A Policy Model of the Wheat and Rice Economy of Pakistan

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1. INTRODUCTION

Consumption of wheat and rice in Pakistan grows vigorously. The causes are well-known: (i) population growth, officially estimated at about three percent per year, is very high and, (ii) at low levels of income per head the income elasticities of wheat and rice consumption are still positive.[1] Clearly, in order to achieve or maintain self-sufficiency in wheat and rice, domestic production of these products has to increase, at least at the same pace as consumption. When viewing the production performance of recent years in this light there is reason for satisfaction. Volumes of wheat imports, expressed as a percentage of domestic production, have tended to fall over the past ten to fifteen years, while rice exports have increased to, and then stabilized around, a level of one million tons per year.

The favourable development in the domestic supply of wheat and rice has called forth a new situation and, concomitant with it, the possible need for a policy adaptation. In this connection a few questions arise naturally. With regard to wheat, such a question is, for example, whether it will be possible for Pakistan to become fully self-sufficient under the prevailing policies. If the answer to this question is negative, a policy of production promotion may be considered desirable. But if the answer is positive, the question can be raised if Pakistan should attempt to become a wheat exporter. And with regard to rice, one may wonder if exports should perhaps be raised even further through a policy of promoting production.

It is not at all self-evident, however, that grain exports should be attractive. In fact, barring unforeseen catastrophes in world-wide grain production, the prospects for suppliers in the international grain markets are not favourable. First, the acceleration in the growth of grain production experienced in Pakistan also occurred in other Asian countries, reducing import needs and even turning some importing

[1] Statistical confirmation of this observation is provided in Section 3 of this paper.

countries into net exporters. Secondly, the price-support measures applied in the United States and in the countries of the European Community resulted in an increase of wheat production in these countries which the world market has been unable to absorb. Prices have consequently dropped to a low level and there are no signs that this situation will change much in the near future. Thus, exporting wheat does not seem to be an attractive proposition and the problems that Pakistan already has with the export of rice are not likely to be of a short-term nature.

If this reasoning is correct, the growth of wheat and rice production needs to be carefully controlled. On the one hand, the increase in output must be large enough to meet the increase in domestic demand, while, on the other hand, it should not be so high as to create a surplus production for which there is no market. It is to this matter that the present paper addresses itself by setting up a simple policy model. In essence, the model consists of equations explaining the volumes of domestic production and consumption of wheat and rice. Because of its preoccupation with policy formulation the model includes variables which can be used by the government to influence the domestic balances of wheat and rice.

The presentation is organized as follows. The next section is concerned with the domestic production of wheat and rice. Results of statistical tests of sets of functions relating to production are presented there. Thereafter aggregate consumption functions for wheat and rice are discussed and tabulated in Section 3. The combined findings are then used in Section 4 to obtain projections of wheat and rice balances under different policy regimes.

2. THE DEVELOPMENT OF WHEAT AND RICE PRODUCTION

Inspection of production volumes of wheat since 1961 reveals accelerated growth after 1965 with an average rate of growth for the entire period of 4.9 percent per year. For rice the annual growth rate for the period after 1969 is found to be 2.9 percent.[2] These figures are highly significant as Equations W.1.1 and R.1.1 in Table 1 show. Still they are not entirely satisfactory for our purposes because they suggest a mechanical expansion of production. Not only do we know that this is not an accurate picture of reality. Our foremost aim is precisely to find out how growth can be affected through policy measures. It follows that a more refined approach must be adopted. So, in order to allow for more detail, we divide production volumes into their component parts, viz. area sown and yield.[3] Next, we attempt to explain

[2] The annual rate of growth of rice production during the period 1961–1986, the period corresponding with the period of observation of Eq. W.1.1, is 4.3 percent. The difference with the growth rate observed during the shorter period after 1969 is remarkable. It illustrates the variable growth performances in rice output over time, a phenomenon to which we return subsequently.

[3] Although increments in yield have made a larger contribution to production growth, the effect of increases in areas under wheat and rice must not be underestimated.

