europe (17). One of the environmental problems is disposal of wastes from the initial processing at the mine. In North Carolina, expansion is limited by the risk of harming local aquifers (16). If processing ore takes too much water from the local aquifer, sea water will intrude.

Figure A-5
Decline in Real Price of Ammonia, but Not in Phosphate Rock and Potash Prices



The U.S. Bureau of Mines forecasts that through 1995 the supply of phosphate rock will be greater than demand from domestic consumption and exports as phosphate rock or phosphate products (17). The Bureau forecasts that by 2000, as existing operations are mined out, and if investment in new mines cannot be justified, U.S. production will be only adequate to meet domestic needs (1). After 2000, if domestic phosphate rock production costs continue to rise, making investment in new phosphate mines uneconomical, imports will be needed.

Potash and Phosphate Rock Prices No Higher Than in the 1950's; Ammonia Prices Much Lower

Manufacturing costs for ammonia dropped in the mid-1960's, with the development of centrifugal compressors in large plants and improved energy efficiency. The real cost of nitrogen is declining (fig. A-5), though the energy and food crises of the 1970's temporarily reversed the trend.

Real prices for phosphate rock and potash also declined through the 1950's and 1960's, rose sharply during the crises of the 1970's, and have now declined below the levels of the mid-1950's.

Summary

Historically, the availability and cost of natural gas and phosphate and potash ores have determined whether fertilizer raw materials are obtained domestically or are imported (table A-2). They are likely to continue to do so in future.

Canada's lower transportation costs to the Upper Midwest, the principal U.S. consuming region, put U.S. potash producers at a competitive disadvantage.

When deregulation allowed U.S. natural gas prices to rise, domestic ammonia producers became less competitive. The technology that helped make the United States a net exporter of nitrogen in the 1960's and 1970's transferred abroad as U.S. plants closed and new plants were constructed in countries with lower-cost natural gas.

Despite abundant U.S. deposits of phosphate ore, investments to open new mines are not being made. Lower grades of the unmined ore and increasing environmental restrictions are raising mining costs above those of foreign competitors, especially North Africa. As existing U.S. phosphate rock deposits are mined out, and if new supply sources are not developed, the country likely will increase imports of phosphate fertilizers.

Low-cost imported plant nutrients have boosted U.S. competitiveness in world agricultural markets. Without replacing nutrients, U.S. farmers would be mining their soils of essential nutrients, eventually reducing yields and raising unit production costs.

Table A-2--Chronology of U.S. trade of crop nutrient inputs for fertilizer manufacture

Step by step, the United States is becoming dependent on imported crop nutrients			
Time line	Potash	Ammonia	Phosphate rock
1940's	New Mexico output substitutes for imports from Europe in parts of the	U.S. is a net importer of nitrogen.	Abundant, high quality ores allowed the U.S. to be major exporter after World War II.
1950's	country and leads to exports	Large investment in ammonia plants using low-cost U.S. natural gas makes U.S. a net exporter of nitrogen.	
1960's	Transportation advantages lead to large Upper Midwest imports from Canada. U.S. becomes a net importer. U.S. production declines.		
1970's		Rising natural gas prices in U.S. and technology transfer to	
1980's		USSR and Middle East restructure ammonia trade. U.S. becomes a net importer.	Competition from North Africa and rising costs due to environmental re-
1990's			gulations slow investment to open new U.S. mines. As existing U.S. mines are
2000	Continued decline in U.S. production.	Continued increase of ammonia imports from countries with low-cost natural gas.	exhausted, phosphate exports will decline, and eventually imports will be needed to supply domestic needs.

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Taiwan's Application for GATT Membership and Agricultural Reforms

by
Sophia Wu Huang*

Abstract: Taiwan's application for GATT membership and its willingness to join the organization as a developed economy represent a milestone in Taiwan's agricultural policy. To accompany its application, Taiwan proposes a thorough farm reform to slow the decline of a dwindling agricultural sector and to ease its transition to a smaller, more efficient one. If Taiwan is successful in joining the GATT, it should lead to the further opening of agricultural markets in conformance with GATT rules.

Keywords: GATT, trade barriers, trade liberalization, rice, high-value products.

On January 1, Taiwan greeted the 1990's by applying for membership in the General Agreement on Tariffs and Trade (GATT) under Article 33 as the "Customs Territory of Taiwan, Penghu, Kinmen, and Matsu." Although membership has been complicated by political considerations, the application demonstrates Taiwan's desire to strengthen its relations with the international community. More importantly, Taiwan's willingness to join the organization as a developed economy signals Taiwan's intention of conforming to internationally accepted trade disciplines, including those applying to the agricultural sector of a developed economy.

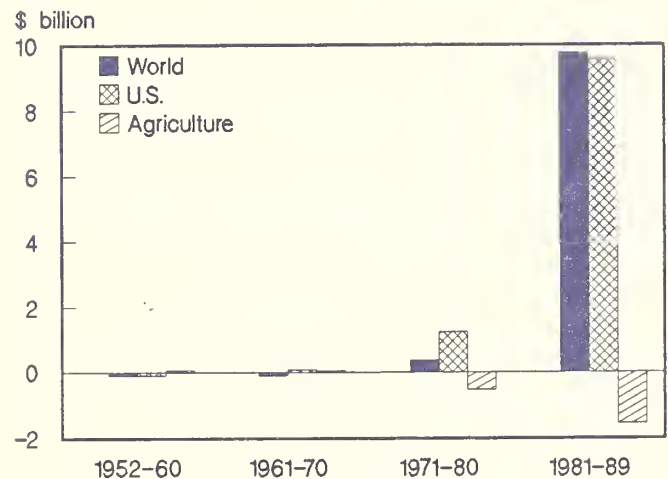
The farm programs recently proposed in the 6-year (1992-97) Consolidated Adjustment Plan (CAP) shed some light on future agricultural policy in Taiwan. The goals of the drafted CAP are seen by analysts as twofold: to enable the domestic agricultural sector to begin the adjustment to the internationalization of Taiwan's agricultural economy, and to develop competitive agricultural products (3).

In the plan, Taiwan proposes, among many bold policy initiatives, unprecedented guidelines on agricultural trade liberalization. Agricultural trade issues have contributed to Taiwan's friction with its trading partners (4, 5, 6). The policy reorientation reflects the harsh reality of survival for a dwindling agriculture in Taiwan's rapidly growing industrial and service economy.

Agriculture Is a Focal Point of Trade Friction

Taiwan, like Japan and South Korea, has been accused of unfair trade practices, specifically taking advantage of open foreign markets but allowing for little reciprocity. Accusations have intensified since the mid-1980's when trade surpluses with the United States—the largest market for Taiwan's exports—grew rapidly (fig. B-1). Taiwan's trade

Figure B-1
Trade Balances in Taiwan



policies, particularly those related to agriculture, have become a major source of friction with the United States. With huge foreign exchange reserves (about \$73 billion, the second largest in the world at the end of 1989) and trade surpluses with the United States (about \$12 billion in 1989), Taiwan has been under increasing pressure to open its agricultural markets, particularly for value-added food items.

To some extent, tariff barriers and import controls on agricultural products have been relaxed since Taiwan began to liberalize its trade system in the mid-1960's. However, high tariffs and licensing restrictions continue to account for the majority of U.S. firms' market access complaints. To help supply consumers with low-priced meat and wheat flour, Taiwan reduced tariffs and relaxed import controls on wheat, feed grains, and soybeans.

In 1978, the United States and Taiwan decided that both the benefits and obligations of the Tokyo Round of multilateral trade negotiations should be extended to Taiwan, which was not a contracting party to the GATT, through a process of

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parallel negotiations. Since then, trade between the United States and Taiwan has been subject to bilateral trade agreements with provisions comparable to those in the GATT.

The negotiations were concluded in a 1979 exchange of letters between Taiwan's Coordination Council for North American Affairs (CCNAA) and the U.S. American Institute in Taiwan (AIT). CCNAA and AIT are two nongovernment organizations that were created to handle the commercial, cultural, and other relations that had been performed by the embassies of both countries before diplomatic relations were severed in 1979. Taiwan agreed, in exchange for U.S. concessions on industrial products, to lower tariffs, stage by stage, on a number of products of interest to the United States. These included such agricultural items as eggs, poultry for breeding purposes, other tallow, and a number of horticultural products. The agreement also laid the groundwork for the removal of import controls on apples in 1979.

In general, Taiwan has made significant tariff reductions annually, especially with regard to industrial products. But its agricultural trade policies became even more protectionist at the end of 1987, when political liberalization was accelerated in part by the lifting of the 38-year martial law in July 1987. Taiwanese farmers, long obedient and staunch supporters of the Government, began to rebel more against the Government's trade liberalization policy, which they singled out as the main source of their problems.

In response, the Government excluded agricultural products from Taiwan's otherwise broad tariff cuts in 1987 and 1988. In September 1989, under pressure from local cattle farmers during an island-wide election campaign, the Government abruptly announced a ban on beef imports.

The trade issue was defused by reinstating import permits for higher-quality beef, most of which is provided by the United States. Australia agreed to "monitor" its exports of lower-value beef. Despite years of relaxing trade barriers, tariffs on many agricultural imports remain high and other import barriers, such as bans, import licensing restrictions, and unique sanitation or purity standards, persist.

