Global Competitiveness of Indonesian Rice

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I. Introduction

Rice is an important crop in Indonesia. Any problem related to rice has significant economic, social and political impacts. Realizing this, the Indonesian government has long considered rice as a major strategic commodity since 1969 when the First Five-Year Development Plan was launched (Darwanto, 2000).

In Indonesia, rice has an economic value because most households are farmers, and majority of these farmers cultivate rice. Thus, problems such as low price of rice, high prices of inputs or crop diseases will affect most farmers and households. On the consumption side, rice is the staple food in most areas. Although originally, some people living in Irian Jaya, Maluku eat "sagu" (palm-like stem), and people in Nusa Tenggara Timur and Madura eat corn as their staple food, eating rice is considered prestigious so that people tend to eat rice whenever possible. Rice is also a political commodity. This was true when the rice problem was the major issue that led to the downfall of two powerful presidents, President Soekarno in 1966 and President Soeharto in 1998.

Indonesia has almost always been a rice-importing country since 1945. During the time of former President Soekarno (1945-1965), there was always an excess demand for rice, despite government's efforts to raise domestic rice production. In Soeharto's regime (1966-1998), Indonesia became one of the biggest rice-importing countries in the world, although there were also very brief periods (1985-1987 and 1993) of self-sufficiency.

Since the new administrations Habibi, Wahid and Megawati took over, the currency exchange rate has been volatile, reaching Rp 2,400 per US dollar in 1997 to Rp10,500 per US dollar today. The economic crisis, which resulted directly from stagnation of the food crop sector, induced food crisis, leading to a huge amount of rice import (see Table 1). At

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the same time, however, the sharp devaluation of the rupiah during the crisis has favored tradable goods such as rice despite the higher cost of tradable inputs, particularly fertilizers. It is not evident, however, whether the global competitiveness of Indonesian rice has been strengthened or not by the currency devaluation, because skeptical prospect of the Indonesian economy seems to have undervalued the nominal exchange rate, which contributes to positive trade balance.

Table 1. Rice Supply and Demand in Indonesia, 1966-1999

Year	Domestic Production of Milled Rice ('000 tons)	Net Import ('000 tons)	Rice Consumption per capita (kg/year)	Rice Production per capita (kg/year)
1966	8,288	280	---	76.25
1967	8,029	57	---	72.20
1968	7,917	486	---	69.75
1969	10,866	238	---	94.0
1970	11,656	324	---	98.86
1971	12,174	120	---	102.13
1972	11,694	335	---	96.97
1973	12,958	1,863	---	105.01
1974	13,551	1,132	---	107.38
1975	13,470	693	---	104.26
1976	14,056	1,301	---	106.32
1977	14,084	1,973	---	104.17
1978	15,546	1,842	119.28	112.33
1979	15,855	1,922	120.64	111.97
1980	17,887	2,012	122.00	123.10
1981	19,770	538	123.36	132.77
1982	20,259	310	124.72	133.46
1983	21,296	1,169	126.09	137.57
1984	23,005	403	126.77	145.69
1985	23,546	−371	127.18	146.34
1986	23,964	−213	127.57	146.03
1987	24,176	−64	127.97	144.51
1988	25,140	13	128.89	147.36
1989	26,980	325	129.86	155.15
1990	27,253	32	130.78	153.54
1991	26,957	179	130.94	148.77
1992	29,100	561	130.74	157.72
1993	29,064	−540	130.64	154.93
1994	28,136	643	130.64	147.54
1995	30,007	3,014	130.48	154.83
1996	30,826	1,090	131.34	155.45
1997	31,206	405	131.56	154.95
1998	31,118	5,783	131.65	152.24
1999	31,521	1,701	131.44	151.98

Source: Darwanto, 2000.

In view of the foregoing scenario, this paper aims to investigate the global competitiveness of Indonesian rice in the world market after the crisis, 1998 (the beginning of the monetary crisis). For this purpose, we first described the past and present situation of the Indonesian rice sector then discussed the effect of the currency crisis. The domestic resource cost (DRC) estimates were used to measure comparative advantage and evaluate the impacts of changes in input prices and technology on comparative advantage. The final section focused on the comparative advantage of rice production in Indonesia and its policy implications on the rice sector.

II. The Situation of the Rice Sector in Indonesia: Past and Present

II.1. Rice Supply and Demand

During the 1970's and early 1980's, the government encouraged the rice farmers to increase yield by raising productivity. The efforts had enabled the country to achieve self-sufficiency in rice beginning in 1984 and turned Indonesia into a net rice exporting country. However, the government had decreased public expenditures on irrigation infrastructure and limited the budget on research and extension in 1984, thus causing a slowdown in the growth of rice production (see Table 1).

