PN-ABG-220
ISN 12448

FAPRI
Food and Agricultural
Policy Research Institute

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by

William H. Meyers, Tesfaye Teklu, and S.R. Johnson

Policy Paper Proposal - CEAP Project in Indonesia

February 1986

Project Staff

S.R. Johnson, Professor of Economics
William H. Meyers, Professor of Economics
Helen Jensen, Assistant Professor of Economics
Tesfaye Teklu, Research Analyst
Mohammad Wardhani, Research Assistant

This report is part of a research project funded by the United States Agency for International Development, Bureau for Science and Technology, Office of Nutrition under the technical supervision of the Nutrition Economics Group, Office of International Cooperation and Development, United States Department of Agriculture.

Center for National Food and Agricultural Policy
Department of Agricultural Economics
University of Missouri-Columbia
Columbia, Missouri 65211
314-882-7458

CARD/Trade and Agricultural Policy
Department of Economics
Iowa State University
Ames, Iowa 50011
515-294-1183

The Impact of Rice Price Changes on Rural Income

As a result of domestic and international rice market conditions, rice prices have declined in Indonesia. It is clear that rural and urban consumers experience real income gains as a consequence of lower rice prices, but at the same time rice producers receive less income from the sale of rice. In order to determine the distributional impacts on producers of the decline in rice prices; production, consumption and marketing must be considered. For producers of rice there is both a direct income effect through the marketing receipts and a real income effect through the consumption expenditures.

We address the different aspects of this question sequentially in order to sort out the components of the income effect and suggest empirical methods to estimate the effects.

Estimating Real Income Effects With No Production Response

A rigorous approach to estimating the income effects of price changes is to use a complete demand system. Changes in relative prices affect real income level. The change in real income is stronger in economies where the bulk of the population has low income levels, and the commodity with a price change is dominant in expenditure patterns. Depending on the distribution of income among the population, the price change also has differential impacts on real income levels.

The adjustments in total expenditure per household reflects substitution and real income effects where no production is assumed. In case of farm households, however, the adjustment reflects production effect too. To illustrate the effects of these components, let us assume that there are n consumption foods. The demand for commodity i in expenditure form is

(1) $$\text{where } C_i = P_i(P_1, \ldots, P_n, Y)$$

where C_i is expenditure on commodity i, P_i is price of commodity i, and Y is total expenditure. Suppose the price effect is only through real income effect (no substitution and production effects). Then, the change in expenditure on commodity i due to a price change in j can be written as

$$(2) \qquad dC_i = -(C_i \alpha_j \eta_i) \frac{dP_j}{P_j} \qquad i = 1, \ldots, n$$

where C_i is expenditure on commodity i, α_j is a budget share of commodity j and η_i is expenditure elasticity of commodity i. The sum of the change in these n commodity expenditure measures the change in total expenditure due to the real income effect of change in relative price of commodity i, say rice.

Equation (2) does not allow substitution among these commodities. If both substitution and real income effects are taken into account, the change in expenditure for commodity i

$$(3) \qquad dC_i = C_i(\varepsilon_{ij} - \alpha_j \eta_i) \frac{dP_j}{P_j} \qquad i = 1, \ldots, n$$

where ε_{ij} is the compensated cross price elasticity. If commodity i is a normal good ($\eta_i > 0$), the change in expenditure would reinforce the result in equation (2).

In the case of households who produce and consume, the relative price change on income level also depends on quantity of commodity i marketed, i.e, quantity produced less home consumption. The change in expenditure level which incorporates the standard substitution and real income effects, and output response can be written as

$$(4) \qquad dC_i = C_i(\varepsilon_{ij} + k_j\eta_i)\frac{dP_j}{P_j} \qquad i = 1, \ldots, n$$

where k_j is the marketed share of commodity j. Farmers with positive market share are less sensitive to expenditure change as compared with farmers who are net purchasers, because lower expenditures tend to be offset by lower sales receipts.

The computations on Table 1 use the consumption equations estimated for the SURGARSAR data and apply the model with no substitution effects (equation 2). Rural and urban low income clearly get the greatest real income gain, because they are more dependent on rice. The urban high income group spends the largest share of the higher income on nonfood items and very little on the food budget on rice.

Estimating Total Income Effect For Farm Households

The total income effect is associated with the importance of marketing relative to consumption and production. Obviously, if production exceeds household consumption and the marketed quantity remains constant, marketing receipts will fall by the same proportion as the price. The percentage reduction in total income will depend upon the importance of rice marketing in total income. Similarly, if household consumption exceeds production and purchased quantity remains constant, expenditures on rice will fall by the same proportion as the price. The percentage reduction in total expenditures will depend upon the importance of rice purchases in total expenditures.

Suppose that production of the household is held constant but that consumption increases with declining rice prices and consequently marketed

surplus declines (or market purchases increase). In this case, even some producers who initially were net purchasers of rice will experience a direct income loss. Holding other prices and other income sources constant, it can be shown (see Appendix) that income increases as the rice price declines if the household purchases as a proportion of consumption are greater in absolute value than the price elasticity of demand.

