TECHNICAL ASSISTANCE REPORT

ASSISTANCE TO THE POLICY ANALYSIS UNIT, MOA

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In July 1986, Economic Perspectives, Inc. was requested to assist the Policy Analysis Unit (PAU) to increase its analytical capacity by providing "Start Up" assistance to several new employees.[1] The PAU was planning to expand its staff including personnel who had neither specific training or experience in policy analysis. In late July and early August, the newest PAU employee came to Guayaquil to meet with EPI personnel who were there on a separate project. Several meetings were held that week to discuss concepts and data needs.

Subsequently, during September and October 1986, EPI personnel in Ecuador presented a series of data files, computer disks, and other documents to Mauricio Cuesta and Jorge Munoz, PAU staff. This report is intended to describe the purpose of that assistance and selected accomplishments.

Technical Assistance Overview

The PAU is an especially critical staff unit. Each analyst's responsibilities are defined primarily by the policy decisions he is asked to help document and analyze, and the particular abilities of each analyst to respond to policymaker needs for assistance. In general, the staff must have the capacity to anticipate requirements for analyses and data, and very quickly bring to bear all the information available and evaluate options both quickly and comprehensively.

In early 1985, economist Jorge Munoz was hired as the Director of the PAU. The PAU's scope was separated into four areas: general marketing, grain

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marketing, finance/credit/macroeconomics, and coastal agriculture. In the first three areas, the titles describe the core responsibilities of the position. Because the coastal area is so important in Ecuadorean crop production, and because the MOA maintains a separate subsecretary position with special responsibilities for agriculture in the coastal region, the PAU intends to assign a position to support that Subsecretary to be located with the Subsecretary in Guayaquil.

Based on a series of conversations with Jorge Munoz, with decisionmakers in the MOA, and on the basis of experience in providing policy analysis to cabinet level decisionmakers, the general technical assistance requirements for each PAU analyst were divided into four elements:

A. A working data system with current and historical data relevant to each PAU area in adequate detail to support investigations into anticipated policy issues. For example, for grain marketing, data for the nation and regions on area planted and harvested, yield, production, supply, use, stocks, prices, cost of production, and other detail are required.

B. A system of routine and regular updates of the data base, involving coordination with MOA units and others who collect data and develop estimates, both published and unpublished, that are available to the Minister.

C. An early warning system, based both on reports from MOA units and on PAU analyses that can identify potential problems and estimate their likely impacts and importance.

D. An analytical system to support rapid but effective analysis of policy alternatives and their impacts on producers, consumers, and government

costs. A simple computer model that relates monthly supply, use, and prices for the coming 18 months was prepared.

It is not contemplated that the relatively small amount of technical assistance provided by EPI at this time would produce operational analyses of current problems. Rather, it is to be an initial framework upon which each analyst would elaborate his individual approach to the problems in his area. Thus, the technical assistance concept is to define a flexible approach that can provide solid support to each analyst, but which could be modified as necessary to meet changes in issues and in capacity of the analytical staff.

Technical Assistance Provided

Throughout the period, W.C. Motes and John Pender worked closely with Jorge Munoz and Mauricio Cuesta, who hold primary responsibility for policy analysis in the MOA. Attention was given to each of the four elements described in the preceding section.

A. Data development. This task was further subdivided into six parts:

1. Assemble relevant data and check for accuracy. Data relevant to grain marketing were identified and checked. Some detail for regions, as well as national data were used. This data base was given to the PAU.
2. Data needs and sources. Based on anticipated analytical requirements, a series of data needs and sources was identified and specified for the PAU.
3. Potential data sources were contacted, and methodology identified to provide the necessary regular updates of the information base for the grain policy analyst.
4. Using the best data available, an historical data base was built,

including area, yield, production, prices, costs, etc. These data were organized and assembled for rice, corn, sorghum, and soybeans.

5. Areas where better methods of data gathering are needed were identified (e.g., cost of production) and in some cases, efforts to develop better data were initiated.

B. A system to continuously update the data base as new reports become available was begun.

The strategy for maintaining the data base was discussed in detail with the PAU analysts. For areas where periodic reports provide the latest information available, this is a matter of developing a schedule to collect the new information. Beyond that, special reports are required (e.g., special crop condition reports during the growing season). In many cases, these are already provided. Where they are not, needs that must be defined and reports requested by the analyst were discussed and identified.

C. Early warning system. The concept is to discover potential problems early, and to make this information available to decisionmakers as soon as possible to maximize the time available to make decisions.

Such a system should have several parts. Following regular analyses of current data, trends in production, consumption, and prices will provide information about developments that imply potential policy decisions. These should be identified and reported systematically to the Director of the PAU.

In addition, the PAU analysts, in order to be current in their specialty areas, will need to maintain close contact with the MAG programs

and with the private trade. By this means, they will uncover potential problems that can be identified and evaluated in an early stage.

The final definition of such a system, of course, must be developed for each analyst in coordination with the Director of the unit and the policymaking officials in the MOA.

D. Analytic system to assist in policy decisionmaking.

Policy analysis depends primarily on an objective appraisal of the performance of the subsector under each of the policy options. Under various scenarios, the policy analyst must be able to appraise differences in agricultural sector performance, government cost, consumer costs, and producer returns, and identify additional impacts in other time periods, and on other sectors.

Useful policy analysis must be timely, and so must be done quickly. In an important sense, policy analysis is not research because the analyst has no control over the question asked. Answers must often be provided to questions that are unresearchable for reasons of inadequate data, among others. Nevertheless, policy analysis seeks to apply scientific methods to the extent possible to answer important, urgent questions.

The primary tools are simple economic models that include the major economic relationships in the subsystem.[2] They are based on a few simple identities and several derived economic relationships. For example:

A. Maize supply in any month depends upon:

1. Beginning stocks.

2. Production.

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[2] See appendices for a detailed description of the models developed.

3. Imports.

While beginning stocks are simply ending stocks of the previous period, imports depend on policy and can be anticipated. Production is the result of available credit, area planted several months earlier, and the yield at harves.. As a result, future production depends on several economic variables, including expected prices, credit and interest rates, arable land area, and others. Yields depend on weath· but also on management and production inputs such as fertilizer and pesticides which also depend on costs and expected prices, and credit and interest rates.

B. Maize demand depends on:

1. Compound feed consumption.
2. Exports.
3. Total ending stocks, including public and free stocks.

Consumption of these grains depends on past and current prices and human and animal populations. Public stocks depend on strategic reserve and price support policies. Exports depend on policies, and upon relative domestic and foreign prices. Free stocks are the residual.

C. Maize prices depend on levels of free stocks, which directly reflects the simultaneous interactions of supply and demand in each month.

Such models can be both simple and well specified. All current supply and demand variables depend on past or current economic variables. Given assumptions about public policy and weather, supply, use, and prices can be projected into the future. Thus, the models can estimate in a systematic way the expected impact of alternative policies and permit their comparison.

Example: MAG Feed Grain Stocks Options

Since 1983, when the El Nino floods seriously damaged crops, Ecuador has produced three good crops in a row, and the 1986 crop is record large. This year's nearly 338 thousand metric tons (tmt) is more than two-thirds greater than average, even excluding 1983 (Table 1). Most of the increase is due to exceptional yields.

Table 1. Feed Grain Production and Credit

Year	Corn			Sorghum			Feed Grain Production	Production Credit	
	Harvested Area	Yield	Production	Harvested Area	Yield	Production		Nominal	Real
	(1,000 ha)	(mt/ha)	(1,000 mt)	(1,000 ha)	(mt/ha)	(1,000 mt)	(1,000 mt)	- - $/1,000 - -	
1973	140.3	1.09	153.3				153.3	63,563	129,720
1974	161.6	1.15	185.6				185.6	165,778	275,837
1975	166.0	1.23	203.4				203.4	144,590	210,466
1976	171.2	1.22	209.1	0.7	3.77	2.6	211.7	215,076	284,116
1977	163.0	1.01	164.1	0.6	2.17	1.3	165.4	192,906	225,621
1978	132.5	1.03	136.5	0	3.59	0.1	136.6	211,524	218,743
1979	170.4	1.07	182.3	0.1	2.72	0.3	182.6	189,350	177,793
1980	166.7	1.18	196.4	0.1	2.96	0.2	196.7	269,384	224,300
1981	184.7	1.26	232.6	0.2	3.58	0.6	233.3	340,257	250,373
1982	155.4	1.73	269.3	0.9	3.00	2.7	272.0	270,826	171,300
1983	145.3	1.27	185.0	0.2	2.28	0.4	185.4	695,059	296,274
1984	182.8	1.47	269.0	1.6	3.13	5.0	274.0	887,254	288,257
1985	190.9	1.91	280.6	0	0	12.0	292.6	1,338,928	339,829
1986 1/	169.9	1.93	328.7	3.0	3.00	9.0	337.7	819,457	162,488

1/ MOA estimates.

The result of these good crops and MOA price support policies is enormous and very costly feed grain stocks. In 1986, feed grain production will be an estimated 338 tmt, while consumption will be about 264 tmt, a surplus of 74 tmt. Part of the surplus will be held by private firms, but a large share by MOA.