Table 1

Statistical Explanation of Components of Wheat and Rice Production

Eq. No.	Period	Regression Equation	Reliability Test		
W.1.1	1960-61–1985-86	$Xw_t = 3841.3 \;\; 1.0493^T$ $\quad\quad\quad (20.62)\,(403.23)$	$\bar{R}^2 = 0.095$	$F = 446$	$DW = 1.41$
R.1.1	1968-69–1985-86	$Xr_t = 1680.3 \;\; 1.0290^T$ $\quad\quad\quad (14.7)\;\;(288.4)$	$\bar{R}^2 = 0.81$	$F = 72$	$DW = 0.91$
W.1.2	1960-61–1985-86	$Aw_t = 436.4 + 0.8775 Aw_{t-1} + 4.02 \;\; (Pw/Pf)_t$ $\quad\quad\quad (1.45)\,(15.20) \quad\quad\quad (2.11)$	$\bar{R}^2 = 0.94$	$F = 187$	$DW = 2.01$
W.1.3	1960-61–1985-86	$\ln (Xw/Aw)_t = -1.38 - 0.21 \ln t + 0.35 \ln F_t$ $\quad\quad\quad\quad\quad (15.30)\;\;(4.17)\quad\;(10.39)$	$\bar{R}^2 = 0.96$	$F = 309$	$DW = 1.55$
R.1.2	1960-61–1985-86	$Ar_t = 174.9 + 0.8144 \; Ar_{t-1} + 1.52 \;\; (Pr/Pf)_t$ $\quad\quad\quad (2.23)\,(11.80) \quad\quad\quad (2.30)$	$\bar{R}^2 = 0.94$	$F = 202$	$DW = 1.60$
R.1.3	1969-70–1985-86	$(Xr/Ar)_t = 1.42 + 0.00022 F_{t-1}$ $\quad\quad\quad\quad (40.80)\;\;(4.83)$	$\bar{R}^2 = 0.57$	$F = 23.4$	$DW = 1.50$
F.1	1968–1986	$\ln F_t = 5.10 + 0.10 \; t - 0.0034 \;\; (Pf/Pg)_t$ $\quad\quad\quad (19.78)\,(12.54) \quad (2.35)$	$\bar{R}^2 = 0.97$	$F = 340$	$DW = 1.26$

Notes: Figures in parentheses are t-values.
Meaning of symbols:

Ar	=	area sown with rice	Pf	=	price index of fertilizer
Aw	=	area sown with wheat	Pg	=	general price index
F	=	total fertilizer consumption	Pr	=	price index of rice
			Pw	=	price index of wheat

t	=	time index
T	=	time variable (base year = 1)
Xr	=	production of rice
Xw	=	production of wheat.

the development of each of these variables in regression equations reflecting farmer's behaviour and policy measures influencing that behaviour.

Let us first consider areas under wheat or rice. It has been assumed here that farmers' decision processes regarding the areas to be sown with wheat or rice conform to the adaptive expectations hypothesis. In other words, farmers are assumed to enlarge or reduce areas sown on the basis of their experiences during the past growing season. For example, if wheat-growing gave a good return over the past season, farmers will tend to expand the area under wheat in the next season. In the present case, in order to test farmers' reactions to price changes, the (revenue) prices of wheat and rice respectively and the (cost) price of fertilizer have been included as explanatory variables. For simplicity, revenue and cost prices have been combined in a single price ratio. The results of the tests carried out along these lines are given in Equations W.1.2 and R.1.2 for wheat and rice respectively. It can be observed that both equations are well-behaved in the sense that farmers appear to react to price changes in the way economic theory expects them to do.

Now we come to the other component variable, yield per hectare. After a series of experiments with a variety of explanatory variables, the functions presented as Equations W.1.3 and R.1.3 in Table 1 appeared to give the best results. In the wheat equation the time variable was introduced originally as a proxy for such developments as the gradual adoption of superior production technologies and the improved availability of high-yielding seed varieties. So the regression coefficient was expected to be positive. The present tests suggest, however, that the effect of time on wheat yield is negative, an outcome which is alarming. The use of fertilizer as an explanatory variable is self-evident. On rice fields fertilizer is applied early in the agricultural year, so the fertilizer purchases preceding application relate to the foregoing year. Hence, the lagged relation between rice yield and fertilizer consumption. It must further be stressed that the data on fertilizer consumption used in the tests relate to the entire agricultural sector for lack of figures specifying fertilizer use by individual crops.

