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THE EFFECT OF IMPORTATION ON THE PRICE OF RICE

by

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Mahar Mangahas

When the Philippine government wants to subsidize consumers of a particular food, the classical method is to purchase quantities of it, either from domestic farmers or from abroad, for resale to consumers at special prices. In the case of rice, the government has an effective monopoly on importation but not on the retail supply. The great majority of consumers, who do not purchase their rice from the government but from private retailers, share in the consumer subsidy to the extent that the market retail price is lower than it would have been had government not participated in the market as a competing retailer. The presence of government in the market shifts the demand curve facing private retailers to the left. It is clear that government's intention is that this should decrease the open market prices below the levels which would hold had it not entered the market.

The purpose of this paper is to cast doubt on the effectiveness of rice importation as a means of lowering the retail price of rice on the open market: (a) by pre-

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*Computations were done at the Computer Center of the University of the Philippines.

senting the importation and price evidence for a period when one might have expected to find clear-cut price changes in the opposite direction from changes in importation levels; (b) by offering alternative theories to explain the 'strange' data of the said period; and (c) by an attempt at measurement of the net effect of importation on the retail price level over a longer time span encompassing the above period. The ability of the estimated equation to predict the average 1968 retail price level is then tested.

At this point I wish to set aside the problem of the effect on retail prices of government operations with respect to domestically produced rice, and concentrate on the effects of rice importations. It is far from clear whether domestic operations have any effect on the open market price at all: government merely withdraws rice at the farmers' end and restores it to the market at the consumers' end, with no net effect on *supply* unless the government is prepared for indefinite storage of domestically purchased rice. Net effects on *demand* may come about via the gains in real income of those who have benefited from the government operations---the farmers who obtain a producer's subsidy and the consumers who buy government rice. It is possible for these real income gains to lead either to increased or decreased consumer demand for rice, i.e., either rightward or leftward shifts in the demand curve,

depending on whether rice is or is not an inferior good. Thus, although domestic operations do benefit a good number of individuals, they may have negative, zero, or positive effects on the prices of private retailers, with the positive effects being not at all implausible.

Importations, on the other hand, represent clear additions to the *potential* retail supply of rice. They will bring about decreases in the market retail price, given the market demand curve, if the private retail supply is uninfluenced by them. A theory will be presented later in which the key element is a supply curve which reacts to importations.

Table I gives price, imports and output data for 1956 to 1967. Manila prices are used on the premise that, when government wishes to influence price via importation, it is more anxious to succeed in Manila than in any other single locality. The most interesting sub-period in this time span, to my mind, is 1960-1963. Imports were nil in 1960 and 1962 and very large (by previous years' standards) in 1961 and 1963. But the retail price of rice in Manila was *higher*, not lower, in 1961 and in 1963 than in 1960 and in 1962. (The price changes are even more striking when prices are undeflated.) This observation holds in general for all regions in the country for 1960-1963. In

addition, the record imports of 1965 are associated with an increase in the retail price level.

Theoretical Analysis

There are various situations which make it possible for the price of a good to fall when its demand curve shifts to the right, given that cost conditions in the firm or firms in the industry are unchanged. It is relevant to the problem at hand to consider separately (1) cases of competition and monopoly and (2) the case of an unanticipated demand shift and the case of an anticipated demand shift.

It is not at all clear whether the rice retail trade in all or some of the major cities and towns in the Philippines is competitive or monopolistic. There are obviously a great number of apparently independent retailers. Very many of these apparently independent retailers also happen to be of Chinese descent; and the suspicion, valid or not, that these retailers band together to take advantage of the Filipinos of "purer stock" is no doubt widespread. One may note Republic Act No. 3018, which took effect on January 1, 1961 and provided that the rice and corn industries, including trade and processing, be completely nationalized by the end of 1963. It is doubtful, however, that this Act could have broken up a Chinese cartel.