While MOA stocks were very low at the beginning of 1985, they increased to an estimated 68 tmt by the end of 1985. By September 1986, they reached 85

tmt and by December 1986, MOA stocks will likely be substantially greater than private stocks.

The question of how to handle these large stocks is a matter of serious concern for MOA officials. Large corn stocks, together with equally large stocks of rice, are clogging grain storage and handling facilities throughout the country, and efforts to haul the grain to the cooler Sierra to store are expensive and place a strain on available transportation. In addition, the cost of purchasing has completely exhausted ENAC's line of credit.

By early November, the feed grain harvest is largely over and preparation for the next harvest (beginning April 1987) are underway. The MOA is very much interested in exporting grain, legally or illegally, to reduce surplus stocks. However, as the following comparisons show, the current surplus will disappear rapidly if the 1987 crop is no better than average.

Given a more normal 1987 crop of 270 tmt (about equal to the 1984 crop but far below recent record levels), if the MOA were to export a substantial share of its current stocks, wholesale prices likely would rise sharply, especially during the next 5 months until the next harvest becomes available (Table 2). The reason is that the MOA now owns such a large share of total stocks that by late 1986 and early 1987, private stocks levels could be low enough to cause substantial upward pressure on wholesale market prices.

In this case, the impact would be quite similar whether MOA exported current stocks, or simply held them as long as they were known to be unavailable to the market. As private stocks decline through October-April, prices would strengthen. The higher prices would begin to curtail consumption.

Table 2. MOA Stocks Policy Impacts Estimated, Feed Grains
MOA holds or exports current stocks

Year	Production 1/	Consumption	ENAC Purchases	ENAC Sales	ENAC Ending Stocks	Private Ending Stocks	Wholesale Corn Prices (Quito) Nominal (S/qq)	Wholesale Corn Prices (Quito) Real (S/kg)
	- - thousand metric tons - -							
1986								
Sept.	31.1	20.0			85.0	130.0	1,000	4.4
Oct.	13.7	20.4			85.0	121.9	1,102	4.8
Nov.	4.7	20.8			85.0	105.4	1,310	5.6
Dec.	0.1	21.0			85.0	84.5	1,573	6.5
1987								
Jan.	0	21.1			85.0	63.4	1,840	7.5
Feb.	0	21.3			85.0	42.0	2,108	8.4
March	1.4	21.3			85.0	22.0	2,361	9.2
April	16.3	21.0			85.0	15.6	2,441	9.4
May	43.9	20.6			85.0	34.5	2,203	8.3
June	59.3	20.0			85.0	67.9	2,203	8.1
July	70.3	19.3			85.0	111.9	2,203	7.9
Aug.	32.3	18.7			85.0	122.3	2,203	7.8
Sept.	26.7	18.2			85.0	128.1	2,203	7.6
Oct.	13.5	17.7			85.0	122.6	2,273	7.7
Nov.	6.2	17.2			85.0	111.0	2,419	8.0
Dec.	0.2	16.9			85.0	94.3	2,629	8.5
1987 Total	270.1	233.3						

1/ Field weight.

By mid-December, the MOA will have a clear idea of the size of the 1986 harvest (and thus free stocks levels) as well as beginning indications of the 1987 crop. If private stocks in 1986 are no higher than estimated and the harvest appears to be no better than average, the MOA could choose to attempt to hold wholesale prices within a 30 percent band; for example, it might choose to hold wholesale prices at Quito between S/1,300 and S/1,690 per quintal.[3]

Under this option, the MOA begins to sell as prices reach S/1,690 in January and continues selling to keep prices from rising above this level.

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[3] Wholesale prices at Quito are normally higher than those in Guayaquil, by about S/150. Thus, a Quito wholesale price of S/1,300 per quintal would correspond with a price on the Bolsa de Productos, Guayaquil, of S/1,150, very near the price at which ENAC purchased in 1986.

Private stocks decline more than 40 percent between September and April. Prices strengthen from September lows, but are far below the previous option.

Table 3. MOA Stocks and Policy Impacts Estimated, Feed Grains
Prices are held between S/1,300 and S/1,690 per quintal

Year	Production 1/	Consumption	ENAC Purchases	ENAC Sales	ENAC Ending Stocks	Private Ending Stocks	Wholesale Corn Prices (Quito) Nominal 2/	Wholesale Corn Prices (Quito) Real
	- - thousand metric tons - -						(S/qq)	(S/kg)
1986								
Sept.	31.1	20.0			85.0	130.0	1,000	4.4
Oct.	13.7	20.4			85.0	121.9	1,102	4.8
Nov.	4.7	20.8			85.0	105.4	1,310	5.6
Dec.	0.1	21.0			85.0	84.5	1,573	6.5
1987								
Jan.	0	21.1		12.0	73.0	75.4	1,689	6.9
Feb.	0	21.3		21.0	52.0	75.0	1,692	6.8
March	1.4	21.5		21.0	31.0	75.8	1,692	6.6
April	16.3	21.6		7.0	24.0	75.9	1,691	6.5
May	43.9	21.8			24.0	93.6	1,468	5.5
June	59.3	21.9			24.0	125.1	1,468	5.4
July	70.3	21.7			24.0	166.7	1,468	5.3
Aug.	32.3	21.6			24.0	174.2	1,468	5.2
Sept.	26.7	21.5			24.0	176.8	1,468	5.1
Oct.	13.5	21.3			24.0	167.6	1,468	5.0
Nov.	6 2	21.3			24.0	151.9	1,468	4.9
Dec.	0.2	21.3			24.0	130.8	1,468	4.8
1987 Total	270.1	257.9						

1/ Field weight.
2/ Based on the observed pattern for 1985/86, wholesale prices are assumed to be flat in the harvest period, rising only once private stocks fall below some minimum level (assumed to be 130 tmt). In this example, private stocks stay above the minimum level through December 1987, so prices stay flat. This does not reflect farm level prices, which are likely well below wholesale prices during the harvest period.

The price band policy would have two immediate and obvious benefits, compared to the export policy. First, while domestic prices would be strong enough to pay storage for producers who stored their grain at harvest, they would be much lower than under the export policy, and grain consumption would be higher as a result by 46 tmt. This would mean more pork and poultry for domestic consumption and likely higher feed grain consumption in future years.

Second, the sale of 61 tmt of grain in domestic markets could return S/2.27 billion to MOA, almost certainly a far greater return than if that

grain were exported. Assuming that grain were purchased at S/1,160 and stored 6 months at S/10.20 per quintal per month, its cost would be S/1,221 per quintal, exclusive of handling costs or interest. Interest for 6 months at 30 percent would be another S/174, for a total of S/1,395. Thus, if ENAC bought grain at S/1,160 and sold at S/1,690, it should recover costs plus S/295 per qunital by reselling into the domestic market. In contrast, if the MOA were to export at world prices, it would recover only about S/450 per quintal (about $70 per metric ton), returning only S/610 million for 61 tmt of exports.

This example is based on an econometric model estimated using historical data. It should be used only with several cautions.

1. The exact size of the 1986 crop is not yet known, and estimates of private stocks are uncertain at best. Until better estimates are available in December, only the most tentative estimates should be made for 1987.
2. The estimates above depend on a "normal" 1987 crop. If the 1987 crop is larger or smaller than normal, the results will be different, perhaps drastically different. Again, better estimates will be available by December or early in 1987.

Implications

1. If wholesale prices begin to move up sharply by mid-December, and if the outlook is for an average 1987 crop, the MAG should seriously consider scheduling the resale of MAG owned feed grains into domestic markets.
2. As prices strengthen, the MAG must avoid the temptation to resell stocks at prices that are too low (or too high), or to import grain. The success of the national storage program, and of the Bolsa de Productos depends on free price movements within a band of 30 percent or more.

Thus, wholesale prices at Quito should move between at least S/1,300 and S/1,690 without MAG intervention. Prices on the Bolsa should move at least between S/1,160 and S/1,510 without MAG intervention.

Rice

Rice, like corn, is facing a record large crop (Table 4). As of the end of September 1986, rice stocks (milled basis) were over 100 tmt, the largest ever. However, because of large government purchases this year, over half of these stocks are owned by the MOA. Considering the size of the anticipated harvest from the 1986 summer crop, private stocks alone are inadequate to meet Ecuadorean rice needs through next May. It is thus implausible to project the impacts of a policy in which the MOA holds or exports its rice stocks, since price would be driven to a high enough level to cause either a change in policy or substantial unofficial imports. Assuming that the MOA sells enough stocks to keep the wholesale price below S/3,000 per quintal, the MOA would need to sell a projected 36 tmt in March and April (Table 5). Interestingly, this would reduce government carryover stocks to 20 tmt, a level about adequate to maintain a food security reserve of 1 month's consumption worth of stocks. The MOA could recoup about S/2.4 billion through these sales (assuming the selling price is S/3,000 per quintal).

