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TIME FOR TAPIOCA, 1970 to 1980: EUROPEAN DEMAND AND WORLD SUPPLY OF DRIED CASSAVA†

The rapid growth in imports of dried cassava into the European Community (EC) during the 1970s as animal feed is one of the most interesting developments in trade of agricultural commodities.[1] Between 1971 and 1978, imports increased from 1.3 to 6.5 million tons, an astounding 25 percent annually, and then declined to 5.6 million tons in 1980 (Table 1). Three countries—the Netherlands, West Germany, and Belgium—purchased 70 to 90 percent of these imports.[2] Two countries—Thailand and Indonesia—together

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†With apologies to Charlotte Stryker, whose book, *Time for Tapioca* (1951), reports the adventure of an American family that went to Java shortly before the stock market collapse of 1929 in an ill-fated attempt to establish a tapioca plantation. The present article is based on Chapters II and III of my Ph.D. dissertation (Nelson, 1982) and draws heavily from one of my chapters (Nelson, forthcoming) in *The Cassava Economy of Java* (Falcon, forthcoming). I would like to thank the other authors of that book for their helpful comments. Thanks are also due to the Ford Foundation for its financial support through the Food Research Institute's Indonesian cassava project. Responsibility for any remaining errors or inaccuracies remains with me.

Manihot esculenta Crantz goes by a number of names among English-speaking people. Most British and North American agricultural economists and most English-speaking Africans call it *cassava*, but in the Indian subcontinent, Malaya, and Thailand it is *tapioca*. To American consumers, however, cassaba is a melon and tapioca a dessert. Dried cassava imported to Europe as a feedstuff is probably most often referred to as *manioc* chips and pellets, although it may also be called *tapioca* or *cassava*. References to the plant are somewhat simpler in German and French where the term is *maniok* or *manioc*, in Portuguese where it is *mandioca*, and in Spanish where it is *yuca*. Indonesians use the Dutch term, *cassava*, when speaking in English, but may also use *ubi kayu, ketela pohon*, or *singkong* (see also Jones, 1959, p. 3). Indonesians call dried cassava root *gaplek*, a term whose use extends beyond the countries where the Malay language is spoken. In this article, the terms *cassava* and *dried cassava* are used interchangeably to mean chips or pellets made from the dried roots.

[1] Early works on the topic include Phillips (1974) and the International Trade Centre (1968, 1977).

[2] Imports into countries other than EC members were virtually nil until 1980 when the Soviet Union purchased about 500,000 tons.

TABLE 1—EUROPEAN COMMUNITY NET IMPORTS OF DRIED CASSAVA AND SHARES FROM THAILAND AND INDONESIA
(*thousand tons*)

	1971	1975	1976	1977	1978	1979	1980
Netherlands	514	1,146	1,562	1,865	2,440	2,197	2,274
West Germany	522	507	680	959	1,482	1,480	1,464
Belgium-Luxembourg	274	480	590	704	907	870	849
France	38	147	176	203	715	571	372
Others	0	167	235	301	917	759	654
Total	1,348	2,447	3,243	4,032	6,461	5,877	5,613
Origin (*percent*)							
Thailand	62[a]	77	86	90	88	77	73
Indonesia	31	13	6	4	3	12	6

Source: For 1971, from International Trade Centre, 1977, *Cassava: Export Potential and Market Requirements*, Geneva, Switzerland; for 1975-79 from the Statistical Office of the European Community (EUROSTAT), *Foreign Trade: Analytical Tables (NIMEXE)*, various issues; includes both gaplek and dried sweet potato slices (BTN 0706).

[a]Share of Netherlands, West German, and French imports.

supplied between 90 and 95 percent of those imports, but the growth in exports came entirely from Thailand.

This remarkable increase in trade is the direct consequence of changes in European agricultural policy that accompanied the formation of the EC in 1962. Although some cassava products were imported into northern Europe before World War II, the flow was small and irregular. Both before and shortly after the war, European demand for dried cassava depended primarily on domestic feed-grain harvests. As a general rule, cassava was imported only when there was a serious shortfall in domestic grain supply.

To explain the rapid growth in imports in the 1970s and current European demand for cassava, this article examines the use of cassava in livestock feed rations; the impact of EC agricultural price and trade policies, especially towards grains, on that use; and the distribution of animals and the animal feeding industry in the Community. In addition, factors responsible for the enormous difference in supply response between Thailand and Indonesia are discussed.

The growth of cassava imports has engendered political reactions by several groups in Europe, most notably feed-grain and livestock producers in France, who have pushed for controls on import quantities. The reasons for these complaints are discussed and the recent efforts at control reviewed.

EUROPEAN DEMAND FOR DRIED CASSAVA

Cassava is used in the Community as an ingredient in compound animal feeds. Because it contains about 4,000 kilocalories per kilogram of dry matter, dried cassava is an excellent energy source, but it contains very little protein

TABLE 2—NUTRIENT VALUES OF SELECTED FEEDSTUFFS WHEN USED IN PIG FEED
(*dry matter basis*)

	Protein (*percent*)	Kcals digestible energy (*per kg*)
Cassava	2.84	4,000
Barley	13.03	3,467
Corn (dent yellow)	9.89	3,961
Wheat (soft red winter)	11.86	4,254
Soybean meal (expeller)	47.33	3,870

Sources: Figures for cassava from Z. Muller, K. C. Chou, and K. C. Nah, 1975, "Cassava as a Total Substitute for Cereals in Livestock and Poultry Rations," *Animal Feeds*, Tropical Products Institute, London; for other commodities from the National Research Council, 1979, *Nutritional Requirements of Swine*, National Academy of Sciences, Washington, D.C.

(Table 2). In contrast, the feed grains (barley, corn, wheat, oats, and sorghum), have about the same calorie content but are roughly 10 percent protein. Soybean meal can be purchased with any of several ratios of energy to protein, but the dry matter of a typical meal is 40 percent, about four times as much as the feed grains, and roughly the same calorie content as cassava.

As a result of these very different ratios of protein to energy, it is possible to prepare a mixture of cassava and soybean meal (roughly 80 percent cassava) with the same nutrient value as the feed grains, and the feed compounder can feed either a feed grain or the mixture depending on relative prices. Since requirements for energy and protein differ among species of animals, it can be profitable to use cassava in some feeds but not in others.

In addition to nutritional coefficients, compounders also must consider technical constraints on the maximum amount of cassava that can be used in a feed, and feed grains are often used in feeds containing both cassava and soybean meal. For example, according to industry sources, if poultry feed contains more than about 15 percent gaplek, it tends to be unpalatable and consumption falls. Pig rations can contain up to 40 percent cassava. Cattle rations are typically limited to 15 to 25 percent, and poultry rations range from 7 to 15 percent.[3] As a result of nutritional requirements and compositional restrictions, pig feed is the most important user of cassava. In the Netherlands in 1977/78, 77 percent of cassava consumed was used in pig feed, 14 percent in feed for cattle, goats, and sheep, and 9 percent in chicken feeds (Netherlands Ministerie van Landbouw en Visserij, 1979).