In a policy model it is, of course, inappropriate to treat fertilizer consumption, a variable which is the subject of policy concern, as an exogenous variable. So an effort has also been made to explain farmers' behaviour regarding fertilizer use. The results are given in Equation F.1 (Table 1). It appears that fertilizer consumption is a function of time — a proxy of a variety of parameters, among others a widening recognition among farmers of the favourable effect on yield — and fertilizer price corrected for inflation. Note that the relation between consumption and price is indeed negative.

If we now write

$$X_i = (X_i/A_i)^* A_i,$$

where X=production, A=area, i=index indicating wheat or rice, and substitute Equations W.1.2, W.1.3 and F.1 into this equation, we obtain a reduced-form

production function of wheat expressed in the following variables: time, area under wheat in the preceding year and the prices of wheat and fertilizer. A similar exercise can be carried out for rice. Compared with the mechanical production functions embodied in Equations W.1.1 and R.1.1 the advantage is of course that a direct relation has now been established with sets of prices which can in fact be seen as policy instruments. These results strongly suggest that the levels of production of wheat and rice are indeed sensitive to government policies.

The effect of prices on areas sown and yields according to Equations W.1.2, W.1.3, R.1.2, R.1.3 and F.1 can conveniently be expressed in terms of price elasticities. The values obtained for these elasticities have been presented in Table 2.[4] Note that according to the present findings a considerable difference exists between short-term elasticities (expressing the effect of a price change over a period of one year) and long-term elasticities (expressing the accumulated effects of a price change over a long period). It can be seen that the long-term elasticities are indeed considerable. For example, if the price of wheat is raised by 10 percent, production of wheat is expected to be raised in the long run by about 5.5 percent. Still, it should be realized that such a one-time price increase just lifts production gradually to a higher level, until the effect is worn out. A single price increase does not yield continuous output growth. We come back to this in Section 4.

Table 2

Price Elasticities in Wheat and Rice Production, 1986

	Area		Yield		Production	
	Short	Long	Short	Long	Short	Long
Own Price Elasticities						
Wheat	.068	.554	0	0	.068	.554
Rice	.093	.502	0	0	.093	.502
Elasticities of Fertilizer Price						
Wheat	−.068	−.554	−.195	−.195	−.263	−.641
Rice	−.093	−.502	−.107	−.107	−.200	−.555

[4] The price elasticities obtained by means of the above-mentioned relations vary with time. The values in Table 2 relate to 1986.

Before we move on to an analysis of aggregate consumption of wheat and rice, it remains to be seen whether an indirect estimate of production along the lines described in the preceding paragraph is sufficiently accurate and, more pre-cisely, how this approach compares with a direct estimate applying Equations W.1.1 and R.1.1. For this purpose annual volumes of production have been calculated for both approaches using observed values of exogenous variables only. This exercise shows that the indirect approach provides more realistic results. It is especially note-worthy that the indirect estimates for wheat as well as rice reproduce very well the alternating periods of relatively rapid and relatively slow production growth. The superior performance of the indirect approach can also be expressed in quantita-tive terms, of course. Several measures can be applied in this regard. A simple measure is, for example, the average deviation of estimated volumes from actual volumes of production expressed as a percentage of actual production. For wheat this deviation is 7.89 percent in the direct approach and 5.27 percent in the indirect approach. For rice the corresponding figures are 5.52 and 3.99 percent respectively. Application of other measures yields similar results.

3.   THE PATTERN OF DEMAND FOR WHEAT AND RICE

When analysing the development of consumption of wheat and rice the data problem looms large. Direct estimates of consumption levels are available only for those years in which the Household Income and Expenditure Surveys or other pertinent surveys have been organized. However, the data thus obtained are too few to allow a statistical test of consumption behaviour over time.

In order to cope with this problem one can, of course, derive indirect estimates of consumption with the use of the balance equation:

$$C(t) = X(t-1) + M(t) - E(t) - F(t) - IS(t),$$

where C = consumption, M = imports, E = exports, F = feed, seed and losses, IS = increment in stocks.