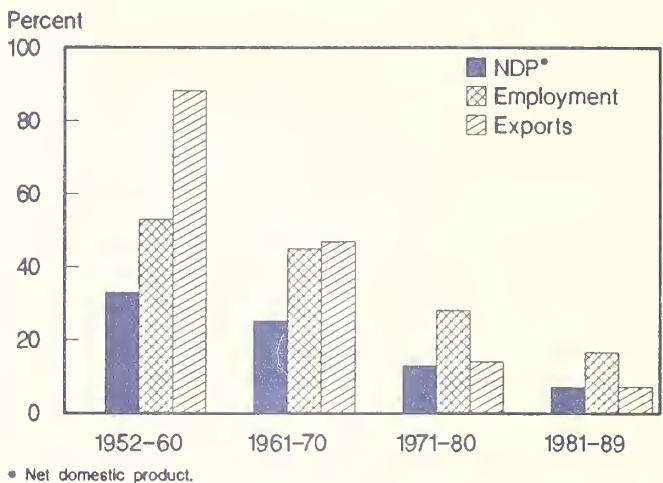
Dwindling Agriculture in Need of Reform

Although the relative contraction of the agricultural sector in the course of economic development is a universal phenomenon, the changes in rapidly industrializing, resource-poor Taiwan have been dramatic. After World War II, agriculture was Taiwan's foremost economic sector. It contributed 33 percent of net domestic product (NDP), 53 percent of employment, and 88 percent of total exports in 1952-60.

During the past four decades, industry's share of national domestic product (NDP) overtook agriculture's. Agriculture's share of total employment, which had been declining gradually since 1953, began to fall rapidly in the

Figure B-2

Agriculture's Share of Taiwan's Total Economy



late 1960's. The agricultural sector was no longer able to perform its traditional role of transferring resources through exports, and it came to depend heavily on imports, especially grains, oilseeds, and feeds for its livestock subsector. By 1981-89, agriculture's contribution to NDP had shrunk to 7 percent and agricultural employment to 17 percent, and agricultural products accounted for only about 7 percent of total exports, while the agricultural trade deficit amounted to \$1.6 billion yearly (figs. B-1 and B-2).

The development of the industrial and service sectors expanded working opportunities outside agriculture, and today fewer young people elect to take up farming. The average age of agricultural workers increased from 34.4 years in 1965 to 45.7 years in 1989. Taiwan's small-scale farming, in which over 70 percent of farm households have less than one hectare, has long been the bottleneck for agricultural development. Although labor-intensive farming to a large extent has become uneconomical because of surging labor costs, substantial mechanization of small holdings is often impractical, if not impossible. Consequently, a marked trend has emerged toward less intensive use of farmland, reflected in a drop in the multiple cropping index from a peak of 190 in 1964 to 133 in 1989 (1).

Faced with a rapidly changing economic structure, the Government had to choose either to facilitate structural change or to cushion rural society from it. Agricultural policy shifted from taxing producers to subsidizing them. Since the late 1960's, when the number of rural laborers began to shrink, agricultural programs have emphasized increasing labor productivity and subsidies to farmers. Farm credit and agricultural mechanization programs provided financial and technical assistance.

Programs detrimental to rice farmers—notably the rice-for-fertilizer barter system—were abolished, and a rice stabilization fund was established in 1974 to guarantee producer

prices. Official procurement prices were raised, and then kept above free-market levels. The change in rice policy quickly resulted in a large rice surplus, which forced the Government to implement a costly rice-land diversion program (1984-89). The program provided cash incentives to rice farmers who idled land or diverted production to corn, sorghum, soybeans, or horticultural crops. This reduced Taiwan's planted rice area from 645,479 hectares in 1983 to 482,000 hectares in 1989. The 1984-89 program was followed by the current 6-year rice-land-diversion program (1990-95).

The Government recognizes the need for structural change in agriculture. For example, it has encouraged some important institutional changes, including joint decisionmaking in specific operations, joint management and contract farming, and the promotion of specialized production areas. Beginning in 1983, the so-called Second Phase Farmland Reform Program (the first took place in the early 1950's) was put into effect. With the subsequent amendment of related regulations, the program establishes a new land-tenure system that allows the enlargement of farm operations without affecting land ownership (2).

The Government also carried out a program in which about 365,000 hectares of farmland were consolidated (1). However, despite the relaxation of land-tenure laws and other measures, the bottleneck of Taiwan's small farm operations will not be easily broken. Factors such as strict limitations on use of farmland for nonagricultural purposes, the traditional attachment to land, and the fragmented nature of rural landholdings have continued to constrain farm enlargement.

Rising production costs, a shrinking and aging supply of farm labor, inefficient farm size, dwindling water resources, and increasing import competition along with other constraints on Taiwan's overall economy—concern for pollution, currency appreciation, labor shortages—bode ill for Taiwan's agriculture. The harsh realities indicate the need for a thorough reform of Taiwan's agricultural policy. Pressure from trading partners to open its markets, the cost of protection to both consumers and the treasury, and Taiwan's interest in joining the GATT, Organization for Economic Cooperative Development (OECD), and other international economic organizations also create a strong impetus for agricultural reform.

Consolidated Adjustment Plan (1992-97)

The recently proposed CAP is intended to slow the decline and ease the transition to a smaller but more efficient agricultural sector. The proposed reforms of the production, marketing, and distribution systems are the most comprehensive and forward-looking in Taiwan's history. Notable examples are policies for farmers' retirement, new land-use law, crop insurance, a phaseout of price-support programs to be replaced by a direct-payment system, and trade liberalization

intentions for many agricultural products. The CAP will provide assistance in marketing products and in production planning for farmers whose crop sales have been adversely affected by imported goods. The plan was submitted for executive approval in June.

To enable the opening of Taiwan's agricultural markets and to develop those commodities in which Taiwan is competitive, the plan thoroughly evaluates all agricultural products based on the following criteria: marketing and technological potentials, return to labor input, environmental costs, food security, farm numbers, and locality of production.

All agricultural products are classified into three categories: (1) products of focused development industries, (2) products of protected industries, and (3) products of other industries. The first two categories are important to the Government's policy considerations, while the third, which includes all products not in the first two, will be guided by market forces without any Government intervention.

Products of focused development industries include the following 13 crops and 6 livestock and fishery products: orchids, ornamental plants, nursery products, papayas, wax apples, passion-fruits, sugar apples, mangos, gladioli, grapes, summer vegetables, tea, forage crops, breeding livestock, milk, broilers, hogs, breeding fish, and offshore and coastal fishery products. The above account for about 40 percent of total value of agricultural production, and the 13 crops account for about 19 percent of Taiwan's total crop area.

These products are characterized by a relatively high return to labor input, high marketing potential, and high technological development potential, but are considered low in environmental damages or pollution. The consequent development strategies will focus on techniques to increase production, improve marketing efficiencies, and expand markets.

Among these products, expanding foreign markets will be emphasized for breeding hogs, nursery products, tea, orchids, and ornamental plants. A trade liberalization timetable will be set for products such as papayas, mangos, grapes, broilers, and pork. Among products intended to be liberalized, pork imports are already allowed except for the cheaper cuts (cuts other than hams, shoulders, tenderloins, and loins), which have required import licenses since January 1989.

Products of protected industries include those uncompetitive but "need-to-be-protected" products on the basis of political and social considerations such as food security and number or location of farmers involved. This category includes the following: rice, sugarcane, peanuts, feed corn, adzuki beans, sorghum, sweet potatoes, soybeans, and beef. These nine products account for about 14 percent of the value of agricultural production, while the eight crops account for about 59 percent of total crop area.

Government interventions are to be used mainly for protecting farm income instead of encouraging production. Import controls, price supports, or input subsidies will be used to protect these commodities, but price support will be gradually replaced by an income-payment system to minimize distortion of markets.

Among these items, the only trade barriers affecting feed corn, sorghum, and soybeans are tariffs of no more than 2 percent. For beef, in addition to Australia's "monitoring" of exports of lower-value beef, tariff rates are NT\$30 per kilogram for low-value beef and NT\$23.8 (reduced to NT\$20 from Aug. 1, 1990 through Jan. 31, 1995) for high-value beef. Rice and sugar are included in the protected category for food security reasons and because a large number of farmers depend on these two crops for their living. Peanuts and adzuki beans are included for their importance in certain localities—farmers producing them have no alternative for their livelihood.

Implications for Future Agricultural Trade Liberalization

Although the proposed CAP continues the policy of protection for certain agricultural products and specialization in areas of comparative advantage, it provides a specific and comprehensive way by which production is to be protected or specialized. The plan also announces the intention to set up a timetable for liberalizing trade in several products such as broilers, pork, papayas, mangos, grapes, and items in the "other industries" category. The plan proposes to continue the policy of reducing production of rice, sugar, and some horticultural products to domestic consumption levels.

Because of limited land and labor, Taiwan's specialization in areas of comparative advantage implies that designated products will be capital- and technology-intensive—or the so-called high-value products (HVP). At present, exporters who are targeting HVP's to Taiwan can find export opportunities in products that Taiwan cannot provide competitively. For example, U.S. products such as deciduous fruits and fruit juices, special beef cuts, and convenience foods are considered by analysts to have the greatest potential for export to Taiwan (3).

In addition to high tariffs on many HVP's, Taiwan's import bans on rice and chicken are at the core of agricultural trade issues with the United States. Because rice is the traditional staple and Taiwan's most important domestic crop, the issue of rice imports creates social and economic concerns as well as being a trade issue. In the CAP, however, import controls on rice will continue.