Policies of the European Community

The basic goal of the Community's Common Agricultural Policy (CAP) is high and stable domestic prices that are the same in all countries. Three policy

[3] Depending upon the country, these restrictions either have the force of law or are recommendations from the agriculture ministry or other agency.

instruments are used to achieve this goal—a floor price (the "intervention" price) supported by government purchases, variable levies on competing imports, and export subsidies to dispose of excess production. A target price is set for each of the agricultural commodities. The floor price is then set somewhat below this level. A ceiling price (the "threshold" price), set somewhat above the target price, is used to determine the variable levy. Together, the variable levy and intervention price create a band within which domestic prices move (Table 3).

TABLE 3—ADMINISTRATIVE PRICES FOR CORN AND BARLEY IN THE EUROPEAN COMMUNITY
(*units of account per ton*)

	1972	1974	1976	1978	1979[a]	1980[a]
Corn						
Threshold price	99.55	112.05	135.10	144.25	178.90	189.50
Intervention price	83.25	94.03	112.20	121.57	149.17	155.88
Barley						
Threshold price	102.00	113.25	135.10	144.25	178.90	189.50
Intervention price	95.70	101.43	116.00	121.57	149.17	155.88

Source: European Feed Manufacturers Association (FEFAC), *Feed and Food Statistical Yearbook*, various issues, Brussels, Belgium. Prices are for the crop year beginning in August of the calendar year indicated.

[a]European currency units per ton.

Implementation of the CAP began in July 1962 when threshold and intervention prices were instituted for all feed grains. Initially these prices were set at different levels in each of the countries, and levies on intra-Community trade were added to eliminate arbitrage. In July 1967, the national threshold and intervention prices were unified and intra-Community border taxes on grains abolished.

The CAP regulations were applied initially only to cassava meal; an import levy was imposed consisting of a fixed component and a variable component based on the barley levy.[4] In July 1967, cassava pellets and chips were added. The meal levy remained at 25 percent of the barley levy plus 0.25 units of account (UA)[5] per 100 kilograms, whereas pellets and chips faced a variable levy of 18 percent of the barley levy and no fixed charge.

[4] The fixed part was orginally set at zero but was changed to 0.25 units of account per 100 kilograms in November 1964. The variable part was originally set equal to 40 percent of the barley levy from July 1962 and finally reduced to 25 percent in November 1964, where it has remained. Other gaplek products were subject to a 3.6 percent *ad valorem* tariff in the three major importing countries—West Germany, Netherlands, and Belgium (International Trade Centre, 1968).

[5] The UA was the Community's first budget currency. It was defined as 0.88867 ounces of gold and was originally equivalent to one United States dollar. In 1979, the UA was replaced by the European Currency Unit (ECU).

The last and most important change in Community regulation of cassava came in July 1968, when the levy on pellets and chips was bound to a maximum of 6 percent *ad valorem* as part of the Kennedy round of the GATT negotiations.[6] As a result, pellets and chips faced an import tariff of 6 percent for most of the 1970s. The exceptions came in 1973 and 1974 when world feed-grain prices increased so much that the levy on pellets and chips was less than 6 percent of the variable import price. Because the meal levy was not bound, meal imports face much higher taxes and have dropped to zero.

One other set of agricultural policy instruments—agricultural exchange rates and associated border taxes called monetary compensatory amounts (MCAs)—affects dried cassava imports and prices. The intervention price is set initially in terms of the Community budget currency (the European Currency Unit (ECU) since 1979) and then converted to national currencies using the agricultural or "green" exchange rate. In order to establish common agricultural prices within the Community, the green rate and the market rate would have to be identical.[7] In practice they have not been, and national prices have seldom been common to all EC members.

Common prices were achieved in 1967 at the end of the five-year period phasing in the grains regulations, but soon diverged. The revaluation of the German mark and the devaluation of the French franc against the UA in 1969 renewed differences in national prices. To protect German farm incomes from the effects of revaluation, the green exchange rate was not changed and farmers continued to receive pre-revaluation prices. In order to prevent arbitrage, border taxes (MCAs) were instituted. Exports of agricultural products from West Germany were subsidized and imports were taxed to offset the difference between market and green rates. In the case of the French devaluation, the green rate was left unchanged to keep food prices low, and the MCAs taxed French exports of agricultural products and subsidized imports. Differences between market and green exchange rates (and corresponding national price differences) were meant to be temporary, but as floating exchange rates became widespread in the early 1970s, most Community members established national prices that differed from the "common" levels.[8]

Green rates affect dried cassava demand by allowing national prices of feed grains to vary. In 1978, for example, exchange rates and barley prices in West Germany and the United Kingdom were as follows (FEFAC, 1980):

[6] The ACP (African, Caribbean, and Pacific) countries received trade preferences from the EC on cassava imports. For meal, the fixed component of the levy was set at zero. The variable component was reduced 1.5 UA per ton for meal and 50 percent for cassava starch. Even with these reductions, the GATT tariff on pellets and chips was the lowest rate and hence the effective tax on imports for most periods. Few cassava imports originate in ACP countries.

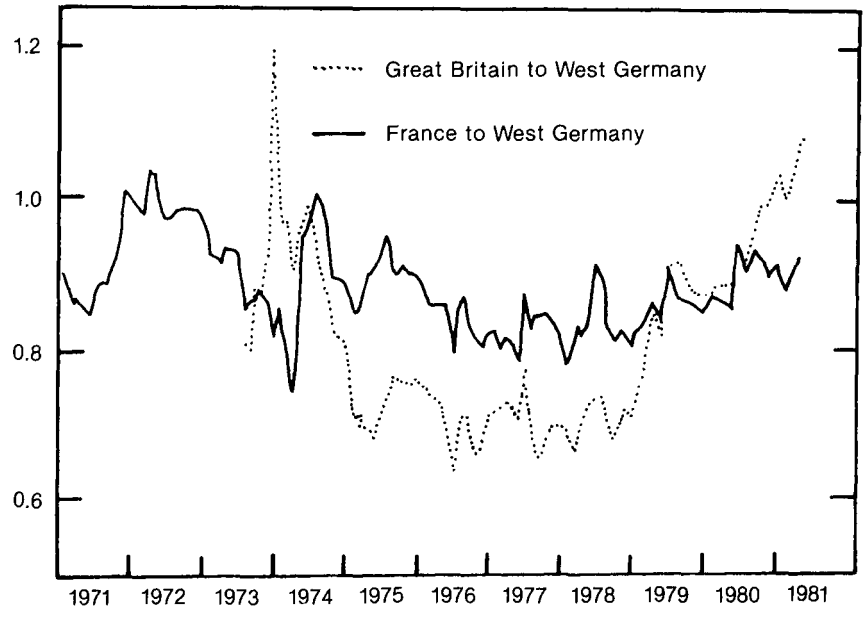
[7] The term "market rate" refers to exchange rates between currencies, including the budget currency, that are equivalent to those obtained in the foreign exchange markets.

