

Estimate of Rice Consumption in Asian Countries and the World Towards 2050

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Introduction

Rice is a staple food for over half of the world's population (FAO, 2004). Rice accounts for over 20 percent of global calorie intake. Over 90 percent of the world's rice is produced and consumed in the Asian Region by 6 countries (China, India, Indonesia, Bangladesh, Vietnam and Japan) comprising 80% of the world's production and consumption. Recently, Asian trend shows that production and export has been increasing but the consumption has been decreasing. With growing prosperity and urbanization, per capita rice consumption has started to decline in the middle and high-income Asian countries like Japan, Taiwan and the Republic of Korea. But, nearly one-fourth of the Asian population is still poor and has considerable unmet demand for rice such as Afghanistan, North Korea, Nepal and Vietnam. It is in these countries that rice consumption could grow faster. The decreases of rice consumption in Asian region are because of the increases in per capita income that leads income elasticity's of demand for rice as a normal good decreasing (Ito *et. al*, 1989) as well as westernize in diet.

The Asian population is growing at 1.8 percent per year at present. Growth in population in this region means an increase on demand for rice (for total consumption but not per capita consumption). So far the annual growth rate for rice consumption in the Asian Region over a period of 45 years (1960 to 2004) has kept a pace with the demand, more through yield increase rather than area expansion. Improved varieties have made a significant impact on the demand side in an ever-increasing order during this period. The world rice production has more than doubled from 150.821 million tons in 1960 (with Asian production of 134.317 million tons) to 406.068 million tons in 2004 (including the region's production of 354.895 million tons). For almost two decades, from the mid-1960s to the mid-1980s, rice production grew at close to 3% per annum. Slower growth since the mid-1980s has been influenced by both supply and demand factors: sharply lower prices for rice, environmental degradation and

over-exploitation of soil and water resources, and a decline in per capita consumption with the rising incomes in Asian regions.

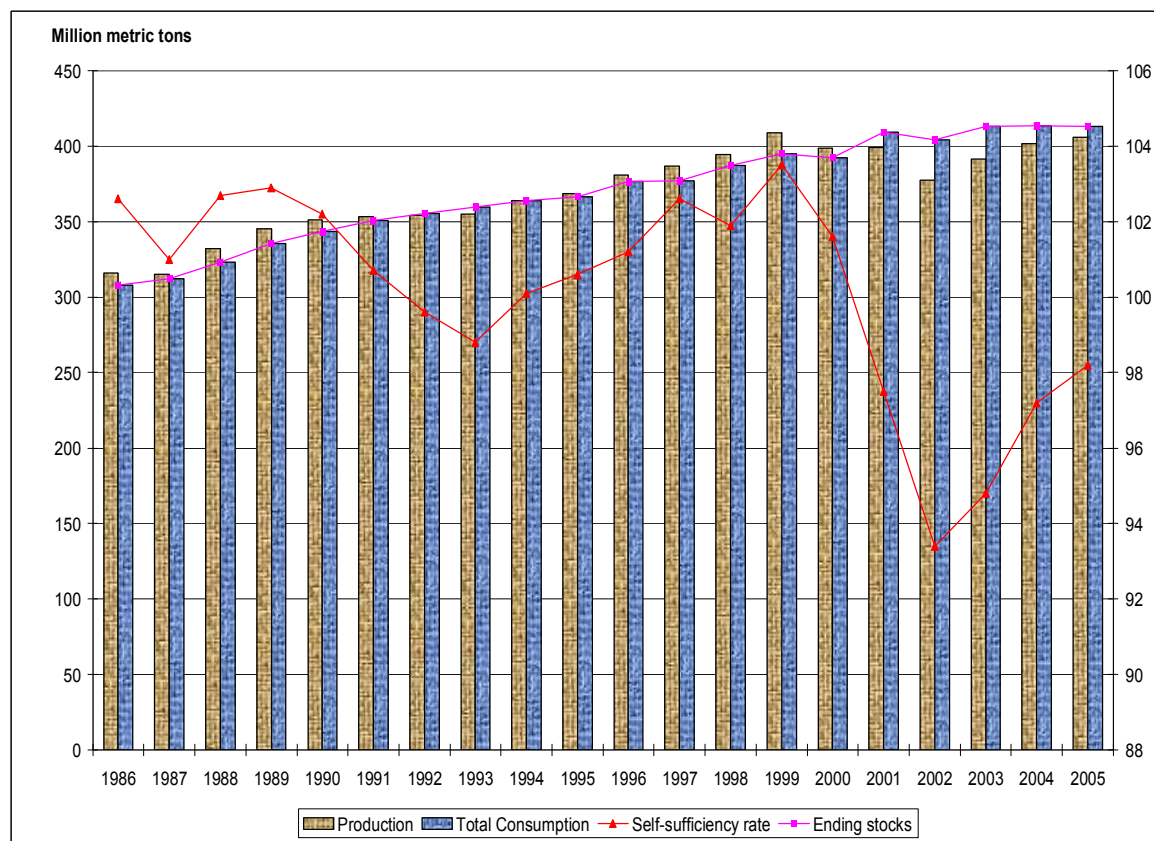
The major structural transformation in Asia's rice economy over the past three decades has been part and parcel of the process of transition towards an industrial economy. Indicators of this transformation are a decline in percentage gross domestic product and labor force in agriculture, a decline in population growth rate, a decline in percentage calories from rice in the diet, the change in rice production practices (many of which had existed for hundreds of years), the decline in percentage of farm income from rice, and a decline in the percentage of households below the poverty line.

