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Is Rice Production in Indonesia Still Profitable?

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In the ongoing debate about rice policy in Indonesia, some proponents of increased rice protection assert that Indonesian rice farmers can no longer compete with inexpensive imported rice. They further argue that to safeguard the incomes of rice farmers and prevent over-dependence on the world rice market, Indonesia should increase tariffs on rice. This paper summarizes the results of field-based empirical analysis of the profitability of rice farming in Indonesia, carried out between October 1999 and April 2001. It concludes that rice farming in the principal rice bowls of Indonesia was highly profitable in the 1999/2000 wet season and in the 2000 dry season. Rice farmers would have earned positive returns to management even if the rice tariff had been zero. Moreover, Indonesian rice production is likely to remain competitive under most reasonable assumptions about future trends in key variables.

Issues Studied and Field Experience

The BAPPENAS/DAI/USAID Food Policy Project began in 1999 when the economy of Indonesia was in deep recession. During 1998, Indonesia had imported six million tons of rice, and the price of rice to consumers had doubled after the exchange rate depreciated deeply. A central concern of food policy was whether Indonesia's rice farmers could compete in the world rice market and earn adequate incomes under the new economic environment. Perceptions of policy makers, the donor community, and the media in Jakarta differed widely and thus needed to be investigated with careful empirical research. The foreign consultants and government researchers in the Food Policy Support Activity (FPSA) project and a field research team from the Center for Agro-Socio Economic Research (CASER), an experienced research institute and division of the Ministry of Agriculture located in Bogor, agreed to collaborate on this research. Because of the importance of rice in Indonesia's food economy, the collaborative team decided to focus its attention principally on that commodity.

The team identified three critical issues – the international competitiveness of rice farming systems, the effectiveness of rural markets, and the levels of household incomes on rice farms – to be addressed in the field research. These three issues are closely linked. Many analysts feared that the rural markets for rice, fertilizer, labor, credit, and land had been severely impacted by the macroeconomic crisis. If that were true, rice farmers would lose income and face difficulties in competing against rice imports (unless they received high protection on rice or subsidies from the government). For example, analysts worried that the country's banking crisis would reduce the availability of commercial credit in rural areas, cause farmers to be short of working capital for their purchased inputs and thus buy less fertilizer and hire less labor, and create undesired reductions in rice productivity and output, farm incomes, and international competitiveness. The focus of the field research thus was to find out how Indonesia's rice farmers were adjusting to the changes brought about by the macroeconomic crisis.

All three of these issues – international competitiveness, rural markets, and farmer incomes – are complicated to analyze and require a combination of field experience and analytic sophistication. The field researchers needed to observe rural markets, interview farmers and marketing agents (traders, millers, and transporters), and gather information on farm household incomes. Effective observation of the functioning of rural markets is an especially tricky task.

Fortunately, each of the four main CASER field researchers had more than ten years of experience in carrying out detailed field-based studies of Indonesian agriculture. The full CASER research team consisted of two agricultural economists with doctorates, three with masters degrees, and one with a bachelors degree. All of the team had ample experience in collecting costs and returns data for farm and marketing budgets, and many had previous experience in carrying out efficiency analysis to study international competitiveness. The CASER field team was complemented by senior Indonesian and foreign agricultural economists in a joint effort to plan the research effort and analyze and interpret the results. The result was a convenient marriage of field savvy and experience in policy analysis.

This paper reports the results of the team's analysis of international competitiveness. (The findings on rural markets and household incomes are reported in companion studies.) Competitiveness depends on the relationship between costs of rice production and revenues from selling rice. The CASER field team focused on measuring the costs of production through interviews. Domestic competitiveness exists if revenues exceed costs in actual market prices, and international competitiveness occurs when costs of producing rice are less than rice import prices. If there is no government protection or subsidy policy, the Rupiah price of imports sets the domestic price of rice. Revenues then depend on the world price of rice and the foreign exchange rate. The analysis presented here reviews the baseline results, derived from actual data in 1999/2000, and then looks at the effects on international competitiveness of varying the most important parameters – the costs of labor and land, the world price of rice, and the exchange rate.

Site Selection and Research Procedures

To investigate rice competitiveness, rural markets, and farm incomes, the team selected five *kabupatens*, one in each of Indonesia's five principal rice-producing provinces – Kediri (East Java), Klaten (Central Java), Majalengka (West Java), Sidrap, (South Sulawesi), and Agam (West Sumatra). (Parallel summary reports are available for all five sites.) This choice of research sites reflects the team's intention to study the regions that produce most of the country's rice. The results are not necessarily representative of all Indonesian rice producers. Rice farmers in provinces omitted from the study could be less (or more) competitive, encounter more (or fewer) rural market imperfections, and earn lower (or higher) rice incomes than those in the five provinces covered in the study.

The team followed research procedures developed by the DAI consultants over three decades for use in numerous other commodity studies in developing countries, including rice, corn, and cassava in Indonesia. In each of the five selected *kabupatens*, the team identified four rice farming systems that differed by production technology and hence had different yields, returns, and costs. The most appropriate discriminant for technology identification was the degree of water control, which differed according to the availability and reliability of irrigation. The study distinguished four systems of water control – good (technical irrigation – permanent canals and water control structures), moderate (semi-technical irrigation – permanent canals but few water control structures), poor (non-technical irrigation – non-permanent canals and few water control structures), and rainfed (no irrigation).

Members of the CASER field team, often accompanied by DAI consultants, visited each study site several times after the study began in October 1999. Multiple site visits ensured good quality information to address all three of the study issues. An understanding of the effectiveness of rural markets required observations at various times throughout the year. Estimation of costs and returns in rice farming and of rice farm household incomes were made separately for the wet and dry seasons. The field team held in-depth interviews with farmers, local, wholesale, and retail traders, millers, and transporters and with government officials (in the Dinas Pertanian, Dinas Industri, Dolog, BPS, PUSRI, BRI, and KUD offices) to assemble farm budgets and household incomes and to search for the presence or absence of rural market imperfections.

