

An Analytical Study on World Rice and Wheat Consumption

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(Received May 31, 1990)

Rice and wheat are the major staple foods in the world. However, their consumption patterns are quite different from each other. While rice consumption is heavily concentrated in Asia, wheat consumption is rather evenly distributed in the world. Regarding per capita consumption based on a study on 125 countries, most of the Asian countries have high levels at around 100 kg for rice but as low as 10 to 50 kg for wheat, and Europeans eat rice less than 5 kg but consume wheat as much as 170 kg or more. Interestingly, each individual country in the world has a rice-wheat consumption relationship; high in rice and low in wheat consumption or vice versa. These results indicate that rice and wheat may be strong substitutes for each other in many countries worldwide.

Introduction

Rice and wheat are the major staple foods for many years in the world. Recently, rice consumption pattern has been changing in Asia, where rice consumption is most heavily concentrated in the world (Ito, Peterson, and Grant, 1989)⁴⁾. Preceding to their study, negative income elasticities for rice in Asian countries were reported by the FAO (1971)³⁾, Daly et al. (1973)²⁾, Chen (1980)¹⁾, Mann (1982)⁶⁾, and Korean Rural Economics Institute (1984)⁵⁾. It is important to study basic world rice consumption characteristics and per capita consumption in individual countries and to grasp whole perspective of the world rice consumption pattern.

In this paper, domestic rice consumption in the world is discussed and compared with consumption of wheat. In particular, distribution patterns in consumption in individual regions of the world are described. Further, amounts of per capita consumption of rice and wheat are calculated for 125 individual countries and analyzed a relationship between the two commodities. In addition, consumption growth rates and fluctuations over time are also studied for rice and wheat with reference to coarse grains. Descriptions in the section clearly indicate: (1) the importance of Asia in world rice consumption compared with other areas; and (2) a sort of consumption relationship between rice and wheat in individual countries in the world. These comparisons provide us with the key factors for specific studies such as econometric analyses for world rice and wheat markets.

The U.S. Department of Agriculture (USDA) classifies types of rice into three categories: long, medium, and short grains. These three types are differentiated by length and length/

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width ratio (USDA, 1973, p. 38)⁹⁾. However, there are other ways to classify rice such as by variety (*Japonica/Indica*), by gluten content, and by aroma. Demand for rice, as well as other food products, depends on the particular combination of characteristics. In Japan, for example, *Japonica* rice is preferred over *Indica* rice. However, there are no data on these individual types of rice for production, consumption, or trade, although differences in preferences can be identified (Rastegari-Henneberry, 1985)⁷⁾. The data used in this paper deal with volumes of rice including all types, therefore. The original data used in this chapter are collected from the United States Department of Agriculture (USDA, 1986¹⁰⁾ and 1987¹¹⁾) for consumption of rice and wheat in individual countries and Urban and Rose (1988)¹³⁾ for population. Data on rice are in milled base throughout. Per capita wheat consumption is flour equivalent, calculated as 80 % of the unmilled quantity (Rooney, 1988)⁸⁾.

Total World Consumption

Total rice consumption in the mid 1980's was 310 to 320 million metric tons (MMT) on a milled basis (USDA, 1988)¹²⁾. In 1985, the largest quantity of rice consumed is found in the People's Republic of China (P.R.C.) at 124 MMT followed by India at 60 MMT. These two countries alone account for almost 60 % of world rice consumption. Indonesia, Bangladesh, Vietnam, and Japan account for another 20 % of world total rice consumption. Thus, the six largest rice consuming countries are responsible for approximately 80 % of world consumption. If consumptions in other Asian countries are included, total consumption in Asia accounts for 90 % of world total rice consumption (Table 1). This clearly indicates that world rice consumption is heavily concentrated in Asia.

