Comparative Analyses of World Rice with Wheat and Coarse Grains Regarding Stocks, Prices, and Trade

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Rice is becoming a more important commodity in world trade overtime. In this paper the nature of rice in world stocks, prices, and trade are analytically compared with those of wheat and coarse grains. Some important results are obtained. First, volumes of stocks and trade relative to world consumption are consistently very small for rice in comparison to those for wheat or coarse grains. Second, variation of prices from one year to next is considerably greater in rice. Third, regarding concentration ratios (CR4) of exporters, rice has the smallest followed by coarse grains and wheat. Finally, the CR4 countries in rice are comprised of developing countries except for the U.S., while those in wheat and coarse grains mostly consist of developed countries. These findings are critical for countries which are implementing domestic policies for rice.

Introduction

Every world commodity market has certain characteristics that differentiate it from markets for other commodities. An overview of world markets for individual commodities is essential for further specific analyses of their markets. To highlight the unique attributes of the world rice market, comparative information on wheat and coarse grains such as corn is presented. The background information presented in this paper includes data on the volume of world trade and stocks, export prices and the market shares of the principal exporters of each commodity.

An understanding of the trends in these variables and their relationships is necessary for any analysis of commodity markets. In the case of rice, a description of the organization of world rice markets is particularly important for two reasons. First, most rice produced in the world is consumed within a few miles of the place where it was produced (Barker et al., 1985[1]; and USDA, 1986[6]). Traditionally, world rice trade has been limited, and there has been less interest among economists in the world market. Second, rice is a relatively minor crop in most industrial nations where more attention has been focused on oilseeds, wheat, cotton, and coarse grains. As a result, the nature and organization of world rice markets is less well known. This paper attemots to present the imortatn features of rice in the world rice market

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relative to those of wheat and coarse grains. The findings in this research should provide us with more information of world rice markets and be useful for analyzing linkage among commodities for which more attention is being paid during the recent years (McCalla and Josling, 1985[4]).

Volumes of stocks and Trade

Relative volumes of stocks and trade to world total consumption are critical to world market prices. Tables 1 and 2 show volumes of stocks and trade and their ratios relative to world total consumption for rice, wheat, and coarse grains between 1961 and 1987. Stocks of rice increased more rapidly than wheat or coarse grains during this period. While rice stocks increased over three times from 15 million metric tons (MMT) in the early 1960's to 50 MMT in the mid 1980's, stocks of wheat and coarse grains increased about two times from 75 MMT to about 170 MMT and from 100 MMT to around 200 MMT, respectively, during the same period./1 Volumes of trade for rice, however, did not increase as fast as those for wheat and coarse grains. Trade volume for rice grew by less than two times from 7.5 MMT to 12 MMT between the early 1960's and the mid 1980's, while the volume of wheat and coarse grains traded increased by two times from 50 MMT to 100 MMT and almost three times from 35 MMT to 100 MMT, respectively.

Surprisingly, ratios of stocks and tade relative to total consumption are very small for rice in comparison to those for wheat and coarse grains, although the ratio of stocks increased more sharply for rice than for wheat or coarse grains over time (Table 2). The ratios of stocks to consumption for rice are one-third to one half of the figures for wheat since 1965. The stock/consumption ratio for rice was 10 % or less during the first half of the 1960's and reached the highest 21 % in 1978 followed by decreashing ratios, therefter. In 1987, when there was a crop failure in Asia, the stock ratio plunged to 12.8 %, the lowest since the worldwide food shortage of the early 1970's./2 The ratio of trade to total consumption for rice is extremely small relative to those for wheat and coarse grains throughout the period. The trade ratio for rice fluctuated only between 3 % and 5 %, while ratio for wheat fluctuated in a range of 15 % to 23 % over time. This suggests that rice is basically a subsistence crop in Asia and that world markets for rice are very thin.

Fluctuation of World Prices

Prices in a thin market are vulnerable to a small change in supply and demand. In fact, world prices of rice fluctuate more than those of wheat or corn (Table 3). If prices are divided by those in the base year, the results should show levels of fluctuations much more clearly. The graph in Figure 1 indicates world prices divided by their individual own prices in 1970. This shows that rice prices increased faster than wheat or corn in 1967, 1974, and 1981. Also, rice prices plunged much more sharply than the others in 1965, 1971, 1976, and

Table 1 Volumes of stocks and trade for rice, wheat, and coarse grains (world), 1961-1987.