The Asian Region, where more than 61 percent of the world's population lives, adds 45 million more rice consumers annually. Despite the problems of soil salinity, high cost of development, water scarcity, alternative and competing uses of water, and environmental concerns, the history has shown that world rice sufficiency just enough to meet the demand. Thus, even for the future, increase of productivity on a time scale has to make the major contribution across ecosystems by using more advanced technologies. Research by FAPRI has shown that land and water resources just enough for agriculture activities to grow food. Therefore, false alarm about the scarcity of land and water is better to be ignored. In other words, for the future there is no limitation for the future rice production in term of resource. It means, the indicators of rice demand are nothing to do with these factors and rice in any situation will fulfill future demand.

Figure 1 presents information on global rice production, consumption, and self-sufficiency rate for the period 1985 to 2005. These data illustrate the two distinct phases that have transpired over the last 20 years. From 1997 to 2000, production exceeded consumption; overproduction was mainly a result of a combination of favorable international prices in previous years, support prices and government support to export in several producing countries. Following these "surplus years", global rice production has declined ever since; consumption has outpaced production. Global stocks have also decreased to compensate for the decline in production. However, global stocks in the last 5 years have remained high. The current production trend is expected to continue until rice stocks reach a more realistic level and if the demand and supply factors cause international rice prices to rise.

Figure 1

Global rice production, total consumption and self-sufficiency rate, 1986-2005



Source: S. Ito World Food Statistics and Graphics (<http://worldfood.apoinet.or.jp>)

As income grows, per capita rice consumption is expected to decline as consumers substitute rice with high-cost quality food containing more protein and vitamins such as processed rice, vegetables, bread, fish and meat. Japan, Taiwan and the Republic of Korea have already made this transition, and rest of the Asia will be making it in proportion to the pace of their economic growth. But these declines will be offset by the population growth and additional income, increasing the net demand of rice to over 481.9 million tons by 2025 and 525 million tons by 2050. Several Asian countries that are now self-sufficient in rice may find it more profitable to import rice in exchange for diverting production resources to more remunerative activities and might not care more in producing rice. If this situation ever happens then of course Asian countries will lose one of their most important strength.

Table 1

Nutritional aspects of rice consumption in selected countries of the world

Country	Consumption	Energy	Protein	Fat	Calcium	Iron	Thiamine	Riboflavin	Niacin	Zinc
	(g/day)	(% of recommended daily intake)								
Bangladesh	441	76	66	18	3	8	18	14	25	30
China	251	30	20	17	2	4	10	8	14	17
India	208	31	24	4	1	4	8	6	12	15
Indonesia	414	51	43	8	3	7	17	13	24	29
Myanmar	578	74	68	20	4	10	23	17	32	40
Philippines	267	41	30	5	2	5	10	8	14	17
Sri Lanka	255	38	37	3	2	5	10	8	14	17
Thailand	285	43	33	5	2	5	12	9	17	21
Viet Nam	465	67	58	14	3	8	19	14	27	34

Source: Kenny, G. 2001.

Data Sources and Research Method

Baker, Herdt and Rose (1985) suggested that specific rice consumption patterns among Asian countries were “unique for each country” and demand increases for cereal grains vary depending upon income level. Ito *et. al.* (1989) has agreed that it is useful to investigate Asian rice consumption patterns among countries using a time-series and cross-sectional method. Recent data need to be included so that the result will be more updated and compatible for the future implications particularly in rice policies and marketing strategies.

For this research, we used time series trend with historical and current data to forecast per capita and total rice consumption for 22 individual Asian countries and the rest of the world. The 22 Asian countries are China, India, Japan, Taiwan, Afghanistan, Bangladesh, Brunei, Burma, Cambodia, Hong Kong, Indonesia, Laos, Malaysia, Nepal, North Korea, South Korea, Pakistan, Philippines, Singapore, Sri Lanka, Thailand and Vietnam. The estimations were done using the USDA total rice consumption data for the period of 1960-2005. The data were recalculated for per capita basis. The main data sources are from S. Ito World Food Statistics and Graphics (<http://worldfood.apionet.or.jp>) and Food and Agricultural Organization of the United Nations (FAO) (<http://www.fao.org>.) The analysis and the forecast were carried out more deeply for China and India as their rice consumption plays the biggest role in Asia and the world.

Our research based on a few assumptions. These are: First, Asian rice consumption is continuously follow current trend; second, rice per capita consumption will not grow any further than 250 kg/capita; and third, rice per capita consumption for developing countries with increasing per capita consumption has eventually started declining as observed in other nation in

the same region.

To estimate the increasing/decreasing rate, a data period for several years with the starting and ending points was decided considering the recent historical trends in each individual Asian countries and the region. These trends were adjusted to certain extent considering hunger and malnutrition, country's economic growth and other factors such as war and natural disaster. However, the unusual years of rice consumption pattern was mainly ignored.

