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## **WELFARE EFFECTS OF GOVERNMENT INTERVENTION IN RICE MARKETING: CASE FOR SRI LANKA**

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### **ABSTRACT**

The fertilizer subsidy, producer price supports were the key short run policies for rice production in Sri Lanka. The removal of fertilizer subsidy results in a loss of producer and consumer welfare. The gain in producer and consumer welfare due to a change in producer price support for rice would be lesser than the loss through fertilizer subsidy. The increases in the value of food stamps have no significance on rice production in the country.

### **1. INTRODUCTION**

Rice in Sri Lanka is an important staple as it provides 45% calories and 40% of per capita daily food intake of an average Sri Lankan. Rice production employs 75-80% of the rural population and uses 33% of the cultivated acreage with an annual rate of growth of 2.5% (Central Bank of Sri Lanka, 1985). In view of the heavy imports of rice and feeding of nearly 50% of the low income food ration and food stamp recipients with subsidized rice the government invested heavily on physical infrastructure such as Mahaweli irrigation project in the dry zone of the country with the aim of self sufficiency in all food staples. Further to these long run developments, short term policies such as price support for rice, fertilizer subsidy for paddy production continued with the aim of stimulating the farm producers to increase rice output along existing production functions to overcome occasional rice shortages and high prices in the world market. Due to the change in the world energy prices and pressure from aid donor countries the fertilizer subsidy was withdrawn in mid 1989. However the producer price of rice was further increased and presently it serves as a major incentive for rice production in the country.

In the long run the food self sufficiency can be achieved by the improvements of the physical and institutional infrastructure such as irrigation and research-extension systems. As such investments require long gestation periods

and large investments the government opt to adopt short run policies such as price supports for farm products and subsidize inputs such as fertilizers. Under a competitive product and factor market government intervention in the form of supporting products and inputs results in a net loss to the economic welfare of the society (Barker and Hayami, 1976). The farm level of modern inputs such as fertilizer is much lower than the economic optimal levels due to factors such as lack of knowledge and risk aversion of the farmers. The subsidy of fertilizer which stimulates increase in its use in the rural farms may result in a net welfare gain to the society. The price support is likely to require more social cost than benefit because in addition to increasing fertilizer it will induce more additional inputs such as land and labor above their economic optimum. The objective of this study is to determine the welfare effects of government Intervention policies such as rice support and fertilizer subsidy in the rice market in Sri Lanka. This study follows the earlier work of Easter (1977), Lutz and Scandizzo (1980), Gerrard and Roe (1983) Gunawardena (1991), Chellaraj and Brorsen (1988) to determine the welfare effects of government intervention policies on cereal markets in the developing countries.

The sources of data collection for the study is in the second part of the paper. This is followed by a descriptions of the analytical model in part III. Results and discussion are presented in part IV and some conclusions are drawn in the final part of the paper,

## **II. SOURCES OF DATA**

This study is based on time series data collected from different government sources such as Central Bank of Sri Lanka, Department of Census and Statistics, Food Commissioners Department, Ministry of Agriculture and Sri Lanka Fertilizer Corporation, Sri Lanka Customs for the period of 1952-1988. The data collected included rice area cultivated, area harvested, production of-rice, input use, government purchases of rice, stocks of rice, imports, distribution of rice under consumer subsidies. open market ration, open market price and ration price of rice.

## **III. ANALYTICAL MODEL**

The analytical model consist of an econometric-simulation model for the evaluation of the rice market. The econometric model is as follows.

- i) Acreage Equation  
 $AC = f ( IR, R, MV, CR, A_{(t-1)}, Pf_{(t-1)} / Pr_{(t-1)} )$
- ii) Yield / ha Equation  
 $Y = f ( IR, R, MV, CR, Pr / Ps, D1 )$
- iii) Total production ( identity )  
 $Qs = AC \cdot Y$
- iv) Domestic Demand ( Open Market ) Equation  
 $QDr1 = f ( Pr1, I, POP, PW, CPI )$
- v) Domestic Demand ( Rice Ration and Food Stamps ) Equation  
 $QDr2 = f ( Pr2, GP / Qs, DPC, D2, FSV )$
- vi) Domestic Demand ( Seed Demand ) Equation  
 $QDr3 = f ( AC, Prs )$
- vii) Import Demand Equation  
 $QDr4 = f ( BP, Q / WR, GS, WPR / WPF )$
- viii) Rice Production in Thailand and Pakistan  
 $WR = f ( t )$
- ix) Government Stock Equation  
 $GS = f ( Qs, Pr, QDr4, QFI, GS_{(t-1)} )$
- x) Total Demand ( identity )  
 $Qd = QDr1 + QDr2 + QDr3 + QDr4$
- xi) Stock ( identity )  
 $Qs + GS_{(t-1)} + QDr4 = QDr1 + QDr2 + QDr3 + GS$
- xii) Demand-Supply ( Identity )  
 $Qs = Qd$