Table I

Calendar Year	Average deflated retail price of Macan 2nd class in Manila, for the calendar year.[a/] Pesos/ganta	Net milled rice imports of the Philippines, for the calendar year.[b/] Thousand m. tons	Philippine palay output in milled rice equivalent, for the crop year.[c/] Thousand m. tons	Crop Year
1956	.8107	42	2125	1955/56
1957	.9406	78	2172	1956/57
1958	.9522	231	2079	1957/58
1959	.7533	6	2392	1958/59
1960	.8633	-2	2427	1959/60
1961	.8978	186	2405	1960/61
1962	.8251	0	2538	1961/62
1963	.8927	256	2575	1962/63
1964	.9676	299	2494	1963/64
1965	1.0020	560	2591	1964/65
1966	1.1314	108	2644	1965/66
1967	1.0855	237	2704	1966/67

[a/] Original monthly averages are (unpublished) Central Bank data; available from Prof. L. Mears' collection of data, identified as Table 19. These averages were then deflated by the Central Bank Consumer Price Index for Manila, adjusted to exclude rice; deflator available from Mears' data, Table 18. Then the deflated data were averaged, weighted by the 1956 Central Luzon harvest distribution, found in D.A. Maulit, "Palay Harvest and the Supply of Rice," The Philippine Statistician, 6:2 (June, 1957).

[b/] Data for 1956-1963 as revised and adopted by an Inter-Agency Committee of the government on March 31, 1965. Data for 1964-1966 from the Bureau of Census and Statistics, Foreign Trade Statistics of the Philippines, 1964-1965-1966. Available from Mears' data, Table 5.

[c/] From the Department of Agriculture and Natural Resources' Crop and Livestock Surveys (only 1955/56 to 1958/59 are published). The 1966/67 figure is the April 1, 1967 forecast. Available from Mears' data, Table 1.

1. Unanticipated shift in demand

In the competitive case, a rightward shift of demand must increase price if the demand and supply curves have the usual slopes. But if there are economies of scale in the industry, so that the supply curve slopes downward and is less steep than the demand curve[1/], then the demand shift will decrease price instead. This is one possible explanation for the price data recorded for 1960-1963.

In the case of monopoly, the addition to demand will decrease price if the monopolist is operating in the region where marginal cost is decreasing, if marginal cost is decreasing at a fast enough rate. This is another possible explanation.

2. Anticipated shift in demand

Theoretical explanations that require downward sloping cost curves or economies of scale find less credibility among economists than explanations that begin with upward sloping cost curves and no special economies of scale even though evidence supporting these assumptions is omitted. Explanations of the latter type are offered here.

[1/] This requires taking Marshall's rather than Hick's definition of stability.

If firms in the industry have upward sloping cost curves, it is possible for an *anticipated* upward shift in demand to decrease price when the industry is competitive but not when it is monopolized. Since this analysis is not of the usual type I will discuss both cases.

It seems reasonable to assume that retailers have been able to anticipate that certain years find heavy competition from government while others find almost no competition. First of all, government negotiations for imports are a public matter. Secondly, in the time span under study, one cannot help but note that 1961, 1963 and 1965 are all election years, and that for obvious reasons a party in power would have strong incentives to distribute large amounts of imported rice during such years, and weak incentives to do likewise during intervening years. Retailers may feel it to their advantage to withhold supplies from the market when competition from government is strong, and wait for better times.

A. The case of competition

Suppose that the firms anticipate that the price of their product in odd-numbered years will be P_1, and that the price in even-numbered years will be P_2, greater than P_1. Refer to these years as Year 1 and Year 2.

Let Q_1+Q_s be total output in Year 1.

Q_1 is sold in Year 1.

Q_s is stored for sale in Year 2.

Let Q_2 be output in Year 2, for simplicity assumed to be entirely sold in Year 2.

The marginal cost function, excluding storage, is assumed the same in both years: $MC(Q_1 + Q_s) = MC(Q_2)$. The marginal storage cost function (storage from Year 1 to Year 2) is $MS(Q_s)$. The corresponding total cost functions are C and S respectively.

Assume that the competitive retailer maximizes his profits over both years, and ignore the rate of interest so as to avoid the maximization of present value complication. The retailer thus maximizes

$$\pi = P_1Q_1 + P_2(Q_2 + Q_s) - C(Q_1 + Q_s) - S(Q_s) - C(Q_2)$$

with respect to Q_1, Q_2, and Q_s. Obtaining first order conditions,

$$\frac{\partial \pi}{\partial Q_1} = P_1 - C'(Q_1 + Q_s) = 0 \longrightarrow$$

$$\frac{\partial \pi}{\partial Q_2} = P_2 - C'(Q_2) = 0$$

$$\frac{\partial \pi}{\partial Q_s} = P_2 - C'(Q_1 + Q_s) - S'(Q_s) = 0$$

Where is the 2nd order condition?!!