This approximation has been used in the exercise underlying the findings presented in this section, but it is important to realize the shortcomings involved. First, as consumption volumes are derived from production figures, an analysis of excess demand or supply is infeasible. Secondly, the quality of the consumption estimates depends directly on the availability and reliability of data for the other variables. Figures on F, for example, are not easily available, while figures on IS do not seem to be reliable and are available only for a few recent years. Thirdly, it is remarkable that the indirect estimates of wheat consumption per head are

consistently about 20 kg lower[5] than the directly estimated consumption figures obtained by means of expenditure surveys.

The consumption estimates for wheat and rice derived with the above-mentioned equation for the period 1961-1985 expressed on a per capita basis have been used for tests of a variety of consumption functions. A selection of the results of these tests has been presented in Table 3. It seems safe to conclude from the figures presented there that volumes of consumption of wheat and rice depend to a large extent on variations in population size and national income. It also follows from the parameters in the functions tested that the income elasticities of both wheat and rice consumption are less than one. Thus, the shares of wheat as well as rice consumption in national income tend to decrease. With a view to Engel's Law this observation does not come as a surprise. Notice further that the functional forms chosen for Equations W.2.1 and R.2.1 allow the elasticities to vary with income. It appears then that the income elasticities for both products fall as income increases, a finding that is in line with the experience in other countries. According to Equation

Table 3

Consumption Functions for Wheat and Rice, 1961–1985

Equations	Regression Equation	$\bar{R}^2$	F	D.W.
W.2.1	$(Cw/D) = -232.7 + 53.7 ln(Y/D)$ $\quad\quad\quad (-4.65)\quad (6.84)$	0.69	46.7	1.60
R.2.1	$(Cr/D) = -29.7 + 7.83 ln (Y/D)$ $\quad\quad\quad (-2.90)\quad (4.86)$	0.52	23.6	2.01
W.2.2	$ln (Cw/D) = 1.42 + 0.51 ln (Y/D)$ $\quad\quad\quad\quad (2.99)\quad (6.90)$	0.69	47.7	1.47
R.2.2	$ln (Cr/D) = 0.47 + 0.40 ln (Y/D)$ $\quad\quad\quad\quad (0.95)\quad (5.13)$	0.55	26.4	1.98

Notes: Figures in parenthesis are *t*-values.
   Meaning of symbols:
   (Ci/D) = Consumption per head of wheat or rice in kgs,
   (Y/D) = Income per head in constant Rs of 1959-60.
   Consumption volumes have been derived using data published in various issues of the Pakistan Economic Survey.
   Values of national income have been obtained from the same source.

[5] Considering that, according to various recent surveys, wheat consumption per head is approximately 140 kg, the difference is considerable.

W.2.1 the income elasticity of wheat was approximately .61 in 1961. while it dropped to .42 in 1985. The corresponding values for the income elasticity of rice according to Equation R.2.1 were .46 and .34 respectively. Finally it must be added that prices of wheat and rice did not contribute significantly to the explanation of consumption volumes of these goods.[6]

So far we have been concerned only with human consumption of wheat and rice; let us now also consider animal consumption. Here we concentrate on wheat, because rice is not normally used as feed. Unfortunately, reliable data on the use of wheat for feed are not readily available. The information that has been published so far lump feed together with seed and other uses, but even then it is worthwhile noting that the share of animal feed, seed and other uses in total wheat use which stands at 11 percent now tends to increase by 0.24 percent per year.[7] This implies that the demand for wheat as feed etc. increases considerably faster than demand for human consumption. Such a development can easily be explained by the shift in diets towards animal protein products going hand in hand with growth of income per head and resulting in a rapid increase in demand for grains for feed.

4. WHEAT AND RICE BALANCES UNDER DIFFERENT POLICY REGIMES

The foregoing sections dealt with the development of domestic production and use of wheat and rice. The various components in the dynamics of supply and demand were considered separately in order to obtain a better idea of the origins of the patterns of change. The knowledge thus obtained will be used in this section to outline the wheat and rice balances for the final years of three successive five-year plan periods, i.e. 1988, 1993 and 1998. Projections will be made on the basis of fixed assumptions regarding income and population growth and of alternative assumptions regarding price policies.