In Wheat, on the other hand, total world consumption in the mid 1980's was 500 to 520 MMT in flour equivalent. The largest wheat consuming country is also the P.R.C. at 74 MMT followed by the U.S.S.R. at 73 MMT. These two countries account for almost 40 % of world wheat consumption. India, the U.S., Turkey, Pakistan, and France account for another 20 % rendering the seven largest wheat consuming countries responsible for approximately 60 % of world total wheat consumption. This contrasts with the higher concentration ratio in rice consumption. Wheat consumption is more evenly distributed around the world: Asia is responsible for only 34 %, while Western and Eastern Europe together account for 40 % of world wheat consumption. Given that population of Europeans account for only 16 % while Asians 55 % of the world, however, the Europeans' 40 % of wheat consumption may be quite heavier than Asians' rice consumption.

Per Capita Consumption

Per capita consumption levels are good indicators of the importance of a commodity in the diet of people in a particular country. Table 2 shows rice and wheat consumption on a per capita basis in 125 countries. These figures were calculated based on country base consump-

Table 1 Share of rice, wheat consumption, and population by region, 1985/86.¹

Region	Rice (%)	Wheat (%)	Population (%)
East Asia	44.0	21.3	25.7
South Asia	26.1	13.0	20.8
Southeast Asia	20.1	0.8	8.4
Oceania	0.1	0.7	0.5
Africa	2.8	5.9	9.3
North America	0.6	7.0	5.4
Central American and Caribbean	0.6	1.5	2.7
South America	3.0	3.5	5.6
Middle East	1.2	6.7	3.3
Western Europe	0.5	12.9	7.2
Eastern Europe	0.7	26.8	8.5

1 : Total percentages for the individual commodities may not be added to 100 % due to rounding errors and some missing countries.

Sources: U.S. Department of Agriculture (1986 and 1987), and Urban and Rose (1988).

tion data from the USDA (1986¹⁰ and 1987¹¹) and population data from Urban and Rose (1988)¹³. In Asia, per capita rice consumption is over 100 kilograms (kg) per year in many countries. It is likely that people in these nations consume rice at every meal. Although per capita rice consumption has been decreasing in some Asian countries such as Japan, Singapore, Taiwan, Malaysia, and Thailand, per capita consumption levels in these countries are still much higher than the average of those in other regions in the world. Per capita rice consumption in Palistan and Afghanistan is exceptionally low relative to other Asian nations.

In non-Asian areas, per capita rice consumption levels of over 100 kg per year are observed in Liberia, Madagascar, Mauritius, Reunion, Sierra Leone, Guyana, and Surinam. Elsewhere in the world rice is generally much less important in consumer diets. Per capita consumption in Central America and the Middle East is at around 30 kg to 60 kg per year but is much lower in most other regions. For example, in Eastern and Western Europe and North America, per capita rice consumption is around 5 kg or less per year except for the U.S. and Portugal, both of which produce considerable amount of rice.

Wheat consumption on a per capita basis contrasts with that of rice in many countries in the world. In Asia, it is interesting to note that per capita wheat consumption is more than 100 kg per year in only two countries, Afghanistan and Palistan. These are also the two countries with the lowest levels of per capita rice consumption in Asia. For the rest of the Asian countries, wheat consumption levels in the P.R.C. and S. Korea are over 50 kg per year, while those in Hong Kong, Japan, N. Korea, Taiwan, India, Nepal, Sri Lanka, Malaysia, and Singapore, where per capita rice consumption levels are low relative to other Asian nations,

Table 2 Per capita consumption of rice and wheat for 125 countries in 1985/86.¹

(rice: milled base; wheat: flour base)