(million metric tons)

	Rice		Wheat		Coarse grains	
	Stocks	Trade	Stocks	Trade	Stocks	Trade
1961	8.5	6.3	71.7	46.8	105.2	30.0
1962	12.4	7.3	77.7	44.3	103.2	31.0
1963	16.2	7.7	72.0	56.0	107.9	34.0
1964	17.3	8.2	79.9	52.0	99.0	35.0
1965	18.0	7.9	59.5	61.0	81.2	42.0
1966	18.6	7.8	86.3	56.0	84.1	40.0
1967	20.9	7.2	97.8	51.0	95.7	39.0
1968	24.7	7.5	122.2	45.0	100.4	37.0
1969	26.1	8.2	104.5	50.0	101.1	39.0
1970	28.7	8.6	81.5	55.0	87.6	46.0
1971	28.4	8.7	90.2	52.0	104.4	49.3
1972	23.4	8.4	75.8	67.0	87.3	59.3
1973	28.5	7.7	82.9	63.0	86.1	71.1
1974	28.2	7.3	81.4	64.3	93.1	65.0
1975	38.9	8.4	86.9	66.7	95.1	75.2
1976	38.7	10.6	127.5	63.3	115.5	83.9
1977	43.9	9.6	108.9	72.8	125.8	89.0
1978	53.9	12.0	134.6	72.0	139.0	93.1
1979	52.4	12.7	120.7	86.0	141.5	99.5
1980	47.2	13.1	112.9	94.1	125.8	108.3
1981	43.3	11.8	112.7	101.3	150.8	97.8
1982	43.3	11.9	130.0	98.7	181.4	90.0
1983	46.7	12.6	145.2	102.0	110.3	93.4
1984	54.8	11.5	164.2	107.0	143.1	100.4
1985	53.8	12.8	168.2	85.0	206.4	83.2
1986	49.5	12.7	176.1	90.7	231.0	83.4
1987	40.0	10.4	147.2	104.7	203.1	83.9

Source: U.S. Department of Agriculture (1988).

Table 2 Rates of stocks and trade relative to world total consumption for rice, wheat, and coarse grains, 1961-1987.

(%)

	Rice		Wheat		Coarse grains	
	Stocks	Trade	Stocks	Trade	Stocks	Trade
1961	5.6	4.2	30.1	19.6	23.5	6.7
1962	8.1	4.8	31.6	18.0	22.4	6.7
1963	9.8	4.6	30.0	23.3	23.6	7.4
1964	9.6	4.5	30.4	19.8	20.6	7.3
1965	10.4	4.5	21.1	21.7	16.2	8.4
1966	10.4	4.3	30.8	20.0	16.3	7.7
1967	11.1	3.8	34.1	17.8	18.0	7.3
1968	12.8	3.9	39.8	14.6	18.6	6.8
1969	13.0	4.0	31.8	15.2	17.8	6.8
1970	13.6	4.0	24.2	16.3	15.0	7.8
1971	13.0	4.0	26.3	15.1	17.1	8.0
1972	10.9	3.9	21.1	18.7	14.0	9.5
1973	12.7	3.4	22.6	17.2	12.8	10.6
1974	12.4	3.2	22.5	17.7	14.9	10.4
1975	16.6	3.6	24.7	18.9	14.7	11.6
1976	15.8	4.4	33.4	16.6	16.8	12.2
1977	17.8	3.9	27.0	18.0	18.2	12.8
1978	21.2	4.7	31.9	17.0	18.7	12.5
1979	20.1	4.8	27.5	19.6	19.0	13.4
1980	17.0	4.7	25.0	20.8	16.8	14.4
1981	15.1	4.1	25.0	22.5	20.3	13.1
1982	15.1	4.1	28.2	21.4	24.0	11.9
1983	15.3	4.1	30.6	21.5	14.5	12.3
1984	17.6	3.6	33.3	21.7	18.3	12.8
1985	16.8	3.9	33.9	17.1	26.5	10.6
1986	15.3	3.9	33.7	17.3	28.5	10.3
1987	12.7	3.3	27.5	19.6	24.9	10.3

Source: U.S. Department of Agriculture (1988).