The standard formula used to estimate per capita rice consumption for the target year is as follows:

$$X_{t+n} = (1 + r)^n Q_t$$

where, **X**- Volume of target year,
r- Average growth rate,
Q_t- Volume of base year,
N- Total number of years ahead.

For the case of China and India, the estimations were based on 3 different scenarios individually for each country. We combined all these 3 scenarios one another to find 3 scenarios of rice consumption for Asia and the world. The 3 scenarios for China were based on the rice consumption of historical trend of China herself (2001-2004) as Scenario 1, Japanese trend (1970-2000) as Scenario 2 and Taiwanese trend (1970-2000) as Scenario 3. The 3 scenarios for India were based on the historical trend for India herself (1996-2003) as Scenario 1, the average rate of Indian rice consumption as a share compared to the other grain consumption as Scenario 2 and the average rate of Indian rice consumption as a share compared to all other food consumption including the other grains as Scenario 3. The 3 scenarios for China and India were considered separately because the food and the nature of Chinese diet changing patterns are closely related to Taiwanese and Japanese while for India, food and diets are very unique. More than half of Indian population are vegetarian and don't eat meat obeying the Indian scripture that is against killing and eating meat.

In Asian region where rice is a staple food, people will react so politically on the increases or decreases of the rice price and the governments try to stabilize the situation in individual countries. Due to the situation, therefore, the justification of method for this research is not inappropriate.

Results and Discussion

The rates calculated for the per capita rice consumption of all 20 Asian countries (except China and India) and the rest of the world are shown in Table 1. Most of the Asian countries show decreases in per capita consumption except for Afghanistan, Nepal, North Korea, Brunei, Philippines, and Vietnam. The trends for Asian countries are opposite to the current situation for the Middle East, African countries and the western countries where rice total consumption is increasing.

Table 2

Changing rate of per capita rice consumption in selected Asian countries

Country	All Consumption		Direct Consumption	
	Period	% Rate	Period	% Rate
Japan	2000 – 2003	-1.38%	1986-2002	-0.97%
Taiwan	2001 – 2003	-0.68%	N/A	N/A
South Korea	2001 – 2003	-1.69%	1992-2002	-1.83%
Thailand	2000 – 2004	-0.67%	1990-2002	-0.31%
Indonesia	1990 – 2003	-0.20%	1999-2002	-0.75%
Bangladesh	2000 – 2003	-0.12%	1990-2001	0.36%
Burma	1967 – 1984	-0.20%	1994-2001	-0.56%
North Korea	1978 – 1988	0.95%	1986-2002	0.92%
Cambodia	2001 – 2003	-0.20%	1986-2002	0.36%
Laos	2001 – 2004	-0.25%	1992-2002	-0.77%
Vietnam	1993 – 1997	0.46%	1996-2002	0.20%
Malaysia	2000 – 2003	-0.87%	1993-2001	-0.60%
Nepal	1993 – 2003	0.70%	1997-2002	0.29%
Philippines	1996 – 2003	0.73%	1987-2002	0.68%
Sri Lanka	1998 – 2004	-0.10%	1994-2002	-0.79%
Afghanistan	1990 – 2003	1.10%	N/A	N/A
Brunei	1970 – 2004	0.13%	N/A	N/A
Pakistan	2001 – 2004	-0.55%	N/A	N/A
Singapore	2001 – 2003	-1.09%	N/A	N/A
Hong Kong	1979 – 2004	-0.83%	N/A	N/A
Rest of the world	2001 – 2003	0.97%	1996-2002	0.46%

Source: S. Ito World Food Statistics and Graphics (<http://www.muses.tottori-u.ac.jp>), FAO, and Authors' projection

Table 3 shows the rate for three different scenarios that have been applied to China and India to determine the per capita and total rice consumption.

