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Author(s): Cristina C. David and Jikun Huang

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# Political Economy of Rice Price Protection in Asia\*

Cristina C. David  
*Philippine Institute for Development Studies*

Jikun Huang  
*China National Rice Research Institute*

## I. Introduction

Rice continues to be the most important food staple in Asia, contributing 40%–80% of total calorie intake. Rice is also the major source of livelihood of small farmers and agricultural labor households in this region, where at least two-thirds of arable land is planted to rice. At least half of that rice area is rain-fed and vulnerable to drought and floods. Even in irrigated areas, higher cropping intensity has increased pest problems, contributing further to the production instability that characterizes the rice economy of monsoon Asia.

Because of the economic and political importance of rice in Asia, no government has left its domestic rice sector freely influenced by market demand and supply forces. Invariably, the central food policy question confronting Asian governments is how to reconcile the conflicting objectives of providing low rice prices to consumers and remunerative incentives to farmers. Maintaining stable domestic rice prices to both consumers and producers is a separate and equally important concern. Moreover, given the political importance of rice and the instability of the world rice market, most Asian countries aim for rice self-sufficiency rather than rely on international trade to pursue their food security goals. Among rice exporters, on the other hand, raising government revenues from rice exports is another policy objective.

To achieve the above objectives, a wide variety of policy instruments have been used to influence output and input prices directly or to increase productivity. Except for Thailand, most Asian governments control rice prices in the short run through a monopoly on international trade, as well as by engaging in domestic marketing operations.<sup>1</sup> On the other hand, governments also invest in irrigation,

research, and extension to increase productivity and lower rice prices in the long run without hurting farmer incentives and, thus, self-sufficiency objectives. Aside from those sector-specific policies, macroeconomic policies with respect to exchange rates, industrial protection, interest rates, and market infrastructure also condition the incentive structure facing rice farmers.

The purpose of this article is to explain the variations in the level of rice price protection in nine selected Asian countries—Philippines, Indonesia, Thailand, Bangladesh, Pakistan, India, Japan, South Korea, and Taiwan—from 1960 to 1988.<sup>2</sup> Past studies have explained protection levels of total agriculture in terms of measures of resource endowments, international terms of trade, trade balance, and political economy factors as reflected in the relative importance of agriculture in the economy.<sup>3</sup> Recent attempts to explain rice price protection have focused on demonstrating the importance of price stabilization as a policy goal.<sup>4</sup> In this study, we examine not only the effects of those factors but whether and to what extent policies to increase productivity such as the introduction of modern rice technology and fertilizer price subsidy have affected domestic rice prices and thus measured price protection.

## **II. Determinants of Price Protection**

In this analysis, the impact of government policies on the price of rice is measured by the nominal protection rate (NPR), defined as the percentage by which domestic price ( $P_d$ ) exceeds world price ( $P_w$ ) at the border, converted at the official exchange rate. Instead of other protection measures such as the effective protection rate, NPR is used, partly because the main purpose of this analysis is to identify factors underlying the policies that affect domestic relative to international prices of rice and partly because the ease of its estimation enables the use of a larger sample. While  $P_d$  corresponds to the marginal cost of rice production,  $P_w$  represents the opportunity cost of producing rice domestically. Several factors may cause  $P_d$  to diverge from  $P_w$ .

First, the strong desire for domestic price stability leads policymakers to insulate domestic rice markets from the extreme instability of world rice prices and major foreign exchange rate adjustments. The fact that rice trade policies are commonly implemented through government monopoly control over international trade of rice and domestic marketing operations rather than through ad valorem duties that leave the domestic price vulnerable to world price fluctuations and changes in the exchange rate suggests that domestic price stability is a dominant policy objective.<sup>5</sup> Changes in the world price and in the foreign exchange rate will then be associated with changes in the nominal protection rate. It will decline (rise) if the domestic price does not increase (decrease) proportionately with increases (decreases) in the

world price or the depreciation (appreciation) of the domestic currency.

Second, changing competitiveness of domestic rice production through technological change such as adoption of modern varieties, expansion of irrigation, increasing availability of land, and lower fertilizer prices will tend to reduce the nominal protection rate. If rice is initially a protected industry in an importing country, a rightward shift in the supply curve due to modern varieties, irrigation, and lower fertilizer and land prices will lower domestic relative to border prices, unless the levels of imports are further restricted.