[8] See Josling and Pearson (1981) for a discussion of the factors determining green rates and MCAs.

	West Germany	United Kingdom
Target price per ton		
Units of account	122	122
National currency	415	72
U.S. dollars	197	140
Green rate	3.4 DM/UA	0.59 £/UA
Market rate	2.11 DM/$	1.94 $/£

With the 1978 intervention price for barley of 122 UA per ton and the green rates given above, the national currency prices in West Germany and the United Kingdom were DM 415 and £72 per ton, respectively. At the prevailing market exchange rate, the German price was $197 per ton while the British price was only $140 per ton. In 1977/78, landed prices for pellets were on the order of $100 per ton, making it extremely profitable to feed cassava in West Germany but only marginally profitable in the United Kingdom. From 1974 through 1980, both French and British wholesale feed-grain prices were below German feed-grain prices (Chart 1).[9]

CHART 1—EUROPEAN BARLEY PRICE RATIOS



Source: Commission of the European Community, *Agricultural Markets*, various issues. Wholesale prices are from representative markets in each country, converted to dollars using the market exchange rate.

[9] Beginning in 1979, the pound strengthened relative to the mark and British MCAs were reduced steadily. By mid-1981, feed-grain prices were somewhat higher in the United Kingdom than in Germany.

Countries do not have complete freedom to change green rates. After a change in its market exchange rate, a country can choose to leave its green rate unchanged, thereby increasing the difference between the market and green rates, but it cannot change its green rate to increase that difference. The only allowable changes in green rates are those that decrease the differences between market and green rates. Because of this asymmetry, countries whose currencies appreciated relative to the budget currency, such as West Germany and the Netherlands, had national grain prices that were higher than common prices. Countries with depreciating currencies—France, the United Kingdom (until 1980), and Italy—had national grain prices that were lower than the common level.

Animals and Animal Feeding in the Community

Total feed production in the Community in 1979 was 77.9 million tons (Table 4). The three major cassava-importing countries—the Netherlands, West Germany, and Belgium—manufactured 46 percent of the total animal feed although they had only 32 percent of the livestock.

The European animal population is spread widely throughout the Community, but there are several regional concentrations. The three cassava-importing

TABLE 4—EUROPEAN COMMUNITY PRODUCTION OF COMPOUND FEEDS
(*million tons*)

	1960	1970	1979
Netherlands			
All feeds	4.30	7.90	14.06
Pig feed	n.a.	3.31	5.97
West Germany			
All feeds	3.60	9.70	16.44
Pig feed	n.a.	3.36	6.18
Belgium			
All feeds	1.60	4.30	5.00
Pig feed	n.a.	2.19	2.66
France			
All feeds	2.20	7.60	14.01
Pig feed	n.a.	2.78	4.72
European Community[a]			
All feeds	22.43	47.80	77.92
Pig feed	n.a.	15.57	26.46

Source: European Feed Manufacturers Association (FEFAC), *Feed and Food Statistical Yearbook*, various issues, Brussels, Belgium.

[a]Belgium, Denmark, France, Ireland, Italy, Luxembourg, Netherlands, United Kingdom, and West Germany.

countries had 50 percent of the pigs and made 56 percent of the compound pig feed. West Germany, France, and the United Kingdom have two-thirds of the cattle, and France, Italy, and the United Kingdom have 40 percent of the poultry (EUROSTAT, 1980).

Remarkable change occurred in the number and distribution of animals and the composition of compound feeds simultaneously with the growth in imports of cassava. The number of pigs in the three cassava-importing countries increased by 6.7 million head (21.8 percent) between 1970 and 1979, while the number of pigs in the remaining countries declined slightly (Table 5). The share of grains in compound feeds in the Netherlands, the largest user of cassava, dropped from 32 percent to 18 percent between 1974 and 1978 (Table 6). West Germany and Belgium experienced declines of 9 and 8 percentage points respectively during the same period.

TABLE 5—NUMBER OF PIGS IN THE EUROPEAN COMMUNITY
(*thousands*)

	1950	1965	1970	1975	1979
Netherlands	2,274	3,987	6,340	7,016	10,044
West Germany	11,969	17,723	20,532	19,805	22,374
Belgium	1,234	1,885	3,835	4,679	4,987
France	6,824	9,238	11,215	11,890	10,525
Others	n.a.	n.a.	27,662	25,164	27,365
European Community[a]	n.a.	n.a.	69,584	68,554	75,295

Source: Statistical Office of the European Community (EUROSTAT), *Yearbook of Agricultural Statistics*, various issues, Luxembourg.

[a]Belgium, Denmark, France, Ireland, Italy, Luxembourg, Netherlands, United Kingdom, and West Germany.

TABLE 6—SHARE OF CEREALS IN COMPOUND FEEDS IN SELECTED EC COUNTRIES
(*percent*)

	1974	1978
West Germany	39.74	30.34
Netherlands	31.90	18.33
Belgium	42.63	35.08
France	51.03	44.08
United Kingdom	55.45	49.42
European Community	45.44[a]	38.04[b]

Source: European Food Manufacturers Association (FEFAC), *Feed and Food Statistical Yearbook*, various issues.

[a]Includes Belgium, France, Ireland, Netherlands, United Kingdom, and West Germany.

[b]Belgium, Denmark, France, Ireland, Italy, Luxembourg, Netherlands, United Kingdom, and West Germany.

Interviews with traders and feed firms in Europe indicate that four regional concentrations of feed-making capacity in the Community, with more than 40 percent of the total EC pig herd and characterized by relatively low intra-regional transport cost, used sizable amounts of dried cassava at some time during the 1970s (Map 1). Region 1, the southern half of the Netherlands, the northern half of Belgium, and German areas bordering the Netherlands, contains the single largest concentration of feeding capacity in Europe and roughly 25 percent of the EC pig herd (Table 7). This region is interwoven with canals, most of which are large enough to handle the standard barge used to transport commodities from alongside ocean-going vessels. According to industry sources, the transport cost from Rotterdam is less than $5 per ton.[10] The industry in this region used about 2.5 million tons of cassava for pig and chicken feed and another 0.6 million tons for cattle feed in 1980. In 1978, the year of record cassava imports, consumption rose to 3.5 to 4.0 million tons.