Assuming next year's rice crop is a more normal 374 tmt, rice prices can be expected to fall next May through July, but to recover to over S/2,700 per quintal by December 1987, in the absence of MOA purchases next year. If MOA decides to buy again next year, prices would of course be higher. In order to keep the wholesale price within a 20 percent price band of S/2,500 to S/3,000 per quintal, the MOA would have to buy a projected 16 tmt of rice during the

Table 4. Rice Production and Credit

Year	Rough Rice: Harvested Area	Rough Rice: Yield	Rough Rice: Total Production	Rough Rice: Summer Production	Rough Rice: Winter Production	Nominal: Production Credit	Nominal: Official Producer Price	Real: Production Credit	Real: Official Producer Price
	(1,000 ha)	(mt/ha)	- - thousand metric tons - -			(S/mil)	(S/qq)	(S/mil)	(S/qq)
1970	76.0	3.03	230.1			42.6	75	114.7	202
1971	70.5	2.80	197.7			39.2	75	96.3	184
1972	79.8	2.40	191.4			40.5	81	92.8	185
1973	82.8	2.80	231.9			197.9	93	403.9	190
1974	101.1	2.99	302.5			546.1	110	908.6	183
1975	135.4	2.79	377.9			592.4	150	862.3	218
1976	126.3	3.73	344.4			643.1	160	849.5	211
1977	103.0	3.10	319.3			403.3	170	471.7	199
1978	81.1	2.78	225.1			418.0	180	432.2	186
1979	100.3	3.17	317.9			597.6	200	561.2	188
1980	126.5	3.01	380.5	159.0	221.5	685.4	240	570.7	200
1981	130.1	3.33	432.6	156.8	275.9	856.6	315	630.3	232
1982	129.0	2.93	378.1	125.2	252.9	763.8	315	483.1	199
1983	93.2	2.90	270.2	173.1	97.1	1,713.8	470	730.5	200
1984	135.9	3.17	430.8	181.1	249.7	2,900.1	720	942.2	234
1985	136.0	2.73	371.6	165.5	206.1	3,163.0	1,200	802.8	305
1986			557.3	182.7	374.6	3,963.0	1,425	828.0	298

1/ MOA estimates.

Table 5. MOA Stocks Policy Impacts Estimated, Rice

MOA sells enough stocks to keep prices below S/3,000 per quintal

Year	Production 1/	Consumption	ENAC: Purchases (Rough)	ENAC: Sales (Milled)	ENAC: Ending Stocks	Private Ending Stocks	Wholesale Prices (Quito): Nominal	Wholesale Prices (Quito): Real
	- - thousand metric tons - -				- mt (milled basis) -		(S/qq)	(S/kg)
1986								
Sept.	34.5	21.2			56.2	51.7	2,438	10.8
Oct.	58.7	21.3			56.2	62.7	2,391	10.4
Nov.	44.9	21.5			56.2	65.7	2,380	10.1
Dec.	17.3	22.0			56.2	53.3	2,430	10.1
1987								
Jan.	5.2	22.3			56.2	33.8	2,543	10.4
Feb.	1.7	22.5			56.2	12.3	2,815	11.2
March	1.7	22.7		16.0	40.2	6.5	2,997	11.7
April	6.4	22.8		20.0	20.2	7.2	2,968	11.4
May	63.9	23.0			20.2	19.3	2,689	10.1
June	95.9	23.2			20.2	48.8	2,451	9.0
July	42.6	23.4			20.2	48.9	2,451	8.8
Aug.	12.3	23.6			20.2	32.1	2,557	9.0
Sept.	32.1	23.8			20.2	25.9	2,612	9.0
Oct.	54.6	24.0			20.2	31.9	2,558	8.7
Nov.	41.8	24.3			20.2	30.6	2,569	8.5
Dec.	16.1	24.4			20.2	15.0	2,758	9.0
1987 Total	374.3	280.0						

1/ Field weight.

1987 winter harvest period (Table 6).[4] In this case, the price would be nearly S/3,000 per quintal by December 1987. MOA purchases of 16 tmt of rough rice would require about S/500 million (at a price of S/1,425 per quintal).

Table 6. MOA Stocks Policy Impacts Estimated, Rice
MOA price band policy: S/2,500 - S/3,000 per quintal

Year	Production 1/	Consumption	ENAC Purchases (Rough)	ENAC Sales (Milled)	ENAC Ending Stocks	Private Ending Stocks	Wholesale Prices (Quito) Nominal	Wholesale Prices (Quito) Real
	- - thousand metric tons - -				- tmt (milled basis) -		(S/qq)	(S/kg)
1986								
Sept.	34.5	21.2			56.2	51.7	2,438	10.8
Oct.	58.7	21.3			56.2	62.7	2,391	10.4
Nov.	44.9	21.6			56.2	65.7	2,380	10.1
Dec.	17.3	22.0			56.2	53.3	2,430	10.1
1987								
Jan.	5.2	22.3			56.2	33.8	2,543	10.4
Feb.	1.7	22.5			56.2	12.3	2,815	11.2
March	1.7	22.7		16.0	40.2	6.5	2,997	11.7
April	6.4	22.8		20.0	20.2	7.2	2,968	11.4
May	63.9	23.0			20.2	19.3	2,689	10.1
June	95.9	23.2	16.0		29.0	40.1	2,501	9.2
July	42.6	23.3			29.0	40.1	2,500	9.0
Aug.	12.3	23.5			29.0	23.4	2,639	9.3
Sept.	32.1	23.7			29.0	17.3	2,719	9.4
Oct.	54.6	23.9			29.0	23.4	2,638	8.9
Nov.	41.8	24.1			29.0	22.3	2,651	8.8
Dec.	16.1	24.2			29.0	7.0	2,978	9.7
1987 Total	374.3	279.2						

1/ Field weight.

Given the projected level of rice production in 1987, it appears that some imports would be necessary in early 1988. By the end of 1987, total rice stocks would be reduced to about 36 tmt, insufficient to meet consumption needs until the 1988 harvest.

[4] A wholesale price of S/2,500 per quintal in Quito is roughly comparable to a rough rice price of S/1,425 per quintal, with a 10 percent margin for milling costs.

Implications

1. The MOA should expect to sell most of its rice stocks prior to the 1987 harvest. If it exports stocks now, it will likely have to import later, and will lose a great deal on such exports.
2. If by early 1987 it appears that the 1987 production and beginning stocks are going to be as small as projected, the MOA should be prepared to import (or allow imports of) rice in early 1988.

The cautions listed for corn also apply to these rice projections, of course.

Observations

The development of capacity for policy analysis is an evolutionary process, and these efforts are but a beginning step. They are intended to be useful directly for the PAU, but they have other purposes as well. EPI is developing policy recommendations for grain storage, grain marketing credit, and the operation of the "price band" during 1986 and 1987. Each of these is an important building block for the overall price policy recommendations.

There is an additional purpose. By building capacity for policy analysis in the MOA at the same time specific policy recommendations are presented, the opportunity for the MOA to consolidate the policy recommendations into meaningful action is enhanced, and it is that purpose that is the object of each of the foregoing efforts.

APPENDIX I. SHORT-TERM FORECASTING MODEL FOR RICE AND FEED GRAINS

The model was specified on the basis of logical economic relationships, with coefficients estimated on the basis of historical data, using both annual and monthly information regarding area, yield, production, trade, consumption, prices, stocks, ENAC intervention, and other variables relevant to these crops. This econometric forecasting model of supply, demand, and prices is a monthly model.

Three relationships are basic:

- The supply function. For the current year, production is based on official estimates. However, for the future, harvested area is estimated on the basis of official prices and available production credit. For corn, production credit was the most significant variable and was used for 1987 estimates. Yield is an exogenous variable.[1] Monthly production is annual production allocated by the typical monthly profile of production.
- The demand function. Monthly rice consumption is projected on the basis of the wholesale price of rice, population, per capita income, and the price of wheat. Corn consumption is based on the wholesale corn price and an annual growth rate. Twelve month moving average wholesale prices are used, with rice consumption a function of the last 12 months' prices (including the current month), while corn consumption is a function of the moving average price lagged 2 months.
- The stocks-price relationship. Monthly wholesale prices are estimated on the basis of private stocks. For rice, stocks and prices are

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[1] A detailed specification of the model is included in Appendix II.

estimated simultaneously because current month consumption (and hence stocks) changes with current prices. For feed grains, current consumption depends on lagged prices. The form of the stocks-price relationship is different for the two sectors as well, with the rice price an exponential function of stocks, while the corn price is a discontinuous linear function of stocks (Charts I-1 and I-2).

Given alternative assumptions regarding exogenous variables, the model's solutions simulate the impact of policy alternatives. For example, a change in the official price, production credit, or rice yield in 1987 will change projections of rice production, stocks, prices, and consumption. Similarly, alternative levels of MOA intervention or trade will change private stocks, prices, and consumption. Some macroeconomic parameters (inflation rate, population growth rate, per capita income growth rate) can also be varied and the implications for rice and feed grains projected.

In addition to estimating short-run supply, use, and prices, the model calculates the amount of credit available to ENAC and the accumulated net costs of ENAC intervention based on ENAC's activity and its buying and selling prices. ENAC credit availability can then be seen as a constraint on ENAC purchases and the impact of alternative levels of initial ENAC credit or alternative ENAC buying and selling prices can be determined.