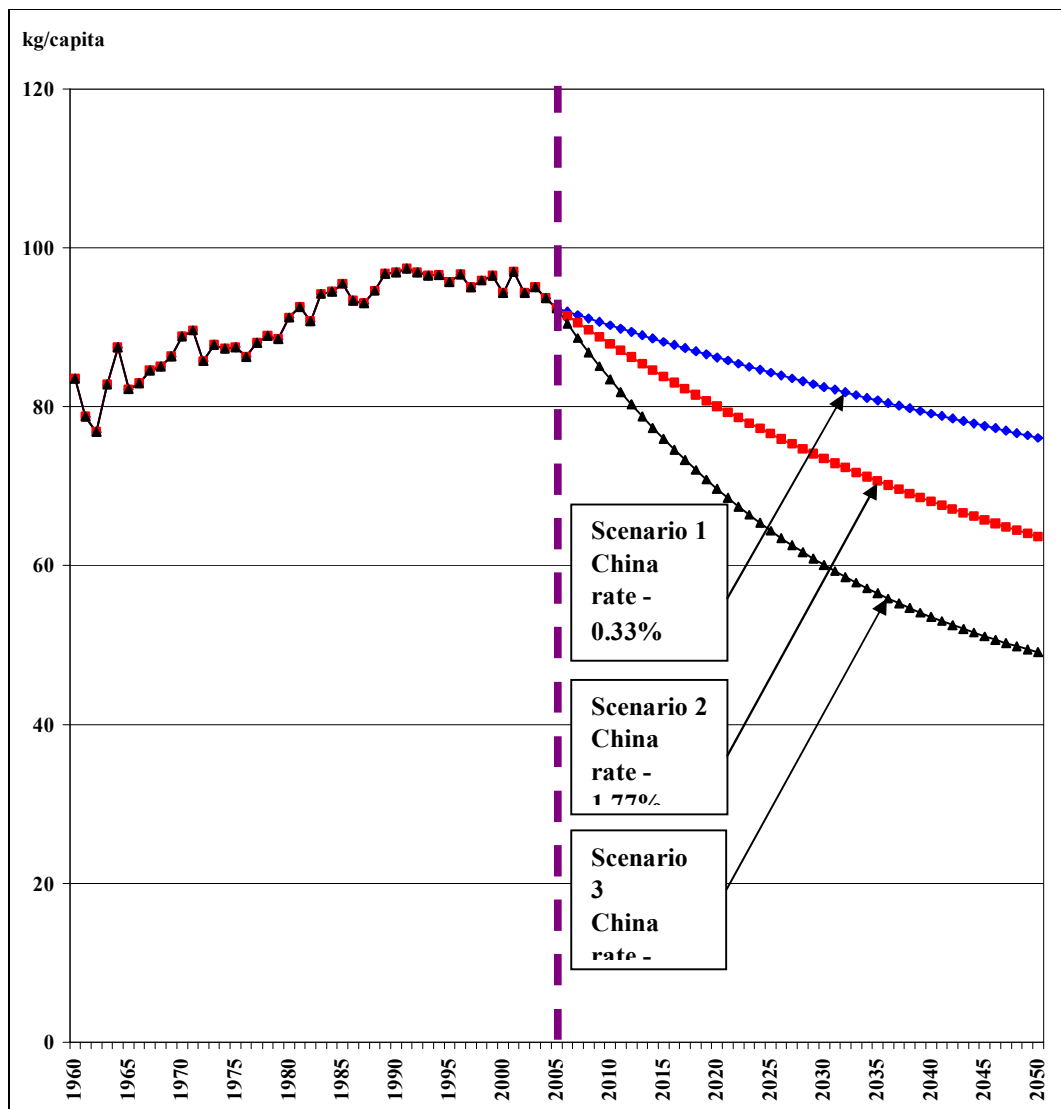
Table 3 Three scenarios for China and India

Scenarios	China			India		
	Reference	Period	Rate	Reference	Period	Rate
Scenario 1	China	2001 – 2004	-0.33%	Indian	1996-2003	-0.93%
Scenario 2	Japan	1970 – 2000	-1.77%	Grain	1998-2004	-1.44%
Scenario 3	Taiwan	1970 – 2000	-3.35%	All Food	1990–2001	-3.03%

Source: S. Ito World Food Statistics and Graphics (<http://www.muses.tottori-u.ac.jp>), FAO, and Authors' projection

Projection results of the 3 scenarios towards 2050 for Asia and the world are summarized in Figures 2, 3, 4 and 5 as follows:

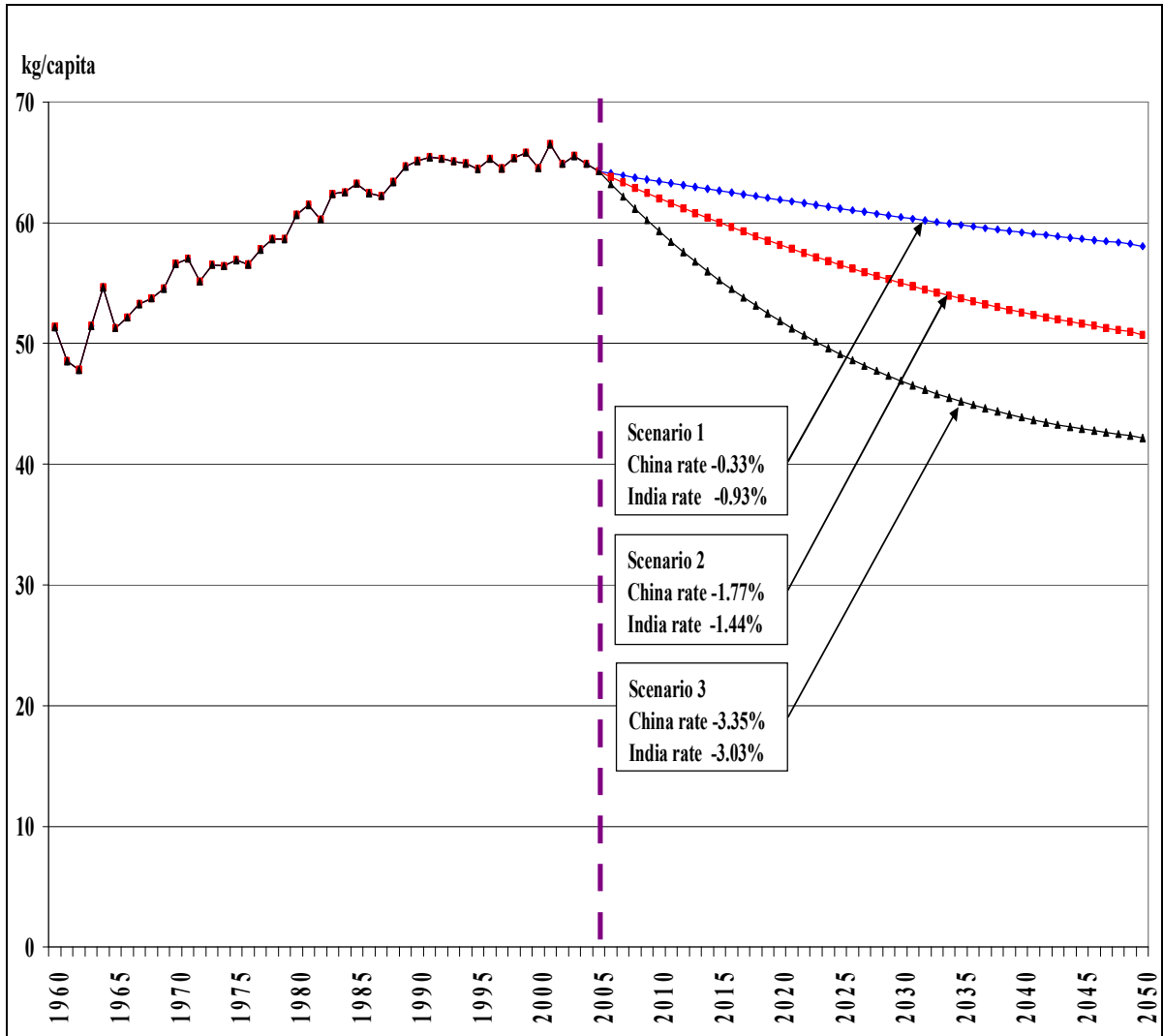
Figure 2
Asian per capita rice consumption, 1960-2050