Country	Rice (kg)	Wheat (kg)
Africa-----		
Algeria	1.1	162.1
Angola	7.6	18.1
Cameroon	10.3	13.1
Cape Verde Island	30.3	.
Chad	4.5	5.4
Egypt	31.4	138.3
Gabon	10.0	32.0
Gambia	95.8	22.2
Ghana	8.1	5.8
Guinea	59.3	3.7
Guinea Bissau	88.7	.
Ivory Coast	65.7	16.4
Kenya	2.4	18.1
Liberia	113.6	5.4
Libya	14.8	113.5
Madagascar	148.4	8.8
Mali	28.2	4.0
Mauritania	62.2	57.7
Mauritius	100.0	68.0
Morocco	0.7	147.8
Mozambique	9.9	6.4
Niger	9.6	1.5
Nigeria	12.8	9.9
Reunion	111.1	74.0
Senegal	61.9	14.9
Sierra Leone	112.7	8.6
Somalia	11.7	16.2
S. Africa	5.7	55.2
Sudan	1.0	27.2
Swaziland	4.4	105.8
Tanzania	11.1	4.8
Togo	12.0	16.0
Zaire	6.8	5.5
Zambia	1.9	9.4
East Asia-----		
China (P.R.C.)	118.4	70.6
Hong Kong	66.3	36.3
Japan	80.9	41.3
N. Korea	157.5	36.0
S. Korea	136.5	61.3
Macao	64.1	.
Taiwan (R.O.C.)	100.0	30.9

Continued.

Table 2 Continued

Country	Rice (kg)	Wheat (kg)
South Asia-----		
Afghanistan	23.3	191.4
Bangladesh	152.5	16.8
India	78.5	45.5
Nepal	104.2	27.7
Pakistan	22.2	103.0
Sri Lanka	118.7	33.0
Southeast Asia-----		
Brunei	109.0	
Burma	237.8	4.7
Indonesia	151.6	6.3
Kampuchea	150.3	4.5
Laos	227.7	
Malaysia	105.0	31.4
Philippines	101.7	11.5
Singapore	75.0	46.1
Thailand	156.7	3.1
Vietnam	169.8	7.8
Oceania-----		
Australia	4.6	149.3
New Zealand		88.9
Papua New Guinea	32.3	11.5
North America-----		
Canada	4.6	181.8
U.S.A.	7.8	95.1
Central America and Caribbean----		
Costa Rica	44.4	37.0
Cuba	54.1	104.0
D'can. Republic	49.3	28.4
El Salvador	7.8	21.6
Guatemala	3.5	19.2
Haiti	15.0	24.0
Honduras	8.4	16.8
Jamaica	21.6	68.3
Mexico	5.5	47.0
Nicaragua	25.3	18.7
Panama	54.5	24.0
Trinidad & Tobago	62.5	106.6
South America-----		
Argentina	4.1	117.3
Bolivia	19.1	47.3
Brazil	46.7	38.8
Chile	7.5	116.6
Colombia	37.4	18.0
Ecuador	30.1	32.5
Guyana	129.8	51.9
Paraguay	11.0	48.0
Peru	27.4	36.8
Surinam	105.2	52.6

Continued.

Table 2 Continued.

Country	Rice (kg)	Wheat (kg)
South America-----		
Uruguay	13.1	86.8
Venezuela	18.5	47.1
Middle East-----		
Cyprus	7.4	106.2
Iran	32.6	139.5
Iraq	36.7	175.0
Israel	14.6	142.2
Jordan	19.2	126.1
Kuwait	44.1	117.6
Lebanon	7.5	93.3
Oman	50.0	93.3
Qatar	68.9	.
Saudi Arabia	38.6	92.3
Syria	13.0	196.0
Turkey	4.8	215.9
U.A. Emirates	81.2	90.0
S. Yemen (Adan)	18.1	42.9
N. Yemen (Sana)	8.0	85.2
EC-12-----		
Belgium-Luxembourg	5.0	155.6
Denmark	2.8	271.6
France	3.8	182.6
W. Germany	2.3	133.1
Greece	5.9	136.0
Ireland	1.4	182.8
Italy	5.5	155.3
Netherlands	3.7	99.7
Portugal	18.0	89.5
Spain	6.6	103.3
U. Kingdom	3.3	157.1
Other Western Europe-----		
Austria	5.9	90.5
Finland	4.0	77.5
Norway	2.3	78.0
Sweden	3.2	82.7
Switzerland	3.8	93.5
Eastern Europe-----		
Bulgaria	5.9	407.7
Czechoslovakia	4.3	308.5
E. Germany	1.8	190.7
Hungary	6.4	368.5
Poland	2.5	179.4
Romania	5.0	202.2
U.S.S.R.	6.7	262.6
Yugoslavia	1.7	172.1

1 : Total consumption including feed use, if any.