where,

AC = area planted in rice in hectares;  
 IR = extent of area planted in rice under irrigation;  
 R = amount of rainfall in millimetres;  
 MV = proportional area planted under modern varieties.  
 CR = amount of agricultural credit given for rice in rupees per hectare;  
 $A_{(t-1)}$  = lagged area planted under rice;  
 $Pf_{(t-1)} / Pr_{(t-1)}$  = ratio of lagged price of fertilizer to lagged price of rice;  
 Y = yield of rice in kilograms per hectare;  
 $Pr/Ps$  = ratio of price of paddy to price of subsidiary food crops;

D1 = dummy variable for season D1 = 1 for wet  
= 0 for dry;

Qs = total production of rice in metric tons;

QDr1 = quantity of open market rice consumed in metric tons;

Pr1 = price of open market rice in rupees per metric ton;

I = index of income;

POP = total population in thousands;

PW = domestic price of wheat flour in rupees per metric ton;

CPI = consumer price index in Colombo;

QDr2 = quantity of ration or food stamps rice consumed in metric tons;

Pr2 = price of ration or food stamps rice in rupees per metric ton;

GP/Qs = ratio of government purchase of rice to total production of rice ;

DPC = daily per capita calories of rice ;

FSV = food ration or food stamp value per household per month ;

D2 = dummy variable D2 = 1 for ration price, D2 = 0 for free rice ;

QDr3 = quantity of seed paddy issued to rice farmers in metric tons ;

Prs = price for seed paddy in rupees per metric ton ;

QDr4 = quantity of rice imports in metric ton ;

BP = balance of payments in rupees million ;

QS/WR = ratio of total production of rice to rice production in Thailand and Pakistan ;

WPR/WPF = ratio of world price of rice to world price of wheat flour ;

GS = ending government stocks of rice in metric tons ;

QFI = quantity of flour imports in metric tons ;

GS<sub>(t-1)</sub> = lagged ending government stocks of rice ;

t = time trend (t = 1952—1988).

The system of equations were specified linearly as it performed better than the other functional forms and estimated using three stage least squares. Hence if the errors were correlated across equations, the estimates, obtained would be asymptotically more efficient than in ordinary least squares (Kmenta, 1971). The analysis of the econometric simulation model for the study was done using Statistical Analysis System/Econometric Time Series (SAS/ETS, 1981) package in a main frame computer.

#### IV. RESULTS AND DISCUSSION

Table 1 shows the results of the econometric analysis. The structural estimates are accompanied by their standard errors and the elasticities at the means of the variables concerned.

The short run inelastic acreage and yield elasticities is a significant feature of the results. Similar results for individual crops have been reported by Askari and Cummings (1977); Bapna (1981); Bapna, Binswanger and Quizon (1984) ; and Bond (1983). The reason for short run inelastic agricultural production responses have long been recognised (Johnson- 1950). In the short run most factors of production are fixed (e. g. land, labor, capital). The only factors that can change are the variable inputs such as fertilizers and pesticides and they account for less than 15-30% of cost of production in rice. Krueger, Schiff and Valdez (1988) have shown that In many developing countries such as Sri Lanka indirect discrimination against agriculture through overvalued exchange rates and industrial protection is quantitatively more important than commodity specific direct policy interventions.

The low price elasticity in the acreage response function suggests the small incentive offered by the subsidized price of fertilizer to price support of rice to rice cultivation. This is further evident in the price elasticity of rice with respect to subsidiary food crops such as chillies, green gram, other pulses and ground nut in the yield function. The extrapolation of short run effects for policy changes of Individual crops over long run periods is a common mistake in policy analysis. The economic literature shows that the long run response of agriculture is large with higher prices showing slow migration out of rural areas and higher investment in agriculture. It will further depend on factors such as markets, roads, irrigation, infrastructure, education, research extension and health (Birkhaeuser, Evenson and Feder, 1988).