Third, a country's trade position with respect to a commodity itself will be a major determinant of the nominal protection rate.<sup>6</sup> When rice is exportable, an export tax or other quantitative trade restrictions that lower the domestic price below the border price may be imposed. Such a pricing policy may be motivated by the desire to generate government revenues, keep domestic prices low to consumers, or raise the world price of rice in case of a monopoly position in the world market. Except in the very short run, positive protection of an exportable commodity will not be observed in developing countries with limited resources, because this requires budgetary outlay and will in effect subsidize the importing countries.<sup>7</sup> In contrast, import tariffs, levies, or other quantitative import restrictions often exist when rice is importable, raising the domestic price above the border price. They generate government revenues, confer positive protection to producers, and apparently raise the self-sufficiency ratio at the expense of consumers. In low-income countries where the capacity to collect direct taxes is low, such trade taxes are an important source of revenues because of the ease of collecting taxes at the border.

Finally, the patterns of the nominal protection rate over time and across countries can also be explained by political economy factors. Following K. Anderson and Y. Hayami,<sup>8</sup> low-income countries with high proportions of the total labor force and gross domestic product in agriculture will tend to tax the rice sector, while high-income countries with smaller proportions of agriculture will tend to subsidize the rice sector. In high-income countries, the high cost of labor and land typically makes agriculture uncompetitive. As a relatively small and more cohesive proportion of the population, the farmers in high-income countries are more effective in lobbying for stronger protection. On the other hand, the burden of subsidizing a relatively small share of the work force in agriculture is relatively low for the larger nonfarm population, especially because the proportion of income spent on food, and hence the impact of high food prices on the cost of living, is already small. In contrast, subsidizing farmers when they represent the majority of the work force will be a heavy burden on the nonfarm minority in low-income countries. Furthermore, electorates in the ur-

ban sector, interested in low food and raw material prices, are better educated and form more cohesive political groups than the population in the rural sector does. Thus, economic development is considered to have critical impacts on the political market for agricultural protection.

### III. Economic Structure, World Prices, and Protection Rates

The nine selected Asian countries covered in this study represent widely varying structures of the economy and rice production (table 1). The countries in South and Southeast Asia generally have a lower per capita gross national product (GNP), ranging from \$599 in Bangladesh to \$1,716 in Thailand in 1984–88. In contrast, per capita GNP of countries in East Asia is five to 10 times higher. The rapid economic growth in these countries was accompanied by dramatic shifts in the structure of the economy. At this time the share of agriculture to total employment ranges from 8% in Japan to 29% in South Korea, whereas in South and Southeast Asia, agriculture still accounts for 49%–71% of total employment.

#### *Comparative Advantage*

Because of very limited land resources, almost all rice land in Japan had been irrigated by the turn of the century and in South Korea and Taiwan by the 1930s.<sup>9</sup> The irrigation developments were accompanied by the introduction of high-yielding and fertilizer-responsive modern

TABLE 1  
DETERMINANTS OF NOMINAL PROTECTION FOR RICE IN NINE  
ASIAN COUNTRIES, 1984–88 AVERAGES

	GNP per Capita* (US\$)	Agricultural Labor Share† (%)	Land per Person Ratio† (Ha/Person)	Modern Variety Ratio‡ (%)	Irrigation Ratio‡ (%)	Fertilizer Nominal Protection‡,§ (%)
Bangladesh	599	71	.12	29	17	1
India	722	68	.34	62	44	12
Pakistan	955	52	.35	49	100	-3
Indonesia	1,267	52	.26	77	78	-34
Philippines	1,331	49	.29	86	56	25
Thailand	1,716	67	.60	19	26	23
South Korea	3,592	29	.20	100	100	87
Taiwan	4,418	16	.22	100	100	43
Japan	9,691	8	.51	100	99	127

\* Gross national product per capita at constant 1980 price and adjusted by purchasing power parity index from the World Bank database.

† Data are from the FAO Production Yearbook.

‡ Data are from the IRRI World Rice Statistics, 1991.

§ Percentage of domestic to border price of urea. Domestic price is retail price of urea. Border price is world price of urea (f.o.b.) adjusted by transport and insurance cost, assuming these are 10% of f.o.b. price.

varieties in these countries, and by the postwar period almost all rice areas were planted to modern varieties, despite heavy protection of the fertilizer industry as evidenced by the relatively high nominal protection rate for fertilizer.

In South and Southeast Asia, land resources are relatively more abundant and the proportion of irrigated areas is lower, as is the adoption rate of modern varieties. Indeed, modern varieties for the tropics were developed only in the mid 1960s and have been adopted primarily in irrigated and favorable rain-fed areas.<sup>10</sup> Modern varieties also induced investments in irrigation and higher fertilizer use.<sup>11</sup> As part of the package of government support for rice production, domestic fertilizer prices were kept low, as reflected in the relatively low and even negative nominal protection for fertilizer.