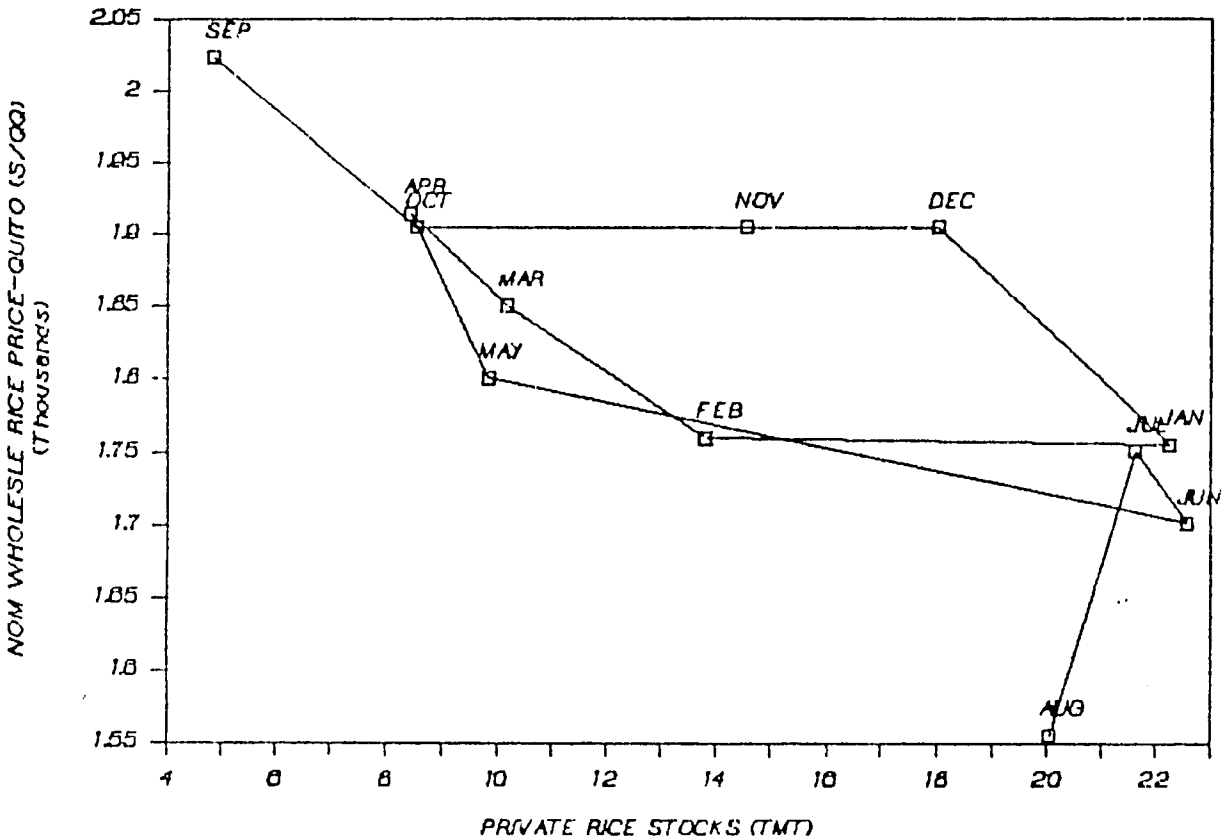
The model is run on IBM LOTUS software, with the rice and feed grains models in separate files. The file names are RICESU and CORNSU.

Examples

Following are some examples of forecasts under different options, using the feed grain model. In Table I-1, production forecasts for 1987 are shown along with the historical data. The production forecast for corn is based an

Chart I-1. Rice Price Versus Private Stocks

1983/84



1986/87 Forecast

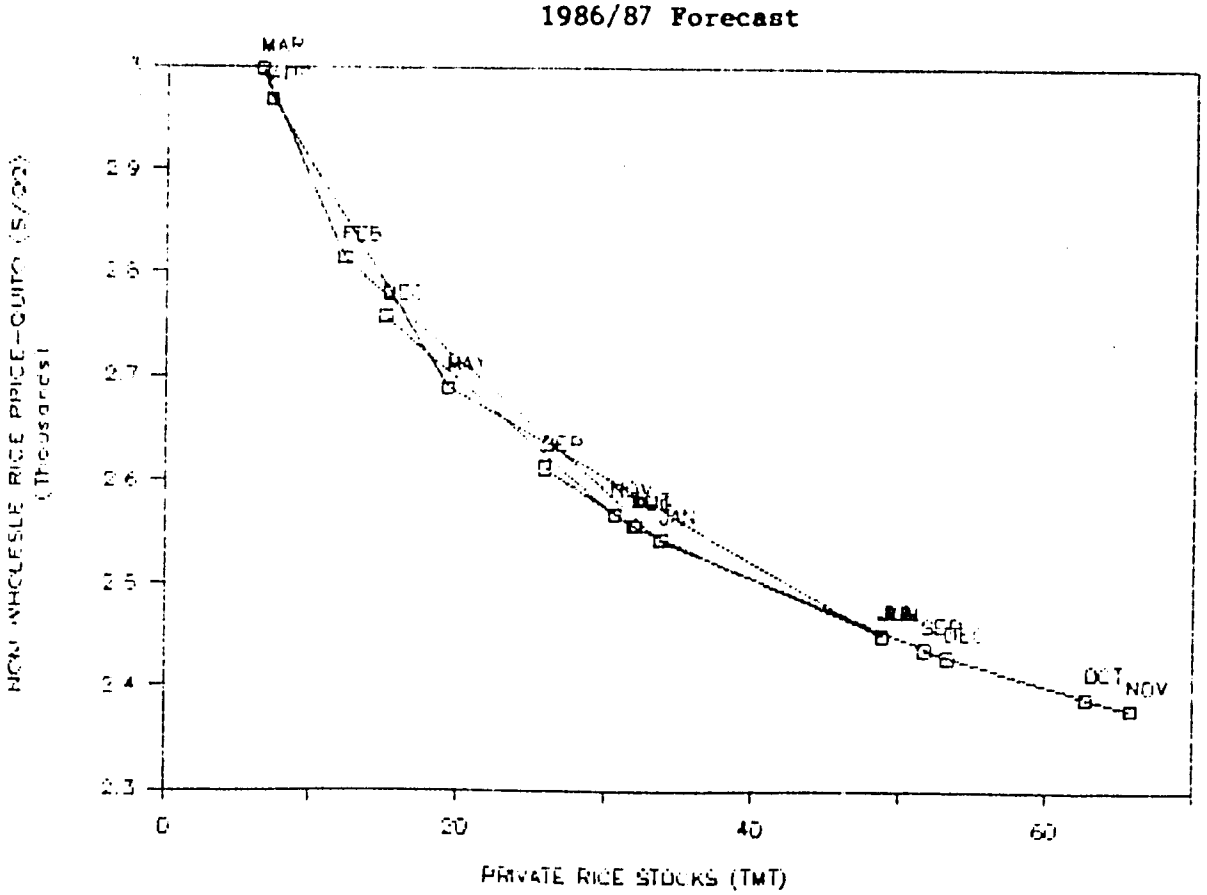
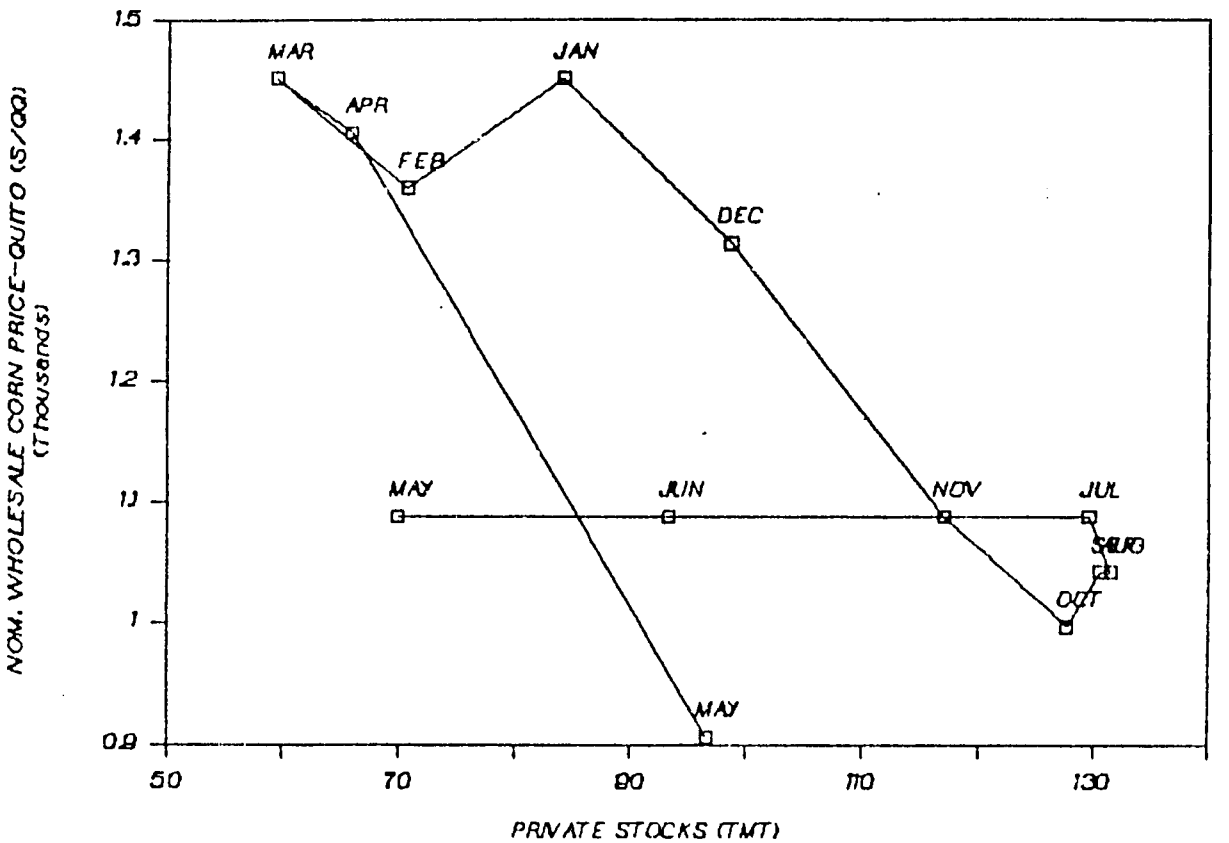
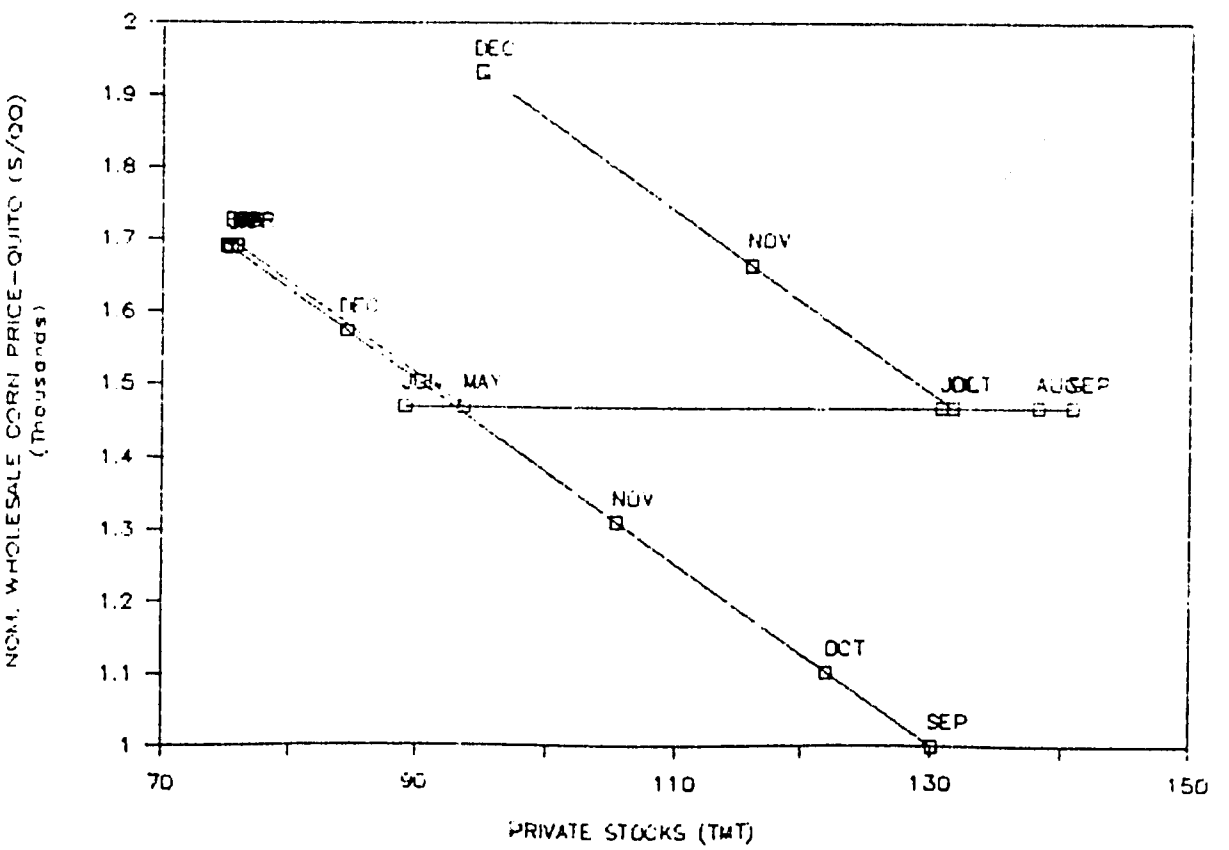