The Rice Millers' Association has repeatedly threatened to ask the U.S. Government to use Section 301 of the U.S. Trade Act of 1974 to retaliate should Taiwan refuse to abide by the terms of the memorandum of understanding on rice with the United States, which expired in December 1988. Basically, the memorandum of understanding restricted Taiwan from placing rice in international markets except for humanitarian reasons, placed quantity limitations on exports, and limited destinations to countries with per capita incomes at or below \$795.

As to chicken imports, U.S. exporters would like to have access to the Taiwan market for higher-value-added products such as poultry meat. Under terms of the 1978/79 bilateral agreement following the Tokyo Round of the GATT, Taiwan included turkey and duck in its list of bound tariff concessions to the United States. Following a ban on turkey meat imports instituted in January 1988, Taiwan agreed to resume imports under quota in January 1989, and ultimately without restriction on Sept. 1, 1990.

Although chicken is Taiwan's second most important livestock product—next to hogs—it is almost totally dependent on imported feedstuffs, breeding stock, and production equipment. Nevertheless, any further movement toward liberalization of poultry imports by the Government could be expected to be strongly opposed by poultry farmers. As indicated in the CAP, Taiwan will set up a timetable for broiler import liberalization.

In short, the proposed CAP seeks to balance the interests of a declining agricultural industry and rural population with the trade liberalization demands of international trading partners and local consumer groups. Because Taiwan has diplomatic relations with only a few nations, good trade relations and open markets for Taiwanese products assume great importance.

If Taiwan is successful in joining the GATT, its agricultural goods markets will open further in order to conform with the GATT rules on agricultural trade. As indicated in the CAP, a trade liberalization timetable will be set up for imports of many agricultural products, while import relief will be available to local producers whose product sales are judged to have been adversely affected by imports.

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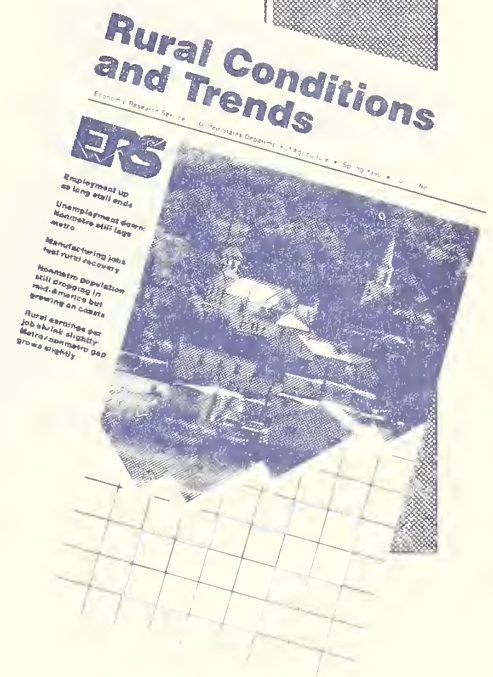
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Diverging Paths of Growth in Developing Countries

by
Thomas L. Vollrath and David W. Skully*

Abstract: Developing countries having neutral trade regimes have experienced much more rapid economic growth than countries that have pursued inward-oriented, import-substitution development strategies.

Keywords: Developing countries, economic growth, trade policies.

The absolute per capita income gap between the developed and developing world widened in the post-1960 era (fig. C-1). If this income gap is to narrow, economic growth rates in developing countries must exceed those in the developed world.

What does the recent historical record say about real comparative growth rates? The data show that developed and developing market economies grew at approximately the same rate between 1961-87 (table C-1). A detailed examination of growth patterns (using 5-year moving averages of annual data to render underlying trends transparent) demonstrates that the developed market economies grew faster than the developing market economies from 1966 through 1970 and after 1980 (fig. C-2). Not since the early 1960's have the developing market economies managed to close the relative income gap. The empirical evidence shows that growth in annual per capita income did not vary inversely with the level of economic development during the past 26 years, as might have been expected because of the difficulty of sustaining large productivity gains on an increasingly productive base.

Divergent Paths

A closer inspection of the historical record reveals considerable unevenness of economic performance within the developing world and through time (figs. C-3 to C-5). Sub-Saharan Africa experienced only a 0.33-percent annual growth rate between 1961-87, with negative absolute growth characterizing the post-1972 period. South and Southeast Asia had the second lowest 26-year average annual rate of economic growth, but growth here accelerated during the last half of this period.

Figure C-1
**Absolute Income Differentials,
Real GDP* Per Capita**

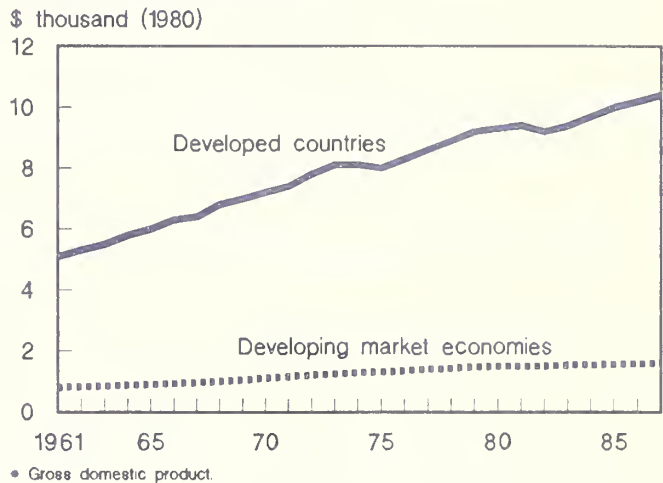
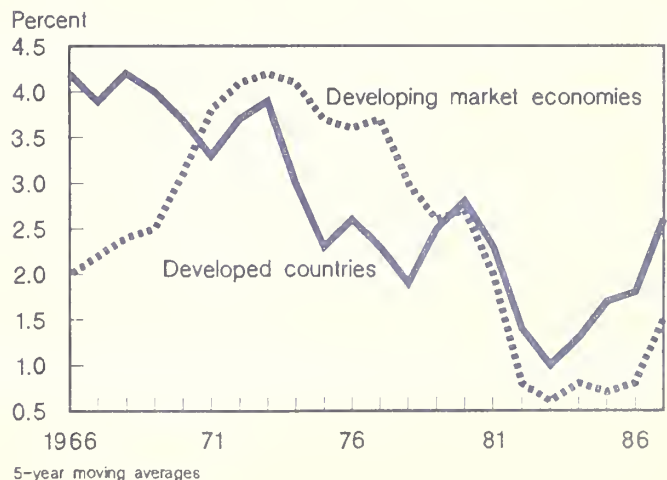


Figure C-2
Economic Growth Rates



*Agricultural economists, Economic Research Service, USDA.

Figure C-3

Absolute Income Differentials, Real GDP^{*} Per Capita

\$ thousand (1980)

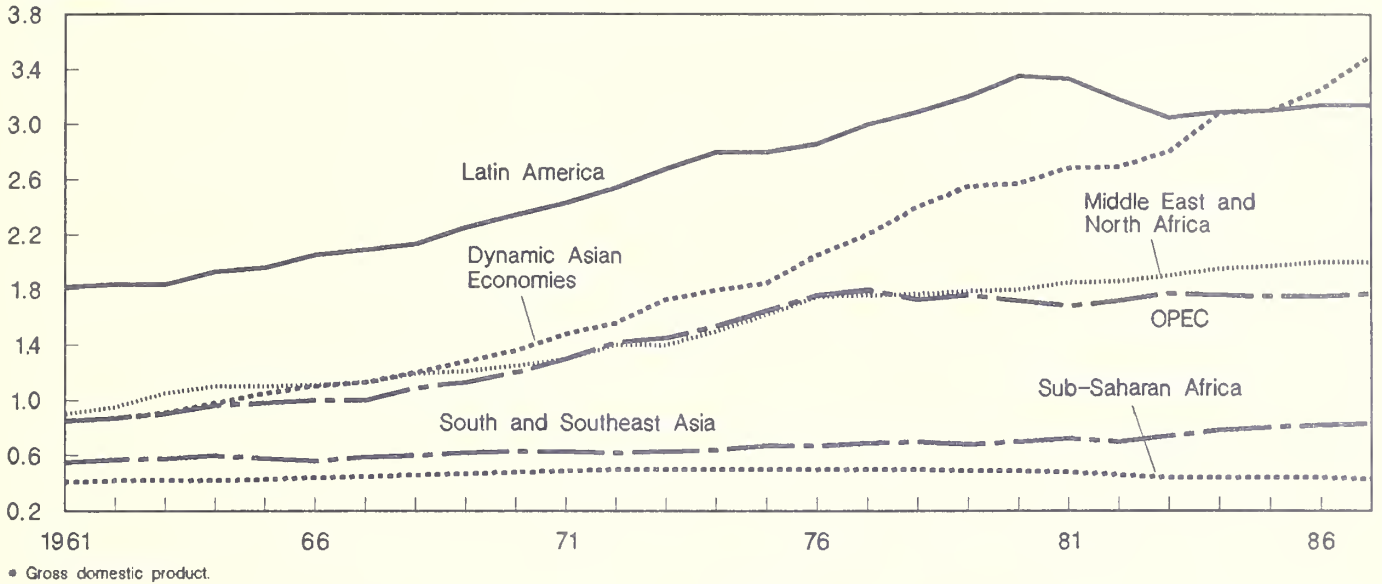
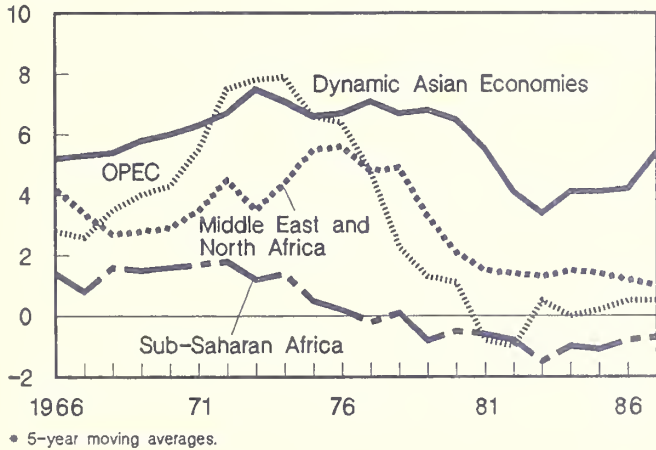