(5) $$\frac{\text{Purchased Rice}}{\text{Rice Consumption}} > |e_d|$$

Suppose that a longer time horizon is assumed and production as well as consumption can respond to the price decline. Thus production declines, consumption increases, and marketed surplus declines (or market purchases increase) even more. Now the conditions for experiencing income gains are even more restricted. Holding other prices and other income sources constant, it can be shown (see Appendix) that income increases as the rice price declines if the household purchases as a proportion of consumption are greater in absolute value then $(e_d - e_s)/(1 + e_s)$ where e_d and e_s are the demand and supply elasticities, respectively.

(6) $$\frac{\text{Purchased Rice}}{\text{Rice Consumption}} > \frac{e_s - e_d}{1 + e_2}$$

Note that

$$\frac{e_s - e_d}{1 + e_s} > -e_d$$

if demand is inelastic.

A way to quickly approximate the size of a rice farm that would experience income gains in each of these cases is:

a. constant production and consumption

(7) $$\ell_1 < QC/y$$

b. constant production

(8) $$\ell_2 < QC(e_d + 1)/y$$

c. variable production and consumption

(9) $$\ell_3 < QC(e_d + 1)/y(1 + e_s)$$

where

ℓ = size of farm (ha)

QC = household consumption (Kg)

y = yield (Kg/ha)

e_d = price elasticity of demand

e_s = price elasticity of supply

Note that

(10) $$\ell_3 < \ell_2 < \ell_1$$

These are crude methods, but they demonstrate that being a net purchaser of rice does not assure that a producer will gain from lower rice prices. A way to quickly approximate the size of the income effect from this model is:

a. constant production and consumption

(11) $$\frac{dI_1}{I} = MS \frac{dPR}{PR}$$

b. constant production

$$\frac{dI_2}{I} = \frac{\frac{MS}{QC} - e_d}{\frac{I}{PR \cdot QC} + n} \frac{dPR}{PR} \tag{12}$$

c. variable production and consumption

$$\frac{dI_3}{I} = \frac{\frac{MS}{QC} + e_s \left(1 + \frac{MS}{QC}\right) - e_d}{\frac{I}{PR \cdot QC} + n} \frac{dPR}{PR} \tag{13}$$

where

n = income elasticity

QC = household consumption

MS = marketed surplus (negative, if net buyer)

The computations on Table 2 use the impact equations (12) and (13) to estimate the impact on farm households of a 10 percent fall in rice prices.

Table 1. Effect of a 10 percent fall in rice prices on commodity expenditures and income--Indonesia

	Rural	Urban		Mean Income
		Low Income	High Income	
Mean Household Expenditure (Rp)	8,814.21	12,344.00	24,727.00	14,702.51
Increase in Expenditure due to real income effect (Rp)				
Rice	28.14	24.74	5.34	6.38
Other cereals & roots	5.31	4.80	2.85	1.94
Beans	3.56	6.44	5.34	4.37
Fruits	6.56	9.65	11.63	7.56
Vegetables	11.50	17.08	7.71	9.17
Animal product	17.81	28.58	40.35	26.31
Fish	22.48	27.60	15.99	21.72
Fats & oils	5.73	7.31	4.63	4.08
Prepared foods	6.81	13.08	16.74	13.62
Sugar	5.95	6.42	2.61	2.92
Beverages	16.32	19.71	7.27	11.86
Other foods	3.92	4.15	3.44	2.71
Nonfoods	62.30	114.30	158.09	126.11
Total increment in expenditure	196.39	283.86	281.99	238.75
Percent increase in income	2.2	2.3	1.1	1.6

Table 2. Computation of percentage change in income due to a 10 percent fall in rice price under four hypothetical cases

	Case Marketed Surplus/Consumption			
	Buys All	Buys Half	Buys None	Sells Half
Assumptions				
MS/QC	-1.0	-0.5	0.0	0.5
QP/QC	0.0	0.5	1.0	1.5
Demand elasticity	-0.6	-0.6	-0.55	-0.5
Expenditure share (%)[a]	43.0	35.0	28.0	19.0
Income elasticity[b]	0.7	0.6	0.5	0.4
100 x dI_2/I (%)	1.3	-1.3	-1.3	-1.9
Supply Elasticity	0.3	0.3	0.3	0.3
100 x dI_3/I (%)	+1.3	-0.8	-2.1	-2.7

[a] See Teklu and Johnson, Report #3, Table B1.7, p.46.
[b] See Teklu and Johnson, Report #3, Table B2.2, P.50.
Adjustments for income level are assumed.

Appendix

Conceptual Model of Direct Price Effects

$QP = g(PR, PX)$	Production Response
$QC = f(PR, PO, I)$	Consumption
$MS = QP - QC$	Marketed Surplus
$I = PR \times MS + IO - CP$	

where

PR = rice price

PO = other price

I = total income

IO = income from nonrice sources

CP = cost of production

For QP constant

$$dI = \frac{MS_0 - f_1 PR_0}{1 + f_3 PR_0} dPR$$

$$dQC = \frac{f_1 + f_3 MS_0}{1 + f_3 PR_0} dPR$$

For QP and QC variable

$$dI = \frac{MS_0 + (g_1 - f_1) PR_0}{1 + f_3 PR_0} dPR$$

$$dQC = \frac{f_1 + f_3 MS_0 + f_3 g_1 PR_0}{1 + f_3 PR_0} dPR$$