The first condition equates P_1 to the marginal cost of producing Q_1 and Q_s together. This determines $Q_1 + Q_s$ at point E_1 in Fig. 1. The second condition clearly determines Q_2 at point E_2 in the diagram. The third condition equates P_2 to the sum of the marginal cost of producing $Q_1 + Q_s$ and the marginal cost of storing Q_s. Therefore $P_2 - P_1$ is the marginal storage cost at the retailer's optimum. In the diagram the marginal storage cost function is a straight line for the sake of simplicity. The distance E_1B is the optimal marginal storage cost, according to the third condition for profit maximization. Draw a line from point B parallel to $MS(Q_s)$ and ending where the distance O'A' equals the distance OA, i.e., shift the $MS(Q_s)$ curve upwards to a new axis with origin at point O'. Then point O' indicates the optimal level of Q_1 and the distance $O'E_1$ is the optimal level of Q_s.

In this model the retailer offers for sale the quantity CO' in Year 1 and the quantity $DE_2 + O'E_1$ in Year 2, because he anticipates $P_2 > P_1$. He offers less in Year 1 and more in Year 2 than if he had no such anticipation. We can take all possible (P_1^*, P_2^*) combinations that a retailer can anticipate, where for every combination P_2 is greater than P_1, say by a constant. For every P_1 in this list of combinations the model will determine Q_1 at a level less than that indicated by the intersection of

the P_1-price line and the marginal cost curve, and for every P_2 in the list of combinations the model will determine $Q_2 + Q_s$ at a level greater than that given by the intersection of the P_2-line and the marginal cost curve. This implies that the relevant supply curve for Year 1 will be to the left of and the relevant supply curve for Year 2 will be to the right of the curve given by the summation of the marginal production cost curves over all retailers.

In Fig. 2, the relevant Year 1 and Year 2 supply curves are S_1 and S_2 respectively; the demand curves are D_1 in Year 1 and D_2 in Year 2, since government participation decreases by assumption from Year 1 to Year 2. Since S, the ordinary supply curve in the absence of economies or diseconomies, must lie between S_1 and S_2, P_1 must be greater than and P_2 must be less than the corresponding prices that would hold in the absence of anticipations, namely P_1^* and P_2^* in the diagram. This conclusion also holds for the anticipations model in the case of monopoly (see next section). It may sometimes be -- and this depends on the position of the marginal storage cost curve -- that S_1 and S_2 are so far away from S that P_2, say, the non-election year price, will be less than P_1, say, the election year price. Fig. 2 illustrates this case, which, as the next section will show, will not be possible in the case of monopoly. This case is a third possible explanation for the 1960-1963 retail price data.