Because of the large amount of detail in the questionnaires (especially for farmers), the researchers often spent as much as half a day per interview. The team determined that in-depth understanding of each interviewed farmer was essential, even if that resulted in a small sample size. The farm budgets assembled to examine competitiveness of rice farming use modal representative values and do not need to be based on large sample sizes. The number of farmers for whom full questionnaires were completed ranged from 112 in Klaten to 143 in Sidrap. Complete questionnaire responses were also obtained from 211 traders and processors.

In each of the five *kabupatens* studied, one village was selected to represent each of the four levels of water control – good, moderate, poor, and rainfed. In total, the CASER team carried out fieldwork in 20 villages (five *kabupatens* times four villages in each *kabupaten* representing one level of water control or rice-farming technology). The team collected information on the costs of rice production for the 1999/2000 wet season (November 1999-March 2000) and for the 2000 dry season (April-September 2000). The study thus identified a total of 40 rice-farming systems (in five sites, with four systems of water control, across two seasons).

Comparative Costs and Returns of Rice Production

This paper reports the results from only one farming system – moderate water control in the wet season – across the five sites studied – Kediri (East Java), Klaten (Central Java), Majalengka (West Java), Sidrap (South Sulawesi), and Agam (West Sumatra). Limiting the coverage to one system greatly simplifies the presentation of results and permits a focus on the key threads of the analysis. The variability of results across systems within each site along with information on rural markets and rice household incomes are discussed in five companion site reports. Appendix Table 1, which contains a summary of the total costs of production for all 40 rice-farming systems, shows the limited amount of variation in costs within sites and between seasons. The moderate water control system thus can be considered as reasonably representative.

Information on costs and returns of rice farming in the moderate water control system during the wet season 1999/2000 for all five sites is summarized in Table 1. Rice yields (tons of unmilled rice or wet paddy per hectare) varied from a low of 5.2 tons/ha in Agam to a high of 6.6 tons/ha in Sidrap. (Yields in the dry season were 8-10 percent higher than those in the wet season). In all five sites, the harvest prices at the farm-gate for wet paddy (*gabah kiring panen* or GKP) were Rp 850/kg in the wet season (November 1999-March 2000) and Rp 950/kg in the dry season (April-September 2000). The value of rice produced per hectare in the 1999/2000 wet season thus ranged between Rp 4.4 million in Agam and Rp 5.6 million in Sidrap.

Table 1. Costs and Returns of Rice Farming Systems, Moderate Water Control, Wet Season 1999/2000, All Sites

	Kediri	Klaten	Majalengka	Sidrap	Agam
1. Production					
a. Quantity (tons of GKP/ha)	6.2	5.4	5.9	6.6	5.2
b. Price (Rp/kg GKP)	850	850	850	850	850
c. Value (Rp 000/ha)	5331	4566	4972	5627	4376
2. Total Cost (%)[1)]	69	77	76	75	78
(Rp 000/ha)	3653	3,498	3788	4241	3401
a. Agro inputs (%)[1)]	14	13	16	12	13
- Fertilizer (%)[1)]	10	9	11	8	10
(Kg/ha)	451	413	444	364	368
- Others (%)[1)]	4	4	5	4	3
b. Labor (%)[1)]	20	25	31	24	25
- Family (%)[1)]	3	6	4	4	8
- Hired (%)[1)]	18	19	27	19	17
c. Capital (%)[1)]	4	6	6	5	4
d. Land rent (%)[1)]	30	33	24	36	37
(Rp 000/ha)	1600	1500	1200	2000	1600
3. Return to management (%)[1)]	31	23	24	25	22
(Rp 000/ha)	1651	1068	1184	1386	974

Note:
1) percentage of value of GKP production

In all five sites, most of the costs of rice farming were incurred through use of land and labor. Some of the farmed land was owned by the household, and other land was rented in. Similarly, some of the labor was provided by the farming household, although most was hired. In compiling budgets, the team assigned market land rental rates to cost land owned by the rice-farming household and market wage rates to cost unskilled or skilled labor provided by the rice-farming household. The actual or implicit land rent ranged from Rp 1.2 million per ha (24 percent of the value of paddy output) in Majalengka to Rp 2.0 million per ha (36 percent of the value of paddy output) in Sidrap. The percentage of labor costs varied between 20 percent (Kediri) and 31 percent (Majalengka). Because of the dominance of land and labor costs in rice farming, Indonesia's rice farmers were fortunate that the markets for renting land and hiring labor were operating without major imperfections.

Despite their importance in influencing yields in irrigated rice farming, agro-inputs (fertilizers, pesticides, herbicides, and fuel) did not claim a large share of the costs of rice production. Across the five sites, agro-inputs ranged between only 12 percent (Sidrap) and 16 percent (Majalengka) of the value of wet paddy output. The shares of chemical fertilizers within agro-inputs were even less, ranging from 8 percent (Sidrap) to 11 percent (Majalengka). As a consequence of this small share of fertilizer costs in rice production, the large increase in fertilizer prices, following the removal of subsidies on fertilizer in December 1998, was more than offset by smaller increases in rice prices.

Because rice farming was land- and labor-intensive, capital costs were a very small share of paddy output value. They ranged between 4 percent (Kediri and Agam) and 6 percent (Klaten and Majalengka). Rice farmers in Indonesia used very little capital equipment, and most of their small capital costs were charges for working capital used to pay for agro inputs, land rentals, and hired labor. Since working capital needs were not high for most rice farmers, they were able to self-finance working capital by using household savings from farming or from off-farm incomes. However, interviewed farmers noted that their limited capital, the difficulties of commercial borrowing, and the very high costs of informal borrowing created serious constraints to their ability to invest in farming higher valued crops that involved larger capital costs and greater risks.