Irrigation is a significant factor affecting the yield and acreage response in rice production. Irrigation development have the main effects of shifting the production function and in Sri Lanka it requires large investment and long gestation periods for desired results. Easter (1977) indicated that canal irrigation- played a significant role in increasing production in the state of Orissa in India. The modern varieties of rice which are photoperiod insensitive, fertilizer responsive and short stature were highly adopted by rice farmers in

**Table 1. Regression Coefficients for Rice Marketing Equations, Sri Lanka**

$AC = 170791 + 191864 \text{ IR} + 130.1857 \text{ R} + 196.1364 \text{ MV}$			
(77835)	(43.136)	(73.624)	
[0.5834]		[0.0915]	
$+ 370.7158 \text{ CR} + 0.3971 \text{ A}_{t-1} - 0.0256 \text{ Pf}_{t-1} / \text{Pr}_{t-1}$			
(127.715)	(0.854)	(0.0106)	
[0.0439]		[0.0993]	
$R^2 = 0.74$			
$Y = 492.8023 + 427.6060 \text{ IR} + 0.4081 \text{ R} + 2.9878 \text{ MV}$			
(208.384)	(0.161)	(1.072)	
[0.3448]		[1.0980]	
$+ 0.1784 \text{ Pr} / \text{Ps} + 11.4659 \text{ D1}$			
(0.0641)	(3.939)		
[0.1790]		$R^2 = 0.69$	
$\text{QDr1} = 21052.9 - 0.9706 \text{ Pr1} + 3.7496 \text{ I} + 0.2006 \text{ POP}$			
(0.308)	(0.321)	(0.091)	
[0.2856]	[0.7490]	[1.2397]	
$+ 0.5127 \text{ PW} + 1.4799 \text{ CPI}$			
(0.224)	(2.473)		
[0.2991]	[0.1066]	$R^2 = 0.81$	
$\text{QDr2} = 29694 - 0.0047 \text{ Pr2} + 9089.46 \text{ GP} / \text{Qs}$			
(0.0366)	(1527.6)		
[0.019]	[0.6009]		
$+ 410,6050 \text{ DPC} - 10301.7 \text{ D2}$			
(135,732)	(8656.8)		
[0.4610]		$R^2 = 0.66$	

( Continued ) Table 1. Regression Coefficients for Rice Marketing Equations, Sri Lanka

$\text{QDr3} = 14765.1 + 0.3989 \text{ AC} - 0.0914 \text{ Prs}$		
(0.1726)	(0.0303)	
[0.2008]	[0.3349]	
		$R^2 = 0.57$
$\text{QDr4} = -1034656 + 107.143 \text{ BP} - 0.0988 \text{ Qs/WR} + 1.9000 \text{ GS}$		
(126,620)	(0.072)	(0.840)
[0.1931]	[0.0456]	[0.1933]
		$R^2 = 0.74$
$- 33.8166 \text{ WPR} / \text{WPF}$		
(12,3535)		
[0.2493]		
$\text{WR} = 4056942 + 1171.4089 \text{ T}$		
(20.2089)		$R^2 = 0.49$
$\text{GS} = 133666.2 - 0.0109 \text{ Pr} + 0.0361 \text{ QDr4} - 0.1241 \text{ QFI}$		
(0.012)	(0.0138)	(0.0524)
[0.1438]	[0.3901]	[0.5951]
$+ 0.2911 \text{ GS}$		
(0.262)	$t-1$	$R^2 = 0.63$

Note : Figures in parentheses are the standard errors and in brackets are the elasticities at the means of the variables concerned.

\* Significant at 5% level;

\*\* Significant at 1% level.

the country for their greater yielding potential as compared to the local varieties. However the adoption of modern varieties have resulted in instability of grain production in the developing countries (Barker, Gabler and Winkelman, 1981; Hazell, 1982; Walker, 1984). Jansen, Walker and Barker (1990) highlighted the importance of regionally directed crop improvement research (e. g. modern varieties) to reduce crop yield instability in India.

In the demand equations all the coefficients have the expected signs. The price elasticities of open market rice (0.2856), rice ration or food stamp rice (0.019) were inelastic. The cross price elasticity, between the open market rice and wheat flour is positive and inelastic (0.2991). The higher the government purchase of rice from the domestic producers, more rice would be available for distribution under the food ration or food subsidy scheme. The quantity of rice imports to the country will significantly depend on the world price of rice to that of wheat flour and government purchases of rice from the farmers. The surplus of rice in the rice exporting countries such as Thailand and Pakistan (to Sri Lanka) would further enhance the rice imports. The government stocks of rice may significantly affect rice imports. The absence of data on private stocks of rice available among the private wholesalers and retailers in the country seriously affected the further evaluation of rice stocks on the rice demand equations. The increase of wheat flour imports would reduce the government stocks of rice.