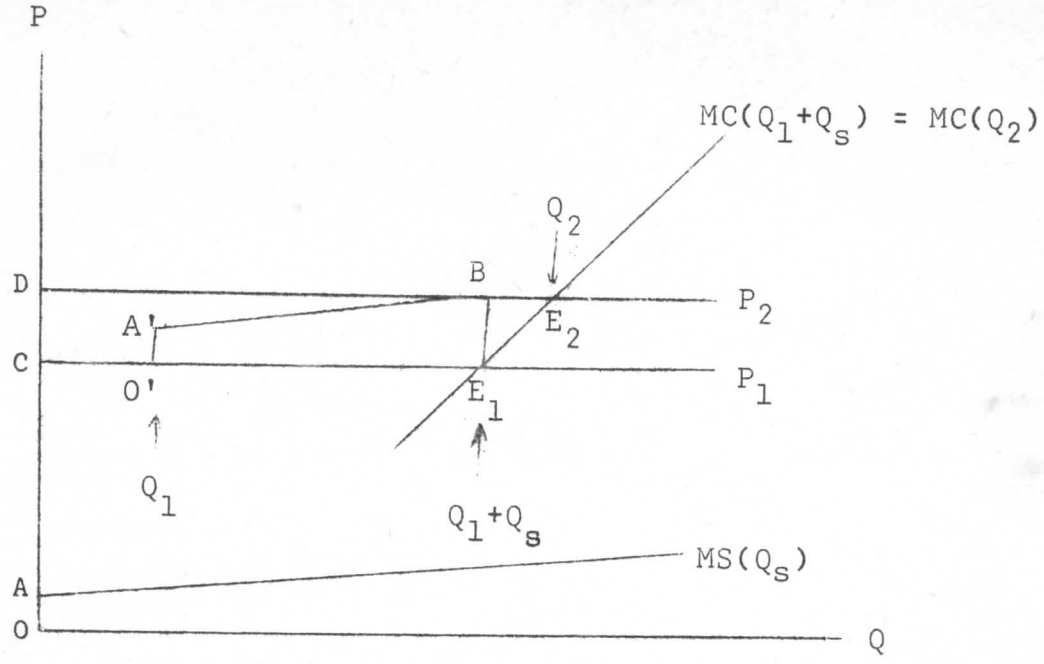

Fig. 1

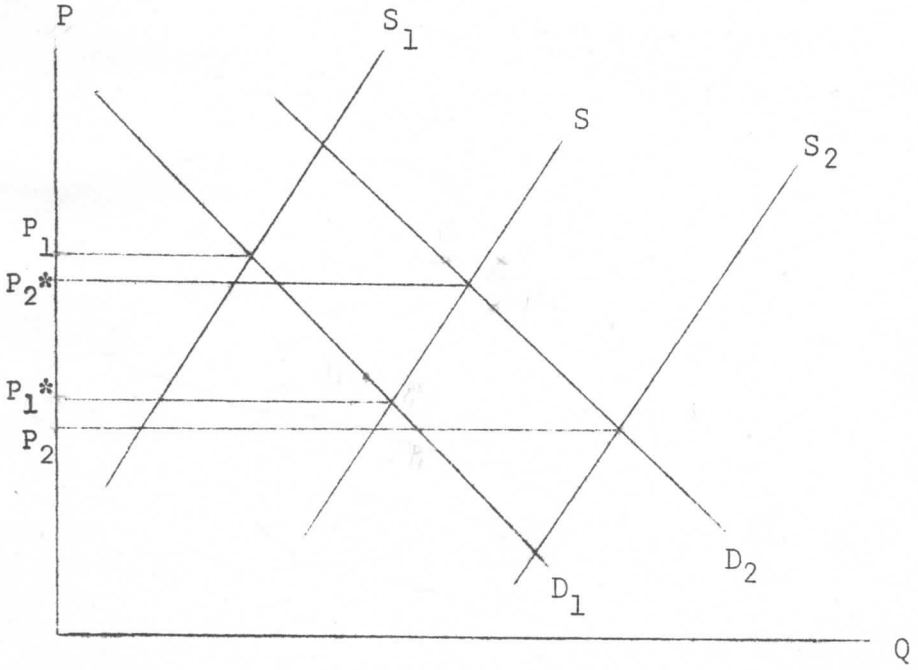

Fig. 2

B. The case of monopoly

Suppose there were a retail cartel instead, so that each retailer faces a downward sloping demand curve, his

It will always be true that P_2 will be greater than P_1, provided that marginal storage costs are positive. The first and third profit-maximization conditions can be combined to give

$$MR(Q_2+Q_s) = MR(Q_1) + MS(Q_s)$$

This implies that at the optimum point the level of marginal revenue must be greater in the second year than in the first. Since in the second year the demand curve facing a retailer is above and to the right of the demand curve in the first year, the price set in the second must be greater than in the first. This is true whether the marginal cost curve applicable to both years is upward or downward sloping. Intuitively, a monopolist or a cartel member who anticipates shifts in the degree of government participation in this two-year situation realizes that storing part of his produce in Year 1 for sale in Year 2 will decrease, cet. par., the price at which he can sell both his stored output and his Year 2 output. At the optimum point he will not store so much as to force himself to sell at P_2, less than P_1. Therefore, although this model does imply a weaker impact of imports on the current price level than the standard model, it does not explain the 1960-1963 price data.