The spread of modern varieties, irrigation expansion, and higher fertilizer use in the mid-1960s shifted comparative advantage of rice production in favor of traditional importers such as Indonesia, India, the Philippines, and Bangladesh in South and Southeast Asia.<sup>12</sup> The share of Asia in world rice imports dropped from about 60% in the early 1960s to 22% by the late 1980s.<sup>13</sup> Although the ratio of irrigated rice crop area is relatively small and adoption of modern varieties is relatively low, Thailand is the leading rice exporter in the world, due mainly to relatively abundant land resources suitable for rice production. Pakistan is also a major rice exporter because of widespread irrigation, comparative advantage in the production of the high-price Basmati rice, and low domestic demand for rice, as wheat is the staple food there.

### *Price Instability and Stabilization Policies*

Figure 1 shows the trends in the world price of rice in real terms, using the manufacturing unit value index as deflator. The world rice price is highly unstable due mainly to the very small proportion of world rice production that is traded in the world market.<sup>14</sup> Between 1960 and 1988, the world rice price peak in 1974 was five times higher than the lowest price experienced in 1986 when the world rice market collapsed.

Because rice is largely a tradable commodity, periodic adjustments in the exchange rate are another potential cause of price instability. Although the real exchange rate (using the ratio of U.S. to domestic consumer price index as deflator) in countries such as Thailand did not substantially change, exchange rate adjustments in others are substantial, almost doubling within 2–3 years (fig. 2).<sup>15</sup>

If such extreme world price fluctuations or exchange rate adjustments were allowed to be fully reflected in the domestic market, the welfare cost of adjustment for both poor consumers and poor producers would be high, given the imperfect credit markets in low-income countries.

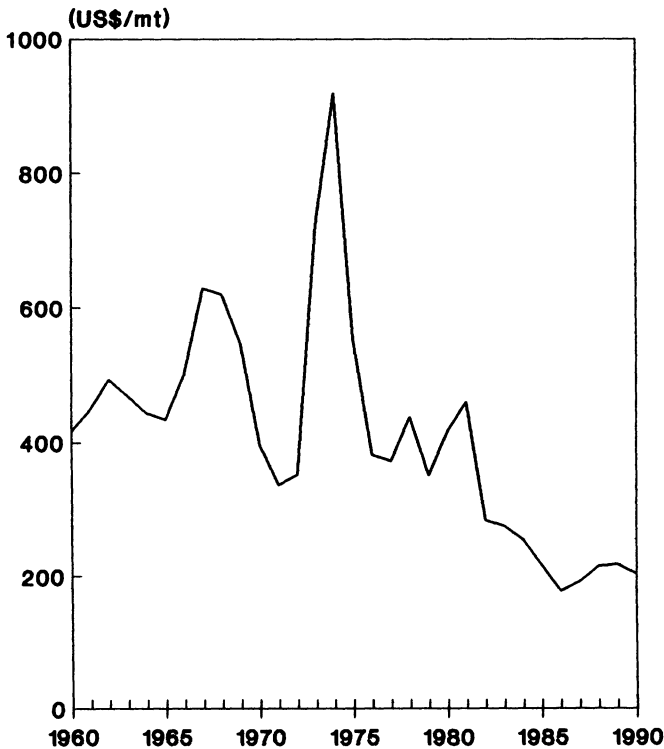


FIG. 1.—Trends in the real world rice price, 1960–90. Based on world price of 5% broken rice (f.o.b. Bangkok) deflated by U.S. manufacturing price index.

Government policies have actually managed to keep domestic rice prices relatively stable compared with the world price (table 2, fig. 3). The estimated coefficients of variation of domestic prices are only 30%–70% that of real world prices. Indeed, government control of imports and exports in rice and other grains to stabilize domestic prices contribute to the higher variability of world rice prices.<sup>16</sup>

Domestic rice prices are not only more stable than world prices but their secular trends also vary across countries. Whereas the world rice price showed a secular declining trend, domestic prices in the high-income East Asian countries exhibited increasing trends. The real rice price in South and Southeast Asian countries either declined or remained generally constant. Among the traditionally rice-importing countries, the real rice price declined most sharply in the Philippines and India, by as much as 40%–50%, as the widespread adoption of modern rice technology led to achievement of self-sufficiency. Although adoption of modern varieties was also high in Indonesia, government policies maintained the real rice price through the 1980s, ef-

fectively insulating domestic producers from the drop in the world rice prices in this period. In Bangladesh, where adoption of modern rice technology was more limited, the real rice price did not significantly differ between the 1980s and early 1960s.

Among the exporting countries, Thai and Pakistani farmers were partly insulated from the sharp drop in the world rice price by changes in trade policy. In recent years, however, the price became more favorable for Thai farmers than for farmers in Pakistan because the Thai government removed all taxes affecting rice exports.