TABLE 7—DISTRIBUTION OF PIGS BY CASSAVA FEEDING REGION
(*thousands*)

	December 1973	December 1977
Region I	15,958	18,198
Netherlands	6,889	8,429
Belgium	4,720	4,935
Nordrhein-Westfalen, West Germany	4,349	4,834
Region II		
Niedersachsen, West Germany	5,869	6,323
Region III		
Bavaria, West Germany	4,080	4,115
Region IV		
Brittany, France	3,885	4,251
Four-region total	29,837	32,887
Community total	70,567	72,130

Sources: Statistical Office of the European Community (EUROSTAT), 1974, "Livestock, Meat Production, Civil Year Balance Sheets," *Agricultural Statistics*, Luxembourg; EUROSTAT, 1978, *Animal Production, 1968-1977*, Luxembourg. The figures are for political regions that most closely approximate the animal feeding regions.

Region 2 is located in northern West Germany near the ports of Bremen and Hamburg and has about 9 percent of the Community's pigs. Feed mills probably used 700,000 tons of cassava in 1980 and as much as one million tons in 1978. Transport costs for cassava in this region are somewhat higher, primarily because smaller ships must be used (30,000- to 50,000-ton vessels in the Bremen and Hamburg ports as opposed to 60,000- to 120,000-ton vessels in

[10] Rotterdam is taken to include the three ports of Rotterdam, Amsterdam, and Antwerp.

Map 1—Regional Centers of Cassava Feeding

the Rotterdam ports). Unloading costs are also higher because cassava must be moved into silos and then to rail cars or trucks.

The southern German state of Bavaria comprises Region 3. Less compound feed is used here because of the distance from ocean ports and proximity to

large feed-grain production. Industry sources estimate that a north German pig eats 367 kilograms in its lifetime while its south German cousin eats only 90 kilograms and makes up the rest of its intake with locally grown grains (Neville-Rolfe, 1979, p. 109). Significant quantities of cassava (more than 100,000 tons) were probably used there only in 1978.[11]

Brittany, in France, was a minor user of gaplek during most of the 1970s and is identified as Region 4. Its port facilities for cassava are inferior to those in the northern European ports, and landed cassava is more expensive than in the Netherlands, Belgium, or West Germany. Furthermore, large amounts of grain are produced nearby. Nevertheless, most of the French dried cassava imports of 715,000 tons in 1978 were probably consumed in Brittany.

Import Demand for Dried Cassava

The determinants of the import demand for cassava can be most easily identified by considering a hypothetical feed mill making pig feed using corn or barley or a 4-to-1 cassava-soymeal mixture. Demand for the mixture, and therefore cassava if the soymeal price is held constant, is a step function. Demand is zero until the cassava price is low enough to equate the cost of the mixture to the administratively determined corn price, infinitely elastic until it has fully replaced corn in the feed, and zero for additional amounts.

Within regions near the Northern European ports where feed-grain prices are the same and transport costs are low, the demand for cassava will be relatively elastic until it is included in all feeds. For additional imports, demand becomes less elastic as the cost of transporting cassava from the port increases, and it must compete in regions where feed-grain prices have been lowered by green rates.

In the short-to-medium run, when the quantity of imports is determined exogenously, the import price of dried cassava should be positively correlated with exogenous feed-grain prices and negatively correlated with soymeal prices.[12] The impact of additional imports depends on the number of pigs in Regions 1 and 2, where transport costs are low. As the number of pigs increases, the elastic portion of the demand curve lengthens.

Table 8 presents two forms of the import price determination function.[13]

[11] Region 3 is often supplied with imported feedstuffs via Bremen or Hamburg rather than Rotterdam because of a subsidized German rail freight.

[12] Although both Thai cassava farmers and Dutch pig farmers are undoubtedly price responsive, they probably respond to prices with a considerable lag, probably a year or more. The regression results, however, are based on monthly data. Moreover, changing freight rates over the 1970s have reduced the correlation between European CIF cassava prices and Thai FOB prices.

[13] The dependent variable in each is the monthly CIF price per 100 kilograms of Thai pellets in northern European ports. Regression I includes dummy variables for 1977 and 1978, when imports increased by about 100 percent in two years. The European handling and distribution system could not yet manage an increase of this magnitude, and prices were pushed below what normally would have obtained. Inclusion of the dummy variables improves the explanatory power of the regression, but scarcely alters the other coefficients, as shown in Regression II.

Since the feed-grain floor and ceiling prices define a band within which market prices can move, both the Dutch corn and the German barley price are included. Coefficients of both feed-grain prices are positive and statistically significant despite expectations of high multicollinearity. The coefficients add to 1.0, indicating that a uniform percentage increase in feed-grain prices will cause a similar increase in the cassava price.

TABLE 8—DETERMINANTS OF THE EUROPEAN CIF CASSAVA PRICE

Variable	Regression I		Regression II	
	Coefficient	t-ratio	Coefficient	t-ratio
Intercept	−7.41*	−1.86	−5.12	−1.00
PBARLEY	0.42**	3.04	0.40**	2.59
PCORN	0.56**	4.00	0.52**	3.33
PSOYML	−0.03	−1.62	−0.04	−1.60
QTYI(−1)	−0.80**	−2.80	−0.98**	−3.60
QTYI(−2)	−1.10**	−3.93	−1.11**	−3.94
CP	−0.70**	−2.00	−0.75**	−2.19
D77	−4.07**	−3.19	—	—
D78	−4.94**	−3.39	—	—
R^2	0.75		0.61	

Sources: Prices of European grains are from Commission of the European Communities, *Agricultural Markets*, various issues. The Dutch pig figures use year-end reports published in the Statistical Offices of the European Community, *Yearbook of Agricultural Statistics*, various issues, and quarterly reports from *Agra Europe* where available. Missing observations are replaced by linear interpolation. Thai exports are unpublished figures from the Thai Ministry of Agriculture. CIF pellet prices were provided by Alfred Toepfer, a German importing firm, and can be found in Boonjit Titapiwatanakun, *Feasibility Study on Regional Cooperative Arrangements in Tapioca*, Trade Cooperation Group, United Nations Economic and Social Commission for Asia and the Pacific, Bangkok, 1980.

There are 115 monthly observations beginning in January 1971. The coefficients have been corrected for first degree autocorrelation and the t-ratios are only asymptotically valid.

The dependent variable is the monthly CIF price of dried cassava in North Sea ports.

The independent variables are:

PBARLEY = German wholesale price of barley per 100 kilograms, in Dutch guilders.
PCORN = Dutch wholesale price of corn per 100 kilograms, in Dutch guilders.
PSOYML = Dutch wholesale price of soymeal per 100 kilograms, in Dutch guilders.
QTYI(X) = Exports of pellets from Thailand, in hundred thousand tons. X is the number of months lagged; for example, QTYI(−1) is a one-month lag.
CP = $QTYI(-1)^2 / DPIGS$.
D7X = Dummy for the year 197X.
DPIGS = Number of Dutch pigs, in thousands, used as a proxy for pigs in the port regions.

*Significant at the 10 percent level.
**Significant at the 5 percent level.