A Test of the Anticipations Hypothesis, 1956-1967

The main implications of the anticipations models, both of competition and monopoly, is that competition from government in the rice retail market is less effective in lowering the current retail price level than would be expected using standard theory. The main difference between the cases of competition and monopoly is that the anticipations model in the former case allows instances in which the retail price is greater when imports are large than when they are small, whereas in the latter case it does not.

A test of the anticipations hypothesis has been made in the following manner. A competitive model allowing for the possible anticipations effect was specified:

(1) $M_t = \alpha_0 + \alpha_1 P_t + \alpha_2 t + u_{1t}$ Demand

(2) $M_t = \beta_0 + \beta_1 P_t + (1+\beta_2) I_t + \beta_3 Q_t + u_{2t}$ Supply

where M_t is the quantity marketed, P_t is the retail price level, t is time in years (proxy to account for population and real income growth), I_t is imports, Q_t is domestic output and the u's are stochastic error terms. Total supply is the sum of domestic and imported supplies; $\beta_2 \neq 0$ allows for I_t to have a possible effect on *domestic* supply. Under the anticipations model, $\beta_2 < 0$, making the coefficient of I_t in the supply function close to zero or even negative.

The reduced equation for P_t is

$$(3)\quad P_t = \text{Const.} + \frac{1+\beta_2}{\alpha_1-\beta_1} I_t + \frac{\beta_3}{\alpha_1-\beta_1} Q_t - \frac{\alpha_2}{\alpha_1-\beta_1} t + v_t$$

with I_t, Q_t and t all being exogenous from the viewpoint of the current price level. The denominators of their coefficients are all a priori negative, since α_1 is the demand price coefficient and β_1 the supply price coefficient. The a priori sign of the reduced coefficient of Q_t is therefore negative and that of t is positive.

The sign of the reduced coefficient of I_t is negative if the anticipations hypothesis ($\beta_2=0$) does not apply, and is either negative (but small) or positive if the hypothesis does apply. By an earlier argument, the sign may (not must) be positive if competition is the case but not if monopoly is the case. It must be admitted that the form of equation (3) in itself does not positively identify the model from which it sprung as either one of competition or one of monopoly. An estimated coefficient which is positive is evidence in favor of competition; one which is negative will not discriminate between competition and monopoly.

Using all the data in Table 1, altering the units of the variables a bit, a regression of P_t on I_t, Q_t, t and a constant term gives reasonably good fit:

$$(4) \quad P_t = 281.5 - \underset{(1.448)}{1.536}\, I_t - \underset{(2.767)}{9.735}\, Q_t + \underset{(1.757)}{7.727}\, t$$

$$R^2 = .811$$

Durbin-Watson statistic = 2.270[2/]

where P_t is in centavos/ganta,

I_t and Q_t are in units of 100,000 m. tons, and

t = 1 stands for 1956.

The coefficients of Q_t and t have the right signs and are significant at the 1% level; their partial correlation coefficients are -.78 and .84 respectively. The coefficient of I_t is negative but not significantly different from zero; neither is it significantly different from +1.0 at the 10% level, so a null hypothesis that it is positive cannot be rejected either. Its absolute size is small: an increase in importation by 200,000 m. tons implies a decrease in the retail price level of only about 3 centavos/ganta. Whereas an increase in domestic output by the same magnitude implies a decrease in the retail price level of about 19 centavos/ganta. The hypothesis that the true coefficients of I_t and Q_t are of equal size is rejected at the 1% level.

[2/] Critical values are available for $n \geq 15$. For $n < 15$, at the 5% level for three independent variables, $d_L = .82$ and $d_U = 1.75$. Judging from Durbin and Watson's graph of 5% values of d_L and d_U for $15 \leq n \leq 100$ (*Biometrika*, June 1951, p. 162), at $n = 12$ the hypothesis of no serial correlation may be accepted against an alternative of positive serial correlation; the test is inconclusive if the alternative hypothesis is that serial correlation is negative.

The regression equation predicts the direction of change of P_t correctly in all years but 1965. In this year of record-size imports, P_t 'ought' to have fallen from the 1964 level, but it did not.