Chart I-2. Corn Price Versus Private Stocks

1983/84



1986/87 Forecast



assumed level of S/. 1.0 billion in BNF production credit and an assumed yield of 1.70 mt/ha, resulting in harvested area of 153.6 thousand ha and production of 261.2 tmt. Sorghum production is based on assumed area of 3,000 ha and yield of 3.0 mt/ha, resulting in 9,000 mt production. The same production forecast is used for all of the options presented.[2]

Table I-1. Feed Grain Production and Credit Forecast, 1987

Year	Corn			Sorghum			Feed Grain Production	Production Credit	
	Harvested Area	Yield	Production	Harvested Area	Yield	Production		Nominal	Real
	(1,000 ha)	(mt/ha)	(1,000 mt)	(1,000 ha)	(mt/ha)	(1,000 mt)	(1,000 mt)	- - S/1,000 - -	
1970								6,034	16,264
1971								7,227	17,757
1972								7,349	16,817
1973	140.9	1.09	153.3				153.3	63,563	129,720
1974	161.6	1.15	185.6				185.6	165,778	275,837
1975	166.0	1.23	203.4				203.4	144,590	210,466
1976	171.2	1.22	209.1	0.7	3.77	2.6	211.7	215,076	284,116
1977	163.0	1.01	164.1	0.6	2.17	1.3	165.4	192,906	225,621
1978	132.5	1.03	136.5	0	3.59	0.1	136.6	211,524	218,743
1979	170.4	1.07	182.3	0.1	2.72	0.3	182.6	189,350	177,793
1980	166.7	1.18	196.4	0.1	2.96	0.2	196.7	269,384	224,300
1981	184.7	1.26	232.6	0.2	3.58	0.6	233.3	340,257	250,373
1982	155.4	1.73	269.3	0.9	3.00	2.7	272.0	270,826	171,200
1983	145.3	1.27	185.0	0.2	2.28	0.4	185.4	695,059	296,274
1984	182.8	1.47	269.0	1.6	3.13	5.0	274.0	887,254	288,257
1985	146.9	1.91	280.6	0	0	12.0	292.6	1,338,928	339,829
1986 1/	169.9	1.93	328.7	3.0	3.00	9.0	337.7	819,457	162,488
1987	153.6	1.70	261.2	3.0	3.00	9.0	270.2	1,000,000	154,912

1/ MOA estimates.

The first option assumes that no trade or ENAC intervention in the feed grain market occurs through the end of 1987. The resulting production, consumption, stocks and prices are shown in Table I-2. The production forecast by month for the remainder of 1986 is from the National Corn Program. The monthly forecasts for 1987 are based on the annual forecast above and

[2] As with sorghum, corn harvested area and production can be specified exogenously, rather than forecast based on credit.

assumed monthly profiles of production. Consumption is assumed to be 20 tmt per month in Sept. 1986, and changes based on changes in the lagged moving average real corn price (not shown). Prices are forecast based on changes in private stocks. With no trade or ENAC intervention, private stocks fall to a very low level prior to the 1987 harvest, causing prices to rise significantly and consumption to begin to decline. Based on the assumed form of the stocks-price relationship, wholesale prices then stay constant during the harvest period. After the 1987 harvest period, prices again begin to rise as private stocks fall, reaching a level well above current prices by December 1987.

Table I-2. Option I: No ENAC Intervention, No Trade

Year	Production 1/	Consumption	ENAC Purchases	ENAC Sales	ENAC Ending Stocks	Private Ending Stocks	Wholesale Corn Prices (Quito) Nominal	Wholesale Corn Prices (Quito) Real
	- - thousand metric tons - -						(S/qq)	(S/kg)
1986								
Sept.	31.1	20.0			85.0	130.0	1,000	4.4
Oct.	13.7	20.4			85.0	121.9	1,102	4.8
Nov.	4.7	20.8			85.0	105.4	1,310	5.6
Dec.	0.1	21.0			85.0	84.5	1,573	6.5
1987								
Jan.	0	21.1			85.0	63.4	1,840	7.5
Feb.	0	21.3			85.0	42.0	2,108	8.4
March	1.4	21.3			85.0	22.0	2,361	9.2
April	16.3	21.0			85.0	15.6	2,441	9.4
May	43.9	20.6			85.0	34.5	2,203	8.3
June	59.3	20.0			85.0	67.9	2,203	8.1
July	70.3	19.3			85.0	111.9	2,203	7.9
Aug.	32.3	18.7			85.0	122.3	2,203	7.8
Sept.	26.7	18.2			85.0	128.1	2,203	7.6
Oct.	13.5	17.7			85.0	122.6	2,273	7.7
Nov.	6.2	17.2			85.0	111.0	2,419	8.0
Dec.	0.2	16.9			85.0	94.3	2,629	8.5
1987 Total	270.1	233.3						

1/ Field weight.