Sources: S. Ito World Food Statistics and Graphics (<http://worldfood.apionet.or.jp>) and Authors' projection

Figure 3

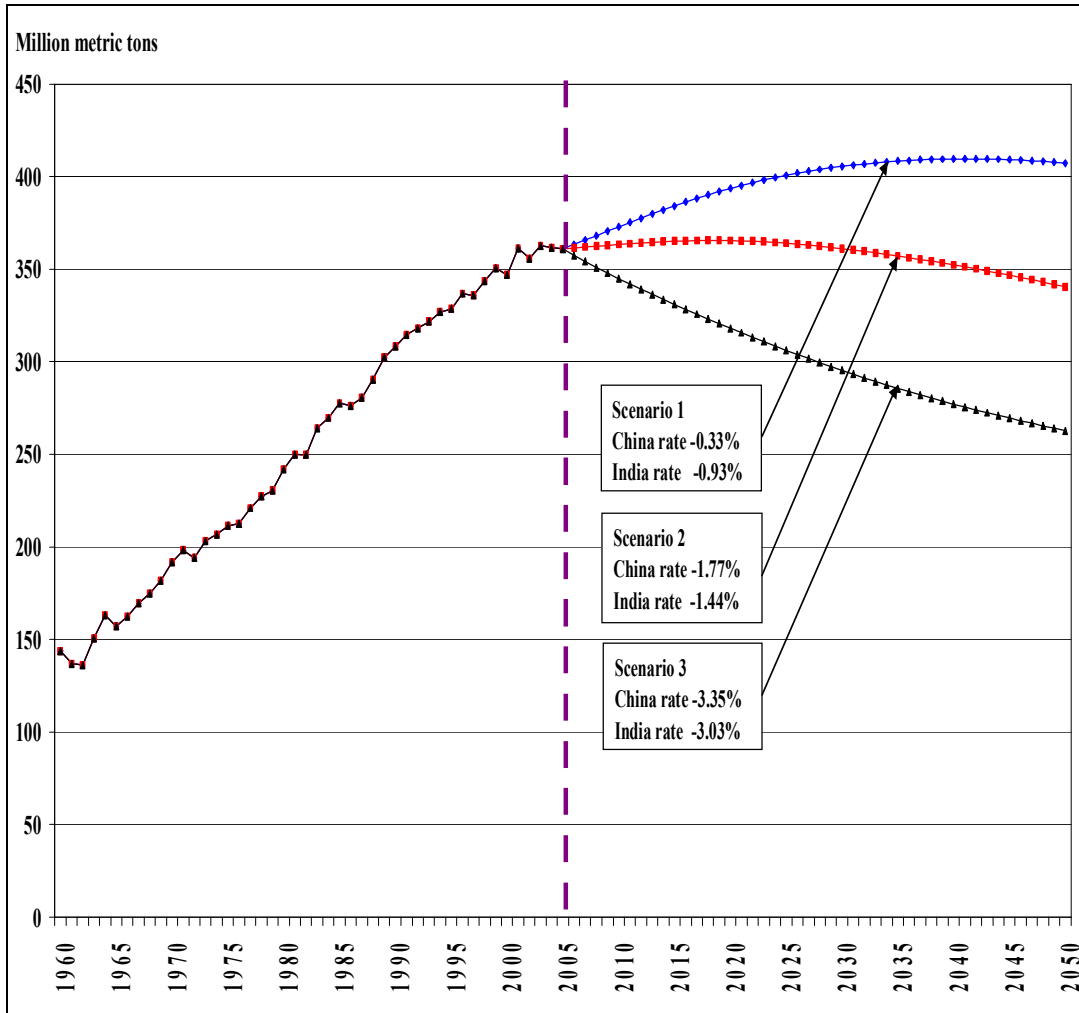
World per capita rice consumption, 1960-2050