Figure C-4

Economic Growth Rates^{*}

Percent



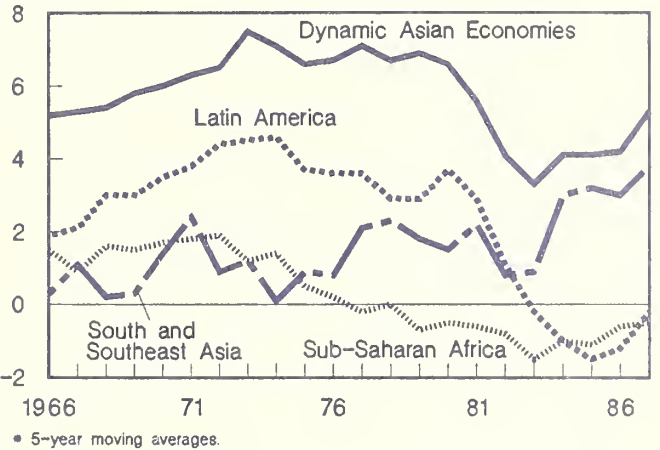
North Africa region, the OPEC countries, and Latin America grew more rapidly during the 1961-87 period than did the developed countries. But the 5-year annual growth rates sharply fell in OPEC countries after 1974, in the Middle East and North Africa after 1976, and in Latin America after 1980.

The inability of the developing countries to grow more rapidly than the developed countries during the last quarter century indicates that absolute income differentials between the two groups may continue to widen. However, given the diversity of economic performance in the Third World, hopefully lessons can be drawn about how today's poorest countries can avert persistent poverty.

Figure C-5

Economic Growth Rates^{*}

Percent



At the beginning of the 1960's, the developing countries looked a lot more like each other than they do today. Take India and South Korea, for example. Both had about the same level of income in 1961. But by 1987, per capita income in South Korea was over 4.5 times as great as in India (6).

India's approach to planning its economy, best summed up in its various Five-Year Plans (e.g., 5), revolved around a concern about the length of time that would be required for market forces to induce growth. India was also fearful that specialization along comparative advantage lines would expose its economy to international price shocks (e.g., skyrocketing oil prices in both 1973-74 and 1979-80) and manipulations by stronger trading partners (e.g., the Multi-Fiber Agreement among OECD countries).

Table C-1--Annual economic growth rates 1/

Region	1961-67	1967-73	1973-80	1980-87	1961-87
Sub-Saharan Africa	1.20	1.61	-0.39	-0.73	0.33
South and Southeast Asia	0.65	1.01	1.83	3.17	1.53
Latin America	2.02	4.31	3.17	-0.99	2.52
Middle East and North Africa	3.55	3.83	3.42	1.25	3.17
OPEC	2.64	7.27	1.50	0.42	3.21
Dynamic Asian economies	5.03	6.84	6.20	4.46	5.70
All market LDC's	2.08	4.03	2.72	1.00	2.63
United States	3.62	2.03	1.78	2.11	1.93
Developed market economies	3.96	3.66	2.21	1.90	2.67

1/ Instantaneous growth rates obtained from estimating a semilog regression: $\ln y^* = \cos + \beta t + \epsilon$

Note: Sub-Saharan Africa includes Burkina Faso, Cameroon, Chad, Ethiopia, Ghana, Ivory Coast, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritius, Niger, Rwanda, Senegal, Sierra Leone, Somalia, Sudan, Tanzania, Togo, Uganda, Zaire, Zambia, and Zimbabwe. South and Southeast Asia includes Bangladesh, India, Nepal, Pakistan, Papua New Guinea, Philippines, and Sri Lanka; Latin America includes Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad, and Uruguay. The Middle East and North Africa includes Egypt, Israel, Jordan, Morocco, Syria, Tunisia, Turkey, and Yemen; OPEC includes Algeria, Ecuador, Gabon, Indonesia, Iran, Kuwait, Nigeria, and Saudi Arabia. The dynamic Asian economies include Hong Kong, Malaysia, Singapore, South Korea, Taiwan, and Thailand. All market LDC's include all the previously cited. The developed market economies include Australia, Austria, Belgium, Canada, Denmark, Finland, France, Greece, Iceland, Japan, Ireland, Italy, Luxembourg, Netherlands, New Zealand, Norway, Portugal, South Africa, Spain, Sweden, Switzerland, United Kingdom, United States, and West Germany.

Sources: (8, 12)

By contrast, South Korea pursued an outward-oriented development approach, encouraging trade with the rest of the world. South Korea's surge of growth began in the mid-1960's when it first lowered domestic protection levels. South Korea increased its support for heavy industry in the late 1970's. Shortly thereafter, the economy experienced some difficulties and policymakers responded by moving the domestic economy towards increased liberalization.

Domestic Interaction With the Global Market

After World War II, trade was not viewed as being able to serve as the engine of growth in the same way it had for the countries which industrialized during the 19th century. This pessimistic view was based upon the belief that traditional developing-country exports of primary agricultural and extractive products would slacken over time and that the price of developing-country imports from developed countries would increase.

Most development experts did not believe that developing countries could compete in the global market. They thought that growth in developed-country import demand for Third World imports was the only means by which developing countries could reap benefits from international trade. A consensus emerged that the developing countries needed to strive for self-sufficiency in such areas as steel, heavy engineering, chemicals, and consumer goods, and that the import content of domestic output had to be reduced.

The empirical record shows that these experts were wrong. The key to the success of the DAE's was their willingness and ability to compete directly with more developed countries in the global market. The DAE's did not merely export primary goods for which there were no close substitutes in the developed countries. Rather, they exploited their comparative advantages, specializing production in industries using lots of cheap, unskilled labor—resources they possessed in relative abundance.

It is, and will continue to be, particularly important that developing countries take advantage of the human resources available to them. An examination of global demographics shows why. Today, roughly three-quarters of the world's population is located in the developing countries. If trends continue, they will have five people in six by the year 2025. 1/ Reproduction rates in poorer countries remain high, while human fertility in rich countries is falling below replacement levels. Ninety percent of the next generation will be born in the three-fourths of the world that is less developed.

The economic implication of developing-country population outstripping developed-country population is twofold. First, labor-abundant countries in the Third World should seek to specialize in economic activity that requires intensive use of human capital. Second, subsidiaries of multinational firms needing low-cost labor will find it advantageous to locate at the source of abundant labor, namely in the developing countries.

Trade Composition and Economic Growth

The role that trade can play in inducing income growth critically depends upon the composition of country trade. Japan, which climbed the development ladder more rapidly than any other industrialized economy, is a good example of a country changing the composition of its trade in response to changing comparative advantages. During the 1950's, Japan specialized in production and export of manufactured goods that embodied relatively unskilled labor. Today, Japan no longer supplies the world with such goods, rather it exports sophisticated commodities requiring highly skilled labor. Taiwan and South Korea, on lower rungs of the development ladder, now specialize in the production of manufactured goods that Japan used to export.

ERS research identifies economic sectors in which developing and developed countries possess relative competitive (RC) advantages and disadvantages. Low-income countries were found to have a competitive edge in such primary producing sectors as agriculture and fisheries and forestry (fig. C-6). They also have a positive and growing competitive edge in light industries that include industries include such labor-using manufactures as textile, clothing, leather, footwear, and furniture. But low-income countries were found to operate with comparative weaknesses in more sophisticated manufacturing, including the iron, steel, and other heavy industry complex.

1/ Admittedly, Malthusian checks, such as the acquired immune deficiency syndrome (AIDS) and emigration growth, may diminish somewhat the fall in the developed-country population ratio.