Sources: U.S. Department of Agriculture (1986 and 1987) and Urban and Rose (1988) .

are between 25 kg and 50 kg. In Burma, Indonesia, Kampuchea, Thailand, and Vietnam, where per capita rice consumption is high, the wheat consumption is relatively small at less than 10 kg per person per year. Accordingly, there seems to be a substitute relationship between rice and wheat in Asia.

The figures in Table 1 indicate that wheat consumption is high in Eastern Europe. Indeed, per capita wheat consumption in each country in the region is 70 kg per year or more. Among the EC-12 countries, per capita wheat consumption is around 100 kg except for Portugal, where per capita rice consumption is the highest in the region. African per capita wheat consumption levels are generally small relative to other regions. Per capita wheat consumption is over 100 kg per year in most of the Middle East. In the Oceania region, Australian per capita wheat consumption is the highest at almost 150 kg per year. In the North American and South American regions, per capita wheat consumption levels exceed 100 kg in Canada, Cuba, Trinidad & Tobago, Argentina, and Chile, while per capita rice consumption is far below 10 kg in all of these countries except for Cuba. Interestingly, comparison between rice and wheat on per capita consumption basis in individual countries indicates that high per capita rice or wheat consumption level is associated with low per capita wheat or rice consumption level, respectively. This suggests that rice and wheat may well be substitutes for each other in non-Asian countries, also.

Growth Rates in World Total and Per Capita Consumption

Table 3 shows growth rates in world total consumption of rice and wheat with reference of coarse grains. The growth rates of rice and wheat are similar. Between the early 1960's and the mid 1980's, consumption of both commodities doubled. The total volume of consumption in 1985 was 320 MMT for rice and 495 MMT for wheat. Increases in consumption of coarse grains are slower than rice and wheat. Between the early 1960's and 1985, consumption of coarse grains grew by only 66 %. In terms of variations in consumption over time, patterns for wheat and coarse grains are similar, while the fluctuation pattern of rice is somewhat different from the others. This may be because consumption is indirectly affected by production. Wheat and coarse grains are produced in the same weather conditions, while rice, on the other hand, is produced mainly in Asia and its production depends on monsoon patterns rendering substantial amount of water supply rather than the temperate weather patterns that determine wheat and coarse grain production.

Average annual per capita consumption for the world as a whole increased from 48.2 kg to 65.6 kg for rice and from 61.5 kg to 81.2 kg for wheat (flour basis) between 1961 and 1985 (Table 4). Per capita wheat consumption is larger by a quarter than the counterpart for rice. Per capita consumption of coarse grains increased from 145 kg in 1961 to around 160 kg in the mid 1980's. While per capita consumption of rice and wheat increased by about 30 % during the period, per capita consumption of coarse grains increased by only 10 %. The faster growth in rice and wheat than in coarse grains indicates that rice and wheat have been

Table 3 World consumption of rice, wheat, and coarse grains, 1961-1987.¹
(crop year, million metric ton)