The estimated volumes of production of wheat and rice presented in Table 4 have been calculated using what we have called the indirect approach. As indicated, the advantages compared with the direct approach are, first and foremost, that a link exists with policy instruments and, secondly, that the predictions tend to be more accurate. Application of this approach requires specification of the values of exogenous variables assumed to hold in the future. Here it concerns the ratio of the price of wheat (or rice) to the price of fertilizer and the real price of fertilizer. In selecting the values to be substituted in the relevant equations, values observed for these variables since 1961 have served as points of orientation. Thus, for each exogenous variable three values have been considered: the highest value observed,

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[6] However, in a cross-section analysis presented in Ehtesham Ahmad *et al.* (1987) using figures relating to 1977 the compensated price elasticity of wheat consumption was found to be −0.63.

[7] Based on data obtained from various issues of World Wheat Statistics.

Table 4

*Estimates of Wheat and Rice Production
under Five Price-policy Regimes, 1988, 1993 and 1998*

(in 000 tons)

Years	Case 1	Case 2	Case 3	Case 4	Case 5
Wheat Production					
1988	11602	12847	12872	12736	14103
1993	12216	13528	14527	15617	17295
1998	13446	14889	16629	18641	20642
Rice Production					
1988	2994	3182	3317	3463	3680
1993	2977	3251	3689	4166	4549
1998	3345	3776	4392	5024	5672

Note: See the text for an explanation of the five policy cases.

the lowest value and the average value. Production volumes corresponding with five selected combinations of values of exogenous variables are presented in Table 4. The five cases in question are:

1. A case of output restriction combining a low price of wheat (or rice) with a high price of fertilizer
2. A combination of low prices for wheat (or rice) and for fertilizer;
3. A combination of average prices for both wheat (or rice) and fertilizer;
4. A combination of high prices for wheat (or rice) and fertilizer; and
5. A case of output promotion combining a high price of wheat (or rice) with a low price of fertilizer.

The estimates tablulated below illustrate clearly the considerable impact of prices on volumes of wheat and rice production. Note, for example, that under a production promoting price regime (case 5) wheat output in 1998 is estimated to be approximately 54 percent higher than under a production-discouraging regime (case 1). For rice the corresponding difference is even higher (70 percent). It can, therefore, be concluded that ample opportunity exists for policy-makers to control wheat and rice production through the application of pertinent price policies. We return to these findings below, but first we examine some estimates of future aggregate consumption of wheat and rice.

The rate of growth of domestic demand for the two products examined here must not be underestimated. First we consider human consumption. The analysis in Section 3 has shown that population and income are the main determinants of this component of demand, so the projected growth paths of these two explanatory variables must now be decided upon. Population has been assumed to continue increasing by 2.9 percent annually. For national income a growth rate of 6.3 percent per year has been adopted — equal to the planned rate of growth of national income for the Sixth Five-Year Plan ending in 1988. Substituting the projected values of these exogenous variables into Equations W.2.1 and R.2.1 one obtains the estimated quantities of future human consumption of wheat and rice as presented in the first column of Table 5.[8]

The share of feed, seed and other uses in total wheat use is likely to continue rising, if relative prices of grains will not undergo much change. With reference to the pattern observed in the past. This share is assumed to increase by 0.24 percent annually starting from the present level of 11 percent. For rice the corresponding share is assumed to remain constant at 5 percent of total use. The estimates obtained on the basis of these assumptions can be found in the second column of Table 5. The quantities of total use of wheat and rice foreseen of 1988, and 1993 and 1998 are given in the last column.

Table 5

Estimates of Volumes of Wheat and Rice uses,
1988, 1993 and 1998

(in '000 ton)

Years	Human Cons.	Feed, Seed etc.	Total use
Wheat			
1988	14155	1894	16049
1993	17402	2599	20001
1998	21313	3551	24864
Rice			
1988	2515	132	2647
1993	3057	161	3218
1998	3707	195	3902

[8]Equations. W.2.1 and R.2.1 incorporate the tendency for the income elasticity of wheat and rice consumption to fall as income rises. On the other hand, Equations. W.2.2 and R.2.2 imply constant income elasticities and this renders them less suitable for projection purposes.

Comparison of the figures in Table 5 with those given in Table 4 provides a preliminary indication of the balances of domestic demand and supply of wheat and rice in the three future years for which the calculations have been carried out. A positive balance can be interpreted as an exportable surplus. While a deficit indicates a need for supplementary imports.

