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Welfare Analysis of Rice Trade Under WTO Regime: A Case Study of Pakistan

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Abstract: Rice is highly valued cash crop and earns substantial foreign exchange for the country. The stable growth of rice production has helped Pakistan meet domestic demand and have surplus for export. To find out the impact of the trade liberalization on basmati and non-basmati rice, the data for last 24 years was analyzed. It was assumed that world price of rice would increase by 7%. The results showed that wholesale and farm gate prices of basmati rice would increase by 7.26 and 7.53%, respectively, whereas, the wholesale and farm gate price for non-basmati rice is anticipated to increase by 7.35 and 6.75%, respectively. These price signals could lead to positive price incentives for farmers to increase production, which is estimated to expand by 2.50 and 1.37% for basmati and non-basmati rice respectively. Increased production would generate a producer surplus of Rs. 3150 million and Rs. 798 million for basmati and non-basmati rice respectively. Thus increase in wholesale price and resulting decrease in quantity demanded would have caused a loss in consumer surplus of Rs. 2986 million for basmati and Rs. 787 million for non-basmati rice. This loss in consumer surplus will be offset by the gain in the producer surplus. The overall gain to the economy was found positive by the margin of 175 million.

INTRODUCTION

Pakistan is an agrarian based developing country and like many other developing countries, its agriculture sector is subject to domestic forces of demand and supply and changes in price at international level as well. More specifically, in the late 1990s, the World Trade Organization (WTO) emerged as one of the major players affecting such market changes more vigorously at international arena. The WTO's Agreement on Agriculture, which was established as a result of the Uruguay Rounds (UR) of Talks, requires, for both developed and developing countries to initiate a process of reforms in their agrarian economics with the objective of establishing a fair and market oriented agricultural trading system through multilateral trade negotiation. This Agreement on Agriculture (AoA) specifically asks for major reductions in export subsidies, domestic support and import barriers on agricultural products to achieve this objective[1].

Agricultural trade liberalization is also taking place in the context of several Regional Trading Agreements. Many countries of the region have liberalized their agriculture sectors by eliminating or reducing input subsidies, removing or reducing guaranteed producer prices, reducing the number of subsidized commodities and liberalizing the exchange rate and the trade regime[2].

Rice is a highly valued cash crop that earns substantial exchange for the country. It accounts for 5.7% value added in agriculture and 1.3% to GDP[3]. Rice has two distinct varieties. IRRI is a short duration variety and Basmati rice is a long duration variety. Basmati rice accounts for 63% whereas, IRRI rice for the remaining 37% of total rice area in Pakistan. Pakistan is one of the ten exporting countries that dominate world rice trade. Two stylized facts are always listed in characterizing the rice world market. First, the market is thin in the sense that the ratio of exports to production is smaller than for other grains. Second the market is segmented by type and quality[4].

About 28 million tons of rice (6% of total production) is traded across international borders each year. Pakistan is one of the ten exporting countries that dominate world rice trade and has exported around 2 million tons in 2003 that is 7 % of the world total export as indicated in Table 1[5]. The stable growth of rice production has helped Pakistan meet increasing domestic demand and have surplus for export. Rice export on the average increased over the last two decades. Government intervention in rice production and marketing was eliminated in mid-1990s and no paddy intervention purchases by PASSCO have been reported since then. Minimum producer prices are announced every year for indicative purpose[6]. Trade liberalization is having a profound impact on the

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Table 1: Production, consumption, imports and exports of selected countries

Country	Production (million tons)		Consumption (million tons)		Imports (million tons)		Exports (million tons)	
	2002-03	2003-04	2002-03	2003-04	2002	2003	2002	2003
China	122.18	112.46	134.80	135.00	0.54	0.37	1.96	2.58
India	71.82	88.28	79.86	85.38	-----	----	6.65	4.42
Thailand	17.20	18.01	9.46	9.47	----	----	7.25	7.55
Bangladesh	25.19	26.15	26.10	26.40	0.31	1.11	----	----
Pakistan	4.48	4.84	2.65	2.70	----	----	1.60	1.96
Japan	8.09	7.09	8.74	8.36	0.62	0.65	----	----
Indonesia	33.41	35.02	36.50	36.00	3.50	2.75	----	----
United States	6.54	6.42	3.53	3.66	0.42	0.46	3.30	3.83
World Total	377.22	391.19	406.39	414.95	27.81	27.55	27.81	27.55

Source: USDA/ERS Rice Yearbook[5]

international rice market because rice market has been highly protected in both industrialized and developing countries[7].