	Rice		Wheat		Coarse grains	
	Cons'n.	Index	Cons'n.	Index	Cons'n.	Index
1961	149	91	237	93	447	95
1962	151	92	245	97	458	98
1963	165	100	239	94	457	97
1964	179	109	262	103	478	102
1965	172	105	281	110	498	106
1966	178	109	279	110	514	110
1967	187	114	286	112	530	113
1968	191	117	306	120	537	114
1969	200	122	327	129	566	120
1970	211	128	336	132	582	124
1971	216	132	342	135	609	130
1972	214	131	357	141	619	132
1973	222	136	366	144	670	143
1974	226	138	361	142	624	133
1975	233	142	351	138	644	137
1976	238	145	380	150	684	146
1977	245	150	402	158	690	147
1978	254	155	421	166	742	158
1979	260	159	438	173	741	158
1980	276	169	450	177	747	159
1981	285	174	449	177	741	158
1982	286	175	460	181	753	160
1983	305	186	474	187	758	162
1984	311	190	492	194	781	166
1985	320	195	495	195	778	166
1986	322	196	521	205	809	172
1987	313	191	533	210	812	173

1 : Index for each commodity is 100 for the average between 1961/62 through 1965/66.

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

the staple food in many places in the world and more in necessity than coarse grains. Coarse grains, on the other hand, are mainly fed to livestock, and the high level of per capita consumption for coarse grains is, in part, a reflection of the loss of weight when grain is converted to meat rather than eaten directly.

It is clear from the preceding discussion that rice consumption is highly concentrated in Asia. Accordingly, changes in consumption patterns in Asia can dramatically affect the world rice market and trade. In Asia, there is a tendency that rice is becoming an inferior good. Ito, Peterson, and Grant (1989)⁴⁾ reported that per capita rice consumption⁴⁾ in Asian countries increases to a peak then start decreasing as income grows. This is, according to their explanation, because Asian people are eating around 100 kg of rice per person annually: This means that they eat rice at every meal. Therefore, it is only natural for Asians to gradually diversify their diet consuming more wheat, meats, fish, and dairy products as their incomes grow and allow them to have more varieties of food. Their results suggest that income

Table 4 Per capita world consumption of rice, wheat, and coarse grains, 1961-1987.

(crop year, kg)
(rice: milled base; wheat: flour base)

	Rice		Wheat		Coarse grains	
	Cons'n.	Index	Cons'n.	Index	Cons'n.	Index
1961	48.2	95	61.5	98	144.7	100
1962	48.0	95	62.4	99	145.7	101
1963	51.3	101	59.5	94	142.0	98
1964	54.6	108	63.8	101	145.4	101
1965	51.3	101	66.9	106	148.3	103
1966	52.1	102	65.2	103	150.1	104
1967	53.4	105	65.4	104	151.7	105
1968	53.7	106	68.6	109	150.6	104
1969	54.9	108	71.9	114	155.2	107
1970	56.7	112	72.3	115	156.5	108
1971	57.0	112	72.0	114	160.4	111
1972	55.3	109	73.8	117	159.7	110
1973	56.3	111	74.0	117	169.5	117
1974	56.2	111	71.7	114	154.9	107
1975	56.8	112	68.4	109	157.1	109
1976	57.0	112	72.9	116	163.8	113
1977	57.8	114	75.7	120	162.4	112
1978	58.8	116	77.9	124	171.6	119
1979	59.1	116	79.7	126	168.6	117
1980	61.8	122	80.5	128	167.0	115
1981	62.6	123	78.9	125	162.7	113
1982	61.8	122	79.4	126	162.5	112
1983	64.6	127	80.4	128	160.7	111
1984	64.8	128	82.1	130	162.8	113
1985	65.6	129	81.2	129	159.4	110
1986	64.8	128	84.0	133	162.9	113
1987	62.0	122	84.5	134	160.8	111

Sources: U.S. Department of Agriculture (1988), and Urbana and Rose (1988).

elasticities are already strong negative in Japan (-0.708), Malaysia (-0.671), Nepal (-0.332), Singapore (-0.599), Thailand (-0.437), and Taiwan (-0.594). Further, income elasticities in heavily populated countries such as the Peoples' Republic of China, India, and Indonesia are decreasing sharply although they are still positive; the P.R.C. 0.133, Indonesia 0.108, and India 0.125. It had been well understood that rice was an inferior good in Japan and Taiwan, in both of which economies are advanced. It is surprising that so many Asian countries have negative or positive decreasing income elasticities. Total consumption grows as population grows. However, once income elasticity in a country decreases well below zero, its total consumption may decrease in spite of increasing population as observed in Japan and Taiwan.