### *Economic Development, Trade, and Protection*

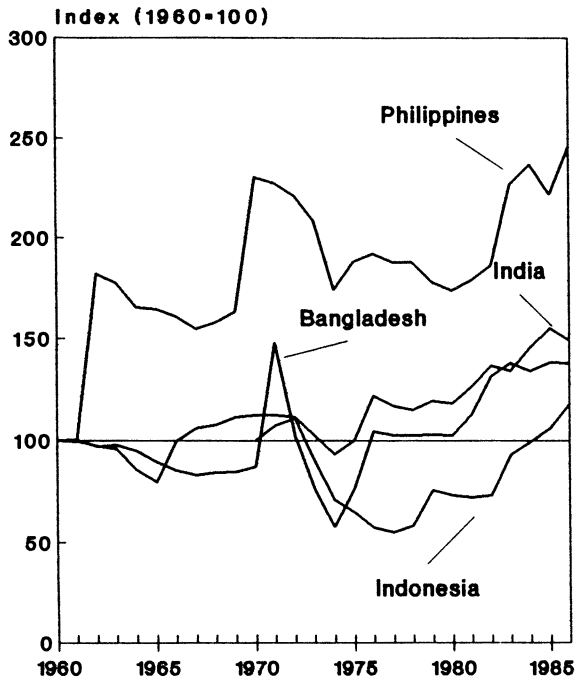
The trends in the nominal protection rate (table 3, fig. 3) show more sharply the impact of government interventions on domestic prices.<sup>17</sup> Several general patterns emerge from the comparison across countries and over time. First, high-income countries—Japan, South Korea, and Taiwan—have much higher levels of protection than low-income countries in South and Southeast Asia. In the European Community the normal protection rate of rice was estimated to be 44% in 1980,<sup>18</sup> while estimates for the United States from 1982 to 1987 averaged 92%.<sup>19</sup> Although much lower than those of the three East Asian countries, these rates are still generally higher than those for South and Southeast Asian countries.

Second, exporting countries have negative protection, while importing countries have zero or positive nominal protection rates. In Pakistan, the higher export tax on Basmati compared with ordinary rice is due to the perceived monopoly position of the country in the international trade of this type of rice.

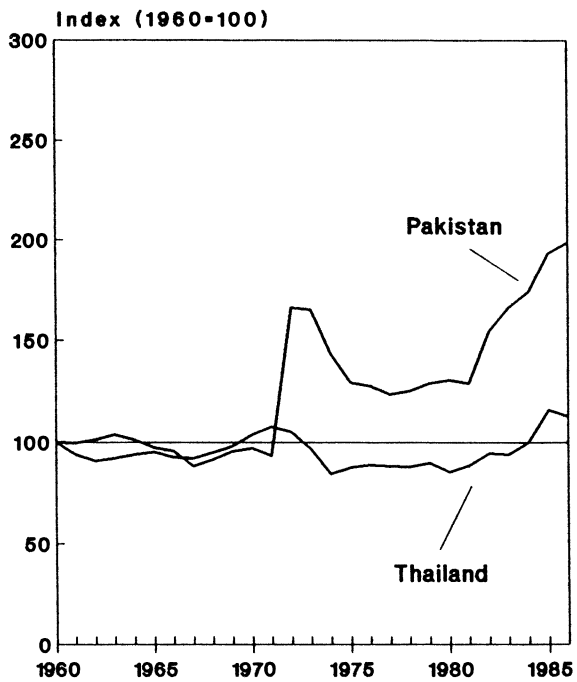
Third, over time, the nominal protection rates for rice have increased quite sharply in the East Asian countries that experienced the most rapid economic growth. In the 1980s, nominal protection rates also seem to have risen in Indonesia, Thailand, and Pakistan, not so much to increase incentives but, rather, to protect farmers, at least in part, from the collapse of the world rice market. Hence, the domestic rice price in these countries did not increase, while the sharply rising nominal protection rates in Japan and Korea increased the real domestic rice price, despite a declining trend in the world rice price.