Figure C-6
**Economic Competitiveness,
Low-Income Countries**

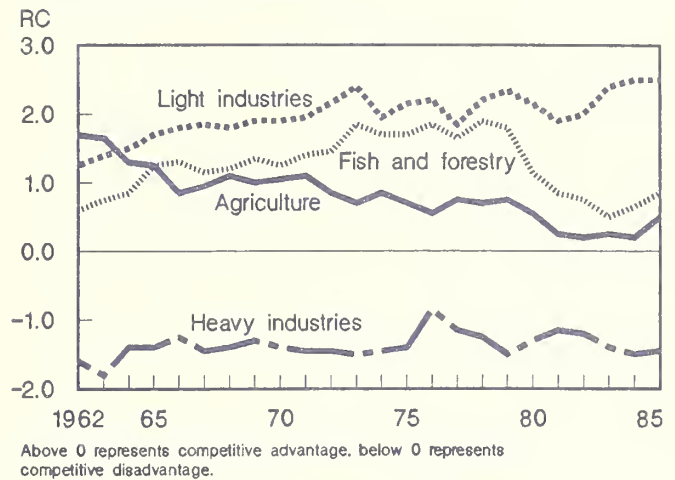
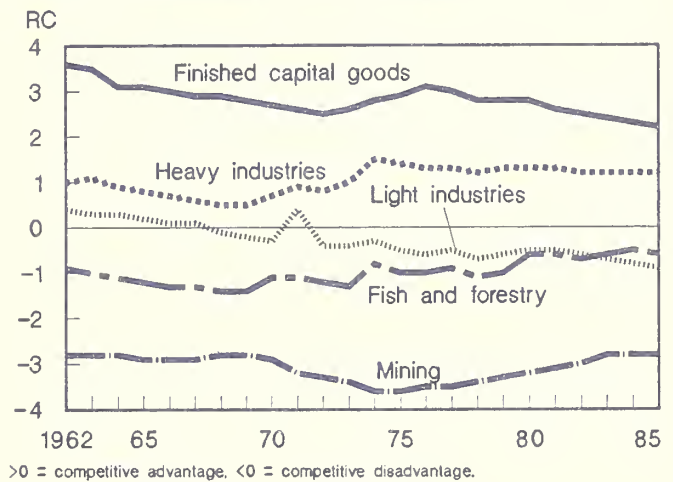


Figure C-7
**Economic Competitiveness,
Industrialized Market Economics**



The industrialized market economies, by contrast, were found not to possess comparative strengths in the extractive sectors—mining and fisheries and forestry—and in the light manufacturing sector (fig. C-7). But, they have strong competitive advantages in such capital-using sectors as finished capital goods and heavy industries. These relative patterns of competitiveness underscore the complementary aspects of developed- and developing-country commodity trade and the potential for mutual gain.

It is obvious that the composition of a country's trade is different at various levels of development. Not as obvious is whether international trade stimulates domestic economic growth. In an effort to shed some light on this issue, Vollrath and Johnston (9) examined the extent to which income growth at different stages of economic development is affected by trade specialization patterns across economic sectors.

In their study, a leading sector (Sector A) is defined as a group of commodities for which an increase in relative competitiveness generates income in both Sector A and the overall national economy. A lagging sector (Sector B) is defined when an increase in relative competitiveness increases income in Sector B but actually decreases overall domestic income because of inefficient resource use at the national level.

In the Vollrath and Johnston study, leading economic sectors identified for low-income countries were natural-resource dependent-extractive industries, such as mining, fisheries and forestry, as well as agriculturally linked light industries which use a lot of semi-skilled labor—a resource which these countries possess in relative abundance. By contrast, light industries and fisheries and forestry were shown to be lagging sectors among upper-middle- and high-income countries. High-tech, finished capital goods, and basic intermediates were found to be leading sectors for countries within the upper-middle- and high-income grouping.

The Vollrath-Johnston study showed that domestic incomes increased when countries specialized production in economic sectors in which they had a competitive edge—at all levels of development except for one group of developing countries. This group was characterized by highly distorted price systems in which misaligned prices generated incorrect information about relative scarcities, preventing the market system from functioning efficiently.

Trade Policy Orientation and Economic Growth

A wide spectrum of trade regimes characterize countries' commercial policies. In a classic study directed by Bhagwati (2) and Krueger (6), the bias of a country's trade regime is defined as the ratio of the exchange rate effectively received by its exporters to the exchange rate effectively paid by its importers. 2/ The export-to-import, effective exchange-rate ratio measures export protection relative to import protection. If it is lower than one, the country's trade policy regime is biased against exports. If it is greater than one, it is biased in favor of exports.

Using the relative exchange-rate measure, country trade regimes can be classified along a continuum with one extreme designating an import-substitution orientation and the other an export-promotion orientation. In the middle is a neutral regime characterized as having an overall orientation that does not discriminate between exports and imports. An import-substitution regime deliberately discriminates against imports that compete with domestically produced goods. It

indirectly discourages exports, often inadvertently. An export promotion regime is characterized by active government intervention aimed at boosting export performance. A country having a neutral regime may indicate laissez-faire, in which case its regime is classified as liberal. But a neutral regime may also mean that government intervention, on average, does not distort the relative exchange rate ratio. 3/

Edwards (4) investigated the relationship between trade orientation and rate of output growth using trade-intervention indexes that measured the presence of import taxes and export subsidies in 30 developing countries. Controlling for the role of capital accumulation, growth in the labor force, and technological differences, he found that developing countries with lower degrees of trade intervention grew more rapidly than countries with higher trade restrictions.

Edwards' empirical finding of an inverse relationship between trade intervention and economic growth is significant. It implies that developing countries which become more market oriented will grow more rapidly than those that increase trade regulations.

Why are liberal trade regimes more conducive to economic growth? One reason is that such regimes provide a favorable milieu for the exchange of ideas and information. Countries having liberal trade regimes establish closer linkages with the rest of the world than more closed economies. Such integration is particularly important for developing countries. The Vollrath-Johnston study found trade to be a more important source of domestic income growth as the level of economic development declines. Increased openness in developing countries means that these countries will become better able to absorb technological innovations generated by the more advanced nations.

Why Is Comparative-Advantage-Based Trade a Source of Growth?

Trade based upon comparative advantage increases the output that can be squeezed from any given collection of resources and the consumption that can be obtained from any given set of production possibilities. It enables domestic consumers to reach a higher real income because countries specialize in the production of commodities for which they have a relative advantage.

Trade can induce growth in other ways as well. For instance, it can break up monopoly power. Domestic monopolists lower consumer real incomes by producing less and charging more for the commodities they market. Because trade enhances competitiveness, however, it is generally not possible for domestic monopolists to survive. Trade and

2/ An effective exchange rate corrects the nominal rate from market interventions such as export subsidies, import tariffs, and quantitative restrictions.

3/ To determine whether a country is truly laissez-faire, it would be necessary to have information on the complete structure of protection.

competitive pressures are also beneficial because they provide producers with incentives to pay attention to quality control and innovation.

Exposure to the international market also enhances efficiency because it eliminates rent-seeking behavior. Rent seeking occurs when producers use resources to exploit or evade the distortions caused by protection. The financial officers of Argentine companies provide a classic example of rent-seeking behavior. Their alacrity in shifting into and out of short-term investments and buying and selling dollars can make the difference between profit and bankruptcy. Truly productive effort concentrates on production instead of speculation.

Finally, there are dynamic growth gains from trade. Economists often account for growth by breaking it into two parts: the part explained by increases in the quantity of labor and capital used and the part due to increases in productivity. Research at the World Bank (11, pp. 83-85) shows that outward-oriented developing countries have experienced faster output and income growth than inward-oriented developing countries. Moreover, the outward-oriented countries owe a bigger share of their output growth to productivity increases than do the inward-lookers.

Conclusion

Whalley (10) observes that recent trade liberalization in developing countries "appears to have gone relatively unnoticed." This observation is important because current liberalization is "more extensive and reflects deeper intellectual change than earlier episodes." An important factor driving this round of liberalization is the idea of using increased openness to the international economy as a way of disciplining domestic policies.

Another is the view that import-substitution development strategies have dragged down economic growth because they spawned domestic inefficiency and created a cumbersome bureaucracy to administer import controls. Evidently, the idea that enhanced export competitiveness is an effective way to achieve improved economic performance is finally being recognized.

Many developing countries are currently abandoning state-dominated models of development. Since 1985, major liberalization has occurred in Bolivia, Mexico, and Nigeria. Lesser liberalization has occurred in Argentina, Brazil, Costa Rica, India, Kenya, China, Philippines, and Tanzania. The movement toward liberalized trade is spreading because it holds the best promise for increases in developing-country incomes, in both absolute and relative terms.

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Resource Use and Deforestation in Brazil's Amazon

by

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Abstract: Few global resource issues receive more attention today than the destruction of the world's tropical forests. Much of this attention stems from growing public awareness that the environment and the world's economic markets are two interconnected systems. Of particular interest is the resource use and deforestation in one of the world's most important tropical forests, the Amazon region of Brazil.

Keywords: Deforestation, tropical forests, Amazon, environmental policy, alternative resource uses.

Over the last 25 years, Brazil has spent billions of dollars on development in the Amazon (or Amazonia). However, a consequence has been the destruction of hundreds of thousands of square kilometers of forest. Since about 1980 the rate of deforestation has accelerated sharply. More recently, international pressure on Brazil to adopt policies that discourage, or at least do not encourage, deforestation has grown.

While the world community has been long on both criticism and advice, it has been short on solutions that are consistent with the economic, social, and political realities of Brazil. These realities, nevertheless, will ultimately determine the success or failure of any attempt to preserve large tracts of the Amazon's forest. A better understanding of the alternative uses that are competing for the Amazon's resources will clarify the issues that must be addressed by any successful preservation strategy.

Extent of Deforestation

As with tropical forests in general, considerable debate exists as to how much of Brazil's Amazon rain forest actually has been destroyed. In 1988, estimates ranged from 5.1 percent, provided by the Brazilian Government, to 8 percent, calculated by Philip Fearnside, a scientist with Brazil's National Institute of Amazon Research, to 12 percent, by the World Bank. Applying Fearnside's figure to a forest range of 3.7 million km² implies that some 260,000 km² (an area about the size of Arizona) had been cleared as of 1988.

