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A Sensitivity Test of the SEAPA Price Mechanism

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Model

SEAPA is the version of the price determining mechanism used in the KASS model which is documented in Working Paper 74-2. The basic model consists of a system of demand equations and a national budget constraint which are solved simultaneously, taking policy determined prices into account. A model determines market prices in response to the fixed supplies arriving in the urban market. The model also incorporates the reservation price mechanism which puts a lower bound on the price which is determined in the model.

Parameters

This test of the model used demand elasticities for food grains which were estimated by Forrest Gibson. These elasticities are presented in Table 1. In the demand equations for non-food grain commodities the basic KASS elasticity set was used. These are presented in Table 2. The model assumed that the total supply available to the domestic urban market was equal to the 1971 KASS Alternative II projection. (See Table 3.) In addition to these supplies, the base level of imports equaled the residuals which were calculated in the KASS Alternative II projection. Urban population was assumed to be 15.82 million people and rural population was assumed to be 15.87 million

people. These population assumptions correspond to the KASS assumptions for 1970. The urban non-food price index was set equal to one, which implies that all prices are relative to the non-food price level. Total urban consumption expenditures were assumed to be 1,827 billion won, which represents two thirds of the 1973 total consumption expenditure in 1970 constant prices.

Method

The supply of one commodity at a time was changed from the base level and the resulting price levels were calculated. Only the price levels which resulted from those changed supplies in the first year were examined. The primary attention was focused upon the unconstrained prices which were generated by the price determination mechanism, that is, the prices which did not reflect the reservation price constraints.

Results

The results of the price sensitivity test are presented in Table 4. This shows the sensitivity of the prices of rice, barley, wheat, pulses, beef, milk, and eggs to changes in the assumed urban market supply of the respective commodities. Market clearing prices are available for the other commodities in the KASS commodity list, but price sensitivity tests were not run on those commodities.

The price which was obtained in the base run is the

price opposite the entry zero in the Δ Q column. Thus, in the base run the price of rice was 95₩ per kilogram the price of barley 48½₩ per kilogram and the price of wheat was 26 3/4₩ per kilogram. Each of the price sensitivity runs generated a whole array of prices for all of the KASS commodities. However, since the magnitude of the changes in the prices for the other commodities is small relative to the magnitude of the change of the own price, those price changes were not tabulated.

From Table 4 we see that a change in the supply of rice in the amount of 100,000 tons will change the price of rice by approximately 6.6₩ per kilogram. The same size change in the supply of barley will change barley price by approximately 6₩ per kilogram and the same size change in the supply of wheat will change the price of wheat by approximately 1.6₩ per kilogram. Because the other commodities have smaller base levels of supply the price change comparisons will be made based upon the response to a 1000 metric ton increase in supply. A 1000 metric ton increase in the supply of pulses will change the price of pulses by approximately 1.6₩ per kilogram, a 1000 ton increase in the supply of milk will change the price of milk by approximately by 7.3₩ per kilogram, and a 1000 ton increase in the supply of eggs will decrease the price of eggs by approximately 8½₩ per kilogram. The price of beef is most sensitive to changing supply assumptions, with a response of more than 44₩ per

kilogram to a 1000 metric ton increase in price.

Qualifications

The first and the most important qualification to these results is that the effects of the price change in two or more commodities is not directly additive. Because of the cross elasticities and the operation of the budget constraint, the effect of changing the supply assumptions for two commodities will not be the sum of the effects of each individual price change.

The prices which are presented are directly a function of the elasticity set which is assumed. Any reservation that a person has with respect to that set of elasticity assumptions would then be directly reflected as a reservation about the prices which are subsequently calculated in the price determining process.

Since the basic population assumptions are approximately equal to the 1970 population figures, interpreting this set of prices as being currently prevailing prices will be erroneous unless domestic supplies increased proportionally with domestic population. If domestic population increased faster than the increase in domestic population, then the real market prices would then be higher than those calculated in this model.

In order to compare these prices with the currently prevailing market price it is necessary to inflate these prices

by the rate of non-food price inflation. The consummer price index for non-food pruchases in early 1974 is currently approximately 140% of the 1970 base levels. The calculated price for wheat is the price based on wheat as a grain rather than as wheat flour. The price per kilogram of wheat grain is approximately 60% of the per kilogram price of wheat flour.

Using these approximations the price of rice in the base run is approximately 10,662₩ per 80 kilogram bag, the price of barley is 5,194₩ per 76.5 kilogram bag, and the price of wheat flour is approximately 1,373₩ per 22 kilogram bag. It must be remembered however, that these price assumptions do not reflect the 1974 population levels. Incorporating these population levels into the model would raise these prices somewhat.