The major types of distortions in the world rice market are import tariffs and tariff rate quotas in key importing countries and price support in key exporting countries. Global trade weighted average rice tariffs in 2000 for medium and short grain rice were 217% compared to 21% for long grain rice[7]. Increased market access has been the most significant impact of the Uruguay Round (UR) of Agreement on Agriculture for rice, following the implementation of minimum access commitments for Japan and South Korea.

Given this background, our questions are: has the WTO agreement had any impacts on rice supply, demand and prices of Pakistani rice and if so, what have those impacts been? To answer these questions we have formulated following objectives.

To evaluate the price transmission elasticities in order to measure the effect on domestic prices of rice resulting from change in international prices following the implementation of AoA.

To measure price elasticity coefficients for demand and supply of rice for forecasting the likely impact of trade liberalization on domestic production and consumption of rice at national level.

To examine the extent of benefits and losses to be gained by Pakistan as a result of trade liberalization with special reference to rice.

MATERIALS AND METHODS

In evaluating the quantitative effects of liberalization on rice, following functions were estimated i.e., domestic demand and supply functions and two price linkage equations. Secondary data published by ministry of food, agriculture and livestock, Finance division and Pakistan and Agricultural Prices Commission was used for estimation purpose. Nominal prices were used for the analysis purpose. The equations were estimated through double log standard regression analysis.

On the basis of demand theory, demand of rice in Pakistan is the function of rice own price, prices of the substitutes and complementary products and per capita income[8]. For the study most important factor that is commodity's own price was used. Per capita income was dropped from the function as it was reported to be insignificant in explaining variation in per capita consumption[9].

$$Qd_r = f\left(Pm_{dr}, I\right) \quad (1)$$

$$Ed_r = \frac{(\%\delta Qd_r)}{(\%\delta Pm_r)} \quad (2)$$

The supply response of rice can be assumed to be a function of own output price, prices of all other relevant crops, prices of inputs and technology[10]. The supply function estimated was in the form of:

$$Qs_r = f\left(Pf_r, T\right) \quad (3)$$

$$Es_r = \frac{(\%\delta Qs_r)}{(\%\delta Pf_r)} \quad (4)$$

In order to develop the relationship between world and domestic prices and between the wholesale and farm level prices the price linkage equations were estimated. The price linkage equations were of the form:

$$Pm_{dr} = Pw_r + Tariff + Transfer\,\cos t \quad (5)$$

$$Pf_r = \alpha + \beta Pm_r \quad (6)$$

$$Et_m = \frac{(\%\delta Pm_{dr})}{(\%\delta Pw_r)} \quad (7)$$

In order to determine the benefits and losses to be gained by Pakistan as a result of trade liberalization, the welfare analysis was done. Consumer and producer surplus were calculated by using following formulas:

$$Consumer\,surplus = \left(P_{rb} - P_{rt}\right)\left[D_r^t + (D_r - D_r^t)\right] * 0.5 \quad (8)$$

$$Pr\,oducer\,surplus = \left(P_{rb} - P_{rt}\right)\left[S_r + (S_r^t - S_r)\right] * 0.5 \quad (9)$$

Net gain = Producer surplus - Consumer surplus   (10)

Where:

Qd_r	=	Total quantity demanded of rice
Pm_{dr}	=	Domestic market price of rice
I	=	Income
Ed_r	=	Demand elasticity
Qs_r	=	Total quantity supplied of rice
Pf_r	=	Farm gate price of rice
T	=	Trend (years as proxy for technology)
Es_r	=	Supply elasticity of rice with respect to its price
Pw_r	=	World market price of rice
β	=	Farm gate price transmission elasticity of rice
Et_m	=	Market price transmission elasticity of rice with respect to its world price
P_{rb}	=	Price of rice in base year
P_{rt}	=	Price of rice after trade liberalization
D_r	=	Quantity demanded of rice in the base year
D_r^t	=	Quantity demanded of rice after trade liberalization
S_r	=	Quantity supplied of rice in the base year
S_r^t	=	Quantity supplied of rice after trade liberalization