Of as much interest as the total quantity of land deforested is the rate at which new clearing is occurring. Brazil's Institute for Space Research estimates that in 1988 121,000 km² of Amazonia were burned to make room for crops and pasture, of which 48,000 km² were rain forest. These numbers imply that Brazil is losing an area of rain forest about the size of

Vermont and New Hampshire combined (48,933 km²) each year.

While all states in Amazonia have experienced some deforestation, the distribution is not even. Mahar (8) indicates that the clearing has been most intense in the southern states. In Maranhao, about 33 percent of the land has been cleared, and around 10 percent in Goias, Mato Grosso, and Rondonia. In contrast, the northern and western states of Amapa, Roraima, Amazonas, and Acre still have over 95 percent of their forests.

Deforestation in the Amazon has followed a very predictable pattern. Much of the clearing has been concentrated along a few major highways or in areas targeted by the government for development. These distributional aspects of deforestation have important implications for possible strategies to preserve large tracts of the rain forest.

Activities Resulting in Deforestation

Most deforestation in Amazonia is the result of cattle ranching, small-scale farming, logging, and road construction. Also contributing to the loss of substantial tracts of forest are mining, hydroelectric dams, and urban growth. Because deforestation activities are not independent events, it is impossible to attribute to each a proportion of the deforestation taking place. One type of disruption tends to predispose the forest to other types of disruptions. As a result, land frequently goes through a succession of uses in the transformation from undisturbed forest to cleared land. For example, the process might start with the government building a road into a virgin forest. The newly accessible land is first utilized by loggers who remove the commercially valuable species and move on. Next, marginal farmers burn the remaining forest to improve the soil's fertility. After 3 to 4 years, falling yields force the farmers to leave. The land then becomes pasture, or is abandoned.

Estimates can be made of changes in land use. In 1987, the states in Classic Amazonia (see box) produced 24,606,120 cubic meters (m³) of lumber (5). Assuming an average hect-

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are contains 60 m^3 of commercial timber (9), this production implies that $4,100 \text{ km}^2$ of rain forest were logged. Similar calculations for 1980 yield $1,900 \text{ km}^2$. When the Legal Amazon is considered, the area logged increases from $2,470 \text{ km}^2$ in 1980 to $4,760 \text{ km}^2$ in 1987. 1/ These numbers suggest that the scale of logging operations in the Amazon doubled between 1980 and 1987. State data show that this increase was heavily concentrated in the southern Amazon.

As with the area being logged, the amount of land being used to grow crops in the Amazon at any point in time can only be estimated. The estimates presented below were derived from annual state data on land in production for an extensive list of crops (5). For the Amazonian states, we summed the hectare quantities of the various crops to arrive at estimates of total cropland. For 1980, the estimated areas of cropland were $9,386 \text{ km}^2$ in Classic Amazonia and $67,542 \text{ km}^2$ in the Legal Amazon; for 1987, the respective numbers were $14,092 \text{ km}^2$ and $89,473 \text{ km}^2$. 2/ These numbers imply that between 1980 and 1987 the land being used to grow crops increased about 50 percent in Classic Amazonia and about 32 percent in the Legal Amazon. Again, the increase in cropland was heavily concentrated in the south.

Because converted rain forest can only be farmed for 3 to 4 years, considerable forest clearing is necessary just to maintain the current quantity of cropland. The above estimates indicate how much more important farming pressures are as a source of deforestation in the Amazon than the pressures from logging. Assuming farmers just maintain the present level of cropland ($89,473 \text{ km}^2$) and each hectare has a 4-year productive life, $22,368 \text{ km}^2$ of forest must be cleared each year. This is over four times the estimated area being logged. It also implies that a large quantity of commercially valuable timber is simply being destroyed under current farming practices.

We derive point estimates of the amount of pasture in Amazonia from state data on cattle herds. In 1987 there were about 6.9 million head of cattle in Classic Amazonia (5). A stocking rate of 0.75 head per hectare (9) implies that about $92,000 \text{ km}^2$ were in pasture. The 1980 estimate was $49,160 \text{ km}^2$. For Legal Amazonia, excluding Goias, the esti-

mated areas of cattle pasture for 1980 and 1987 were $156,960 \text{ km}^2$ and $178,560 \text{ km}^2$, respectively. 3/

Although rough, these numbers do highlight the fact that cattle ranching uses twice as much land as farming ($178,560 \text{ km}^2$ versus $89,473 \text{ km}^2$). Consequently, pasture expansion is now the leading cause of deforestation in the Amazon, about $28,000 \text{ km}^2$ annually. Like logging and farming, cattle ranching is heavily concentrated in the southern Amazon.

While people clear forests for different reasons, we must recognize that they are usually motivated by economic considerations. In turn, economic incentives are often created by governments to promote development and achieve political goals. In this sense, the programs and policies of the Government have been responsible for most of the deforestation in the Amazon (1, 7, and 8). Since the mid-1960's, Brazil's strategies in Amazonia have been designed to: (1) strengthen claims of national sovereignty in disputed boarder areas; (2) relieve the political and social pressures created by landlessness and poverty in other parts of the country; and (3) increase foreign-exchange earnings by encouraging the establishment of export-oriented industries.

To accomplish these objectives, the government has built thousands of kilometers of highways across vast tracts of forest. The government also has provided billions of dollars in tax breaks and subsidized credit to cattle ranchers, small farmers, and wood-processing firms to help them establish operations in the Amazon (7, 12). The government's programs have encouraged deforestation in other ways as well. Farmers and ranchers, for example, have usually been able to claim title to multiples of the quantity of land they clear. Hence, they have had a strong economic incentive to clear as much land as possible, even more than needed for crops or cattle.

As discussed by Mahar (7, 8), Brazil has received very little economic return for its investment in the Amazon. Cattle ranching in particular has been a big loser. Despite more than US\$700 million in assistance, only 92 of 631 government-approved livestock operations had been awarded certificates of completion by late 1985 (7). Additionally, a Government survey of nine completed ranches found that, on average, production levels were only 16 percent of what had been projected (7).

1/ These figures include southern Goias and eastern Maranhao, which are not part of the Legal Amazon. Estimates will be little affected because these areas are not heavily forested.

2/ The cropland estimates for the Legal Amazon are biased upward by the inclusion of southern Goias and eastern Maranhao.

3/ Estimates of pasture land in Legal Amazonia are biased downward by the omission of Goias. Goias, however, is a major cattle-producing state and much of this industry is located in its southern region. Hence, including it here would have greatly exaggerated the area of pasture in the Legal Amazon.

The Government's two major programs to resettle in the Amazon poor farmers from other regions of the country have also been expensive. The National Integration Program (1970-75) had a cost per person resettled of \$39,000, and the Northwest Brazil Integration Development Program (begun in 1981) had a cost per family resettled of \$17,000 through 1987 (11).

The Brazilian Perspective

To Brazilians, the Amazon is an immense natural resource, and the benefits of its conservation must be balanced against its alternative uses viewed in the context of the country's overall economic and social needs. These latter needs are very acute. During the last 10 years, living standards have improved little overall, and have actually dropped for many segments of the population. In 1989, the inflation rate was nearly 1,800 percent, real incomes were at 1978 levels, and the foreign debt was in excess of \$110 billion. Ongoing austerity programs have forced deep cuts in social programs, slowed infrastructural investments, and greatly increased the opportunity cost of funds spent on conservation.

Against this background, the exploitable resources of the Amazon assume great value. 4/ These include vast tracts of potential (albeit marginal) agricultural land, proven reserves of iron ore and gold valued in the tens of billions of dollars, an inventory of timber estimated to be worth well over a trillion dollars (5, 9, and 11), and seven rivers (not including the Amazon) over 1,000 miles (1,610 km) long. It is hardly surprising, therefore, that the Amazon is seen as a resource to be traded, in part or in whole, for a higher standard of living in much the same way as the developed Western economies have used their natural resources.

Many in Brazil view the international pressure to reduce the rate of deforestation in the Amazon as unjustified. For example, while the world community has focused intensely on Brazil, it has largely ignored the destruction of forests in the other Amazon countries. According to a 1987 World Resources Institute study, Peru, Colombia, Ecuador, and Venezuela all had annual deforestation rates equal to or in excess of Brazil's (11). Furthermore, while the combined forest holdings of these four countries amount to less than half of Brazil's holdings, the area being cleared each year is, in sum, greater than the area being cleared in Brazil (11). In a similar vein, there is an obvious asymmetry between the quantities of their own forests the developed countries have chosen to protect and their pressure on Brazil to preserve a forest that is approximately twice the size of Alaska.

primitive methods, causing little permanent damage to soils or vegetation.

Brazilians also have a tendency to see the pressure to preserve the Amazon as an attempt to pass on to Brazil the costs of environmental degradation in the developed countries. Much of the growing concern for the world's tropical moist forests stems from recent scientific studies linking tropical deforestation to possible global warming. The Brazilian view is that most greenhouse gas emissions (including carbon) are the result of economic activity in the industrialized countries and that these countries should focus on modifying their own behavior if they want to reduce global emissions levels.

Finally, foreign criticism of Amazonia policies often lacks an appreciation of the economic, social, and political realities that result in the use, or misuse, of the Amazon's resources. If peasant farmers have no access to land elsewhere in Brazil, they will seek to farm in the Amazon. The politically powerful cattle industry, for its part, wants continued access to the Amazon. Brazil is also very dependent on imported oil for its energy, and in the eyes of many the Amazon's rivers are an attractive alternative source of hydroelectric power. Past government programs have tried to bring some form of orderliness to this use of resources. On the other hand, if government resettlement programs in the Amazon that look good on paper simply result in a transfer of the problems--crop failure, soil erosion, farm abandonment, landlessness, impoverishment, shantytown urbanization, land speculation, and violence--that exist in other rural areas of Brazil, then it can be said that there has been little gain from the programs either to the people or to Brazil. In addition the forest has been lost.