Conclusions

From the table we can conclude that the SEAPA is generating fairly reasonable prices for all commodities. It is fairly insensitive to changes in the supplies of grains. But the price response of the more minor commodities is somewhat more sensitive than those of grains. Because the results of this model are dependent heavily upon the elasticities there is a continuing need to provide an empirical basis for the elasticity estimates used in the model.

'able 1.

URBAN DEMAND RELATIONS FOR FOOD GRAINS

Commodity	Initial[1] per Capita Consumption (kg/capita)	Price Cross Elasticities[2/3] Rice	Barley	Wheat	Income[2/4] Elasticity	Per Capita Consumption Target[1] (kg/capita)
Rice	128	-.387	.482	-.430	.121	100
Barley	26.5	.964	-1.742	1.362	-.076	10
Wheat	40	1.356	-.807	-.997	0.010	60

1/ Source: Korean Agricultural Sector Study

2/ Source: Derived from Forrest Gibson,

3/ The negative of the sum of the income elasticity and all price elasticities is assigned as the elasticity respect to nonagricultural price changes.

4/ Values tabulated are 1970 Base values. Income elasticities were assumed to change through time as per capita consumption levels change relative to consumption targets.

Table 2.

URBAN DEMAND RELATIONS

Commodity	Initial 1/ Per Capita Consumption (kg/Capita)	Own 1/ Price Elasticity	Cross 1/ 2/ Elasticities Beef Price	Cross 1/ 2/ Elasticities Pork Price	Income 1/ Elasticity 3/	Per Capita Consumption Target 1/ (kg/capita)
Other Grains	3.0	-.4			0.0	2.5
Fruit	15.0	-1.0			1.0	100
Pulses	11.0	-.4			.8	14
Vegetables	72.0	-.8			.4	150
Potatoes	24.4	-1.0			.5	55
Beef	1.8	-.48			1.7	20
Milk	1.5	-.4			3.5	50
Pork	3.7	-1.5	.10		.5	20
Chicken	2.5	-1.3			1.0	20
Eggs	4.7	-.4			1.3	30
Fish	32.0	-.7	.36	.40	.35	70
Residual Agriculture	10.0	-.5			1.3[illegible]	60
Non Agriculture	50700	-1.0			1.38	366625

1/ Source: Korean Agricultural Sector Study

2/ The negative of the sum of the income elasticity and all price elasticities is assigned as the elasticity with respect to nonagricultural price changes. In the case of the demand for nonagricultural consumption the negative of the sum of the income and own price elasticities is allocated according to the shares of the agricultural budget to obtain the cross elasticities with respect to agricultural prices.

3/ The values tabulated are 1970 base values. Income elasticities were assumed to change through time as per capita consumption levels change relative to consumption targets.

Table 3.

URBAN MARKET SUPPLY ASSUMPTIONS

Commodity	Domestic Marketed Surplus (1000 MT)	Marketing Losses %	Net Imports (1000 MT)
Rice	1343.0	3	763
Barley	434.	3	0
Wheat	-136.0	7	886
Other Grains	34.6	5	12
Fruit	323.0	20	10
Pulses	165.0	5	16
Vegetables	1370.0	20	0
Potatoes	479.0	10	0
Beef	37.3	7.2	0
Milk	42.3	15	0
Pork	60.9	5.6	0
Poultry	46.2	2	0
Eggs	103.1	15	0
Fish	524.3	15	0
Agricultural Residual	150.5	7	0

Source: Korean Agricultural Sector Study.

Note: Domestic production was not sufficient to satisfy all rural demands for wheat.

Table 4.

Price Sensitivity of Selected Commodities
KASS-Gibson Elasticity Assumption

Initial Level of Urban Demand (1000 MT)	Rice 2066		Barley 421.0		Wheat 740.5		Pulses 172.7		Beef 34.61		Milk 35.96		Eggs 87.64	
ΔQ 1/	P 2/	ΔQ	P	ΔQ	P	ΔQ	P	ΔQ	P	ΔQ	P	ΔQ	P
0	95.17	-200	60.47	-386	33.08	0	174.37	0	991.66	0	126.40	0	362.33
100	88.52	-100	54.48	-186	29.80	29	127.6	10	534.9	5	89.42	20	188.0
200	81.89	0	48.49	0	26.74	44	103.5	15	311.4	10	52.56	40	17.02
300	75.27	+100	42.51	+414	19.96			20	91.00	15	15.84	50	-67.20
400	68.66	+200	36.54	+614	16.68			40	-760.7	20	-20.75		
500	62.06	+300	30.56	+1614	.36					40	-165.8		
600	55.48	400	24.60										
800	42.34	500	18.64										
1000	29.24	700	6.73										
1200	16.19	800	.78										
1400	3.18	900	-5.16										
1500	-3.31												

1/ Quantity change (1000 MT)

2/ Unconstrained own price (₩/kg)