In the second option, ENAC is assumed to operate a price band policy with a buying price of S/.1300 per qq. and a selling price 30 percent above this (S/.1690 per qq) (Table I-3). ENAC sells enough stocks in January through

Table I-3. Option II: ENAC Price Band Policy, No Trade

YEAR	MONTH	FEED GRAIN PROD.	FEED GRN CONS COMPUTED	PRIVATE TRADE IMPORTS	PRIVATE TRADE EXPORTS	ENAC OPERATIONS IMPORTS	ENAC OPERATIONS EXPORTS	DOMESTIC PURCHASES	TOTAL ENAC SALES	ENAC ENDING STOCKS	PRIVATE ENDING STOCKS	WHOLESLE (QUITO) (S/QQ)	REAL WHOLESLE CORN PR QUITO
	SEP	31.1	20.0							85.0	130.0	1000	4.4
	OCT	13.7	20.4		0.0					85.0	121.9	1102	4.8
	NOV	4.7	20.8	0.0			0.0	0.0	0.0	85.0	105.4	1310	5.6
	DEC	0.1	21.0						0.0	85.0	84.5	1573	6.5
1987	JAN	0.0	21.1						12.0	73.0	75.4	1680	6.9
	FEB	0.0	21.3						21.0	52.0	75.0	1692	6.8
	MAR	1.4	21.5						21.0	31.0	75.8	1692	6.6
	APR	16.3	21.6						7.0	24.0	75.9	1691	6.5
	MAY	43.9	21.8							24.0	93.6	1468	5.5
	JUN	59.3	21.9					5.0		28.5	120.6	1466	5.4
	JUL	70.3	21.7					10.0		37.5	153.2	1468	5.3
	AUG	32.3	21.6					19.0		54.6	143.6	1468	5.2
	SEP	26.7	21.5							54.6	146.2	1468	5.1
	OCT	13.5	21.3							54.6	137.0	1468	5.0
	NOV	6.2	21.3							54.6	121.3	1665	5.5
	DEC	0.2	21.3						19.0	35.6	119.2	1692	5.5

YEAR	MONTH	ENAC NEW CREDIT	ENAC AVAILABLE CREDIT	ENAC BUYING PRICE	ENAC SELLING PRICE	ACCUM. ENAC COSTS
		(S/. MILLION)		(S/QQ)		(S/.MIL)
	SEP		0.0			0.0
	OCT		0.0	1300	1690	0.0
	NOV		0.0	1300	1690	0.0
	DEC		0.0	1300	1690	0.0
1987	JAN		0.0	1300	1690	-447.1
	FEB		0.0	1300	1690	-1229.5
	MAR	1000.0	1000.0	1300	1690	-2011.9
	APR		1000.0	1300	1690	-2272.7
	MAY		1000.0	1300	1690	-2272.7
	JUN		856.7	1300	1690	-2129.4
	JUL		570.1	1300	1690	-1842.8
	AUG		25.6	1300	1690	-1298.3
	SEP		25.6	1300	1690	-1298.3
	OCT		25.6	1300	1690	-1298.3
	NOV		25.6	1300	1690	-1298.3
	DEC		25.6	1300	1690	-2006.2

April to keep the price at the maximum, requiring 61,000 mt in sales. During the harvest period, the wholesale price has not fallen to the minimum although likely farm level prices have. Thus, it is assumed that ENAC will be able to purchase at its minimum price as much as its available credit will allow. Assuming ENAC has S/.1.0 billion available to buy corn, it is able to purchase 34 tmt in 1987. As the price begins to rise again in late 1987, ENAC sells 19,000 mt to keep the price at the maximum. In this option, ENAC is able to keep the wholesale price within its specified range and recovers S/.2.0 billion as it sells off its stocks.

The third option assumes ENAC operates the same policy, but 20,000 mt of private exports occur in late 1986 (Table I-4). Because supplies are tighter in this case, ENAC has to sell more stocks to keep the price below the maximum; this time selling 80,000 mt between December and April. ENAC thus recovers more money in this option, but has little stocks available at the end of 1987 to supply prior to the 1988 harvest. Thus the ENAC policy will probably fail to keep the price below the maximum in early 1988, under this option.

Model Limitations

In constructing this model, significant efforts were made to assemble the best available data and to ensure that the technical relationships used were both supported by the data and intuitively reasonable. Nevertheless, significant limitations and uncertainties exist in the data and in the economic relationships used in the model. These include:

- o Consumption data. No reliable consumption studies are available for either rice or feed grains. Thus, consumption numbers are estimates based on supply, changes in stocks, etc. For rice, a data series of

Table I-4. Option III: ENAC Price Band Policy, 20 tmt Exports

YEAR	MONTH	FEED GRAIN PROD.	FEED GRN CONS COMPUTED	PRIVATE TRADE IMPORTS	PRIVATE TRADE EXPORTS	ENAC OPERATIONS IMPORTS	ENAC OPERATIONS EXPORTS	ENAC OPERATIONS DOMESTIC PURCHASES	TOTAL ENAC SALES	ENAC ENDING STOCKS	PRIVATE ENDING STOCKS	WHOLESLE (QUITO) (S/QQ)	REAL WHOLESLE CORN PR QUITO
	SEP	31.1	20.0							85.0	130.0	1000	4.4
	OCT	13.7	20.4		0.0					85.0	121.9	1102	4.8
	NOV	4.7	20.8	0.0	20.0		0.0	0.0	0.0	85.0	85.4	1562	6.6
	DEC	0.1	21.0						11.0	74.0	75.5	1687	7.0
1987	JAN	0.0	20.9						21.0	53.0	75.6	1687	6.9
	FEB	0.0	20.9						21.0	32.0	75.7	1687	6.7
	MAR	1.4	21.1						21.0	11.0	76.8	1687	6.6
	APR	16.3	21.2						6.0	5.0	76.3	1694	6.5
	MAY	43.9	21.4							5.0	94.4	1465	5.5
	JUN	59.3	21.5					5.0		9.5	121.8	1465	5.4
	JUL	70.3	21.3					10.0		18.5	154.8	1465	5.3
	AUG	32.3	21.2					19.0		35.6	145.6	1465	5.2
	SEP	26.7	21.1							35.6	148.0	1465	5.1
	OCT	13.5	21.0							35.6	135.6	1465	5.0
	NOV	6.2	20.9							35.6	124.3	1658	5.5
	DEC	0.2	21.0						18.0	17.6	121.6	1693	5.5

YEAR	MONTH	ENAC NEW CREDIT (S/. MILLION)	ENAC AVAILABLE CREDIT (S/. MILLION)	ENAC BUYING PRICE (S/QQ)	ENAC SELLING PRICE (S/QQ)	ACCUM. ENAC COSTS (S/.MIL)
	SEP		0.0			0.0
	OCT		0.0	1300	1690	0.0
	NOV		0.0	1300	1690	0.0
	DEC		0.0	1300	1690	-409.8
1987	JAN		0.0	1300	1690	-1192.2
	FEB		0.0	1300	1690	-1974.7
	MAR	1000.0	1000.0	1300	1690	-2757.1
	APR		1000.0	1300	1690	-2980.6
	MAY		1000.0	1300	1690	-2980.6
	JUN		856.7	1300	1690	-2837.3
	JUL		570.1	1300	1690	-2550.7
	AUG		25.6	1300	1690	-2006.2
	SEP		25.6	1300	1690	-2006.2
	OCT		25.6	1300	1690	-2006.2
	NOV		25.6	1300	1690	-2006.2
	DEC		25.6	1300	1690	-2676.8

stocks is available but no data on private stocks of feed grains exists. Thus, rice consumption estimates may be more reliable than feed grain consumption, except that unreported trade flows make any consumption estimates suspect. Using consumption estimates from the National Rice Program, total rice consumption between July 1984 and August 1986 exceeded milled rice production by 183,000 mt, while less than 70,000 tons of imports were reported and stocks increased. Thus, either very large undocumented imports occurred, or the consumption estimates are too large (or both). For feed grains, annual consumption by chickens was estimated based on data on the chicken population and feed rations, and this was used as the basis of the feed grain demand model. Total feed grain consumption for 1985/86 was calculated assuming no change in private stocks, and this figure was used to estimate feed grain consumption at the beginning of the projection period.

- Stocks data. As mentioned above, no data on private stocks of feed grain exist. Thus, private stocks have to be chosen at some point in time, and stocks at other times estimated based on estimated consumption, production, trade and ENAC stocks in each period. Unfortunately, monthly ENAC stocks data are available only through the end of 1984, so it is not possible to construct a continuous series up to the present. Thus, the level of private feed grain stocks assumed in the model for Sept. 1986 (130,000 mt) is purely conjecture. Fortunately, price changes computed in the feed grain model depend only on the change in private stocks, not in the absolute level, since

the relationship is linear. For rice, it is also not possible to construct a continuous series of private stocks up to the present, but since total stocks are reported, private stocks can be determined in any period when ENAC stocks are reported also.[3] Thus, we have a better idea of how much private stocks of rice exist presently, which is important since the model for rice depends on the level of private stocks.