Conservation requires a commitment of resources in terms of the area set aside for conservation and what is needed to ensure the protection of the conservation area. Brazil has recently started to implement an ambitious program called Nossa Natureza (Our Nature). This will end subsidized cattle ranching and farming in the Amazon, create several national parks and reserves, and centralize responsibility for conservation.

The amount of conservation Brazil can afford is limited, however. It has appealed to the world community for assistance but, to date, has been offered little in terms of resources or incentives to protect the Amazon. Debt-for-nature swaps are a case in point. Under these arrangements, a developing country agrees to protect a certain natural resource and, in exchange, part of its foreign debt is forgiven. Some success has been achieved in preserving rain forest in Costa Rica with such a scheme. But the scale of the problem is much greater in Brazil. Also, seen from a political point of view, the conditions agreed to in schemes such as these involve relinquishing some sovereignty over

4/ Not considered here is traditional resource exploitation by the population of forest dwellers whose density does not exceed the land's carrying capacity and who use generally

national territory. Economically, Brazilians see no obvious benefits because there is no flow of foreign exchange to Brazil, and there is a high probability that debt reduction might be accomplished in a future rescheduling agreement at no cost.

A Global Perspective

The recent intense international pressure on Brazil to adopt more environmentally sound policies in the Amazon is evidence that many in the world community see the value of this rain forest in global terms. This is a sharp change from barely a decade ago when the tropical rain forests were considered as reserves of land for additional agricultural production needed to feed a growing world population.

If preserving the Amazon rain forest is more important for the world in general than for Brazil in particular, then it makes sense to consider an international scheme for paying for its preservation. If the world is unwilling to pay for the benefits it derives from the Amazon forest, then the amount that is ultimately preserved will be less than is optimal from a global perspective.

Rain forests contain immense genetic inventories (or biological diversity). Although only 7 percent of the earth's land surface is tropical rain forests, they house over half of all plant and animal species. This diversity is particularly rich in the Amazon. It contains at least 20 percent of the earth's bird species, over 2,000 species of fish, and more than 2,500 species of trees (2, 11). At least 8,000 species of Amazonian insects have been classified. On only 3 percent of the land area, Ecuador has 20-30 percent more plant species than all of Europe. Near Manaus, one study found 236 tree species over 5 centimeters wide on a single hectare and another found 1,652 plants belonging to 107 different species on about 1,900 square feet (2, 10).

The potential economic value of this biological diversity is impossible to assess. For one thing, very little of it has been studied for its commercial use, and just inventorying all the species of the Amazon would be a formidable task. One calculation (6) is that it would take 3,000 scientists 50 years just to describe the diversity of life in the Amazon. 5/ Still, based on what is known about the relatively few tropical species that have been studied, and, given the recent advances in genetic engineering, it is not hard to imagine that the economic value of the Amazon's genetic pool could be large. Many tropical plants, for example, have evolved defense mechanisms against insects and diseases that might be crossbred into commercially valuable crops. In one notable

5/ The estimate is based on a total of 3 million plant and animal species and the assumption that one biologist can catalogue 20 species in a year.

instance, an Amazonian wild peanut saves American farmers an estimated \$500 million a year by improving the resistance of domestic varieties to leafspot.

A second global-benefits argument for preserving the world's tropical moist forests stems from the "greenhouse effect." Tropical deforestation is the second leading source of carbon dioxide emissions into the atmosphere after the burning of fossil fuels in the industrialized countries, contributing about 20 percent of the total (4). The scientific community, however, disagrees on both the existence and the consequences of global warming. Hence, the value of keeping carbon sequestered in tropical forests depends on how real and how damaging one believes this possible threat to be. (See References on Page 33)

Tropical Forests: A Global View

Tropical forests occur throughout a global belt defined by the Tropic of Cancer on the north and the Tropic of Capricorn on the south. It has been estimated that tropical forests once covered 16 million square kilometers (km²). Today they cover about 10 million km², of which some 6 million can be considered undisturbed (or closed canopy) forest.

Depending on one's definitions of forest and forest destruction, these resources are disappearing at an annual rate of 1 to 2 percent. Each year man destroys or severely damages about 195,000 km² of tropical forests (an area about the size of Nebraska), of which, at least 75,000 km² were previously undisturbed. Regardless of which measure one uses, these forests are being cleared on a scale that is far greater than anything experienced in the past.

Most tropical forests receive abundant moisture, and a tendency has developed to refer to them in general as rain forests. The loose application of this term, however, tends to obscure the fact that the tropics also contain large areas of seasonal and dry forests, as well as smaller areas of mangrove and palm forests. Because these are generally closer to population centers and relatively small, they are actually more threatened than the true rain forests. The term "tropical moist forests" is often used to refer collectively to all but the dry forests.

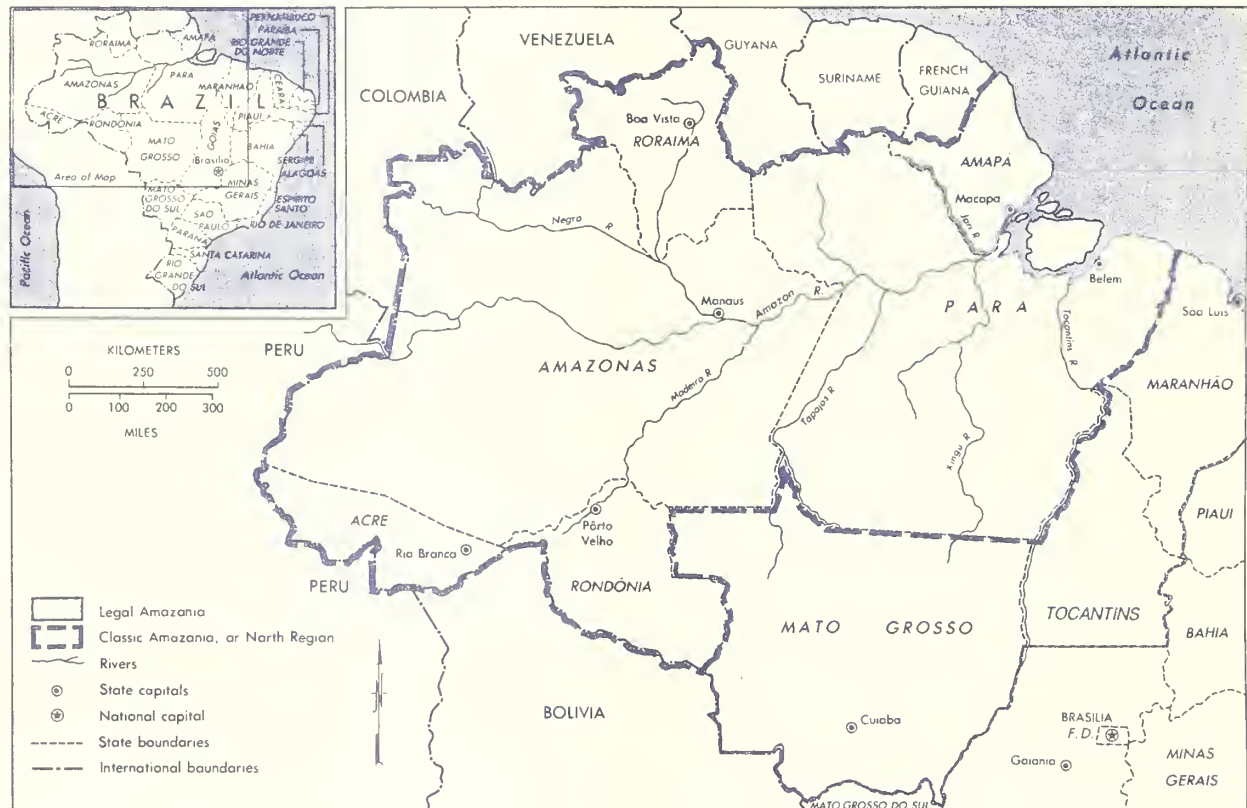
Rain forests are characterized by broad-leaved evergreen vegetation, abundant year-round precipitation, and relatively little floor covering. Seasonal forests contain mostly deciduous trees and have a very thick floor covering. While they receive abundant precipitation (sometimes more than rain forests), their year is divided into distinct wet and dry seasons. The Amazon is primarily rain forest, but it also has vast tracts of seasonal forest, where much of the clearing has occurred.

The Amazon is a prime candidate for preservation because of its size, the remoteness of much of its area, and Brazil's democratic form of government. Its size means that the Amazon offers the potential of meeting a large part of a future global-forest-preservation strategy through negotiation with a single developing country. Much of Amazonia is still inaccessible to large-scale human settlement. Classic Amazonia makes up nearly half (47 percent) of Brazil, but contains only about 6 percent of the country's population (and nearly 70 percent of these people live in Rondonia or Para) (5).

Maintaining this inaccessibility may well be the least-cost strategy for preserving large tracts of tropical forests.

Finally, Brazil's recent change to democracy, highlighted by the adoption of a new constitution in October 1988 and the popular election of President Collor in 1990, means there is now a representative political body that can give effect to a forest preservation agreement between Brazil and the world community. Popular support is a necessary condition of success for implementation of a forest preservation policy.