1986. It is interesting to estimate a magnitude of price variation for each commodity. To do this, an average absolute variation index (AAVI) can be expressed as follows:

(1) $AAVI=\{\Sigma_{t=2}(IP_t-IP_{t-1})^2/N\}^{1/2}$

where, IP is a series of prices divided by a price in certain year, and N is the number of

Table 3 World prices for rice, wheat, and corn, 1961-1987.[1]

(US$/metric ton)

	Rice	Wheat	Corn
1961	136.58	58.79	47.63
1962	152.75	64.30	48.81
1963	143.25	64.66	53.93
1964	137.83	67.60	54.72
1965	136.25	59.52	55.11
1966	165.67	62.83	57.87
1967	221.00	65.77	54.32
1968	204.67	62.83	47.63
1969	185.08	58.42	51.96
1970	143.00	54.74	58.26
1971	130.33	61.73	58.26
1972	149.92	69.81	55.90
1973	296.58	139.99	97.63
1974	541.50	179.67	132.27
1975	363.17	149.18	119.67
1976	254.08	133.01	112.19
1977	272.42	103.25	95.27
1978	368.50	127.86	100.78
1979	334.33	160.20	115.74
1980	433.67	172.69	125.58
1981	482.83	174.90	130.70
1982	293.38	160.20	108.26
1983	276.83	157.26	135.82
1984	252.25	152.48	135.82
1985	217.42	135.95	112.19
1986	210.19	115.00	87.79
1987	276.00	115.00	81.88

1 : Prices are at Bangkok for rice, and at U.S. Gulf for wheat and corn.
Source: International Monetary Fung (1987).

observations excluding the first observation. This method is a better measure of year-to-year variation than variance or standard error of a population; the variation index (AAVI) expressed above shows magnitude of variation of years relative to respective previous years disregarding the mean of the sample, while population variance is measured relative to the

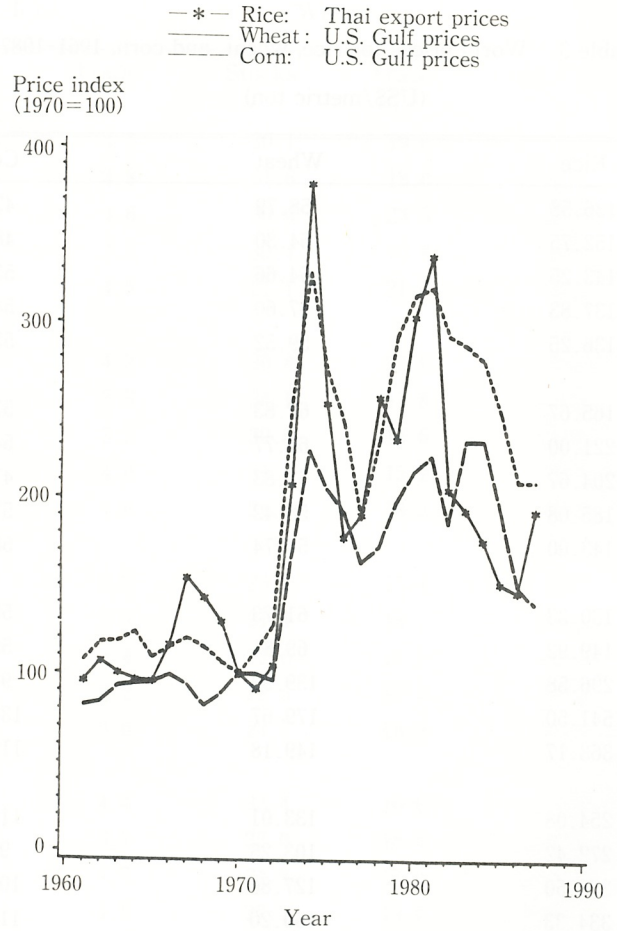

Fig. 1 Changes in export prices for rice, wheat, and corn.
Source: IMF (1987).

Table 4 Variation of prices for rice, wheat, and corn, 1961-1987.

	Rice	Wheat	Corn
Variation Index[1] (AAVI)	61.0	38.6	27.0

1 : Variation indices are calculated following Equation (1) and deflating data on Table 3 by 1970 prices.

mean. This is particularly useful when one compares consecutive variations of variables. The results of the variation indices, which are calculated by dividing the price series by 1970 prices and using the form expressed in Equation(1) for the individual commodities, are reported in Table 4. The variation index for rice is more than 50 % larger than the index for wheat and more than 100 % larger than that for corn.