- o Production data. Inconsistences exist in the production data reported by the national programs and the data reported by the Central Bank. The Central Bank data was used, mostly because it was possible to assemble a more complete time series with Central Bank data. Monthly production estimates are based on estimates from the national programs of the typical monthly profile of production, and do not necessarily correspond to actual production in any month.
- o Price data. No series of farm level prices exist. To forecast production of rice, official price was used as an indicator of expected farm price. Apparently, the official price for corn is a very poor indicator of expected farm price, because the official corn price had a statistically insignificant coefficient in every regression with corn area, usually with a negative sign. For demand and stocks-price relationships, the wholesale price in Quito was used. This is primarily because a more complete series was available for Quito than any other location. Projections of wholesale prices in

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[3] However, inconsistencies between ENAC rice stocks data and National Rice Program total stocks data exist. For example, ENAC reported rice stocks exceeded total reported rice stocks for several months in 1983.

Quito are not necessarily indicative of wholesale prices everywhere in Ecuador, and are almost certainly not indicative of farm level prices during the harvest period, when wholesale prices for corn are observed to stay relatively constant. All reports indicate that farm level prices fall significantly below wholesale prices during the harvest.

- Stocks-price relationship. Given all the problems with stocks data, one would expect the stocks-price relationship to be uncertain. Furthermore, projecting prices on the basis of private stocks alone is a tremendous simplification of reality, unable to account for any number of other factors which may affect the price. Finally, because of the limited data set, this relationship was based on a very limited number of data points from a single year. Thus, the parameters used in the model for this relationship are best viewed as indicative, useful in providing a general picture of the order of impacts to expect under various scenarios, but not in giving the precise answer.

To summarize, the model is best viewed as an indicative tool helpful in identifying the types and order of magnitude of impacts to expect under alternative scenarios. It should be complemented by the judgments of experts and reports from the field, and updated as new and better information become available.

Most critical to improving the performance of the model is to develop better data series on consumption and private stocks, especially for feed grains, and to assess and improve the specification of the stocks-price relationship, which is perhaps the most critical relationship in the model.

APPENDIX II. MODEL SPECIFICATION

Rice Model Equations

FILE NAME: RICESU

Worksheet Field

PRODUCTION

J24 1. Area Harvested (Annual)

$\ln(A) = a + b * \ln(\text{Production Credit Real}) + c * \ln(\text{Official Price Real})$

Regression Results:

Years: 1970-85 1/

a = 0.447

BN$130 b = Credit Elasticity of Harvested Area = 0.20

BM$130 c = Official Price Elasticity of Area = 0.56

$R^2 = 0.828$
Standard Deviation (b) = 0.042
Standard Deviation (c) = 0.26
Standard Error [ln(A)] = 0.114
Degrees of Freedom = 11

E24 2. $\text{Production Credit Real} = \frac{\text{Production Credit Nominal}}{\text{CPI (Annual)}} * 100$

C24 Production Credit Nominal - Exogenous

AV24 CPI = Consumer Price Index

F24 3. $\text{Official Price Real} = \frac{\text{Official Price Nominal}}{\text{CPI}} * 100$

D24 Official Price Nominal - Exogenous

AV24 4. CPI (Annual) = AVG [CPI(Months)]

1/ Dummy variables were included for 1978 and 1983 to discount for the effects of severe bad weather in these years.

AV 5. CPI (Month) = CPI (Previous Month)

$$* \left(1 + \frac{\text{Inflation Rate}}{100}\right)^{1/12}$$

AV130 CPI (August 1986) = 486.3

BU$130 Inflation Rate - Exogenous

P24 6. Rough Rice Production (Annual) = Area Harvested (Annual) * Yield (Annual)

M24 Yield - Exogenous

R24 7. Winter Rice Production (Annual) = 0.57 x Rough Prod. (Annual)

Q24 8. Summer Production (Annual) = 0.43 x Rough Prod. (Annual)

R 9. Winter Prod. (Mo.) = Winter Prod. (Annual) *

$$\frac{\text{Winter Prod. Profile (Mo.)}}{100}$$

Q 10. Summer Prod. (Mo.) = Summer Prod. (Annual) *

$$\frac{\text{Summer Prod. Profile (Mo.)}}{100}$$

T Winter Prod. Profile (Month) - from National Rice Program

S Summer Prod. Profile (Month) - from National Rice Program

P 11. Rough Rice Prod. (Mo.) = Winter Prod. (Mo.) + Summer Prod. (Mo.)

CONSUMPTION

V 12. Consumption (Mo.) = Consumption/Capita (Mo.) * Population (Mo.)

X 13. Consumption/Capita (Mo.) = Consumption/Capita (Previous Mo.) *

$$\left[\frac{\text{Moving Avg. Rice Price (Mo.)}}{\text{Moving Avg. Rice Price (Previous Mo.)}}\right]^{d} *$$

$$\left[\frac{\text{Moving Avg. Wheat Price (Mo.)}}{\text{Moving Avg. Wheat Price (Previous Mo.)}}\right]^{e} *$$

$$\left[1 + \frac{\text{Income/Capita Growth Rate}}{100}\right]^{f/12}$$

X131 Cons./Capita (Sept. 1986) = 28.6 kg
BT$130 Income/Capita Growth Rate - Exogenous

BP$130 d = Rice Own Price Elasticity of Demand = -0.5
BR$130 e = Wheat Cross Price Elasticity of Rice Demand = 1.0
RQ$130 f = Income Elasticity of Rice Demand = 0.7

Elasticities based upon the following regression:

Years: 1970-84

$$\ln(\text{Cons./Capita}) = 2.296 - \underset{(0.15)}{0.57} * \ln(\text{Rice Price-Real}) - (\text{Standard Deviation})$$

$$+ \underset{(0.13)}{1.07} * \ln(\text{Wheat Price-Real})$$

$$+ \underset{(0.07)}{0.66} * \ln(\text{GNP/Capita})$$

$R^2 = 0.910$
Standard Error [ln(Cons./Cap.)] = 0.052
Degrees of Freedom = 11

AZ 14. Moving Average Rice Price (Mo.) =
Average [Real Wholesale Rice Price-Quito (Last 12 Mo.)]

BB 15. Moving Average Wheat Price (Mo.) =
Average [Real Wheat Price (Last 12 Mo.)]

Real Wheat Price (Mo.) - Exogenous

W 16. Population (Mo.) = Population (Previous Mo.) *

$$\left[1 + \frac{\text{Population Growth Rate}}{100}\right]^{1/12}$$

W131 Population (Sept. 1986) = 8,894 thousand

BS$130 Population Growth Rate - Exogenous

PRICES

AW 17. Real Wholesale Rice Price-Quito (Mo.) =

$$\frac{\text{Nominal Wholesale Rice Price-Quito (Mo.)}}{\text{CPI (Mo.)}} * 100$$

AP 18. Nominal Wholesale Rice Price-Quito (Mo.) =

Nominal Wholesale Rice Price-Quito (Previous Mo.) x

$$\left[\frac{\text{Private Stocks (Mo.)}}{\text{Private Stocks (Previous Mo.)}}\right]^{g}$$

AP131 Nominal Wholesale Rice Price-Quito (Sept. 1986) = S/.53.75/kg

?0$130 g = Elasticity of Price to Stocks = -0.10

The price-stocks elasticity is based on the following regression:

Months: Sept. 1983 - July 1984 2/

ln[Nominal Wholesale Rice Price-Quito (S/qq)] = 7.753

-0.0978 * ln[Private Stocks (tmt)]
(0.0133)

+0.0608 Dummy Nov. + 0.0817 Dummy Dec.
(0.0214) (0.0219)

R^2 = 0.897
Standard Error = 0.020
Degrees of Freedom = 7

BF 19. Import Price (S/qq) = Import Price ($/qq) * Exchange Rate

Import Price ($/qq) - Exogenous

BG 20. Export Price (S/qq) = Export Price ($/qq) * Exchange Rate

Export Price ($/qq) - Exogenous

BE 21. Exchange Rate (Mo.) = Exchange Rate (Previous Mo.) *

$$\left[1+\frac{\text{Exchange Rate Inflation}}{100}\right]^{1/12}$$

BE132 Exchange Rate (Oct. 1986) = 143.0 S/$

BV$130 Exchange Rate Inflation - Exogenous

2/ See Chart I-1 in Appendix I.

STOCKS

AO 22. Total Ending Stocks (Mo.) = Total Ending Stocks (Previous Mo.)
+ 0.55 x Rough Production (Mo.)
+ Total Net Imports (Mo.)
- Consumption (Mo.)

AO130 Total Ending Stocks (Aug. 1986) = 110.1 tmt

AN 23. Private Ending Stocks (Mo.) = Total Ending Stocks (Mo.)
- ENAC Ending Stocks (Mo.)

AM 24. ENAC Ending Stocks (Mo.) = ENAC Ending Stocks (Previous Mo.)
- Net ENAC Sales (Mo.)
+ Net ENAC Imports (Mo.)