Examining first the situation regarding wheat, it can be concluded that there does not seem to be reason for unconstrained optimism. It is particularly noteworthy that considerable and increasing deficits are foreseen even under a scenario of historically favourable price ratios (case 5). And in case 3 which can be considered a normal case as it is based on average price ratios observed during the period 1961-1985, the deficits are of disastrous magnitude. When the "unfavourable" cases 1 and 2 are assumed to hold, the situation is, of course, still worse. At first sight these observations seem to be in conflict with the trend of the wheat balance in the recent past which suggests a much brighter future than the one painted here. (See for example the opening paragraph of this paper.) So let us examine the results of our exercise a bit more closely.

Recall that the historical growth rate of wheat output was found to be 4.9 percent per year (see Equation W.1.1). However, when inspecting the development of wheat production according to the "normal" case 3, it will immediately be seen that the growth rate is much lower. Even the increase in output implied by case 5 does not match the performance of the past twenty-five years. The explanation of this paradox is rather simple. In the past the production of wheat has been stimulated by step-wise increments in the ratio of wheat to fertilizer prices. Thus, in a mechanical extrapolation of output on the basis of observed production statistics (as is done when using Equation W.1.1) it is implicitly assumed that this price ratio will continue to rise in the future. In our exercise, however, the ratios of wheat to fertilizer prices have been kept constant at levels which differ only among the various cases examined. The results show that the impact on output is dramatic. If our findings are correct, it follows that self-sufficiency in wheat cannot be achieved by maintaining the presently prevailing, relatively favourable ratio of wheat to fertilizer prices. The latter ratio needs to be raised continuously for such a goal to be reached.

The picture obtained for rice is considerably less precarious. Compared with wheat, already the starting position — a consistent and sizeable exportable surplus — is of course more favourable. But this lead seems to grow with the passage of time. For one thing, total use does not expand as rapidly, because the income elasticity of consumption is lower for rice than for wheat and because the share of feed, seed and other uses in total use remains constant for rice, while it increases for wheat. Further, the production estimates listed in Table 4 indicate that in nearly all cases rice production increases at a faster pace than wheat production. As a result, a policy regime in accordance with case 4 would maintain the exportable surplus at

about one million tons while a scenario according to case 5 would even enlarge the surplus in the course of time. Thus, it may seem advisable to adopt a policy of price moderation with regard to rice, in strong contrast to the need for steadily increasing prices for wheat in order to avoid a rise in wheat imports.

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Comments on
"A Policy Model of the Wheat and Rice Economy of Pakistan"

Before commenting upon the paper, I would like to thank the organizers of the Annual General Meeting of the Pakistan Society of Development Economists for inviting me to participate in the Meeting. This has provided me with an excellent opportunity to meet many friends and exchange experiences and ideas about the issues facing Pakistan's economy. The paper, "A Policy Model of the Wheat and Rice Economy of Pakistan" Cornelisse and Kuijpers, which I have been asked to discuss, purports to analyse policy issues relating to two of the most important foodgrains of Pakistan and may have important bearings for our food policy. It is an interesting paper, lucid and systematically organized. The arguments provided are quite sound and well-grounded in economic theory. However, I have a few reservations, about some aspects of the analysis presented in the paper, which are discussed below:

In the introductory section, the authors pose a question whether it will be possible for Pakistan to become self-sufficient in the near future and under what conditions such a situation could be achieved? However, it is not clear in what context this question has been posed? Whether in the context of wheat or of rice? If the question of self-sufficiency relates to wheat then, I think it is not the question of achieving self-sufficiency but more of its maintenance. This is because during 1983-84, 1984-85, 1985-86, wheat imports in Pakistan were only marginal and may have been mainly meant for Afghan refugees. In the case of rice, it hardly needs to be mentioned that Pakistan has been a net exporter of rice for some length of time.