Conclusion

World rice consumption is heavily concentrated in Asia. Per capita rice consumption in Asian countries are also extremely high at around 100 kg per year, while that in most of European countries is less than 5 kg. Interestingly, however, per capita wheat consumption is very high in Europe and relatively low in Asia. This rice-wheat consumption relationship is also true among Asian countries, in which high per capita rice consumption in individual countries is often associated with relatively low per capita wheat consumption and vice versa. Accordingly, rice and wheat may globally be substitutes for each other.

Rice in Asia is becoming an inferior good, and total rice consumption in certain countries in Asia has already been decreasing, generating more surplus rice from Asia. It will eventually be important for Asian countries, in particular, to develop new markets for rice for the future. Given that rice and wheat may be substitutes for each other, however, there may be a great market potential for rice in Eastern and Western Europe and other Western countries.

Acknowledgement

The author would like to acknowledge helpful comments from Drs. Dean T. Chen and E. Wesley F. Peterson in the development of this paper.

References

- 1) Chen, W.: *An Economic Study on Government Rice Stock Operation in Taiwan*. A Ph. D. dissertation, Department of Agricultural Economics, University of Illinois at Urbana-Champaign (1980)
- 2) Daly, R.F., Hoffman, R.G., Nelson, F. and Weingarten, H.: *Agriculture in the Vietnam Economy: A System for Economic Analysis*. ERS, U.S. Department of Agriculture, Washington D.C. (June 1973)
- 3) Food and Agriculture Organization of the United Nations (FAO): *Agricultural Commodity Projections, 1970-1980*. Volumes I and II, FAO, Rome (1971)
- 4) Ito, S., Peterson, E.W.F., and Grant, W.R.: Rice in Asia: Is It Becoming An Inferior Good?. *American J. of Agric. Economics*, **71** 32-42 (1989)
- 5) Korea Rural Economics Institute: *Seoul-shi Migok Utong Gaesun Bang Hyang* (Studies for Improving rice Marketing in Seoul Area —Focusing on the Wholesale Market). Seoul, S. Korea (1984)
- 6) Mann, J.S.: *Food Demand Pattern in Thailand*. IED Staff Report, ERS, U.S. Department of Agriculture (1982)
- 7) Rastegari-Henneberry, S.: *The World Rice Market*. Giannini Foundation Information Series No. 85-2, Division of Agriculture and Natural Resources, University of Califor-

nia (1985)

- 8) Rooney, L.W.: a telephone interview, Professor, Department of Soil and Crop Sciences, Texas A&M University, College Station, Texas (June 1988)
- 9) United States Department of Agriculture (USDA): *Rice in the United States: Varieties and Production*. Agriculture Handbook No. 289, Agricultural Research Service, Washington D.C. (June 1973) p. 38
- 10) ____: *Foreign Agriculture Circular, Grains: World Grain Situation and Outlook*, 7. FG 8-86, FAS, USDA, Washington D.C. (August 1986)
- 11) ____: *World Grain Situation and Outlook*. Circular Series FG-2-87, FAS, USDA, Washington D.C. (January 1987)
- 12) ____: *World Grain Situation and Outlook*. Circular Series FG 5-88, FAS, USDA, Washington (1988)
- 13) Urban, F. and Rose, P.: *World Population by Country and Region, 1950-86, and Projections to 2050*. Agriculture and Trade Analysis Division, Economic Research Service, USDA, Washington D.C. (1988)

Footnotes

- /1. The study by the FAO covered most of nations in the world. Japan was the only country estimated to have a negative income elasticity for rice.
- /2. Outside Asia, Egypt, Madagascar, Nigeria, the U.S., Brazil, Colombia, Iran, and the Soviet Union (U.S.S.R.) are among the largest rice consuming countries.