### **Welfare Analysis**

As the equations used in the analysis were nonlinear the standard matrix inversion cannot be applied to solve the model (Johnston, 1972). Hence they were used in a dynamic simulation model to assess the impact of producer price supports, fertilizer subsidy and consumer subsidy of rice. The Newton's procedure were used to obtain the dynamic simulation of the rice model. A simulation is initiated by changing an exogenous variable in the system of equations by a fixed amount. The simulation procedure traces the effect of the changes of the exogenous variables on all the endogenous variables in the system. Two simulations namely the base and policy simulations were made for a simulated period of 5 years. In the base simulation the exogenous variables (producer price of rice, fertilizer price and price of ration rice) were fixed at their 1983 values.

In the policy simulation the following basic change of the policies were made. These included increase of producer price of rice from rupees 5.256.70 per killogram (27% increase) ; removal of fertilizer subsidy of 150% to increase the fertilizer price to rupees 8.50 per killogram and to increase the stamp fees from rupees 300-700 per month per household. These changes were on the basis of the policy changes made by the government between

1978-85. The values of the endogenous variables were reestimated using the same procedure. The differences in the values of base and policy simulations were compared and were used in measuring changes in producer and consumer surpluses by method of numerical integration (Just and Heuth 1979, Tweeten, 1985 ; Tweeten, 1989). The results are presented below.

Tables 2-4 show the changes in the endogenous variables in the system due to removal of fertilizer subsidy, increase in producer price of rice and increase in the value of food stamps to the recipients. The results indicated that the removal of subsidy would decrease the yield per hectare by nearly 7% within 5 years of the simulation. The change in extent cultivated under rice would be 3%. The quantity of rice consumed in the open market

**Table 2. Change in the Base and Policy Simulations due to Removal of Fertilizer Subsidy**

Year	Y	AC	QDr 1	QDr 2	QDr 3	QDr 4	GS
0	97.7	617	901	609	93	764	110
1	93.9	609	879	594	91	776	108
2	91.9	602	874	591	91	792	108
3	90.7	597	871	591	91	796	108
4	90.7	597	871	591	91	797	108
5	83.2	597	871	591	91	797	108

**Table 3. Change in the Base and Policy Simulations due to Increase in Producer Price of Rice**

Year	Y	AC	QDr 1	QDr 2	QDr 3	QDr 4	GS
0	117.8	484	201	118	31	105	89
1	119.6	491	206	121	33	104	92
2	121.4	492	207	123	33	102	92
3	122.9	492	207	123	33	101	92
4	122.9	492	207	123	33	101	92

would reduce by 3.3% as compared to 2.9% of ration or food stamp rice. The quantity of rice imports would increase by 4.4% partly to compensate for the loss in domestic production. The government purchases of rice would fall by 1.8% due to change in fertilizer policy.

The change in producer price of rice would increase in an increase of the yield per hectare by 4.3% and the area cultivated under rice would increase by 1.7% within the simulation period. The consumption of open market rice would increase by nearly 2.9% as compared to 4.2% of ration or food stamp rice. The rice imports would decrease by 3.8% and the government stocks of rice would increase by 3.3% due to increase of domestic production.

The impact of higher food stamp value would have no benefit on the domestic production of rice in the country. The open market rice and ration rice consumption on the other hand would increase by 1.2% and 2.1% respectively due to increase of rice imports by 2.8%.

The formula adopted for the measurement of producer and consumer welfare was adopted from Barker and Hayami (1976) and Tweeten (1985). Table 5 shows the changes in producer surplus, consumer surplus and the economic welfare to the society due to changes of policy. The reduction of fertilizer subsidy would result in a loss to the producers as well as to the consumers resulting in an economic loss to the society. The loss in the producer surplus is higher than that of consumers as the loss in domestic production is partly compensated by the gain in imports of rice. The increase in producer price

**Table 4. Change in the Base and Policy Simulations due to Increase in Food Stamp Value of Food Stamp Holders**

Year	Y	AC	QDr 1	QDr 2	QDr 3	QDr 4	GS
0	79	120	81	97	11	105	77
1	79	120	83	98	11	107	76
2	79	120	82	99	11	108	76
4	79	120	82	99	11	108	76
5	79	120	82	99	11	108	76

**Table 5. Changes in Producer and Consumer Surplus due to Changes in Government Policy ( '100 million rupees )**

Policy	Change in Producer Surplus	Change in Consumer surplus	Change in Economic Welfare to the Society
Removal of fertilizer subsidy of rice	-2.91	-0,22	-3,13
Increase of producer price of rice	1,71	0,31	2,02
Increase of food stamps value	—	0,27	0,27

of rice results in a gain of producer surplus as well as consumer surplus due to gain in domestic production. The increase in food stamp value would increase the consumer welfare slightly,