RESULTS AND DISCUSSION

In order to determine the impact of trade liberalization on domestic prices, production and consumption of rice, the equations specified in the previous section were estimated using the relevant data for the period 1980-2003. Using the FAO's study on Impact of Uruguay Round on Agriculture, 1995; it was assumed that the international price of rice would increase by 7% at world level. Different price elasticity coefficients were then used to estimate this projected increase in price on rice at national level. The estimated equations were as follow:

Estimated equations for basmati rice
Estimated domestic demand equation for basmati rice

$$L_nRCON = 3.417 - 0.220\,L_nRPR$$

(1.716)** (-0.908) *
$R^2 = 0.72$ $E_{dr} = -0.22$ DW = 2.32

Estimated domestic supply equation for basmati rice[11]

$$L_nRPROD = 4.889 + 0.181\,L_nFPR + 0.051TR$$

(4.29)***   (1.17)**   (2.33)

$R^2 = 0.96$ $E_{dw} = 0.181$ DW = 2.08

Price linkage equations
Wholesale price of rice at Lahore verses export price of basmati rice

$$L_nRPR = -1.912 + 1.037\,L_nIPR$$

(-0.83)   (11.02)***
$R^2 = 0.93$ $E_{wbr} = 1.037$ DW = 1.51

Price of wheat received by farmers verses wholesale price of basmati rice at Lahore

$$L_nFPR = 1.880 + 1.126\,L_nRPR$$

(-4.14)***   (22.79)***
$R^2 = 0.97$ $E_{fbr} = 1.126$ DW = 1.91

Estimated equations for non-basmati rice
Estimated domestic demand equation for non-basmati rice

$$L_nRCON = -0.611 - 0.133\,L_nRPR + 1.115\,L_nPCI$$

(-.84)   (-0.41)**   (1.11)***
$R^2 = 0.35$ $E_{dnbr} = -0.133$ DW = 2.05

Estimated domestic supply equation for non-basmati rice[11]

$$L_nRPROD = 2.304 + 0.798\,L_nFPR - 0.067TR$$

(2.79)***   (6.53)**   (-6.14)***
$R^2 = 0.48$ $E_{dnbr} = 0.798$ DW = 2.01

Price linkage equations
Wholesale price of rice at Lahore verses export price of non-basmati rice

$$L_nRPR = -0.480 + 1.050\,L_nIPR$$

(-0.767)   (14.55)***
$R^2 = 0.94$ $E_{wnbr} = 1.05$ DW = 2.06

Price of wheat received by farmers verses wholesale price of basmati rice at Lahore

$$L_nFPR = 0.111 + 0.918\,L_nRPR$$

(0.17)   (13.04)***
$R^2 = 0.97$ $E_{fnbr} = 0.918$ DW = 2.01

Where:

L_nRCON = Natural log of per capita rice consumption (kg/year)

L_nRPR = Natural log of wholesale price of rice at Lahore market

L_nPCI = Natural log of per capita income

TR = Trend (years as proxy for technology)

L_nRPROD = Natural log of basmati and non basmati rice production in thousand of tones.

L_nFPR = Natural log of farm gate price of basmati and non basmati rice in Rs./tones

L_nIPR = Natural log of international price of basmati and non basmati rice (f.o.b, Karachi) in Rs./tones.

The estimated parameters are consistent across the equations. The price coefficient in demand equation, although, has negative sign but insignificant in explaining the variation in demand. The reason may be the lack of consistent time series data on consumption of rice. Cornelisse and Naqvi[12] have mentioned that a consistent time series data of directly observed volume of food grain consumption is not available in Pakistan. Price transmission, demand and supply elasticities for rice are given in Table 2.