The prices that farmers received for their wet paddy – Rp 850/kg in the wet season in 1999/2000 and Rp 950/kg in the dry season in 2000 – were less than farmers had hoped for since the government was not able to defend its very high floor price announced in December 1998 (Rp 1400/kg of dry paddy). However, the actual prices at the farm-gate were 25 percent higher in real terms (after adjustments for inflation) than those set by the floor prices in 1987-1997.

These historically high prices resulted in substantial levels of returns to management for Indonesia's rice farmers. Return to management, often called profit, is a measure of the difference between the value of rice produced (wet paddy at the farm-gate) and all costs of farming. (The by-product, rice bran, typically is used to reduce the costs of milling and hence does not directly accrue to rice farmers as a source of income; its value is accounted implicitly in the price of wet paddy at the farm-gate.) The returns to management across sites varied between 22 percent (Agam) and 31 percent (Kediri) of the value of wet paddy produced per hectare. These substantial returns to management evidenced the ability of Indonesian rice farmers to earn profits at price levels prevailing in 1999/2000 and permitted farmers to save modestly and self-finance future working capital needs.

The level and percent of profit depend on rice prices, yields, and costs of production. The price of rice – Rp 850 per kilogram – was identical for all sites and systems in the 1999/2000 wet season. But yields and costs differed across sites, as evidenced in Table 1. Although yields in Sidrap (6.6 tons of wet paddy per ha) were higher than yields in Kediri (6.2 tons of wet paddy per ha), Kediri experienced higher profits than Sidrap did. Land costs in Sidrap (Rp 2.0 million) were Rp 0.4 million higher than in Kediri, and labor costs in Sidrap (Rp 1.3 million) were Rp 0.2 higher than in Kediri. Kediri thus had the highest profit (Rp 1.7 million or 31 percent of revenue) of the five sites because it had the second highest yield and the lowest costs (Rp 3.7 million or 69 percent of revenue).

The Competitiveness of Rice-farming Systems

Rice production was very profitable in all five sites in the 1999/2000 wet season. Were the high profits due to underlying productivity or to transfers resulting from government policies or market imperfections? Market prices for rice were about 25 percent higher than comparable world prices because of two influences. A tariff of Rp 430/kg on rice imports was introduced in January 2000, and rice traders required a premium to offset the high degree of political, policy, and exchange rate risk that they faced. It is difficult to distinguish how much of this divergence on rice output resulted from the tariff and how much from trader risk. But this effective subsidy was responsible for most of the profit in rice farming in Indonesia during the 1999/2000 wet season, as shown in Table 2. The divergence on rice output accounted for 62 percent of returns to management in Kediri, 80-84 percent in Klaten, Majalengka, and Sidrap, and 112 percent in

Agam. Rice farmers in Agam would have lost money without the transfer when the exchange rate was Rp 7500/$.

Table 2. Competitiveness of Rice Farming Systems, Moderate Water Control, Wet Season 1999/2000, All Sites

	Kediri	Klaten	Majalengka	Sidrap	Agam
Return to Management (Rp 000)	1651	1068	1184	1386	974
Return to management[1)]	100	100	100	100	100
Rice protection[1)]	62	82	81	84	112
Seed subsidy[1)]	1	2	1	1	2
Credit imperfection[1)]	-1	-2	-2	-1	-2
Total divergences[1)]	62	82	80	84	112

Notes:

1) percentage of return to management
2) private price of wet paddy (farm-gate) = Rp 850/kg, world of rice price (fob Bangkok) = US$ 170/ton, exchange rate = Rp 7500/$, social price of wet paddy (farm-gate) = Rp. 686/kg

Competitiveness depends in important part on the relationship between domestic and world prices of rice. During the wet season of 1999/2000, the domestic market price for wet paddy in Indonesia was Rp 850/kg. At the same time, the comparable import price for rice (delivered to wholesale markets) was estimated at Rp 686/kg for wet paddy, resulting in an output price divergence of 24 percent. This import price was based on the prevailing fob Bangkok price of $170/ton and on the prevailing exchange rate of Rp 7500/$. By the dry season of 2000, these parameters had changed. The farm-gate price of wet paddy rose to Rp 950/kg, a 12 percent increase. In the same period, the fob Bangkok price fell 13 percent to $150/ton. This decline in the world price was more than offset by a 17 percent depreciation of the exchange rate, from Rp 7500/$ to Rp 8800/$. The comparable world price for wet paddy in Indonesia thus rose to Rp 759/kg, an 11 percent increase. The result of all these changes was that the rice price divergence changed very little, moving from 24 percent to 25 percent of the world rice price. This example illustrates the critical importance of both world rice prices and the Indonesian exchange rate in influencing the competitiveness of Indonesian rice production

The analysis of rice competitiveness can be illustrated by examining the moderate water control system in Kediri during the 1999/2000 wet season. The return to management for rice produced under good water control in the wet season was Rp 1.65 million (Table 2). The divergence on rice output is defined as the difference between the domestic price and the world price, when both are compared at the wholesale market level in Kediri. About 62 percent of the total return to management, Rp 1.02, was caused by the tariff on rice plus the trader risk premium that together raised the domestic rice price level about 25 percent above the import price. There were only two other divergences, both of them minor, between observed market prices and estimated efficiency prices in Kediri. Rice seeds received a subsidy of Rp 400/kg or about 13 percent of the full cost of seeds. This small subsidy was responsible for about one percent of the return to management. Rice farmers in Kediri had to pay more for their borrowed credit than they would have had to if more non-subsidized lending from commercial banks had been available. This divergence in the credit market imposed an effective tax of about one percent of the return to management. The total divergences thus amounted to a 62 percent increase in rice farming profits and consisted of positive transfers of 62 percent from the higher rice price and one percent from the seed subsidy and a negative transfer of one percent from the credit market imperfection.