Sources: S. Ito World Food Statistics and Graphics (<http://worldfood.apionet.or.jp>) and Authors' -projection

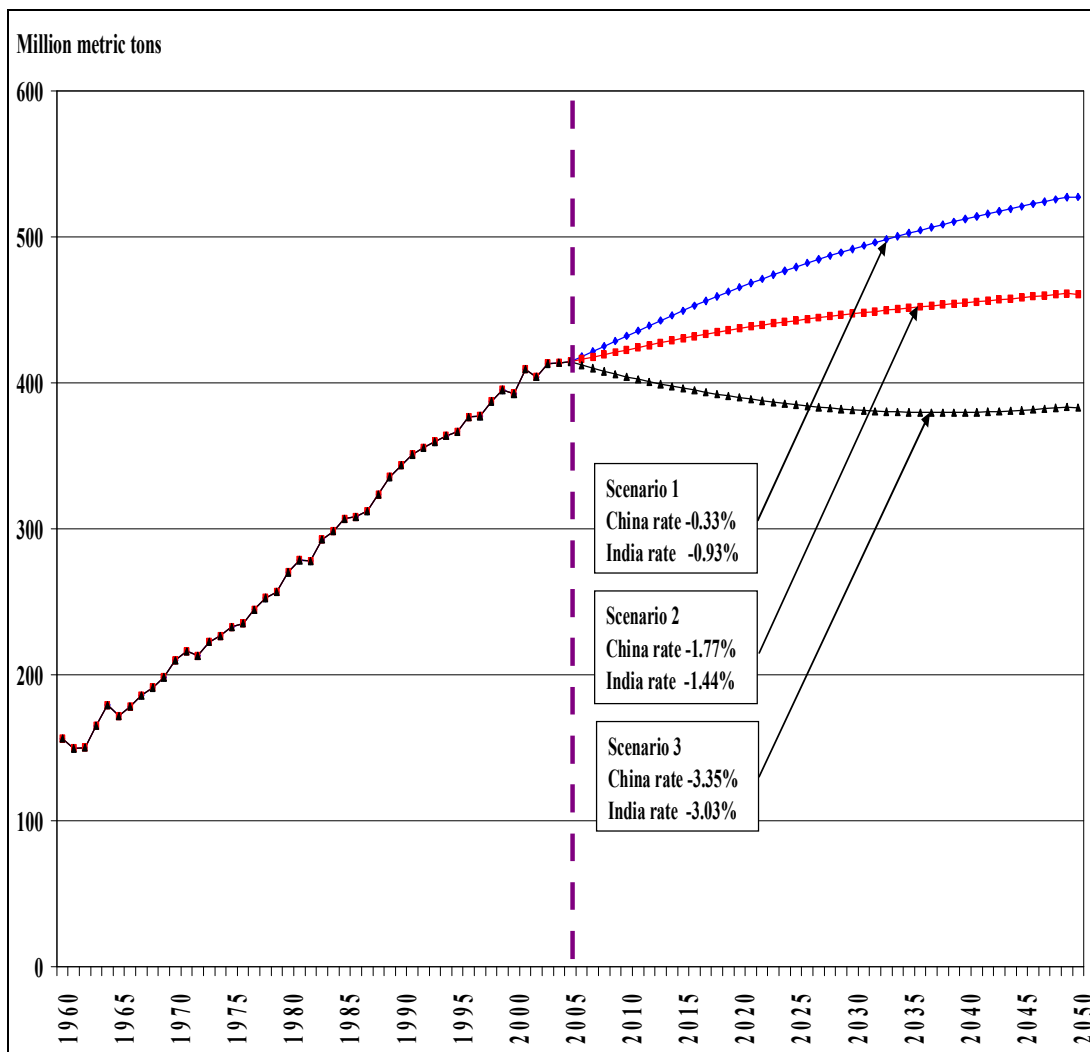
Figure 4

Asian total rice consumption, 1960-2050



Sources: S. Ito World Food Statistics and Graphics (<http://worldfood.apionet.or.jp>) and Authors' projection

Figure 5
World total rice consumption, 1960-2050



Sources: S. Ito World Food Statistics and Graphics (<http://worldfood.apionet.or.jp>) and Authors' projection