AM131 ENAC Ending Stocks (Sept. 1986) = 56.2 tmt

AJ 25. Net ENAC Sales = ENAC Sales - 0.55 * ENAC Purchases

Imports, Exports, ENAC Purchases, and Sales - Exogenous

ENAC FINANCES

BI 26. ENAC Available Credit (Mo.) = ENAC Average Credit (Previous Mo.)
- ENAC Buying Price (Mo.) * ENAC Purchases (Mo.) * .022046
+ New ENAC Credit (Mo.)

ENAC Buying Price, Purchases, New Credit - Exogenous

BI131 ENAC Available Credit (Sept. 1986) - Exogenous

BJ 27. Acc. Net ENAC Costs (Mo.) = Acc. Net ENAC Costs (Previous Mo.)
+ ENAC Buying Price (Mo.) * Purchases (Mo.) * .022046
- ENAC Selling Price (Mo.) * Sales (Mo.) * .022046
+ Import Price (Mo.) * ENAC Imports (Mo.) * .022046
- Export Price (Mo.) * ENAC Exports (Mo.) * .022046

Accumulated Net ENAC Costs (Sept. 1986) - Exogenous

ENAC Purchases, Sales, Imports, Exports - Exogenous

Feed Grain Model Equations

FILE NAME: CORNSU

Worksheet Field

PRODUCTION

N22 1. ln [Corn Area Harvested (Annual)] = a + b * ln (Prod. Credit Real)

a = 2.25

CF$209 b = Credit Elasticity of Harvest Area = 0.233

Relationship based on the following regression:

Years: 1973-84

$$\ln(\text{Corn Harvested Area}) = 2.25 + \underset{(0.068)}{0.233} * \ln(\text{Prod. Credit Real}) - \underset{(0.059)}{0.204} * \text{Dummy 1983} - \underset{(0.068)}{0.226} * \text{Dummy 1978}$$

$R^2 = 0.801$
Standard Error [ln(Area)] = 0.053
Degrees of Freedom = 8

D22 2. Production Credit Real = $\frac{\text{Production Credit Nominal}}{\text{CPI (Annual)}} * 100$

C22 Production Credit Nominal - Exogenous

BO22 3. CPI (Annual) = AVG [CPI(Months)]

BO 4. CPI (Month) = CPI (Previous Month)

$$* \left(1 + \frac{\text{Inflation Rate}}{100}\right)^{1/12}$$

BO208 CPI (Sept. 1986) = 498.4

CC$209 Inflation Rate - Exogenous

P22 5. Corn Production (Annual) = Corn Area Harvested (Annual) * Corn Yield (Annual)

O22 Corn Yield - Exogenous

P 6. Corn Production (Mo.) = Corn Production (Annual) *

$$\frac{\text{Corn Production Profile (Mo.)}}{100}$$

Q Corn Prod. Profile (Mo.) - Average of Profiles for 1985 and 1986 from National Corn Program

T22 7. Sorghum Prod. (Annual) = Sorghum Area Harvested * Sorghum Yield

R22,S22 Sorghum Area, Yield - Exogenous

T 8. Sorghum Production (Mo.) = Sorghum Production (Annual) *

$$\frac{\text{Sorghum Production Profile (Mo.)}}{100}$$

U Sorghum Production Profile = 100 in September
0 other months

V. 9. Feed Grain Prod. (Mo.) = Corn Prod. (Mo.) + Sorghum Prod. (Mo.)

CONSUMPTION

AQ 10. Feed Grain Consumption (Mo.) = Feed Grain Consumption (Previous Mo.)

$$* \left[1 + \frac{\text{Annual Consumption Growth Rate}}{100}\right]^{1/12}$$

$$* \left[\frac{\text{Moving Avg. Corn Price (2 Months Ago)}}{\text{Moving Avg. Corn Price (3 Months Ago)}}\right]^{C}$$

AQ208 Feed Grain Consumption (Sept. 1986) = 20.0 tmt

CE$209 Annual Consumption Growth Rate = 5.0%

CG$209 C = Price Elasticity of Demand = -0.8

Consumption growth rate and price elasticity based on the following regression:

Years: 1976-85

$$\ln(\text{Computed Chicken Feed Grain Cons.}) = -749.9 + \underset{(22)}{100} * \ln(\text{year}) - \underset{(0.19)}{0.85} * \ln(\text{wholesale corn real price})$$

R^2 = 0.884
Standard Error = 0.097
Degrees of Freedom = 7

PRICES

BR 11. Moving Average Corn Price (Mo.) = Average [Real Wholesale Corn Price-Quito (Last 12 Months)]

BQ 12. Real Wholesale Corn Price-Quito (Mo.) -

$$\frac{\text{Nominal Wholesale Corn Price-Quito (Mo.)}}{\text{CPI (Mo.)}} * \frac{100}{45.36}$$

- If Mo. = Aug.-March, Incr. Private Stocks (Mo.) <0, and Private Stocks (Mo.) < Min. Private Stocks; or

- If Mo. = April or May

= Nominal Wholesale Corn Price (Previous Mo.)

- Otherwise

BL208 Nominal Wholesale Corn Price-Quito (Sept. 1986) = S/.1.000/qq

CI$209 d = Price-Stocks Function Slope = - 12.6 S/qq/tmt

CH$209 Min. Private Stocks = Minimum level to which private stocks must fall after harvest before price begins to rise

= 130 TMT 3/

The slope of the price-stocks function is based on the following regression:

Months: Oct. 1985 - May 1986

3/ The form of the price-stocks relationship is based upon the observed price-stocks relationship in 1985/86 and earlier years. Generally, the wholesale corn price falls at the beginning of the harvest as stocks begin to accumulate, but then stays constant after May until stocks have fallen sufficiently to tighten the supply (see Chart I-2 in Appendix I). The flat wholesale price during the harvest period does not correspond to farm level prices which likely continue to fall in this period.

Nominal Wholesale Corn Price = 2.565 - 12.63 * Private Stocks
(1.22)

- 358 * Dummy (Feb.-May)

(55.7) 4/

R^2 = 0.957
Standard Error = 53
Degrees of Freedom = 5

BV 14. Import Price (S/qq) = Import Price ($/mt) * $\frac{\text{Exchange Rate}}{22.046}$

BS Import Price ($/mt) - Exogenous

BW 15. Export Price (S/qq) = Export Price ($/mt) * $\frac{\text{Exchange Rate}}{22.046}$

BT Export Price ($/mt) - Exogenous

BU 16. Exchange Rate (Mo.) = Exchange Rate (Previous Mo.) *

$$\left[1+\frac{\text{Exchange Rate Inflation}}{100}\right]^{1/12}$$

BU209 Exchange Rate (Oct. 1986) = 143.0

CD$209 Exchange Rate Inflation - Exogenous

STOCKS

BH 17. Private Stocks (Mo.) = Private Stocks (Previous Mo.) + Increase in Private Stocks (Mo.)

BH208 Private Stocks (Sept. 1986) - Exogenous

BI 18. Increase in Private Stocks (Mo.) = Apparent Cons. (Mo.) - Cons. (Mo.)

BJ 19. Apparent Cons. (Mo.) = 0.9 * Feed Grain Prod. (Mo.)
+ Total Net Imports (Mo.)
+ ENAC Ending Stocks (Previous (Mo.)
- ENAC Ending Stocks (Mo.)

4/ The dummy variable for Feb.-May was included to account for a shift in the curve which apparently occurred in Feb. 1986. This shift may have been caused by unreported feed grain imports or use of wheat as a feed source.

BG 20. ENAC Ending Stocks (Mo.) = ENAC Ending Stocks (Previous Mo.)
+ 0.9 * ENAC Purchases (Mo.)
- ENAC Sales (Mo.)
+ Net ENAC Imports (Mo.)

BG208 ENAC Ending Stocks (Sept. 1986) = 85.0 tmt

BA,BD,AX,AY ENAC Purchases, Sales, Imports, Exports - Exogenous

AT 21. Total Net Imports = Total Imports - Total Exports

AR 22. Total Imports = ENAC Imports + Private Imports

AS 23. Total Exports = ENAC Exports + Private Exports

AX,AY,AU,AV ENAC Imports, Exports; Private Imports, Exports - Exogenous

ENAC FINANCES

BY 24. ENAC Available Credit (Mo.) = ENAC Average Credit (Previous Mo.)
- ENAC Buying Price (Mo.) * ENAC Purchases (Mo.) * .022046
+ New ENAC Credit (Mo.)

BZ,BA,BX ENAC Buying Price, Purchases, New Credit - Exogenous

BY208 ENAC Available Credit (Sept. 1986) - Exogenous

CB 25. Acc. Net ENAC Costs (Mo.) = Acc. Net ENAC Costs (Previous Mo.)
+ ENAC Buying Price (Mo.) * Purchases (Mo.) * .022046
- ENAC Selling Price (Mo.) * Sales (Mo.) * .022046
+ Import Price (Mo.) * ENAC Imports (Mo.) * .022046
- Export Price (Mo.) * ENAC Exports (Mo.) * .022046

CB208 Accumulated Net ENAC Costs (Sept. 1986) - Exogenous

BZ,CA,BA, BD,AX,AY ENAC Buying Price, Selling Price, Purchases, Sales, Imports, Exports - Exogenous