Monthly import figures were not available and monthly exports from Thailand were used as a proxy. This quantity variable enters in three ways. Because information transmission from Thailand is nearly instantaneous, whereas the shipping time is more than a month, exports in nearby months influence prices. Hence, exports lagged one and two months (corresponding to imports lagged zero and one month) were included in the estimation. Both are significant and have the expected negative sign. In order to capture most of the declining elasticity effect of larger imports, a composite quadratic term called CP, consisting of imports squared divided by the number of Dutch pigs, is included. As imports increase, the negative effect on demand is captured both in the simple quantity variables and the squared term. As the number of pigs increases, however, it reduces the effect of the squared term. This variable is also significant and has the correct sign.

Although the soymeal coefficient has the correct sign, it is not significant. This result is not surprising; the share of soymeal in the mixture is small, thus its impact on cassava prices should also be small.

Other Importers

Although the European Community has been the largest importer, other countries have occasionally imported cassava. In 1973 and 1974, when world grain prices reached record highs, Japan imported sizable quantities. In most years in the 1970s, however, Japanese feed needs were met with imported corn that was rarely more expensive than an equivalent mixture of cassava and soymeal.[14]

The Soviet Union purchased about 500,000 tons of cassava from Thailand in 1980 and substantial quantities in 1981 (FAO, 1981, p. 18). According to some reports, the price paid was substantially more than the market price. The motive for the purchases is unclear, but Soviet relationships with countries in Southeast Asia and problems with the United States grain embargo of 1980/81 were most likely involved. The potential market in Russia is large, but cassava cannot compete with corn (at least at 1980 world market prices) unless political factors continue to play a part.

Hong Kong and Singapore import small amounts of cassava for their domestic feedlots. Neither country is likely to develop a local livestock industry great enough to import large quantities of cassava, regardless of price.

At current world prices for feed ingredients, cassava is unlikely to find substantial markets outside the Community. Because EC feed manufacturers have been willing and able to buy all exported cassava at prices determined by their high domestic grain prices, other markets have not been able to compete.

[14] According to a Japanese importer interviewed in 1980, gaplek imports into Japan are hindered by a Japanese regulation prohibiting imports of feed containing excessive amounts of hydrocyanic acid (HCN). Although traded gaplek rarely contains HCN, Japanese traders and feeders prefer to use other feeds when prices do not clearly favor gaplek.

EXPORT SUPPLY OF DRIED CASSAVA

Asked to choose the Southeast Asian country that would be the world's leading exporter of cassava products in the late 1970s, an observer in the late 1950s would probably have picked Indonesia. Indonesia was the leading exporter before World War II and was one of the top five producers of cassava in the world. Thailand production and exports were small. Yet while Thailand's exports reached six million tons in 1978, Indonesia's largest dried cassava exports were only 710,000 tons, in 1979 (Table 9).[15]

TABLE 9—DRIED CASSAVA EXPORTS
(*thousand tons*)

	Thailand	Indonesia			China
		Total	Lampung	Java	
1965	578	156	n.a.	n.a.	n.a.
1970	1,097	332	71	261	n.a.
1971	970	458	87	365	n.a.
1972	1,111	342	101	240	16[a]
1973	1,530	75	33	42	11[a]
1974	2,030	394	199	187	4[a]
1975	2,104	303	207	87	4
1976	3,316	149	138	10	8
1977	3,669	183	142	38	1
1978	6,041	308	194	98	1
1979	3,880	710	192	495	52
1980	n.a.	386	161	220	336

Sources: For Thailand, from the Customs Department, Office of Commodity Standards, Board of Trade of Thailand. For Indonesia, from Central Bureau of Statistics, *Exports*, various issues. For China, imports into the EC are from the Statistical Office of the European Community, *Foreign Trade: Analytical Tables (NIMEXE)*, various issues.

[a] May include sweet potato slices.

Clearly, the CAP-induced world price changes were the major initiator of Thai export growth. Yet, while both countries faced the same world prices, Indonesian exports changed little during the 1970s.

Cassava Production in Thailand and Indonesia

Although cassava was probably introduced to Thailand by the midnineteenth century (Titapiwatanakun, 1974), it remained a minor crop for many years. Shortly after World War II, a cassava starch industry developed, primarily in the provinces of Rayong and Chonburi southeast of Bangkok, in response to shortfalls in starch exports from Indonesia. Starch exports stagnated

[15] Indonesian exports in 1979 were almost double the previous postwar high.

after 1961, but the introduction of the CAP stimulated an enormous increase in exports of dried cassava that continued almost unabated from 1962 until 1979.

Root production originally centered in the provinces of Rayong and Chon Buri. In response to demand, first from the starch industry and later from dried cassava exports, production increased in this area, reaching a peak of 4.5 million tons in 1978 (Tables 10 and 11). Production in the Northeastern Region expanded very rapidly in the 1970s. Northeast production grew from 108,000 tons in 1968 to almost 9.6 million tons in 1978, and then dropped back to 6.8 million tons in 1979, an average annual growth rate of more than 40 percent. In both the East and the Northeast, the increase was due to area expansion. National yields were about 18.5 tons per hectare in 1952 and declined to 14.9 tons by the crop year 1978/79 (Thailand Ministry of Agriculture, 1979).[16]

TABLE 10—THAI CASSAVA PRODUCTION STATISTICS
(*thousand tons fresh roots*)

	1968	1970	1976	1977	1978	1979
Northeastern region	108	334	4,822	6,738	9,572	6,804
Central provinces	n.a.	n.a.	4,410	4,472	4,536	3,559
Total production	2,611	3,431	10,138	12,372	15,048	10,600

Source: Total for 1968 and 1979 and regional production figures for the years 1974 to 1978 are for the crop year beginning in the year indicated and are from Thai Ministry of Agriculture and Cooperatives, *Agricultural Statistics of Thailand*, various issues. Northeast Region production figures for 1970 to 1973 are from Sunthorn Rajvongsuek, 1977, *An Analysis of the Competition Between Kenaf and Cassava Production in Northeast Thailand, 1967-1976*, master's thesis, Thammasat University, Bangkok, Thailand. Where these series overlap there are sometimes large discrepancies, and the national total is sometimes less than the sum of the two regions. The Northeastern Region consists of 16 provinces. The central provinces included here are in the area southeast of Bangkok including Chachoengsao, Prachin Buri, Chon Buri, Rayong, Chanthaburi, and Trat.

Cassava was introduced to Indonesia from the Americas perhaps as early as the seventeenth century. By 1850 new varieties were being imported from Surinam for experimental culture at the botanical gardens in Buitenzorg (present-day Bogor), and official efforts were made to encourage cultivation for famine relief. For a long time cassava culture on Java was limited to Bantam in West Java and Japora in Central Java. It gradually spread to eastern West Java, where the establishment of tapioca factories in Bandung and Garut stimulated its production. By 1915 the greatest plantings were in Central Java.[17]

[16] This decline was probably the result of a loss in natural soil fertility that was not replaced by the use of chemical fertilizers.

[17] For early accounts of cassava in Indonesia, see Blokzeijl (1916) and van Hall and van den Koppel (1946).