The Efficiency of Rice-Farming Systems

Efficiency is a measure of the ability of rice-farming systems to make profit (or at the margin to break even) when there are no government policies or market imperfections influencing rice production. If the government removed the tariff on rice and the seed subsidy and improved macroeconomic management so that rice traders' risks and commercial banking were to return to normal, could Indonesian rice farmers compete with imported rice? Economists at the International Rice Research Institute (IRRI) estimate that the world price of rice (25% broken, fob Bangkok) will be about $200 per ton in the long run. At that expected trend price and at an assumed long-run exchange rate of Rp 9000/$, all five of the leading rice-producing areas in Indonesia would be highly profitable, as shown in Table 3. Indonesian rice thus could compete internationally without protection or subsidy.

Table 3. Efficiency of Rice Farming Systems, Moderate Water Control, All Sites, (Exchange Rate = Rp 9000/$, World Rice Price = $200/ton fob Bangkok)

	Long-run social profit [1]		Break Even World Price [2]		Actual Farm-gate Price
	(Rp 000)	(%)[3]	(US$/ton) fob BKK)	(Rp/kg GKP at farmgate)	(Rp/kg GKP)
Kediri	2437	40	117	627	850
Klaten	1736	33	132	707	850
Majalengka	1953	34	129	691	850
Sidrap	2135	34	132	707	850
Agam	1369	29	144	772	850

Notes:
1) If world price = $200/ton (fob Bangkok), exchange rate = Rp 9000/US$, private and social price of paddy (farm-gate) = Rp 974
2) Where long-run social profit = zero, exchange rate = Rp 9000/US$, and divergences = zero
3) Percentage of social revenue

Long-run social profits – defined as the returns to management in the absence of any divergences (policies or market imperfections) affecting rice production – range between Rp 1.4 million (Agam) and Rp 2.4 million (Kediri) for the moderate water control systems in the wet season. It is convenient to interpret these figures by comparing them with social revenue for each system, that is, rice output valued at the import price (the social or efficiency valuation). The shares of social revenue accruing to social profit fall in the range of 29-40 percent in the wet season. These results mean that most rice farmers would earn profits amounting to about one-third of their sales of rice even if they did not receive any assistance from government policy.

Efficiency hinges on the choices of the long-run world price for rice and of the long-run equilibrium exchange rate for Indonesia. If the exchange rate were to settle at Rp 9000/$ under conditions of political stability and sound macroeconomic management, at what long-run world prices for rice (lower than $200/ton) would Indonesia's rice-producing systems begin to lose their ability to compete? How far would the fob Bangkok price for rice have to fall before each rice system in Indonesia would just break even (in the absence of policy transfers and market failures)? The break-even world price during the wet season varies between $117/ton fob

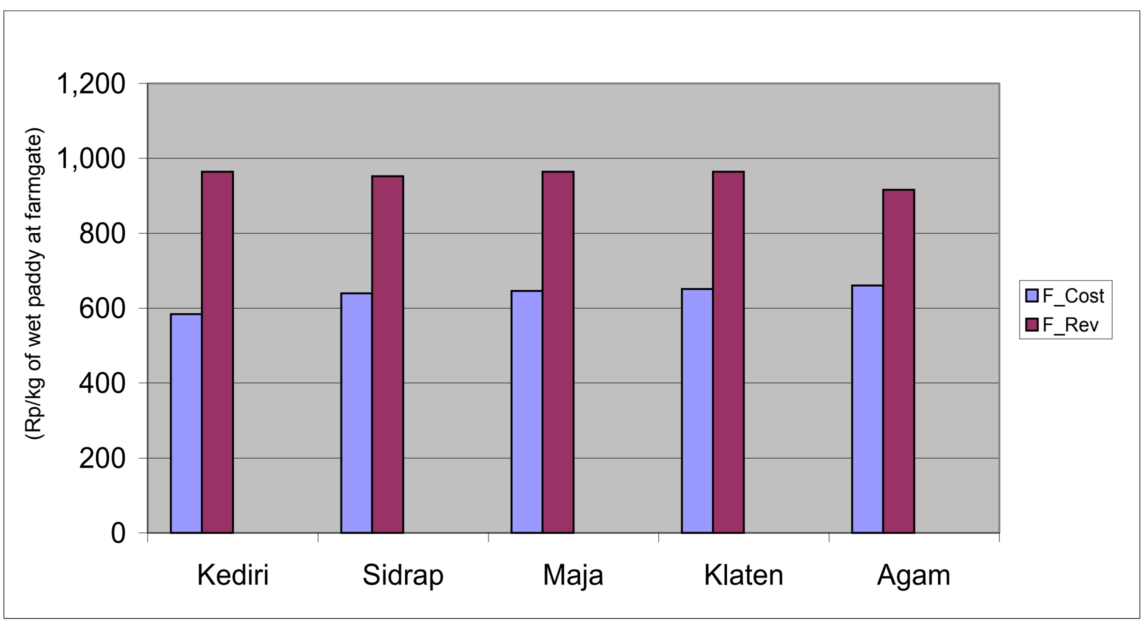
Bangkok (for rice produced in Kediri) and $144/ton fob Bangkok (for rice produced in Agam). Hence, rice systems in Indonesia would begin to lose social profitability if the fob Bangkok price were to lie in the range of $117/ton-$144/ton – and if the long-run exchange rate were Rp 9000/$.

Sensitivity Analysis of Rice-farming Systems

Sensitivity analysis entails an assumed change in one or more key parameters to test the robustness of results. The key parameters influencing the competitiveness of rice-farming systems are the world price of rice, the foreign exchange rate, and the level of tariff protection (which affect revenues) as well as the wage rate and land rental rate (which affect costs). Bar graphs provide a convenient way of representing comparative costs and returns under various scenarios that combine reasonable assumptions about levels of these key parameters.