Nevertheless, I agree with the authors that there is a substantial potential for increasing the production of both wheat and rice. This can be achieved by improving production efficiency. This should also lower unit cost of production and facilitate, exports by making them more competitive. The yields within Pakistan's agriculture vary widely across various farmer groups. Farmers using modern inputs and adopting better husbandry practices are reported to have much higher yields than those obtaining on the majority of farms Agricultural Prices Commission, (1986). However, the questions of improving efficiency of marketing operations and access to markets assume greater importance for having a larger share in export markets. The provision of regular marketable surplus of that quality which is in demand in the world markets is equally important in developing export markets. However, the developments in wheat and rice production and marketing would need to be carefully monitored to have sufficient exportable surpluses at competitive prices. Monitoring the

situation in the international markets to keep abreast of the developments and establishing efficient marketing channels would assume special importance if export markets are to be exploited to the best advantage.

Development of Wheat and Rice Production

There are a few problems of specification in Section 2, providing empirical estimates of various parameters of the models used in explaining production behaviour of wheat and rice. For example in Equations W.1.2 and R.1.2 of the paper reproduced below :

$$Aw_t = 436.4 + 0.8775\ Aw_{t-1} + 4.02\ (Pw/Pf)_t \quad \ldots \text{W.1.2}$$
$$Ar_t = 174.9 + 0.8144\ Ar_{t-1} + 1.52\ (Pr/Pf)_t \quad \ldots \text{R.1.2}$$

The variables $(Pw/Pf)_t$, $(Pr/Pf)_t$, where Pw = price index of wheat, Pr = price index of rice and Pf = price index of fertilizer, are perhaps meant to assess the influences of changes in the real prices of wheat and rice, respectively, on the changes in wheat and rice acreage. If so, the appropriate deflator in these cases may have been some index of the annual inflation rates in the economy rather than the prices of chemical fertilizers. Fertilizer is no doubt an important purchased input in wheat and rice farming but its contribution in the total costs is no more than 20 percent at best, (Government of Pakistan 1986).

Another observation which I have about the specification of the yield equation on rice i.e., Equation R. 1.3 in the paper is the inclusion of aggregate fertilizer use level as a lag variable to explain the current yields of rice. It is rather difficult to understand how the fertilizer use in the previous year may have affected current yields. Moreover, use of total fertilizer data hides the real picture of fertilizer use on rice. I may add here that data on fertilizer in Pakistan are available in fairly disaggregated form. From these data, with some ingenuity, one can estimate the amount of the fertilizer used in rice production to a fairly satisfactory extent and its use in the model may have provided a better explanation for the performance of rice yield. Another problem with respect to the rice equations is the aggregation of data relating to fine and coarse varieties. As the production technology of these varieties is quite different, therefore their combined treatment may not be of much help to policy planners.

The Pattern of Demand for Wheat and Rice

The problems of calculating per capita consumption of food commodities through the balance sheet approach are too well known to be repeated here. Nevertheless, it is worth noting as the authors have pointed out that through this approach,

it is not possible to analyse excess demand or supply. Moreover, the consumption figures derived from the production data represent availability and not actual consumption and also hide the equity and distribution aspects.

It is not surprising that per capita consumption of wheat derived from production data through the balance sheet approach does not tally with the consumption estimates obtained from the expenditure survey. A few points about the estimation of consumption figures from the expenditure surveys are in order as data problems loom really large here. To obtain precise consumption estimates through expenditure surveys, in a society where (i) the literacy rate is barely about 26 percent, (ii) no consumption records are available and (iii) bulk of the population living in rural areas does not rely on formal markets to meet their food requirements, is at best problematic. Therefore, it would have been really surprising if the consumption data obtained through the balance sheet approach had matched with the data available from the expenditure surveys.

One is rather surprised at the authors' remark that the prices of wheat and rice did not contribute significantly to the explanation of consumption volumes of these goods. The price variable is conspicuous by its absence in the consumption equations estimated by the authors. In such a situation one wonders how the authors could conclude about the insignificance of the price variable in explaining the consumption behaviour.

Wheat and Rice Balance under Different Policy Regimes

Under this section the authors have provided interesting scenarios about the production and uses of wheat and rice under various policy options. The analysis provided herein is quite revealing.

The authors have pointed out that despite improvement in the yields in Pakistan, international comparison indicates much scope for improvement. It is true that tremendous scope exists for raising crop yields in Pakistan as this is evident from the yields obtained by 'progressive' farmers. However, international comparisons of yields involving widely dissimilar agricultural and climatic conditions may be spurious and not provide practical guidelines for improving the situation.

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