TABLE 11—AREA OF SELECTED CROPS, NORTHEAST REGION AND SELECTED CENTRAL PROVINCES OF THAILAND
(*thousand hectares*)

	1960	1970	1978
Northeast Region			
Cassava	5	30	674
Corn	n.a.	110	328
Kenaf	n.a.	329	314
Sugarcane	n.a.	8	46
Peanuts	n.a.	28	23
Central provinces			
Cassava	85	131	278
Corn	12	26	16
Sugarcane[a]	32	56	75
Kenaf[b]	1	3	5

Sources: Figures for Northeast Region for 1960 and selected central provinces for 1960 and 1970 from Jamlong Atikul, 1978, *An Econometric Model of Thai Cassava*, School of Development Economics, Bangkok, Thailand; for Northeast Region for 1970 from Sunthorn Rajvongsuek, 1977, *An Analysis of the Competition Between Kenaf and Cassava Production in Northeast Thailand, 1967-1976*, master's thesis, Thammasat University, Bangkok, Thailand; for 1978 from Thailand Ministry of Agriculture and Cooperatives, 1979, *Agricultural Statistics of Thailand, Crop Year 1978/79*, Bangkok, Thailand. A list of the central provinces is included in Table 10.

[a]From 1960 to 1970, Prachin Buri province is not included. Only small amounts of sugarcane are planted there.

[b]From 1960 to 1970 for Prachin Buri province only. Very little kenaf is planted in the other southeastern provinces.

Indonesian exports of cassava products suffered badly from the Japanese occupation during World War II and its aftermath, but by 1960 total production of cassava roots was at prewar levels. Production has grown modestly since then, but the area planted has changed little. Production increased from 10.5 million tons in 1970 to 13.5 million tons in 1980 (Table 12). An all-Indonesia view, however, obscures the striking change in the relative contributions to Indonesian cassava production and exports in the 1970s. While production on Java, where more than 70 percent of Indonesian cassava is grown, increased little in the 1970s, production in Lampung province grew at almost 14 percent annually. Dried cassava exports from Java fluctuated with little trend between 1970 and 1980, whereas exports from Lampung increased at almost 24 percent per year from 1970 to 1975 but then remained relatively constant as starch processors took an increasing share of production.

TABLE 12—CASSAVA PRODUCTION AND AREA STATISTICS, INDONESIA
(*thousand tons, thousand hectares*)

	Java		Lampung		Indonesia	
	Production	Area	Production	Area	Production	Area
1970	8,003	1,094	311	34	10,478	1,389
1975	9,309	1,065	655	61	12,546	1,410
1980[a]	9,627	997	804	74	13,532	1,418

Source: Indonesia, Central Bureau of Statistics, *Statistik Indonesia*, various years.
[a]Preliminary estimates.

Export Supply Response

Thailand's export growth was the result of fortuitous external circumstances and a rapid response by the private sector to new market incentives. A similar environment did not exist in Indonesia.

The CAP ensured a sizable market for cassava imports at prices that were usually close to and moved upward with the administratively determined feedgrain prices in Europe. Because both the Thai baht and the Indonesian rupiah were tied to the dollar, the dollar's gradual depreciation against the German mark and Dutch guilder during the 1970s as well as periodic devaluations of the baht and the rupiah meant that Thai and Indonesian domestic cassava prices increased more rapidly than did CIF Europe prices in German marks.[18]

In Thailand, the cassava price increases led to a substantial margin of profitability at the farm level for cassava relative to competing crops. Barry Bobst, Anthony Burris, and Harry Hall (1980) report that in Northeast Thailand in 1973/74, returns to labor in cassava production were almost twice as high as in rice, kenaf, peanuts, and vegetables. Sunthorn Rajvongsuek (1977) has shown that in some years between 1967 and 1976, net income per hectare of cassava in Northeast Thailand was ten times that of kenaf.

The increases in production and exports in Thailand were nevertheless based on growth in the area under cassava, not on substitution of cassava for other crops. In the cassava-growing central provinces, total area under the major dryland crops increased from 130,000 hectares in 1960 to 374,000 hectares in 1978 (Table 11). Cassava's share grew only slightly—from 65 percent in 1960 to 74 percent in 1978. In the Northeast Region, area under the major dryland crops increased from less than 470,000 hectares in 1967 (Atikul, 1978) to almost 1.4 million hectares in 1978. Cassava's share increased from

[18] It also meant that Thai and Indonesian domestic prices declined in 1981 when the dollar rose against the European currencies. For example, the CIF Rotterdam price increased from DM324 per ton in January 1981 to DM336 in July. Expressed in dollars, however, the CIF price fell from $162 to $138 (FAO, 1981). The decline in the FOB Bangkok price was somewhat less, from $108 to $93, because shipping rates decreased over the period.

2.8 percent in 1967 to 48 percent in 1978, but no crop had any substantial decline in area. The bulk of the new cassava area was previously uncultivated.

The rapid expansion of cassava area was the result of extensive road development in the northeast. Construction of several major roads running from Bangkok to areas bordering Laos and Cambodia were financed by the United States during the Vietnam war. The Thai government added an extensive network of feeder roads. This construction, essentially complete by 1967, opened up virgin lands to easy access and made transport to Bangkok and other ports quick and inexpensive. It was followed by rapid increase in the number of trucks and reduced cost of road transport.

In order to market the cassava, private investment in processing and port handling facilities grew rapidly. Bangkok harbor was originally used for export but could handle only small ships. Boonjit Titapiwatanakun reported in 1974 (p. 140), "at the present time, the biggest vessels that can load cargos at the port (Bangkok) are vessels less than 15,000 tons capacity." Exporters also loaded from the military harbor of Sattahip, but that proved to be inconvenient because military needs took precedence and the harbor was too shallow for vessels larger than about 50,000 tons.

In 1976, two privately owned loading facilities in the Gulf of Thailand specially designed for dried cassava were finished. Although of completely different design, they yielded similar savings in transport and handling cost. By substantially increasing loading rates they reduced the costs associated with time in port. Furthermore, the ports were built to handle deep-draft bulk carriers of up to 100,000 tons. A 100,000-ton vessel can be loaded in seven days, about the same time it takes to load a 20,000-ton vessel in Indonesia. The savings arising from the use of these facilities gave Thailand a transport cost advantage of 25 to 50 percent over Indonesia.[19]

Early dried cassava shipments were meal or chips, but pelleting equipment was introduced in 1967 to increase product density and reduce shipping costs. Pelleting capacity grew rapidly, originally using imported equipment but quickly turning to domestically produced machinery. Upcountry drying floors and chipping capacity also expanded. All of the investment in the marketing chain, from relatively low-cost chipping equipment to multimillion-dollar loading facilities, was private. None of the projects was funded or sponsored by the government.