Because world rice markets are much thinner relative to those for wheat and coarse grains, the export supply curve for rice may be inelastic in comparison to other grains. Therefore, if export supply curves for rice and wheat, for example, shift-in by the same magnitude due to crop failures in exporting countries, the impact on the world rice market is much greater than is the case for wheat. This situation is illustrated in Figure 2. Sr and Sw are export supply curves for rice and wheat, respectively. Due to the crop failures Sr and Sw shift-in by the same magnitude, A, to Sr' and Sw', respectively. If import demand, assumed to be identical for rice and wheat, also shifts by B from D to D', the effect will be to raise rice prices from P to Pr, a much larger change than is found in the wheat market where the price increases from P to Pw. Furthermore, the volume of trade decreases for rice from Q to Qr but increases for wheat from Q to Qw. This suggests that the thin world market for rice is likely to be less stable than the markets for other grains.

Traditionally, rice has been a minor part of agricultural trade. The values in Table 5 for

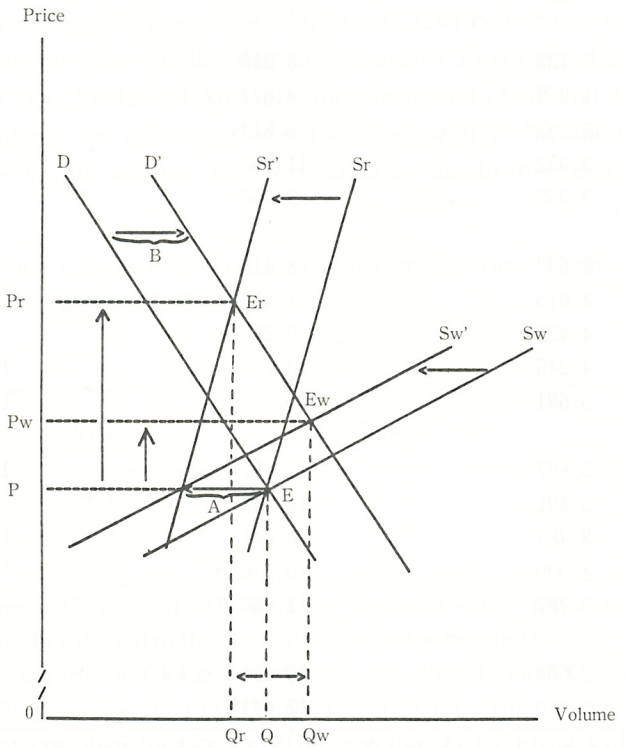

Fig. 2 Comparison of world markets for rice with wheat.

individual commodities are calculated from volumes multiplied by prices based on the data form Tables 1 and 3. Although the total value of trade in these commodities has varied greatly, the value of trade in wheat and coarse grains is much larger than that of rice. Total

Table 5 Values of trade for rice, wheat, and coarse grains, 1961-1987.[1]

(US$, billion)

	Rice	Wheat	Coarse grains
1961	0.860	2.751	1.429
1962	1.115	2.848	1.513
1963	1.103	3.621	1.833
1964	1.130	3.515	1.915
1965	1.076	3.631	2.314
1966	1.292	3.518	2.314
1967	1.591	3.354	2.118
1968	1.535	2.827	1.762
1969	1.517	2.921	2.026
1970	1.229	3.011	2.680
1971	1.133	3.210	2.872
1972	1.259	4.677	3.315
1973	2.283	8.819	6.941
1974	3.952	11.553	8.598
1975	3.050	9.950	8.999
1976	2.693	8.419	9.413
1977	2.615	7.516	8.479
1978	4.422	9.206	9.382
1979	4.245	13.777	11.516
1980	5.681	16.250	13.600
1981	5.697	17.717	12.782
1982	3.491	15.812	9.743
1983	3.488	16.041	12.685
1984	2.900	16.316	13.636
1985	2.782	11.556	9.334
1986	2.669	10.431	7.321
1987	2.870	12.041	6.870

1 : Values are trade volume (Table 1) multiplied by price (Table 4).
Sources: Tables 1 and 3.

value of rice trade reached its highest level at $5.7 billion in 1980 and 1981 at the same time that the trade value for wheat and coarse grains reached their highest levels at $17.7 billion and $13.6 billion, respectively. Comparing the values among the three commodities in this period, the value of rice trade was 32 % of the value for wheat and 42 % of the value for coarse grains. When rice prices fell in 1986, the value of rice trade was $2.7 billion, 26 % and 36 % of the value of trade in wheat and coarse grains, respectively.