The conclusion is that the regression gives firm support to the anticipations hypothesis: importations over 1956-67 have not had a significant effect on the retail price level. But there is no added evidence in favor of either the competition or monopoly variants, besides the data of 1960-1963.

Forecast of the average 1968 price level

A regression equation is more useful if it can predict future events as well as rationalize past ones. The current outlook on the rice industry is quite optimistic, and the possibility of exportation, rather than importation, is a major concern of government. Another policy government may be considering is indefinite storage of part of domestic production (to be interpreted here as a decrease in Q_t, the total current output available to the market), in the interest of farm price support. For both these policies some forecast of the net effect on the retail price level is required. This section treats a test of the consistency of equation (4) with partial data for 1968.

A preliminary estimate of Q_t for crop year 1967/68 is already available: Q_{13} = 2,821 thousand metric tons of milled rice.[3/] (Note that t = 13 refers to calendar year 1968 in the cases of P_t, I_t and t, and refers to crop year 1967/68 in the case of Q_t.) Since the government is exporting rice this calendar year, let us set $I_{13} = 0$ and bear in mind that the following forecast of the average 1968 price level is an *under*-estimate to the extent that I_{13} is in fact negative:

$$P_{13} = 281.53 - 1.536(0) - 9.735\ (28.21) + 7.727\ (13)$$

$$= 107.33 \text{ (centavos/ganta)}$$

Standard error of forecast = 6.839

The associated forecast interval, at the 95% level, is (91.56, 123.10). Since the measure of P_t is relative to the 1955 relative price level, the forecast and forecast interval need to be inflated by the same price index used to arrive at 1956-1967 values of P_t. The following table gives monthly values of the price index and non-deflated as well as deflated rice prices for the first half of 1968:

3/ April 1, 1968 forecast of the Bureau of Agricultural Economics; same source as output data in Table I.

Table 2

	Average undeflated retail price of Macan 2nd class in Manila during 1968.[a]	Central Bank Consumer Price Index (rice excluded)[a]	Average deflated retail price of Macan 2nd class in Manila during 1968
	Pesos/ganta	1955=100	Pesos/ganta
January	1.75	154.4	1.137
February	1.72	151.5	1.135
March	1.70	150.7	1.128
April	1.70	150.2	1.132
May	1.70	150.8	1.127
June	1.70	152.8	1.113

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[a] Same sources as in Table 1.

Assuming that the average 1968 price index level is 152, then the 1968 forecast in terms of current prices consists of (in pesos/ganta):

1.871 = upper bound of 95% interval

1.631 = point estimate

1.392 = lower bound of 95% interval

Judging from the data for the first six months of the year, the forecast is quite adequate. Current monthly prices are between the mid-point and the upper bound of the interval. However, it was expected beforehand that the midpoint would be biased downwards because the true value of I_{13} is negative and not zero. In addition, there are indications that the price level has not increased substantially in the past three months, although these have been traditionally months of seasonal scarcity.

The above forecast is based on the Bureau of Agricultural Economics' estimate of the 1967/68 national palay output at approximately 99 million cavans. The Bureau's estimate thus appears to be quite consistent with present price levels. It is interesting to compare the above forecast with those deriving from other estimates of the national palay output level:

(a) If palay output is 108 million cavans, then

$$Q_{13} = 30.84$$

$$P_{13} = 81.72 \quad \text{(centavos/ganta)}$$

Standard error of forecast = 8.971

In current price terms, using 152 again as the price index level, the 1968 forecast is (in pesos/ganta):

1.557 = upper bound of 95% interval

1.242 = point estimate

.928 = lower bound of 95% interval

(b) If palay output is 118 million cavans, then

Q_{13} = 33.70

P_{13} = 53.88 (centavos/ganta)

Standard error of forecast = 15.407

In current prices, the forecast is (in pesos/ganta):

1.359 = upper bound of 95% interval

.819 = point estimate

.279 = lower bound of 95% interval.

The latter two estimates of the palay output level give forecasts for 1968 that seem to be much too low, considering the evidence of the first six months of the year, i.e., the output estimates seem much too high. This suggests that the information problem currently facing makers of rice import/export policy may lie elsewhere than the estimate of rice production.

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