Since the beginning of the 1990s, food production in Indonesia has been characterized by stagnation due to the declining trend in the price of rice and rapid industrialization. It has even advanced into a critical stage that since mid-1990s, food security itself has come under threat (Fukui, Hartono and Iwamoto, 2002).

II.2. Rice Production in Terms of Area and Yield by Region

The area, yield per hectare and total production of rice in major regions are shown in Table 2. Although rice cultivation is widely spread among farmers in all provinces, the major rice-producing areas in Indonesia are the irrigated areas of Java island and several regions outside Java. However, rice yields are higher in Java compared to areas outside of it, so that the former have higher production despite its smaller area. However, Java, which has a long history of development and which shares nearly sixty percent of rice production in the country, have retrogressive rice technologies, leading to small growth potential.

Table 2. Rice Production, Area and Yield by Region in Indonesia, 1998-1999

Region	Area ('000 hectares)		Yield (tons/hectare)		Production ('000 tons)	
	1998	1999	1998	1999	1998	1999
Sumatra	3,014	2,987	3.7	3.8	11,210	11,225
Jawa	5,467	5,741	4.8	4.9	26,383	28,177
Bali & Nusa Tenggara	613	617	4.1	4.1	2,491	2,527
Kalimantan	911	1,017	2.4	2.6	2,188	2,647
Sulawesi	1,022	1,221	4.0	4.0	4,102	4,855
Indonesia	11,056	11,624	4.2	4.3	46,443	49,534

Source: Central Bureau of Statistics.

II.3. Labor, Machineries, Fertilizers and Irrigation

In the early economic development in 1970s, the majority of the labor force was engaged in agriculture, and especially in Java, the expansion of farm land was not constrained by the availability of labor. On the other hand, in areas outside Java, labor was limited so that the expansion of wetland agricultural area took place with the transmigration program to encourage migration from Java. However, the rapid growth of the non-agricultural sector in the late 1970s until the 1990s has led to rapid rural-urban migration of the population and an absolute decline in agricultural labor force, thus causing labor shortage in suburban areas and in areas outside Java.

The farmers responded to the shortage of labor supply by adopting mechanization methods in farm operations. However, this process took place slowly. Farmers in areas outside Java tended to use 4-wheel tractors since the landholdings were relatively larger, while farmers in Java tended to use 2-wheel tractors, since their landholdings are very small.

Because of the great efforts done by the government in raising farm production, Indonesia once achieved self-sufficiency in rice in 1984. This was done mainly by intensification of the use of inputs, and one of the components of the program was the application of fertilizers. Although fertilizer application is considered to be too intensified,

the amount of fertilizers used since 1990s did not increase.

Until 1990s, the government made a massive investment in irrigation system in Java and several provinces outside Java. However, since late 1990s, the development of the irrigation system has been very limited.

II.4. Government Price Policies in Rice

The philosophy behind rice price policy are based on the following: (1) support for a floor price high enough to stimulate production; (2) setting of ceiling price protection assuring a reasonable price for consumers; (3) establishment of a sufficiency range between the floor and ceiling prices to provide traders and millers reasonable profit after keeping rice between two seasons; (4) setting appropriate price relationships in the domestic and international markets (Mears, 1981). To implement the policy, the government which had monopoly over rice trading nationally and internationally, accumulated reserve requirement as buffer stock by constructing "*gudang*" or storage houses in every rice-growing province and in several districts. Recently, the monopoly right was lifted and private rice trading was allowed freely. As can be seen from Table 3, import was done by the government marketing arm, BULOG, but since 1998, rice importation was carried out by the private traders. In 1999, the volume of rice importation by private traders exceeded that of the importation done by the government.

Table 3. Rice Imports by BULOG and Private Traders (tons), 1990-1999

No.	Years	Imported by		Total Import
		Bulog	Private	
1.	1990	49,557	0	49,557
2.	1991	178,880	0	178,880
3.	1992	634,217	0	634,217
4.	1993	24,317	0	24,317
5.	1994	876,240	0	876,240
6.	1995	3,014,204	0	3,014,204
7.	1996	1,090,258	0	1,090,258
8.	1997	405,947	0	405,947
9.	1998	5,782,926	1,317,753	7,100,679
10.	1999	1,873,270	3,170,602	5,043,872

Source: Amang and Sawit, 2001.