#### V. CONCLUSIONS

Rice is the main staple food in Sri Lanka. In addition to the long term policy measures such as irrigation development, research and extension, short run policies such as producer price support, fertilizer subsidy for rice were operational in the country for the past decade. The rice ration which was substituted with food stamp scheme in the late 1970's continues to be a consumer welfare measure in the country serving the low income sector of the rural and urban population. This study evaluated some of the recent policy changes in price support of rice, fertilizer subsidy and food stamp scheme adopted by the government through a econometric simulation model. The results indicated that the removal of the fertilizer subsidy would result in a loss of producer surplus and consumer welfare of rice. The loss in the welfare to the society by this policy measure is greater than the gain through increase in producer price support of rice. Hence the introduction of the fertilizer subsidy for rice farmers needed to be reconsidered to increase and stabilize the rice production while adjusting the producer price supports to equate with the changes in marginal cost of production of rice at all times. The increase of food stamp value do not have an impact on the rice production in the

country. However this policy benefits a large number of low income rural, urban landless population in the country. It is an indirect income enhancement scheme for the subsistence rice producers in the country. Further research in the food stamp scheme need to be done prior to a policy change.

### References

- Askari, H. and Cummings, J. T. (1977) "Estimating Agricultural Supply Response with the Nerlove Model: A Survey. *International Economic Review* 18 (June) : 257-92.
- Bapna, S. L. (1981). *Aggregate Supply Response of Crops in a Developing Region*. New Delhi : Sultan Chand and Sons.
- Bapna, S. L., Binswanger, H. P., and Quizon, J. B. (1984). "Systems of output supply and factor demand equations for semitropical India., *Indian Journal of Agricultural Economics*, 39(2), 179-202.
- Barker, R. and Hayami, Y. (1976). "Price support versus input subsidy for food self-sufficiency in developing countries", *American Journal of Agricultural Economics*, 617-628.
- Barker, R., Gabler, E. C, and Winkelman, D. (1981). Longterm Consequences of Technological Changes in Crop Yield Stability in A. Valdes (ed.), *The Case of Cereal Grain in Food Security for Developing Countries*, Westview Press, Boulder.
- Birkhaeuser, D., Evenson, R. E., and Feder, G. (1988). "The economic impact of agricultural extension. A review." New Haven.; Yale University. Processed.
- Bond, M. E. (1983), "Agricultural responses to prices in Sub-Saharan Africa." *International Monetary Fund Staff Papers*, 30 (4), 703-26.
- Chellareaj, G. and Brorsen, B. W. (1988). "An evaluation of Indian government rice policy in Tamil Nadu.", *Agricultural Economics*, 1 (4), 355-364.
- Central Bank of Sri Lanka. (1985), *Review of the Economy*, Colombo
- Easter, K. W. (1977). "Improving village irrigation system : An example from India", *Land Economics*, 53, 56-66.
- Gerrad, C. D. and Roe, T. L. (1983). "Government Intervention in food grain markets : An econometric study in Tanzania.", *Journal of Development Economics*, 12, 109-32.
- Gunawardena, P. J. and Oczkowski. (1991). "Government Policies and Supply Response in the Paddy Sector of Sri Lanka", Paper presented at the 35th Annual Conference of the Australian Agricultural Economics Society, University of New England, Australia, 12-14 February.
- Hazell, P. B. R. (1982), "Instability in cereal grain production.", Research report No. 30, International Food Research Institute, Washington.
- Jansen, H. G. P., Walker, S. T., and Barker, R. (1990). "Adoption ceilings and modern coarse cereal cultivars in India.", *American Journal of Agricultural Economics*, 72 (3), 653-663.
- Johnson, D. G. (1950), "The nature of the supply functions for agricultural products.", *American Economic Review*, 40 (4), 539-64.

- Johnston, J (1972), *Econometric Methods*, McGraw Hill, New York.
- Just, R. and Heuth, D. L. (1979), "Welfare measures in multimarket framework.", *American Economic Review*, 69, 947-954.
- Kmenta, J. (1971), *Elements of Econometrics*, Macmillan, New York.
- Krueger, A. O., Schiff, M., and Valde's, A. (1988). "Agricultural incentives in developing countries : Measuring the effect of sectoral and economywide policies.", *World Bank Economic Review*, 2(3), 555-71.
- Lutz, E. and Scandizzo, P.L. (1980). "Price distortions in developing countries.", *European Review of Agricultural Economics* 7(1), 1-27.
- Tweeten, L (1985), "Introduction to agricultural policy analysis : The distribution of economic costs and benefits from market intervention. Paper B-5, Department of Agricultural Economics, Oklahoma State University, Stillwater.
- Tweeten, L (1989), *Farm Policy Analysis*, Westview Press, Boulder.