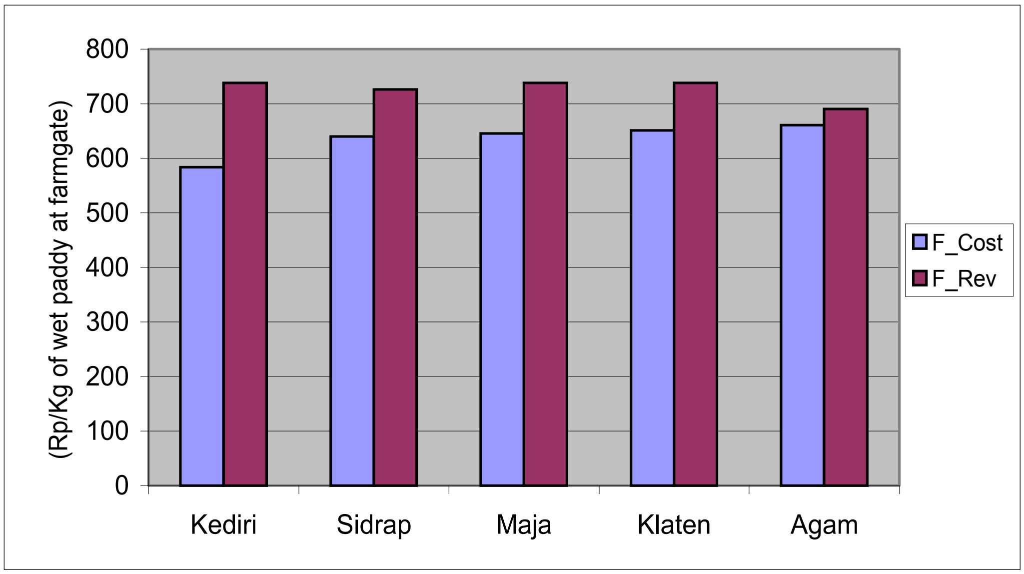
The first scenario is a representation of actual conditions in 2000, the base year of the fieldwork and analysis. In much of that year, the world price of rice was $150 per ton fob Bangkok for Indonesian import quality (25 percent brokens) and the exchange rate was around Rp 9000/$ (although it fluctuated in a range of Rp 8000/$ to Rp 10,000/$). A specific tariff of Rp 430 per kilogram of rice imported was imposed in January 2000 and was in force throughout the year. The costs of production for the moderate water control systems during the 1999/2000 wet season are shown above in Table 1. Land and labor costs together constitute the lion's share of rice production costs – between 50 and 62 percent of the value of rice production. Figure 1, which portrays this first scenario, graphically echoes the results given above in Table 1. Rice protection led to very high profits per ha, between a fourth and a third of the value of rice produced.

Figure 1
Costs and Returns, 1999/2000 Wet Season, Full Cost, Moderate Water Control, Five Sites
(Exchange Rate = Rp 9000/$, World Rice Price = $150/ton fob Bangkok, Tariff = Rp 430/kilogram)



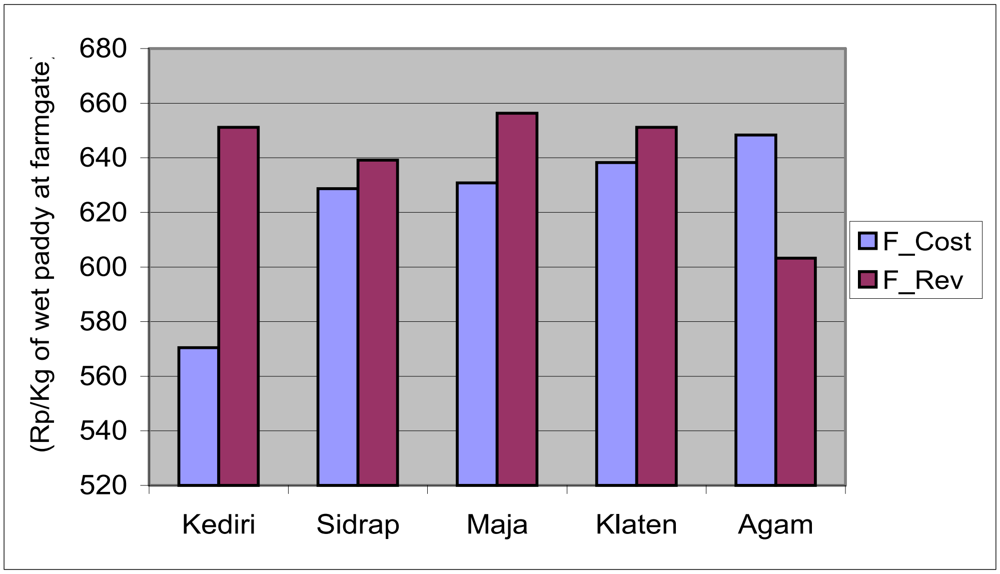
The second scenario examines the impact of eliminating the tariff on rice of Rp 430 per kilogram while retaining all other base case parameters. For purposes of illustration, it is assumed that the elimination of the tariff would reduce the domestic price of rice by Rp 430 per kilogram. However, three forces could prevent a full price reduction if the tariff were in fact removed: smuggling might cause a less than full enforcement of the existing tariff; trader risk premia might continue even after elimination of the tariff; and non-tariff barriers might restrict rice imports and keep domestic prices high without a tariff. Figure 2 shows the reduction in rice revenue if these three forces are ignored and the elimination of the rice tariff causes a price decline by the full Rp 430 per kilogram. All five sites remain competitive although profits are greatly reduced.