Map 1. Amazon Region of Brazil



Source: World Bank

Brazil's Amazon

Although some 76 countries have holdings of tropical forests, Brazil has about 30 percent of the total (3). The world's largest tropical moist forest is contained in a 5.5 million km² area of the Amazon River Basin (11). Of this, about 3.7 million km² are in Brazil. (The seven other countries with territorial claims in the Amazon are Bolivia, Peru, Colombia, Ecuador, Venezuela, Guyana, and Suriname. All are members of the Treaty of Amazonic Cooperation, or the Amazon Pact.) In 1980 it was estimated (9) that the Brazilian Amazon included about 2.86 million km² of rain forest, 0.5 million km² of seasonal forest, and about 0.3 million km² of nonforested area.

Within Brazil, two Amazons are distinguished. Classic Amazonia is defined as the states of Amapa, Roraima, Amazonas, Acre, Rondonia, and Para. Virtually all of Classic Amazonia is, or was originally, rain available forest. Legal Amazonia includes Classic Amazonia, the states of Mato Grosso and Tocantins (until recently the northern part of the state of Goias), and part of the state of Maranhao. With respect to natural vegetation, Maranhao is mostly palm forest; Mato Grosso and Tocantins are primarily a mixture of seasonal forest and savannah. Legal Amazonia covers over 5.0 million km² (about 59 percent of Brazil) and is about 1.3 million km² larger than Classic Amazonia. Both Amazonias are referred to in this article.

Country Briefs

Egypt's Agricultural Production Forecast To Rise 5 Percent in 1990

With a record wheat harvest and expected rebounds for cotton and the livestock sector, Egypt's aggregate agricultural production is forecast to increase about 5 percent in 1990. Such an increase would offset the 5.5-percent loss in 1988, when irrigation water was scarce, and the lackluster 2.3-percent growth in 1989, which was less than the population increase. Grain production for 1990 is estimated at 11 million tons, a fifth greater than in 1989, and includes 4 million tons of wheat, up from 3.2 million tons in 1989, 4.6 million tons of corn, 1.6 million tons of milled rice, 600,000 tons of sorghum, and 170,000 tons of barley.

Because cropland area is limited to about 6.4 million acres and multiple cropping is already prevalent, it is difficult to achieve great gains in one crop without offsetting losses for another. One way Egypt has increased production is by importing feed to bolster output of meat, milk, and eggs. But feed imports are expensive for Egypt, and while the subsidy on imported corn and soybean meal fueled strong gains in output of livestock products during 1981-87, much higher feed prices jolted the poultry industry after the subsidy was removed in July 1988. Previously, prices for imported feed delivered to commercial feedlot and broiler operators was only 60 Egyptian pounds per metric ton, and at the early 1988 exchange rate this was only \$26 per metric ton. By early 1990, the open market price for corn, domestic or imported, had increased to about 550 Egyptian pounds, or \$212 per ton at the prevailing exchange rate.

Furthermore, uncertainty about steady feed supplies for efficient commercial operations hampered investments in the livestock sector. Much of the larger corn crop was used by villagers as feed for their expanding livestock operations. As a consequence, commercial firms near Alexandria and Cairo complained that domestic corn availability was less reliable than imported supplies.

The elimination of the subsidy coincided with privatization of the corn trade. And while poultry producers and consumers had to pay more for poultry products, the theory that curtailing corn imports through government intervention would raise domestic prices and result in greater corn production proved to be correct. In response to producer prices of over \$200 per ton, a record 4.5 million tons were harvested in 1989. However, the increase in corn area limited gains in cotton and vegetable output. Further gains for corn are likely in 1990 to over 4.6 million tons, with greater yields from hybrid varieties.

In 1989, cotton production declined 6 percent to 294,000 tons, following a series of earlier declines, and in 1990 Egypt became a net importer of cotton. A slight rise in area

and better yields should result in a rebound to over 320,000 tons of cotton in 1990. Vegetable production is also expected to rebound with the help of improved cultivation practices and more intense multiple cropping. Fruit output at 3.5 million tons is increasing, but domestic consumption continues to exceed supply. [John B. Parker (202) 786-1683]

U.S. Agricultural Exports to Saudi Arabia Rising

U.S. agricultural exports to Saudi Arabia in 1989 increased 3.6 percent to \$470 million, and rose another 6 percent in the first half of 1990. Total 1990 exports are likely to be near \$500 million. Larger sales of animal feed, seed, and ingredients used in food manufacturing are offsetting smaller exports of wheat and rice. The recent growth stemmed from a rebound in exports of high-value products, especially apples, frozen poultry, corn oil, and record sales of corn. Yet, the U.S. share of total Saudi agricultural imports is declining, because the total value is rising at an even faster pace. The EC, Southeast Asia, and India are increasing their market shares.

Barley, the major U.S. export to Saudi Arabia, increased 13 percent to 714,700 tons in 1989—all through the Export Enhancement Program (EEP). The value of these exports totaled \$89.3 million, as the average price rose from \$115 to \$125 per ton. Still, this was less than a third the 1987 peak, as much larger EC deliveries, assisted by export restitution payments, were recorded. In 1989, total Saudi barley imports were steady at about 4.2 million tons, with half supplied by the EC. In the first half of 1990, U.S. barley exports to Saudi Arabia declined 29 percent to 261,000 tons, due to intense competition from the EC, Australia, and Canada.

Competition is also intense in the Saudi rice import market, where Asian competition is chipping away at the U.S. market share. In the late 1980's, Thailand and Pakistan increased their shares of Saudi Arabia's relatively steady total rice imports of about 525,000 tons annually, while the shares for the United States and India declined. U.S. rice exports to Saudi Arabia declined from 192,747 tons in 1988 to 189,138 tons in 1989. The total value fell from \$100 million to \$86 million, as the price declined from \$521 to \$455 per ton. This decline caused rice to fall behind barley as the leading item in terms of value among U.S. farm exports to Saudi Arabia.

U.S. corn shipments also grew in 1989, rising to 646,239 tons for \$74 million (\$115 per ton, up from \$104 per ton in 1988), and in the first half of 1990 they were up a further 30 percent. Saudi Arabia needs more imported corn for its expanding poultry industry and for dairy and sheep feedlots. This expansion has also resulted in the purchase of more soybean meal from the United States, Brazil, and India. U.S. soybean meal sales to Saudi Arabia declined from 161,830 tons in 1988 to 152,615 tons in 1989, and the value fell from \$45 million to \$39 million, mostly because of greater competi-

tion from India. However, U.S. exports of soymeal to Saudi Arabia were a fourth higher at 109,000 tons in the first half of 1990.

Vegetable oil demand continues strong and U.S. corn oil sales increased 26 percent in 1989 to 43,300 tons for \$26.7 million, rising another 22 percent in the first half of 1990. The average price declined from \$708 per metric ton in 1988 to \$616 per ton in 1989, thereby keeping U.S. offers competitive with those of the EC and Singapore.

Demand for specialty items continues strong and market development activities are helping to increase U.S. exports of snack foods, including peanut butter, popcorn, and fruit. Saudi Arabia remained the leading export market for U.S. peanut butter in 1989, with purchases of \$2 million. In addition, sales of U.S. peanuts soared from only 27 tons in 1988 to 2,423 tons for \$4.2 million in 1989, and more than doubled in the first half of 1990. Sales of popcorn nearly doubled in 1989, to 3,047 tons for \$1.19 million. Exports of almonds rose 58 percent to 1,832 tons for \$6.2 million in 1989 and advanced 30 percent in the first half of 1990. Demand for almonds is increasing because of greater use by new factories producing candy, bakery products, and breakfast cereals. Strong gains in December allowed U.S. apple exports to show a slight gain to 14,839 tons in 1989, up from 13,735 tons in 1988. The value rose by a third to \$7 million. U.S. apple and pear exports more than doubled in the first half of 1990.

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Due to a change in the accounting of U.S. wheat exports in recent years, virtually all seed that had been classified as wheat is now reported in the seed category. This contributed to the rise in U.S. seed exports to Saudi Arabia from 26,485 tons (\$17.9 million) in 1988 to 134,538 tons (\$53.3 million) in 1989. Saudi Arabia is also an important market for U.S. seed for tomatoes, watermelons, and fodder crops.

U.S. exports of frozen poultry to Saudi Arabia are rebounding in 1990 as some of the remaining 19,500 EEP is used. U.S. exports of frozen poultry quadrupled to 3,861 tons in the first 6 months of 1990. Brazil and France have developed an oligopoly for Saudi frozen-poultry imports, which remained steady at 195,000 tons in 1989. Their delivered prices are usually much lower than smaller suppliers can quote. Combined, these two suppliers provided over 95 percent of Saudi frozen poultry imports in 1986-89. The United States remained a small supplier, with about 1 percent of the market in the late 1980's. Other suppliers that have left the Saudi poultry meat market include Romania, Denmark, Lebanon, and Poland, although Hungary made a rebound in 1989.

U.S. exports of pulses to Saudi Arabia increased fivefold to 2,055 tons (\$1.2 million) in 1989. U.S. exports of a wide range of grocery items to Saudi Arabia increased in the first half of 1990, including canned vegetables, raisins, chocolates, corn chips, and ingredients for Saudi food-processing facilities such as fruit juice concentrates and soft drink flavorings. U.S. coffee exports to Saudi Arabia increased 42 percent to 437 tons (\$2.9 million) in 1989. [John B. Parker (202) 786-1683]

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