Concentration Ratios of Exporters

Exports of a particular agricultural commodity are frequently dominated by a small number of countries. It is of interest to compare the concentration ratios of world grain markets among the exporters. Concentration can be expressed as the ratio of the supplies of the largest four suppliers relative to total supply in the market (CR4) such as in Marion (1986)[3] and Scherer (1980)[5] for domestic industry studies. In this research, one and two country concentration ratios (CR1 and CR2) are reported as well. Table 6 shows the CR1, CR2, and CR4 for rice, wheat, and coarse grains in world export markets in 1987. The largest exporters are Thailand for rice, and the U.S. for wheat and coarse grains with CR1 of 34.2 %, 31.3 %, and 56.9 %, respectively. The level of CR1 for rice is slightly larger than that of wheat and substantially smaller than coarse grains. The CR2, where the U.S. for rice and Canada for wheat and coarse grains are added to the CR1 countries, are now smaller for rice than wheat and substantially smaller than coarse grains. Finally, in the CR4, where Pakistan and the P.R.C. for rice, EC-12 and Australia for wheat, and EC-12 and Argentina additionally join the CR2 countries, the ratio for rice is the smallest at 71 %, and the ratio for wheat is the greatest at 89 % followed by 78 % for coarse grains. In this respect, rice exporters are

Table 6 Concentration ratio of exporters for rice, wheat, and coarse grains in 1987.[1,2]

(%)

	Rice	Wheat	Coarse grains
CR1	34.2	31.3	56.9
CR2	53.4	54.2	64.8
CR4	70.9	88.7	78.2

1 : Countries in CR1 include Thailand for rice and the U.S. for wheat and coarse grains. Countries in CR2 add to those in CR1 the U.S. for rice and Canada for wheat and coarse grains. Countries in CR4 add to those in CR2 Pakistan and China for rice, EC-12 and Australia for wheat, and EC-12 and Argentina for coarse grains.

2 : Calendar year 1987 for rice and crop year 1986/87 for wheat and coarse grains.

Source: U.S. Department of Agriculture (1988).

less concentrated relative to exporters for wheat and coarse grains. In general, however, export suppliers for all grain markets are highly concentrated.

Interestingly, the CR4 countries in rice are comprised of all developing countries except for the U.S., while the CR4 nations for wheat and coarse grains are mostly developed countries. It is generally true that economically advanced countries have more capability to hold stocks and better transportation system than less developed countries. In this context, stocks available for exports are apt to be much smaller in rice than in other grains. If the stocks for exports are limited, export supply tends to be inelastic. This situation, in line with more evenly distributed exporters among developing nations in rice exports, helps us understand why world prices for rice fluctuate more than those for other grains.

Conclusion

Rice has its own uniqueness in trade, stocks, and price movements in world transaction. Although rice and wheat are the two major staple foods in the world, both commodities have different characteristics from each other. Meanwhile, most of coarse grains are utilized for feeding animals.

Fluctuation of prices of commodity is deeply related to rates of world stocks and trade relative to consumption and economic situations of the exporters. Rice is quite different from other grains in this respect. As analyzed above, magnitude of price fluctuation of world rice is one and half to twice as large as those for wheat and corn, respectively. Several reasons are considered for this. First, volume of rice trade relative to total world consumption is consistently very small at 3 to 4 % while those for wheat and coarse grains are 20 % and 10 %, respectively, indicating that rice is basically a subsistence crop for own producing countries rather than an export oriented crop. Only a surplus amount of rice would be used for exports. Second, rate of stocks to consumption is also low in rice. The rate for rice is only half or less than those for wheat or coarse grains. A low stock rate implies less responsiveness to change in prices. Third, concentration ratio of the four largest exporters (CR4) is composed of developing countries for rice except for the U.S., while the CR4's for wheat and coarse grains are mostly consisted of developed countries.

Generally, infrastructure of developing countries are not well organized, and transportation of commodities are not fluent. This also suggests that responses of rice traders to change in prices are not so efficient. Ironically, the CR4 for rice is the lowest among the grain commodities.

These characteristics of rice are critical for understanding the world rice market. Rice trade may become far more active in the future. Some countries such as Japan may partly open the market. Some others such as S. Korea may change to be a rice exporter due to less domestic consumption. Once a country is involved in trade, the country is affected by change in world prices. Such influence may be quite large in rice.

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Footnotes

/1. Data for rice are all expressed in milled equivalent figure. Major data sources are IMF (1987)[2] and USDA (1988)[8].
/2. The U. S. rice export policies such as the marketing loan, under which U. S. rice exports have been subsidized and increased since 1986, is also in part responsible for the low stock ratio.