The floor price. Floor price was first implemented in 1969 and 1970 to guarantee farmers that the market price of rice was above the set price. This was designed as an incentive to farmers to encourage them to increase rice production. Together with the implementation of the floor price, the government also set up a pricing system for fertilizers (Table 4). The ratio between the floor price of rice and the price of fertilizers was constant, although the actual prices fluctuated year after year.

The ceiling price. The ceiling price was also first implemented in 1969 and 1970 to set the maximum price that should prevail in the retail market. This was designed to protect consumers from excessive price due to scarcity of rice supply especially during off season in certain areas.

Buffer stock. In order to effectively implement price policies, the government needs buffer stock which can be used as market operation stock, commitment stock, emergency stock and carry-over stock.

Table 4. Floor Price of Rice, Urea Fertilizer, and Its Ratio, 1980-1998

Year	Floor price of Unhusked paddy Rp/kg	Urea Rp/kg	Floor price/urea price
1980	105	70	1.50
1981	120	70	1.71
1982	135	70	1.93
1983	145	90	1.61
1984	165	90	1.83
1985	175	100	1.75
1986	175	125	1.40
1987	190	125	1.52
1988	210	135	1.56
1989	250	165	1.52
1990	270	185	1.46
1991	295	210	1.40
1992	330	220	1.50
1993	340	240	1.42
1994	360	260	1.38
1995	400	260	1.54
1996	450	330	1.36
1997	525	400	1.31
1998	1000	450	2.22
1999	1400	—	—

Source: Amang and Sawit, 2001.

Market operation. In order to maintain the floor price, the government procures rice from farmers directly at a set price or through traders or cooperatives (Koperasi Unit Desa - KUD). This is done during harvest season. To maintain the ceiling price, the government, through BULOG, sells rice in the market, especially during off-season and in urban markets. In recent years after the crisis, a special market operation program in which rice was subsidized to poor people was implemented.

Tariff. After the currency crisis, IMF suggested that rice trade be liberalized restrain the government from rice monopoly. In doing so, citizens were able to trade rice both locally and internationally. In the beginning, tariffs and other restrictions were not imposed, but after some negotiations with the IMF, the latter finally agreed to impose tariff at the rate of Rp430 per kilogram.

As a result of government intervention, the price of rice became distorted. Such distortion can be seen as the difference between domestic and border prices, and can be measured by the nominal protection rate (NPR). The NPR likewise fluctuates from year to year (Deoranto, 2002 and Masyhuri, 1988). In general, however, the NPRs in the old regime were positive, while it is negative under the new one (Masyhuri, 1988). A positive value for NPR indicates that farmers are given protection, while a negative value means that the consumers enjoy protection.

III. Global Competitiveness of Indonesian Rice

III.1. Domestic Resource Cost (DRC) Estimation and Comparative Advantage of Indonesian Rice in the Past

Global competitiveness in rice production can be evaluated using a measure of profitability which is calculated as the ratio of Domestic Resource Cost (DRC) of foreign exchange to the Shadow Exchange Rate (SER). DRC is a measure of the value of domestic resources needed to earn a unit of foreign exchange through exports or to save a unit of foreign exchange through import substitution. It therefore reflects the efficiency by which foreign exchange can be earned or saved by producing rice domestically. The SER, on the other hand, is the DRC of the marginal activity that will be chosen to balance the foreign exchange budget when all DRCs of economic activities are ranked from lowest to highest. Thus, an activity with a DRC that is lower than the marginal one or a resource cost rtio (DRC/SER) equal to less than unity reflects comparative advantage. A decline in the

resource cost ratio indicates an increase in comparative advantage.

The SER can be calculated using the following formula: SER = official exchange rate / conversion factor. The conversion factor is calculated using a formula developed by the World Bank (see Ali, 1986; Masyhuri, 1988; and Simatupang, 1990).

The use of DRC to determine the comparative advantage of Indonesia in rice production dates back to 1986. Some research studies on rice production in Indonesia using this measure were conducted by Masyhuri (1988), Hadipurwanto (2001) and Deoranto (2002). Comparable studies were also undertaken by Ali (1986) and Simatupang (1990). Both sets of studies used rice cost structure data from the Central Bureau of Statistics (CBS) of Indonesia for several years. The present study uses the cost structure data from the latest publication of CBS. The grouping of the regions is nearly the same as in the previous two sets of studies.