The elasticity of price transmission of wholesale price of basmati rice with respect to international price of basmati rice is 1.037. Thus expected 7% increase in international price of rice[13] due to trade liberalization, would increase wholesale price by 7.26% in Pakistan. Thus Rs. 23702 ton^{-1} wholesale price of basmati rice in 2003, which was taken as a base year, would become Rs. 25639 ton^{-1} after trade liberalization at current market price. Whereas, price transmission elasticity of farm gate price with respect to wholesale price, is 1.126. Since wholesale price is expected to increase by 7.26% under total liberalization, farm gate price to be received by farmers in Pakistan is expected to increase by 7.53% that is from Rs. 15063 ton^{-1} to Rs. 16294 ton^{-1}.

The price elasticity of demand for basmati and non basmati rice for food was calculated as -0.220 -0.133, respectively. It shows that one percent increase in rice price will cause 0.22 and 0.133% decrease in rice consumption of both types of rice respectively. Under a totally liberalized regime in rice sector on the world level, wholesale price would increase by 7.26% in case of basmati rice. Thus with a demand elasticity estimate of

Table 2: Demand, supply and price transmission elasticities for basmati and non-basmati rice

Categories	Elasticity coefficients for basmati rice	Elasticity coefficients for non-basmati rice
Domestic Demand elasticity	-0.22	-0.133
Domestic Supply elasticity	0.181	0.798
Wholesale price transmission elasticity	1.037	1.050
Farm gate price transmission elasticity	1.126	0.918

-0.122, domestic consumption is expected to fall by 1.60% that is from 2650 thousand tones to 2608 thousand tones. Loss in consumer surplus due to higher prices paid by them, calculated by equation 10 would be Rs. 2986 million at current market price.

The supply elasticity of rice with respect to its farm gate price was found to be 0.181. The elasticity coefficient indicates that if price of basmati rice goes up by one percent, the production of basmati rice goes up by 0.181%. As such a 7.53% increase in farm price would increase basmati rice production by 1.36 % that is from 2522 thousand tones to 2559 thousand tones. This increase in production would generate a producer surplus of Rs. 3150 million. However, the net impact to Pakistan is positive (161 million).

Impact on non-basmati rice of domestic prices: The wholesale price transmission elasticity of non-basmati rice with respect to international price is 1.050. A projected 7% increase in international price would raise the wholesale price by 7.35%. In monetary terms the wholesale price would change from Rs. 10747 ton^{-1} to 11537 ton^{-1} at current market prices.

The price transmission elasticity for farm gate price with respect to wholesale price was found to be 0.918. Thus, 7.35% increase in wholesale price would increase farm gate price by 6.75% from 6020 to 6420 ton^{-1}.

The price elasticity associated with the demand of non-basmati rice was computed as -0.133. Overall, the implementation of the UR is estimated to bring about 7.35% increases in wholesale price of non-basmati rice. Based on the relative inelastic demand elasticity of 0.133, consumption is expected to drop by 0.98% only that is from 1002 thousand tons to 991 thousand tons. Loss in consumer surplus resulting from increased prices was found to be Rs. 787 millions.

From the estimation of supply equation, the supply response of non-basmati rice to an increase in farm gate price was found to be 0.798. Farm gate price calculated from price transmission elasticity is likely to increase by 6.75% under free market conditions. This will boost the production of non-basmati rice by 5.40% that is from 1901 thousand tons to 2028 thousand tons and would generate a producer surplus of Rs. 798 million. The loss in consumer surplus would almost be balanced out by gains in producer surplus and net gain to the society is of Rs. 11 million in case of non-basmati rice.

CONCLUSIONS

From the present study it can be concluded that domestic prices are expected to be higher than they would have been in the absence of UR. Such increase, on domestic level, would increase the production, whereas,

on the world level would mean higher prices for rice export. The effect on consumption of rice would be relatively small mainly due to basic necessity of life and rising trend in diversified food consumption. Loss in consumer surplus resulting from having to pay a higher price by consumer can be completely compensated by gain in producer surplus.

In conclusion it may be said that membership in WTO is not a magic formula that will abruptly bring only positive aspects to Pakistan. However, globalization trend in the coming years suggests the need for a critical review of Pakistan's agricultural policies and it is understood that with right policies and right reforms, necessary environment for improved and sustained economic performance will be at hand.

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