The same external forces that encouraged production of cassava in Thailand were present in Indonesia. Indonesian exports are sold to the high-priced European market, and the rupiah is tied to the dollar. Total Indonesian cassava export figures, however, indicate a weak overall response to favorable market conditions, although they obscure dissimilar developments on Java and in Lampung, Sumatra.

[19] The size of the cost saving depends on charter rates. In 1980, freight charges from Indonesia to northern European ports were on the order of $40 a ton while from Thailand they were $25.

Because little uncultivated (and cultivable) land existed on Java, most increases in production had to come either from increased yields or at the expense of other crops. The increase in domestic cassava prices in Indonesia was not sufficient to encourage large-scale substitution of cassava for other crops. Furthermore, irrigated area on Java expanded in the 1970s as the result of rehabilitation of old canals, making it possible to grow rice on land formerly used for cassava. A small decline in cassava area on Java during the 1970s was offset by yield increases of about 3.5 percent a year beginning in 1973, a result of increased use of fertilizer.[20]

Uncultivated land exists off Java, but in the 1970s only Lampung had infrastructure favorable to the rapid growth of production. With renovation of the trans-Sumatran highway in Lampung by the beginning of the 1970s, the transportation system became adequate to allow profitable production of cassava for export. High prices for dried cassava paid by pelleting mills in the southern port of Panjang encouraged rapid expansion of cassava production in areas previously under shifting cultivation. Planting materials were readily available for greater production by smallholders because immigrants from Java were already growing cassava for small starch mills and for their own consumption.

Cassava production in Lampung increased by 14 percent a year during the decade, with cultivated area expanding at 9.7 percent annually and yields improving at the same rate as on Java. Fed by this striking production growth, dried cassava exports from Lampung increased from about 71,000 tons in 1970 to 206,000 tons in 1975, remaining at that level thereafter as starch processors took an increasing share of Lampung production.

Very little Thai cassava is consumed domestically. A growing animal feed industry uses some dried cassava, but because domestic corn prices are determined by world markets, widespread feeding of cassava has been unprofitable. The food industry also uses minor amounts of fresh roots and starch. Home consumption, however, is reported to have been a small portion of production.[21] Because domestic markets are small, regular supplies of dried cassava are available for export at prices determined by world demand, and investors in large-scale processing for export facilities are assured a regular supply of raw materials.

In contrast to Thailand, most Indonesian cassava production is consumed domestically, either as food or for industrial purposes. As a result, domestic prices are sometimes determined by domestic rather than world demand (Unnevehr, 1982). In years when production of cassava or other food crops is low, demand for food pulls domestic prices above world price levels, and exports decline. Whereas the Thai exporter has always been able to count on domestic

[20] See Roche (1983) for discussion of factors affecting cassava production in Java.

[21] Atikul (1978) reports that in the early 1970s, domestic direct consumption of fresh roots was about 3 percent of total production, consumption of starch about 6 percent, and small amounts were used as feed. It is unlikely that growth in consumption was anywhere near as fast as production during the 1970s.

prices being determined by world prices with no government interference, the Indonesian exporter has seen one temporary ban on exports and three extended periods in the 1970s when domestic prices rose above world prices. The possibility of another ban on exports and uncertainty about availability of supplies at world prices has undoubtedly deterred privately financed expansion of export processing facilities in Indonesia.

Other Exporters

Besides Thailand and Indonesia, only China has sold significant quantities of dried cassava on the world market in recent years. Chinese exports were significant only in 1979 (50,000 tons) and 1980 (300,000 tons). Little information is available about the likelihood of future Chinese exports. At various times in the past, Tanzania, Madagascar, Ghana, Brazil, and Nigeria have also exported small amounts of cassava. Although these countries grow large quantities of cassava, it seems unlikely that they will export cassava in the near future. High domestic prices and overvalued exchange rates make domestic prices too high for profitable export.

THE POLITICS OF EUROPEAN COMMUNITY IMPORTS OF NONGRAIN FEED INGREDIENTS

Three groups—Commission officials, especially those in Directorate General 6 (DG 6), which is responsible for agriculture; French feed-grain and livestock growers; and German, Dutch, and Belgian traders, feed compounders, and animal feeders—have been most affected by gaplek imports. The concerns of Community officials are on two interrelated grounds.[22] First, dried cassava imports are seen as the most visible part of a wave of imports of nongrain feed ingredients (NGFI) classified as processing wastes that pay low or no import taxes.[23] The share of NGFI (including soybean cake) increased from 54.6 percent of total compound feed consumption in 1974 to 62 percent in 1978 and is undoubtedly higher now. Oilcakes (imported duty free) currently make up more than half of the NGFI imports, but imports of citrus pulp and corn gluten, which have an energy-protein ratio closer to grains than to oilcakes and thus compete directly with the grains, have grown rapidly. While cassava imports increased roughly three times between 1974 and 1978 and then declined moderately in 1979 and 1980, citrus pulp and corn gluten imports tripled in the first four years and continued to increase. EC officials argue that imported NGFI enter through what is belatedly seen as a loophole in the variable levy

[22] It would be incorrect to imply that the whole of the Community bureaucracy is of one mind on the issue of cassava imports or that all individuals within DG 6 hold the views ascribed here to it.

[23] NGFI include dried cassava, molasses, milling byproducts, corn gluten, dried beets, oil cakes, and citrus pulp.

protection, replacing domestically produced grains in animal feeds and increasing sales to the Community.[24]

Second, the Community finances its operations, including intervention and export subsidy programs, with import levies and a share of the value-added tax revenues in each member country.[25] To the extent that free or lightly taxed imports of nongrain feed ingredients replace imports of more heavily taxed grain, there is a loss of revenue. NGFI imports also raise the cost of the price support program because the grain purchased under intervention must then be sold at a loss on the world market. There is some justification for these concerns individually, but not simultaneously—a ton of cassava either substitutes for imported grains and has no effect on the quantity of domestic grains fed or does not affect imports of grains but increases sales into intervention.

At first glance, it might appear that the French grain farmers should be unconcerned about cassava and other NGFI imports because they can always sell their feed grains to the intervention program. They have two reasons, however, for being unhappy about imports. It is often more convenient to sell grain on the open market, and the subsidy is less obvious. Furthermore, cassava imports tend to push grain prices toward the lower end of the band set by threshold and intervention prices.[26]

French animal producers are also opposed to imports of NGFI. Because the Rotterdam and Hamburg port facilities are better than those in France, feed firms in the Netherlands, West Germany, and Belgium pay less for imported feedstuffs. This lowers the relative price for feed in these countries and makes it difficult for French meat products to compete. For these reasons, the French government has been the strongest proponent of decreased cassava imports.

German, Dutch, and Belgian traders, feed compounders, and feeders rely on dried cassava and other NGFI imports to retain the competitiveness of their respective industries. The increased use of NGFI in these countries was a major cause of the relatively rapid increase in animal numbers, and until 1982 their governments opposed measures to reduce cassava imports.