Considering the comparative advantage over time, the estimates of DRCs from all of these studies showed a certain pattern of change in the level of comparative advantage of rice production in Indonesia. In 1983, the DRC-SER ratios in the areas of West Java, Aceh, North Sumatra, South Kalimantan, are equal to or more than 1 (see Table 5), implying that

Table 5. Domestic Resource Cost of Rice Production and Its Ratio in Selected Regions of Indonesia, 1983

Region	DRC, Rp/US$	DRC/SER
Indonesia	865	0.83
Aceh	1,345	1.30
N.Sumatra	1,103	1.06
W.Sumatra	987	0.95
W.Java	1,050	1.01
C.Java	857	0.83
E.Java	661	0.64
Bali	585	0.56
W.Nusatenggara	819	0.79
S.Kalimantan	1,127	1.09
S.Sulawesi	815	0.79

Source: Ali, 1986.

those areas had no comparative advantage in rice production. For the remaining areas, the ratio is less than or equal to 1, suggesting comparative advantage for these areas. In 1986, the ratios were equal to or less than 1 (Table 6), indicating that all these regions have comparative advantage. The results of the present study is consistent with the results of Simatupang (1990) in the sense that all regions (provinces) had comparative advantage in rice production. It is interesting to note that the ratios in the present study have shown only a slight decrease in comparative advantage even though input prices have been increasing since mid-1980s. This is because during the crisis, rupiah devaluated so that the domestic price for rice increased thus offsetting any increase in input prices.

III.2. DRC Coefficients in Terms of Real Equilibrium Exchange Rate

In the previous studies, DRCs were estimated by using the shadow exchange rate which would be used if all trade distortions were removed while the trade balance remained constant.

However, in addition to implementing policies that have direct effects, such as taxation policies, the government may adopt policies that may seem to be unrelated to the rice sector but actually influence this sector, such as the macroeconomic policies believed to be mainly responsible for the current negative account balance and inflation. After the crisis, skeptic views about the Indonesian economy may have reinforced the undervaluation of the local currency. The relevant price in the foreign exchange market is the price of the foreign currency relative to the domestic price level. If a country is experiencing a more rapid

Table 6. Comparative Advantage Indicators of Rice Production by Region, 1986

Region	DRC, Rp/US$	DRC/SER
West Java	758.66	0.4615
Central Java	664.13	0.4040
East Java	742.40	0.4516
Sumatera	507.03	0.3084
Sulawesi	421.29	0.2563
Kalimantan	458.13	0.2787
Bali & N Tenggara	492.49	0.2996

Source: Simatupang et al., 1990.

inflation than its partner country, and the nominal exchange rate does not adjust to the price changes, it is useful to distinguish between nominal and real exchange rates. The relevant concept for "real exchange rate" is the nominal rate adjusted for the difference in inflation rates between the home country and the foreign country.

To estimate the global competitiveness correctly, there is a need to estimate the exchange rate that would prevail in a non-distorted environment (Sadoulet and de Janvry, 1995). For the purpose of estimating such an "equilibrium real exchange rate," we used the elasticity approach as described by Isvilanonda and Fukui (2002).

Isvilanonda and Fukui (2002) estimated the equilibrium real exchange rate (RER^*) using the following formula:

$$RER^* = RER[1 + (D - D^*) / (\varepsilon_X E - \varepsilon_M M)].$$

where:

RER= real exchange rate

D= trade deficit

D^*= sustainable deficit,

ε_X= export elasticity

ε_M= import elasticity

E is export and M is import.

We assumed that the level of D^* is set at 2% of GDP (Garcia and Llamas, 1989), while import elasticities were taken within the range of −0.1 to −2.0, while export elasticity was equal to 1 (Sadoulet and Janvry, 1995 and Khan and Ostry, 1992).

Based on these premises, this study tried to estimate the DRC of rice production after the currency crisis. DRCs were estimated using equilibrium real exchange rates that were calculated through the elasticity approach and shown in Table 7.

Table 7. Real Equilibrium Exchange Rate in 1998/99(Rp/$)

Official Exchange Rate	Real Equilibrium Exchange Rate			
	Em=−0.1 Ex=1.0	Em=−0.5 Ex=1.0	Em=−1.0 Ex=1.0	Em=−2.0 Ex=1.0
8,934.45	5,965.99	6,467.69	6,878.65	7,310.17

Source: Authors' calculations.

