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THE EFFECT OF IMPORTATION ON THE PRICE OF RICE

by

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The Effect of Importation on the Price of Rice*

by

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-

*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>
<thead>
<tr>
<th>Calendar Year</th>
<th>Pesos/ganta</th>
<th>Thousand m. tons</th>
<th>Thousand m. tons</th>
<th>Crop Year</th>
</tr>
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<tbody>
<tr>
<td>1956</td>
<td>.8107</td>
<td>42</td>
<td>2125</td>
<td>1955/56</td>
</tr>
<tr>
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<td>.9406</td>
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<td>1967</td>
<td>1.0855</td>
<td>237</td>
<td>2704</td>
<td>1966/67</td>
</tr>
</tbody>
</table>

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 1936 Central Luzon harvest distribution, found in D.A. Maulit, "Paley Harvest and the Supply of Rice," The Philippine Statistician, 6:2 (June, 1957).


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, 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.

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

\[
\pi = P_1 Q_1 + P_2 (Q_2 + Q_s) - C(Q_1 + Q_s) - S(Q_s) - C(Q_2)
\]

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

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

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

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

Where are the 2nd order conditions?!
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 $0'A'$ equals the distance $OA$, i.e., shift the $MS(Q_s)$ curve upwards to a new axis with origin at point $0'$. Then point $0'$ indicates the optimal level of $Q_1$ and the distance $0'E_1$ is the optimal level of $Q_s$.

In this model the retailer offers for sale the quantity $CO'$ in Year 1 and the quantity $DE_2 + 0'E_1$ 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 intersec-
tion of the $P_2$-line and the marginal cost curve. This im-
plies 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 antici-
pations 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.
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

$$\text{MR}(Q_2 + Q_s) = \text{MR}(Q_1) + \text{MS}(Q_s)$$

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:

\[(1) \quad M_t = \alpha_0 + \alpha_1 F_t + \alpha_2 t + u_{1t} \quad \text{Demand}\]

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

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 $I_t$ on the supply function close to zero or even negative.
The reduced equation for $P_t$ is

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

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 $\alpha_1$ is the demand price coefficient and $\beta_1$ 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:
\[
\begin{align*}
(4) \quad P_t &= 281.5 - 1.536 I_t - 9.735 Q_t + 7.727 t \\
&\quad (1.446) \quad (2.767) \quad (1.757)
\end{align*}
\]

\[R^2 = .811\]
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.\footnote{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:

\[
P_{13} = 201.53 - 1.536(0) - 9.735 (28.21) + 7.727 (13)
\]

\[
= 107.33 \text{ (centavos/ganta)}
\]

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:

\footnote{3}{April 1, 1968 forecast of the Bureau of Agricultural Economics; same source as output data in Table I.}
Table 2

<table>
<thead>
<tr>
<th>Pesos/ganta</th>
<th>1955=100</th>
<th>Pesos/ganta</th>
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<td>1.75</td>
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</tr>
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<td>February</td>
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<td>151.5</td>
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<td>March</td>
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<td>1.70</td>
<td>150.2</td>
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<td>150.8</td>
</tr>
<tr>
<td>June</td>
<td>1.70</td>
<td>152.8</td>
</tr>
</tbody>
</table>

\(^a/\) 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

$$Q_{13} = 30.84$$

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

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

\[ Q_{13} = 33.70 \]
\[ P_{13} = 53.88 \text{ (centavos/ganta)} \]

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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