Figure 2
Costs and Returns, 1999/2000 Wet Season, Full Cost, Moderate Water Control, Five Sites
(Exchange Rate = Rp 9000/$, World Rice Price = $150/ton fob Bangkok, Tariff = 0)



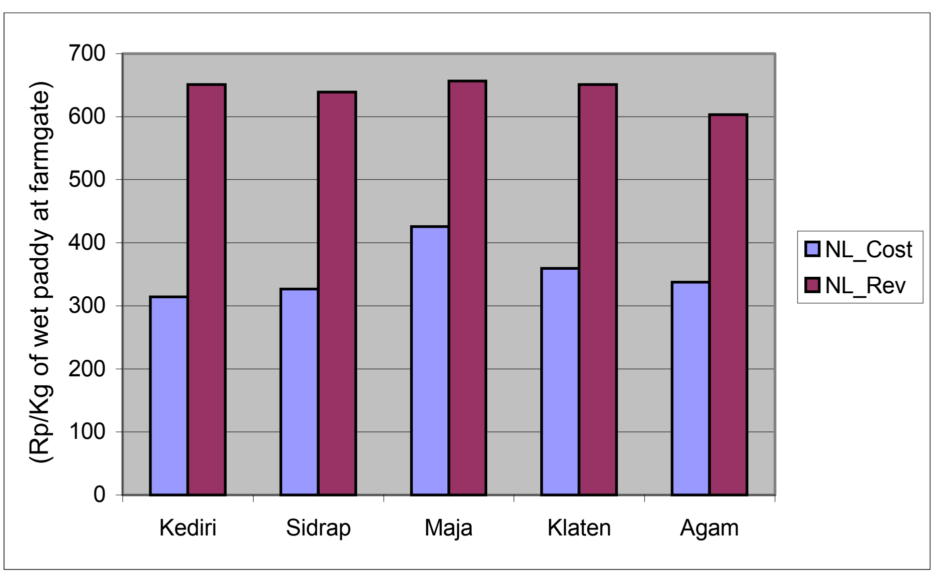
A few optimistic analysts of Indonesia’s macro economy feel that the exchange rate might settle at a long-run rate of Rp 8000/$, more appreciated than the range of Rp 8600/$ to Rp 10,000/$ in which it has fluctuated in the past two years. Although a stronger exchange rate is good for some parts of the Indonesian economy, it would hurt rice farmers because it would reduce the price of rice imports in domestic currency and thus lower the structure of rice prices throughout the economy. (The domestic price is set by the import price in the absence of protection. The Rupiah price of imports is equal to the world price (in dollars) times the Rp/$ exchange rate.) Figure 3 depicts the impact of an appreciated exchange rate on the profitability of rice-farming systems. With an exchange rate of Rp 8000/$ and all other parameters unchanged, costs exceed revenues in Agam, profits remain positive but small in Klaten, Majalengka, and Sidrap, and profits continue to be quite healthy in Kediri. The low Rupiah rice price, triggered by the appreciated exchange rate, thus would threaten the continuation of rice farming in Agam and reduce rice incomes throughout the country.

Figure 3
Costs and Returns, 1999/2000 Wet Season, Full Cost, Moderate Water Control, Five Sites
(Exchange Rate = Rp 8000/$, World Rice Price = $150/ton fob Bangkok, Tariff = 0)



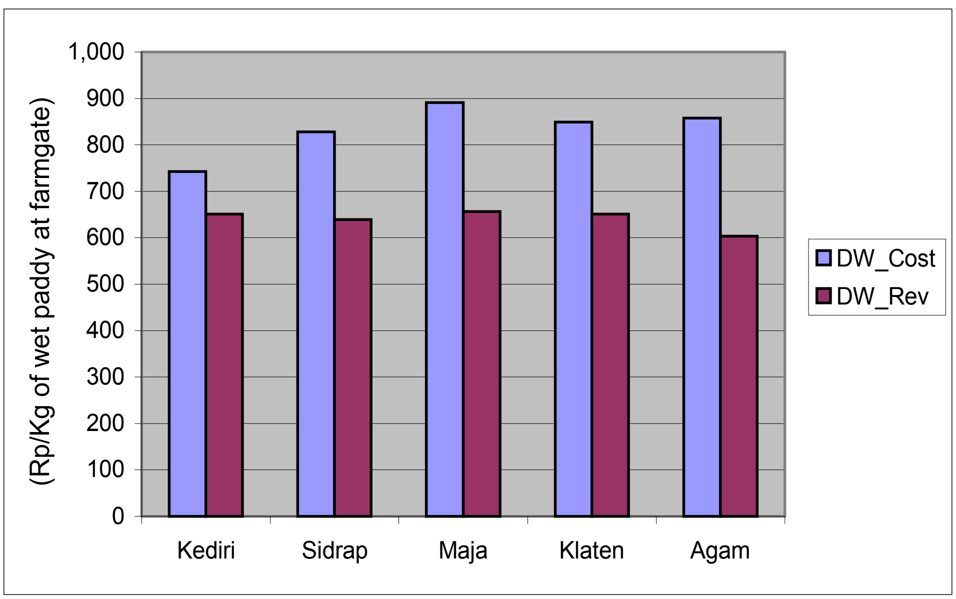
If the profitability of rice production (and of the production of substitute crops that are internationally tradable) were to decline because of an appreciated exchange rate, over time the rental value of rice-producing land would be expected to fall. (Farmers renting in the land would pay less for use of that land if the returns were smaller.) As land rental costs fall, the profitability of rice farming recovers. Figure 4 shows the impact of an extreme assumption of zero land rental rates on costs (and implicitly on profits) of producing rice. Because land rent in the base case constitutes about one-third of the value of rice grown and is the largest single cost item in rice production, the assumed elimination of land rent increases rice profits enormously – to 50-60 percent of the value of rice produced. Although land costs will not go away entirely, as in this example, it is important to consider the downward pressure on land rental rates of declining rice profitability.