In contrast, nominal protection rates declined over time in India, Bangladesh, and the Philippines. In Bangladesh, where the nominal protection rate still averaged about 30% in the 1980s, the domestic rice price in real terms was generally maintained and farmers were protected from the low world rice prices. In India and the Philippines, however, domestic rice prices were, on the average, about equal to world prices over the past 2 decades. This means that not only did benefits from growth in productivity accrue to consumers but farmers were not protected from the depressed world market in the 1980s. This





(a)



(b)

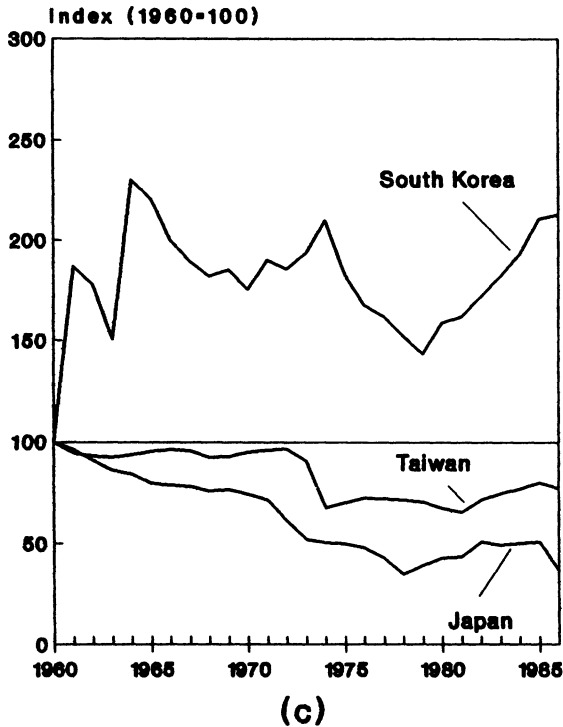


FIG. 2.—Trends in the real official exchange rate (1960 = 100), except Indonesia (1970 = 100).

is a classic case of the treadmill effect due to the domestic (and possibly international) consequence of technological change. In Indonesia this was not the case. There modern rice technology was also rapidly adopted but nominal protection rates were maintained at nearly 30% in the 1980s.

#### IV. Econometric Results

To explain the factors affecting the level of rice price protection, we conducted a regression analysis based on pooled time series, cross-section data of the nine Asian countries from 1960 to 1988. The level of protection is hypothesized to depend on the following exogenous variables: determinants of the border price as represented by the world price of rice deflated by the manufacturing unit value index and by the exchange rate index deflated by the ratio of the country-specific consumer price index to that of the United States (1980 = 100);<sup>20</sup> technology and policy variables lowering the unit cost of production as represented by the ratio of area planted to modern varieties and by the level of nominal protection on fertilizer;<sup>21</sup> natural comparative

TABLE 2  
 COEFFICIENT OF VARIATION OF REAL WORLD  
 PRICE AND REAL DOMESTIC WHOLESALE  
 PRICE OF RICE, 1960–88

Country	Coefficient of Variation
World price*	39
Domestic wholesale price:	
Bangladesh	12
India	16
Pakistan	23
Indonesia	19
Philippines	25
Thailand	13
South Korea	29
Taiwan	14
Japan	20

SOURCE.—IRRI World Rice Statistics, 1991.

\* Refers to world price of 35% broken rice, f.o.b. Bangkok.

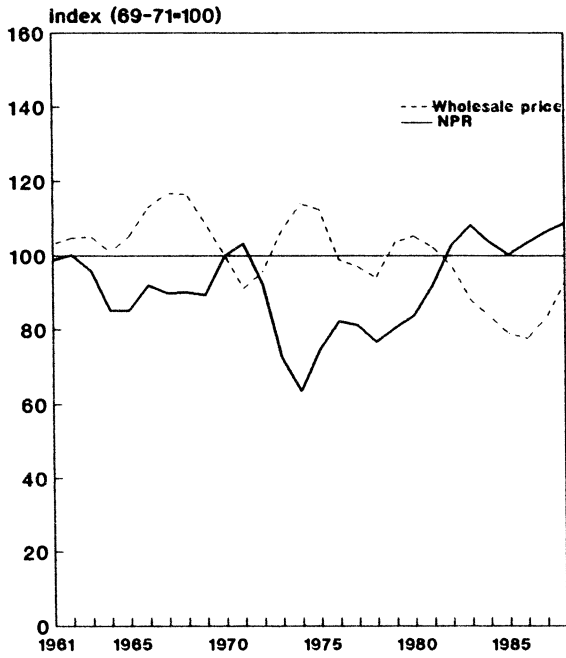
advantage as represented by the ratio of arable land to population; political economy factors or political market conditions as represented alternatively by per capita gross national income in real terms (GNP per capita) or by agriculture's share in the labor force; and a dummy variable to represent the trade position, that is, 1 for exporting countries and 0 otherwise.

The dependent variable is the nominal protection coefficient, defined as the ratio of domestic to border price. Except for the modern variety adoption ratio and the dummy variable, all other variables are specified in logarithms. Because the error terms are serially correlated, the equations were estimated by an autocorrelation model with a restriction of the same autoregressive parameter for all cross sections.<sup>22</sup> It should be pointed out that the inclusion of the nominal protection on fertilizer may introduce simultaneous equation bias to the extent that governments consider rice and fertilizer pricing policies as substitutable instruments for increasing incentives in rice production.