Table 4

China, India, Asia and the World per capita and total rice consumption

Country	Per Capita Consumption (kg/capital)									
	2005	2015			2025			2050		
Japan	64.9	56.4			49.0			34.7		
Taiwan	49.1	45.9			42.8			36.1		
South Korea	99.3	83.7			70.6			46.0		
Thailand	145.0	135.6			126.8			107.1		
		S1	S2	S3	S1	S2	S3	S1	S2	S3
China	75.9	69.1	65.7	55.8	63.0	56.8	41.0	49.9	39.5	19.0
India	81.9	84.9	80.6	68.5	85.7	77.3	55.9	79.8	63.3	30.4
Asia	92.4	88.2	83.8	75.9	84.3	76.6	64.4	76.1	63.6	49.1
World	64.3	62.7	60.0	55.2	61.2	56.5	49.1	58.1	50.7	42.4
		Total consumption (million metric ton)								
Japan	8.3	7.0			5.9			3.4		
Taiwan	1.1	1.1			1.1			0.8		
South Korea	4.9	4.3			3.7			2.2		
Thailand	9.5	9.5			9.3			7.9		
		S1	S2	S3	S1	S2	S3	S1	S2	S3
China	103.8	100.4	89.8	73.8	97.2	77.7	52.5	89.5	54.0	22.4
India	135.2	139.3	124.5	102.4	140.7	112.5	76.1	126.8	76.6	31.8
Asia	360.9	384.1	365.1	330.9	400.7	364.0	306.0	407.2	340.4	262.7
World	414.5	449.4	430.4	396.2	479.4	442.8	384.9	527.4	460.7	383.0

Source: <http://worldfood.apionet.or.jp> and self-projection

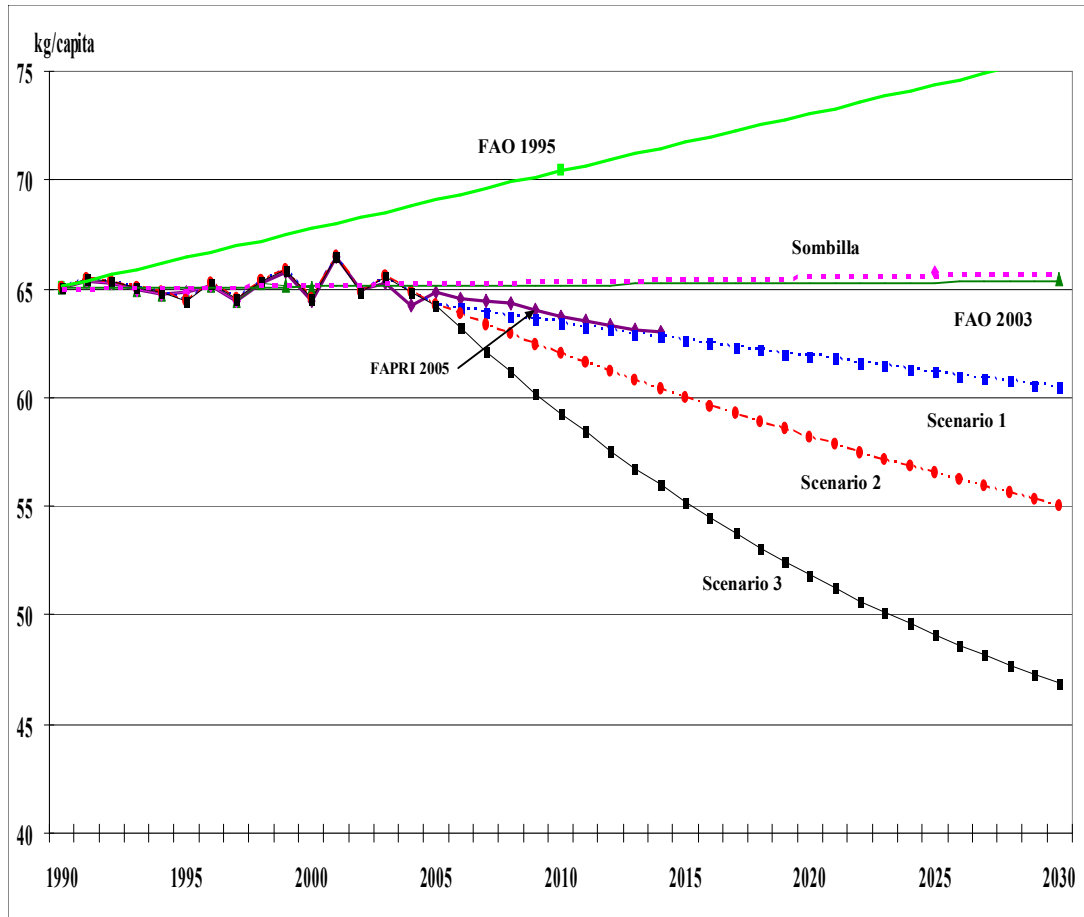
Notes:

For all scenarios, different rates are applied to China and India;

- S1 (Scenario 1): China rate -0.33%, Indian rate -0.93%
- S2 (Scenario 2): China rate -1.77%, India rate -1.44%
- S3 (Scenario 3): China rate -3.35%, India rate -3.03%