The estimation results for DRCs are presented in Table 8. The DRC values range from 0.51 to 0.63 for areas outside Java and 0.71 to 0.87 for Java area alone. The DRCs in terms of equilibrium exchange rates are much higher than those in terms of the ordinary shadow exchange rates. The estimated DRCs in Java are higher than those of areas outside Java because in the former, industrialization has progressed more rapidly and the potentials of productivity growth have already been exhausted.

In addition, compared to those derived in previous studies, our results show that global competitiveness in rice production has weakened faster.

Table 8. Domestic Resource Cost of Rice Production and the Ratio by Region in Indonesia, 1998/99

Province	DRC, Rp/US$	DRC/SER	Official Exchange Rate		Real Equilibrium Exchange	
			Em=−0.1 Ex=1.0	Em=−0.5 Ex=1.0	Em=−1.0 Ex=1.0	Em=−2.0 Ex=1.0
West Java	5,135	0.67	1.01	0.92	0.87	0.82
Central Java	3,689	0.48	0.72	0.66	0.62	0.52
Yogyakarta	4,117	0.53	0.80	0.73	0.69	0.65
East Java	4,925	0.64	0.96	0.88	0.83	0.78
Java	4,466	0.58	0.87	0.80	0.75	0.71
Off Java	3,249	0.42	0.63	0.58	0.55	0.51
Indonesia	3,906	0.51	0.77	0.70	0.66	0.62

Notes: DRC = Domestic Resource Cost
SER = Shadow Exchange Rate

Source: Estimated from CBS data by the authors.

III.3. Sensitivity analysis of DRC

What effective government policies can be implemented to enhance global competitiveness?

To find an answer to this question, we made a sensitivity analysis by estimating the change in DRCs as a result of price and/or yield improvement, increase in wages and increase in the price of fertilizer. For this purpose, we calculated the price and/or yield, wage and fertilizer price elasticities of DRC.

The estimated elasticities, as shown in Table 9, indicates that the DRC is sensitive to any change in output, wages and fertilizer prices. In particular, the value for output was elastic while those for the rest are inelastic because the elasticities are less than one. Among inputs, those for wages are more elastic than those for fertilizer prices. This clearly explains that wage becomes a dominant input in rice production.

Table 9. DRC Coefficient Elasticity with Respect to Price of Rice/Yield, Wage and Price of Fertilizer

Region	Rice price/yield		Wage		Price of Fertilizer	
	Em=−0.1 Ex=1.0	Em=−0.5 Ex=1.0	Em=−0.1 Ex=1.0	Em=−0.5 Ex=1.0	Em=−0.1 Ex=1.0	Em=−0.5 Ex=1.0
Java	−1.07	−2.08	0.52	0.95	0.14	0.22
Off-java	−0.72	−1.36	0.23	0.46	0.06	0.12
Indonesia	−0.95	−1.73	0.35	0.74	0.05	0.17

Source: Authors' calculations.

IV. Concluding Remarks

Based on the analysis made from this study, Indonesia enjoys comparative advantage in rice production in all provinces studied. However, using equilibrium real exchange rate, some provinces like West Java and East Java show signs that they are about to loose their comparative advantage at a fast pace. If import elasticity increases, many other areas will no longer enjoy comparative advantage.

From this study the several policy implications were drawn: First, although Indonesia has comparative advantage, rice production does not increase because of the following constraints: (1) limited water resources; (2) strong competition with other crops; (3) rapid conversion of farm areas into lands for other uses; and (4) decreasing trend in world price for rice and trade liberalization that make the price of rice constant, thus leaving farmers without any incentive to increase production. With the increasing demand for rice due to consistently increasing population, Indonesia may continue to depend on imports in order to provide enough rice for the consumers.

Second, based on the elasticities of the DRC coefficient with respect to rice price or yield, wages and fertilizer price, it can be seen that the elasticity with respect to rice price or yield has the highest elasticity level, followed by wages and fertilizer price. This

indicates that productivity and the improvement of rice quality are very effective in raising the DRC values.

Third, in order to achieve and maintain global competitiveness in rice production in the future, the government should continue investing in rice research, particularly in the areas geared towards increasing yield and enhancing rice quality such as tolerance to drought and resistance to insect pests and diseases. The cropping pattern should also be adjusted to the best condition for each crop to attain greater efficiency.

Finally, the efforts to increase rice production should not be concentrated in Java but they should give more attention on areas outside Java where the area for rice cultivation can still be expanded. Areas near big cities like West Java and East Java can not be selected and not be used for rice farming since this is very critical in achieving comparative advantage in rice production.

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