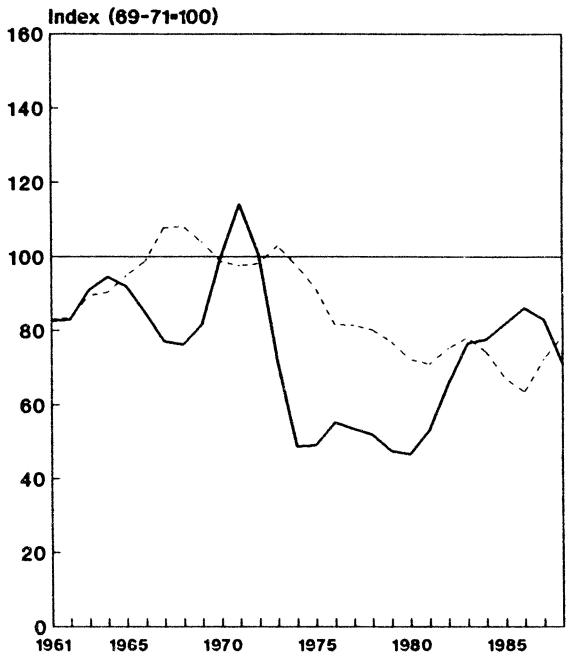
Table 4 presents the estimation results for the pooled nine countries. The regression results are remarkably good. Ninety percent of the cross country and time series variations in nominal protection rates are explained by the explanatory variables. All the estimated coefficients are statistically significant and consistent with a priori expectations.

The importance of price stabilization as a policy goal is reflected in the negative and highly significant coefficients of the real world rice price and real exchange rate. While the nominal protection coefficient