Figure 6

Comparison between projections for world rice per capita consumption

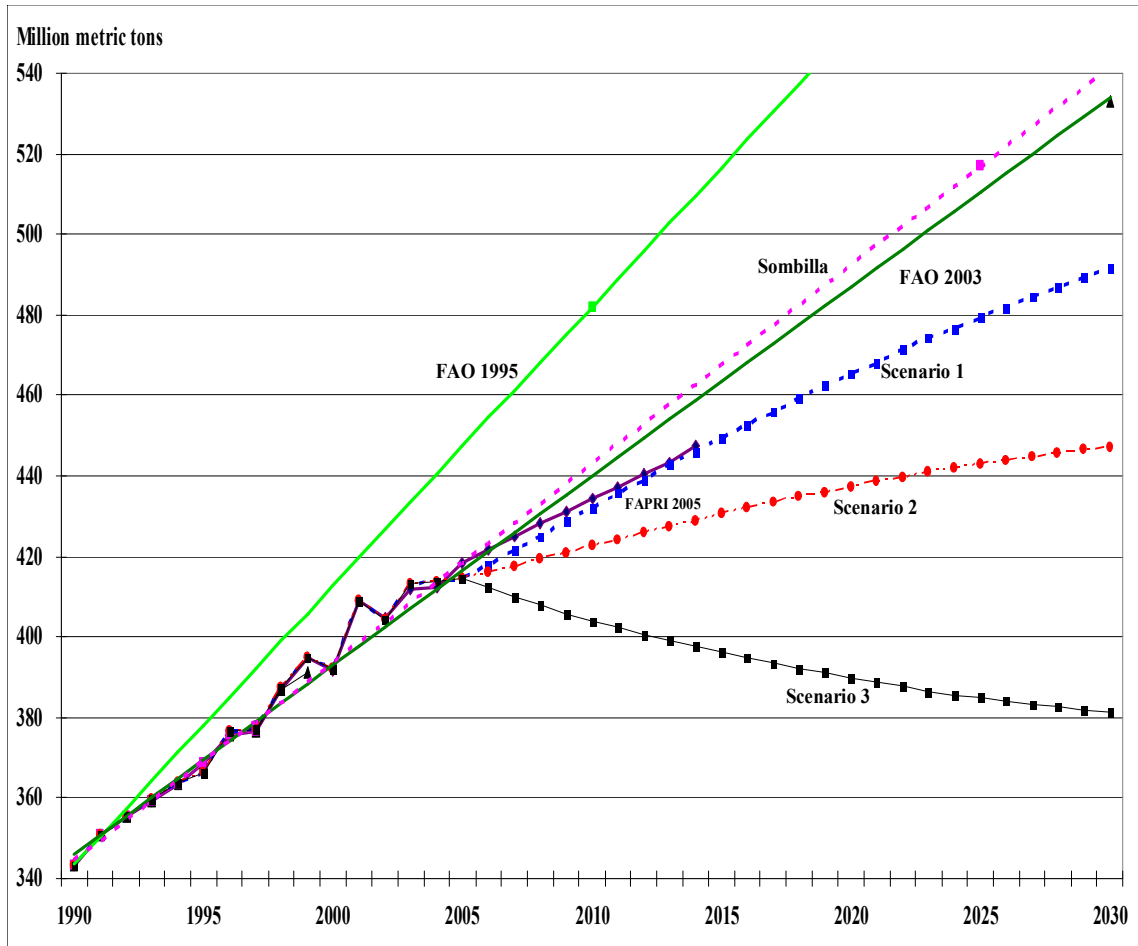


Source: S. Ito [World Food Statistics and Graphics](http://worldfood.apionet.or.jp) (<http://worldfood.apionet.or.jp>),

http://www.fapri.iastate.edu/Outlook2004/PageMker/9_WldRice.pdf, and <http://www.usda.gov/nass>

Figure 7

Comparison between projections for world total rice consumption



Source: S.Ito World Food Statistics and Graphics (<http://worldfood.apionet.or.jp>),

http://www.fapri.iastate.edu/Outlook2004/PageMker/9_WldRice.pdf, and <http://www.usda.gov/nass>

Conclusion

We compare our 3 scenarios projection with other 4 different projections for the world total rice consumption. FAO projected in 1995 that the rice total consumption would increase from 351 million metric tons in 1992 to 482 million metric tons in 2010. FAO latest projection in 2003 indicates that total rice consumption would increase from 395.4 million metric tons in 2000 to 472 million metric tons in 2015 and increase further to 533 million metric tons in 2030. FAPRI's latest projection in 2005 showed that the world total rice consumption would increase from 418.3 million metric tons in 2005 to 447.5 million metric tons in 2014. Sombila (2002) has projected in 1995 that world rice total consumption would increase from 376.8 million metric tons in 1997 to 516.91 million metric tons in 2025. Our projection in 2005 for Scenario 1 shows that the world rice total consumption would be increase from 417.4 million metric tons in 2005 to 452.4 million metric tons in 2015 and 493.5 million metric tons in 2030. For Scenario 2, the world rice total consumption would 415.4 million in 2005, 430.1 million metric tons in 2015, and 449.3 million metric tons in 2030 while for the Scenario 3, the world rice total consumption would decrease from 413.1 million metric tons in 2005 to 411.1 million metric tons in 2015 and would be 414.6 million metric tons in 2030.

Our research has shown that China and India play very important role in the Asian and the world rice consumption. The decreases of rice consumption in Asia will result in the over supply of rice that could put pressure on the world market prices. Importing countries may enjoy cheaper prices but the rice producers in the world could suffer and the poverty in Asian rural areas might increase. The weakening rice demand downward in Asian region means greater opportunity for other crops such as corn and soybean to increase their market shares in Asia. Thus, Asian will lose its competitiveness in rice and agriculture as a whole against other grains. As the price of rice getting lower, the plantation of rice may not be profitable any longer. These situations make rice under pressure for its survival. Asian countries such as China, India and Japan should take the lead to improve the situation as well as to further promote rice consumption in the rest of the world.

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