Figure 4
Costs and Returns, 1999/2000 Wet Season, No Land Cost, Moderate Water Control, Five Sites
(Exchange Rate = Rp 8000/$, World Rice Price = $150/ton fob Bangkok, Tariff = 0)



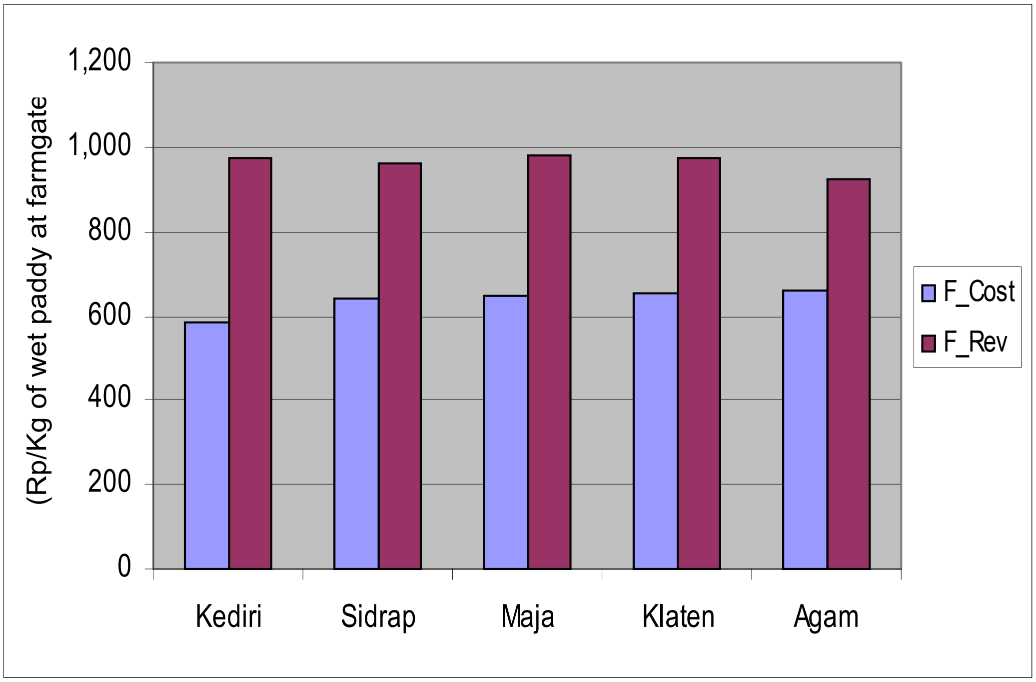
A different cost adjustment would work in the opposite direction and reduce rice profitability. If Indonesia recovers from its recent economic recession and returns to a path of rapid economic growth, real wage rates will resume their steady upward trend. This long-term process will put increasing pressure on labor-intensive production systems like rice agriculture. As labor costs rise, rice farmers will gradually substitute hand-held tractors, equipment rental services, and other inputs (such as herbicides) for labor. This process of labor substitution in rice farming had already started in the late 1980s and 1990s before the Asian economic crisis began in mid-1997. For simplicity, these adjustments are ignored here. Figure 5 shows the impact on rice costs and profits of a doubling of wage costs (which could occur in 10-15 years if high economic growth is resumed). With doubled wage costs, a strongly appreciated exchange rate (Rp 8000/$), and a low world price of rice ($150 per ton fob Bangkok), costs of rice production would be much greater than returns throughout Indonesia. This negative profitability of rice production would trigger adjustments in the land market since land rentals would be worth less. The point, however, is to demonstrate that future rice profitability could be threatened by rapid economic growth unless labor-saving shifts in rice production occur.

Figure 5
Costs and Returns, 1999/2000 Wet Season, Wage Doubled, Moderate Water Control, Five Sites
(Exchange Rate = Rp 8000/$, World Rice Price = $150/ton fob Bangkok, Tariff = 0)



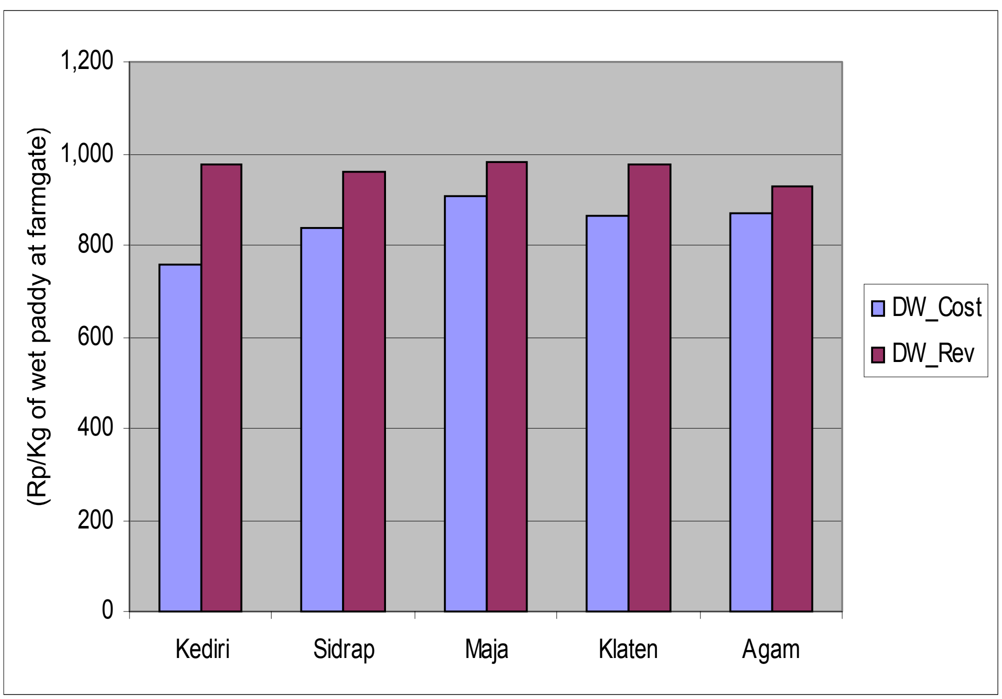
What is the most likely Rupiah rice price that Indonesian farmers will face in the future? As noted above, that domestic price depends on the world price of rice in dollars and on the Rupiah/dollar exchange rate. (The government can, of course, alter that price with protection or subsidy policies, but that prospect is set aside here.) No one can know what the future trend world price of rice or long-run exchange rate will be. Best available guesses are $200 per ton (fob Bangkok for 25 percent brokens), the trend world price of rice estimated by IRRI economists, and Rp 9000/$, the equilibrium exchange rate used by most macroeconomists and planners. These two guesses together lead to a most likely long-run Rupiah price of Rp 974 per kilogram, much higher than the actual price in the 1999/2000 wet season of Rp 850 per kilogram. Figure 6 demonstrates that estimated long-run rice profitability is very robust in all five sites. The long-run costs in that figure are drawn from the base case results and include full costs for land and labor.