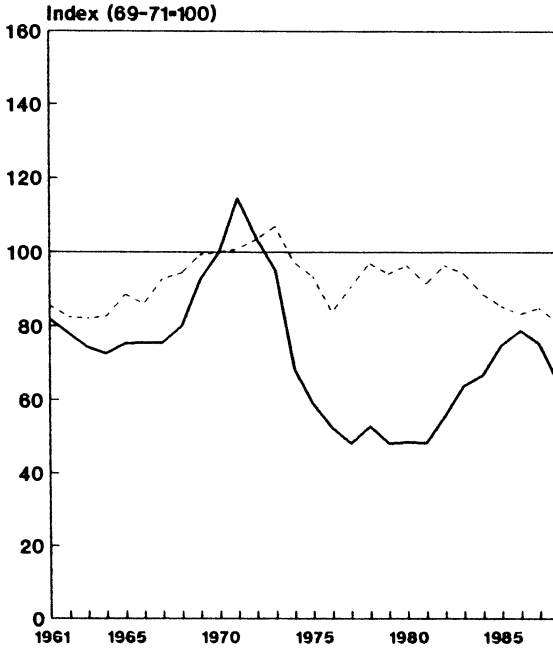
### a) THAILAND



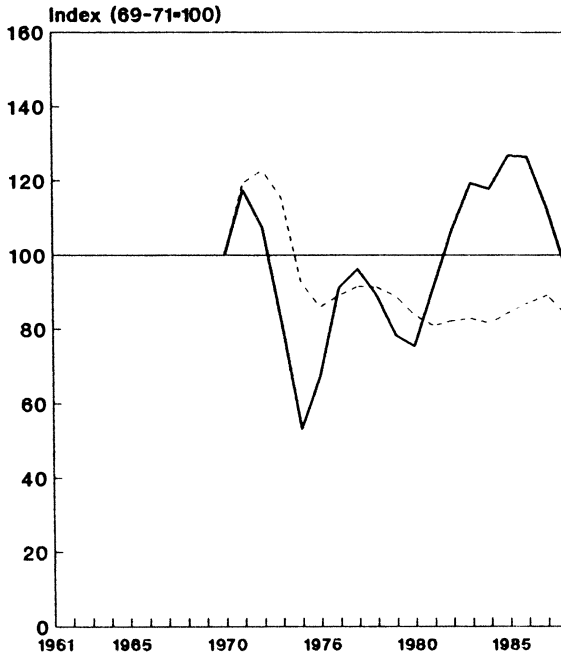
### b) INDIA



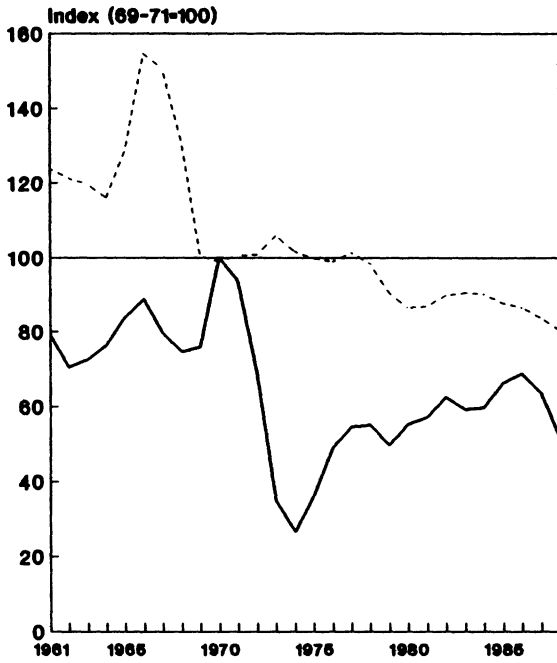
### c) BANGLADESH



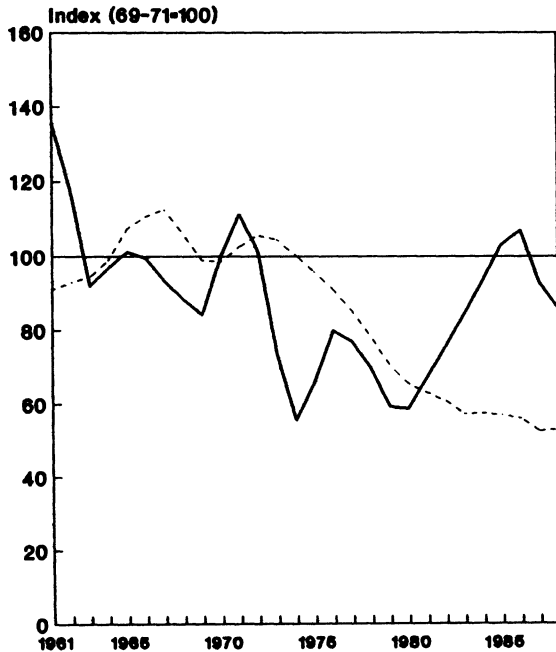
### d) INDONESIA



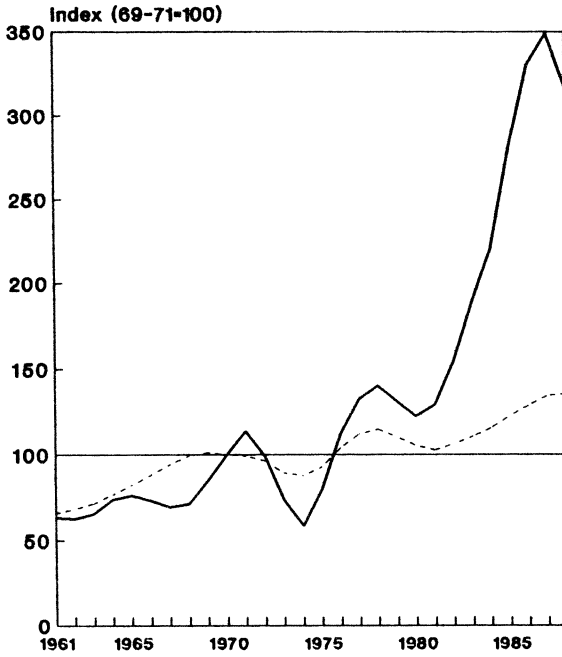
**e) PAKISTAN**



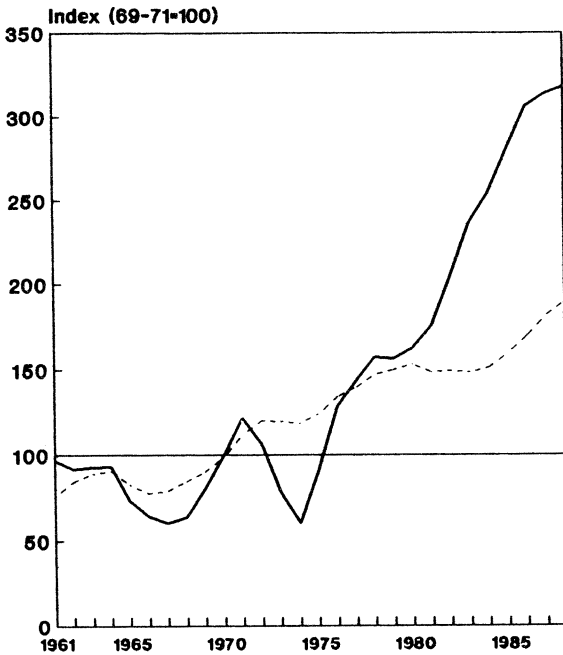
**f) PHILIPPINES**



### g) JAPAN



### h) SOUTH KOREA



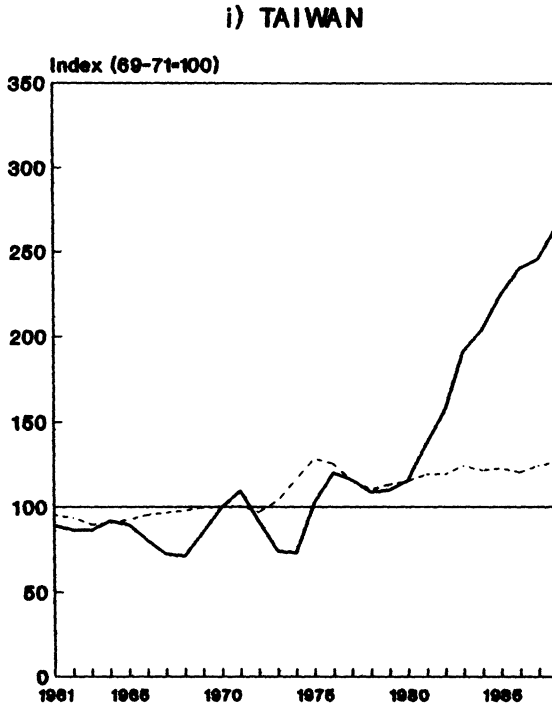


FIG. 3.—Trends in the nominal protection rate and wholesale price of rice in real terms, nine Asian countries, 1960–88.

declines by about 7% as the world price increases by 10%, the decline is only about 4% as the exchange rate increases at the same rate. The lower response to changes in the real exchange rate compared with the real world price suggests the greater propensity of governments to cushion price increases due to changes in the real world price rather than to changes in the real exchange rate. This is not surprising because changes in real world prices often represent short-run price fluctuations, while currency depreciations aimed at correcting disequilibrium in balance of payments are permanent in nature. The negative coefficient of the real exchange rate also reflects the fact that many of these countries have overvalued currencies and thus may have a tendency to raise the nominal protection rate of rice when the domestic currency appreciates.

The significantly negative coefficient of modern variety adoption is consistent with the hypothesis that increases in productivity due to technological change tend to lower domestic prices and therefore the nominal protection rate. A 10% addition to the modern variety adoption rate is estimated to lower the domestic price and thus the nominal protection rate by 2%. The negative and significant coefficient of the



TABLE 3  
 NOMINAL PROTECTION RATES FOR RICE IN NINE  
 ASIAN COUNTRIES, 1960-88\*

Country	1960-70†	1970-80‡	1980-88
Bangladesh	68	51	32
India	19	-5	-3
Pakistan§	1	-42	-17
IRRI	18	-42	-13
Basmati	-40	-38	-27
Indonesia		3	27
Philippines	31	-3	6