Before 1978, proponents of continued free trade in cassava were able to check efforts to restrict imports. Record imports in that year, however, provoked the first systematic efforts at control. In November, then-Commissioner for Agriculture Gundelach negotiated an informal agreement with Thailand,

[24] Corn gluten, a byproduct of the wet-milling process used in making starch, high-fructose corn syrup, and alcohol, poses a special problem for Community officials. The major source of imports is the United States, and production there has grown rapidly as use of cornstarch in high-fructose syrup and alcohol production has increased. Unofficial projections put United States exports in 1990 at as much as five times 1980 levels. This growth depends on a rapid expansion of alcohol for fuel, however, which now appears unlikely. EC officials would like to prevent these exports from entering the Community, but the United States has repeatedly said that any restrictions on imports of corn gluten would be viewed unfavorably.

[25] See Fennell and Harris (1979) for a discussion of Community financial resources.

[26] The band for corn has stayed at about 20 percent of the intervention price. For barley, the band was only about 7 percent of the intervention price in 1972/73, but increased to about 20 percent when the barley and corn threshold and intervention prices were unified in 1977/78.

the largest supplier, to restrict exports to Europe in 1979 and 1980 to 1978 levels. Thai production declined in those years and the effectiveness of the agreement was not tested.

In November 1980, Gundelach negotiated a second agreement. The Thais agreed in principle to limit 1981 and 1982 exports to five million tons each year, plus a 10 percent (500,000 ton) margin to be used over the two years to handle unexpected fluctuations in supply; 1983 and 1984 exports were to be limited to 4.5 million tons a year, plus another 10 percent for the two years; and 1985 and 1986 imports were to be reduced further. In exchange, the Community agreed to increase funds for a cassava diversification program set up as part of the first agreement,[27] and to prevent other countries from increasing their share of the European market at the expense of Thailand.

The most commonly discussed mechanism for restricting the market share of third countries was an increased tax on EC imports from them. To increase the import tax, however, the GATT binding of the dried cassava tariff to 6 percent must be deconsolidated and new trade taxes applied in a discriminatory way.[28] This proved to be a difficult task. Early in 1980, the German, Dutch, and British governments expressed opposition to such a move, blocking deconsolidation.

Commission officials responded by negotiating voluntary export restraints with other suppliers. An agreement was reached with the Indonesian government in late 1981 to restrict 1982 exports to 500,000 tons, 1983 exports to 750,000 tons, and exports thereafter to larger amounts. Because Indonesian exports exceeded 500,000 tons only once in the 1970s, the agreement is unlikely to have any immediate impact on Indonesia.

After completing negotiations with the Indonesians, Commission officials reopened negotiations with the Thais in April 1982, and a final agreement was reached in late 1982. Imports from Thailand in 1982 and 1983 subject to the 6 percent duty are limited to 5.5 million tons per year. Imports from GATT members subject to the 6 percent duty, including those from Indonesia, are restricted to 882,000 tons in 1983, and imports from China in 1983 are limited to 370,000 tons. All other imports are charged a much higher variable levy. The necessary regulations were put in place in late 1982 and early 1983. By persuading the major exporters to "voluntarily" restrict their exports and accept a tariff quota, Commission officials found a way to persuade the Council of Ministers to accept additional restrictions on cassava imports.

[27] The goal of the program was to identify alternative crops for the Northeast Region that would be more profitable than cassava. By the end of 1980, after extensive agronomic and economic research, no immediately profitable alternatives had been found.

[28] Tariff rate changes specified in a GATT negotiation are consolidated into a package that then supersedes previous tariffs. If a GATT-bound tariff is deconsolidated, it is removed from the package and higher rates can be applied. Tariffs can only be deconsolidated once every three years, unless it can be shown that a particular binding is causing hardship. In such a case, the binding can be waived and the importing country must compensate countries that are injured by the increased protection.

SUMMARY

Since the introduction of the Common Agricultural Policy of the European Community, the European market has been the driving force behind international trade in cassava products. With a domestic floor price and variable levy protection from imports, the CAP raised domestic feed-grain prices well above world market levels. The import tariff on cassava chips and pellets was bound at a low fixed tariff of 6 percent, and dried cassava could be combined with duty-free imports of protein concentrates (principally soybean cake) to substitute for feed grains. Cassava prices were therefore raised to levels above what would have been obtained if cassava prices were determined freely in international feed-grain markets.

Despite the price and import increases, two countries—Thailand and Indonesia—have supplied more than 90 percent of imports, and growth in exports came almost exclusively from Thailand. Road development in Thailand opened up large amounts of previously uncultivated area to production, and farmers responded to high cassava prices by planting cassava on most of this area. Private development of processing and port facilities reduced shipping costs. Domestic consumption in Thailand was relatively small.

In Indonesia, expansion of total cropped area was not possible on Java, the island where most cassava is grown, and the price increase did not provide sufficient incentive to substitute cassava for other crops. In Lampung province, where new land was available and infrastructure adequate, cassava production expanded rapidly.

Indonesian domestic demand for cassava is high, so small shifts in either the domestic demand or supply curve can reduce substantially the availability of cassava for export. This fact, combined with more extensive government regulation of cassava in Indonesia than in Thailand, reduced the incentive to Indonesian entrepreneurs to invest in large-scale, cost-reducing processing and port facilities.

The rapid growth of cassava imports by the EC from 1970 to 1978 stimulated opposition from several groups, including French farmers, who claimed that these imports depressed domestic grain prices; French meat producers, who could not compete with producers in other countries using cheap NGFI; and European Commission officials, who viewed rising imports of NGFI as a principal cause of increased EC expenditures on price supports. Through 1981, the Thai voluntary export limitation agreements of 1978 and 1980 were not binding. The limits in the Indonesian agreement of late 1981 also appear to be large enough to not affect exports in the short run.

In 1982, however, the EC Commission persuaded the Council of Ministers to formally accept restrictions on gaplek imports, and future, more restrictive controls should pass the Council with less trouble than the first set of controls. Hence, the prospects for future growth in cassava imports into the EC have become much less certain.

If Eurpean restrictions reduce gaplek exports, however, world starch markets should take up part of the slack. New markets for starch-based products,

especially sweetners, have developed, and demand for starch has increased. If a decline in cassava prices made cassava starch competitive with cornstarch, it might obtain a larger share of this growing market.

Furthermore, world manufacturers of animal feeds will buy dried cassava if the price falls enough. If Indonesia had sold cassava to the United States for animal feed in 1981, a task not unlike carrying coals to Newcastle, the FOB value would have had to be roughly half of the price then paid in Europe. Other potential markets closer to Indonesia—Japan, for example—have higher domestic corn prices and would have paid more for dried cassava.

Finally, it is important to remember that changes in apparently unrelated variables can affect Indonesian cassava prices. Currency fluctuations in late 1980 caused changes in domestic cassava prices of the same order of magnitude as would be caused by an import ban in the European Community.

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