Figure 6
Costs and Returns, 1999/2000 Wet Season, Full Cost, Moderate Water Control, Five Sites
(Exchange Rate = Rp 9000/$, World Rice Price = $200/ton fob Bangkok, Tariff = 0)



At these favorable long-run prices for rice, what would be the impact of rising real wages on the competitiveness of rice-farming systems? Figure 7 depicts the effects of doubling wage rates on rice costs.

Figure 7
Costs and Returns, 1999/2000 Wet Season, Wage Doubled, Moderate Water Control, Five Sites
(Exchange Rate = Rp 9000/$, World Rice Price = $200/ton fob Bangkok, Tariff = 0)



Labor costs account for between 20 and 30 percent of rice output value or about one-third of the total costs of rice production. Significantly, rice profits remain positive in all five sites. They are much reduced throughout the country, and the wage-inflated costs are nearly as high as the returns in Agam and Majalengka, the two least profitable systems studied. This encouraging results bodes well for the future of rice farming in Indonesia. With projected long-run world prices and exchange rates, all five major rice bowls in the country can compete with imported rice without any protection or subsidy – even if wage rates doubled and no labor-saving shifts in production occurred.

Conclusion

Is Indonesian rice production competitive at world prices? At recent world prices of rice ($150 per ton fob Bangkok) and exchange rates (Rp 9000/$), all sites would make profits with current wage rates even if there were no tariff protection (Figure 2). Under the same world rice price assumption but with an appreciated exchange rate of Rp 8000/$, all sites would lose profitability if wage rates were to double (and there were no corresponding fall in land rental rates and no labor-saving shifts in rice production) (Figure 5). All sites would have negative profits as well if wages were to double and the exchange rate were to remain at Rp 9000/$. At assumed long-run world prices of rice ($200 per ton fob Bangkok) and exchange rates (Rp 9000/$), all five sites would be highly profitable at current wage rates, again without needing government assistance (Figure 6). Even if wage rates were to double under this price scenario, all systems would retain their profitability without protection (Figure 7). Is Indonesian rice likely to remain profitable and competitive with rice imports? The answer is a resounding yes.

A key lesson from this analysis is that policy makers concerned with setting rice price policy for Indonesia need to consider carefully the relationships among the world price of rice, the exchange rate for Indonesia, the effective level of the tariff on Indonesian rice imports along with the impact of traders' risk premia, and the domestic prices at which Indonesian rice farmers can compete and rice consumers can purchase adequate calories. If the world rice price recovers to its expected long-run level of $200/ton fob Bangkok and the Indonesian exchange rate settles at a quite heavily depreciated rate (about 9,000/$), there will arise a valuable opportunity to lower or eliminate the tariff on rice to assist poverty alleviation and human nutrition while not impairing the ability of rice farmers to compete against imports. This policy of lower long-run rice prices in Indonesia also would likely assist the process of agricultural diversification by helping to create more off-farm rural employment opportunities. The key for analysts and decision makers concerned with food and agricultural policy is to design a rice price policy that will aid rice consumers while facilitating the process of agricultural diversification and structural change throughout the country.

Appendix Table 1
Costs and Returns, 1999/2000 Wet Season and 2000 Wet Season, Four Systems of Water Control, Five Sites, Full Cost, No Land Cost, Doubled Wage Cost (Rp/kilogram of wet paddy)

	Good		Moderate		Poor		Rainfed	
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
Kediri								
F_Cost	581	622	585	634	576	623	596	622
F_Rev	850	950	850	950	850	950	850	950
NL_Cost	302	347	329	378	340	389	351	381
NL_Rev	850	950	850	950	850	950	850	950
DW_Cost	739	810	758	853	746	825	806	858
DW_Rev	850	950	850	950	850	950	850	950
Sidrap								
F_Cost	586	643	641	679	627	667	690	686
F_Rev	850	950	850	950	850	950	850	950
NL_Cost	303	337	338	360	349	368	390	382
NL_Rev	850	950	850	950	850	950	850	950
DW_Cost	752	832	840	889	828	882	918	910
DW_Rev	850	950	850	950	850	950	850	950
Majalengka								
F_Cost	654	671	648	666	682	652	686	660
F_Rev	850	950	850	950	850	950	850	950
NL_Cost	428	453	442	462	506	481	538	513
NL_Rev	850	950	850	950	850	950	850	950
DW_Cost	902	953	908	941	962	922	989	943
DW_Rev	850	950	850	950	850	950	850	950
Klaten								
F_Cost	670	677	651	659	663	691	683	690
F_Rev	850	950	850	950	850	950	850	950
NL_Cost	365	394	372	404	414	446	444	463
NL_Rev	850	950	850	950	850	950	850	950
DW_Cost	865	936	862	888	906	960	904	980
DW_Rev	850	950	850	950	850	950	850	950
Agam								
F_Cost	657	729	661	715	738	753	717	720
F_Rev	850	950	850	950	850	950	850	950
NL_Cost	332	406	350	412	410	440	425	438
NL_Rev	850	950	850	950	850	950	850	950
DW_Cost	856	990	870	967	997	1,058	955	1,016
DW_Rev	850	950	850	950	850	950	850	950

Notes:
F_Cost = Full Cost
F_Rev = Full Revenue
NL_Cost = No Land Cost
NL_Rev = No Land Revenue
DW_Cost = Doubled Wage Cost
DW_Rev = Doubled Wage Revenue