Thailand	-28	-28	11
South Korea	17	65	243
Taiwan	-12	6	101
Japan	70	148	443

SOURCE.—IRRI World Rice Statistics, 1991.

\* Estimated as the percentage difference between domestic and border price of rice. Domestic price is average wholesale price of rice for each country. Border price for Thailand and Pakistan is the export unit value. For the other countries, the border price is the world price of rice f.o.b. Bangkok, adjusted to include transport and insurance cost, assuming this is 10% of f.o.b. price. World price of rice refers to 5% broken rice for Japan, South Korea, and Taiwan and 35% broken rice for Bangladesh, India, Philippines, and Indonesia. The use of a common adjustment factor for transport cost should not cause major problems because countries included are within the same region and, except for Japan and South Korea, would be importing from within the region. The 10% adjustment factor is based on estimates for the Philippines.

† 1960-69 for Pakistan.

‡ 1973-75, 1978-80 for Pakistan.

§ Weighted average of IRRI and Basmati varieties.

land-man ratio means that countries with comparative advantage in rice production due to relative abundance of land resources tend to have lower domestic prices and lower nominal protection rates. The coefficient of the nominal protection rate of fertilizer is positive and significant, suggesting that a government policy to lower fertilizer price increases rice production and consequently lowers the domestic rice price. In effect, benefits from lower unit costs of production resulting from technological change, greater land resources, and favorable fertilizer prices have not fully accrued to rice farmers but have been widely shared with consumers in terms of lower rice prices.

The influence of economic growth on the political market for rice protection is also confirmed by the significant coefficients of either per

TABLE 4  
ESTIMATES OF REGRESSIONS TO DETERMINE THE NOMINAL  
PROTECTION COEFFICIENT FOR RICE, NINE  
ASIAN COUNTRIES, 1960–88

	(1)	(2)
World rice price	-.70** (-12.57)	-.73** (-13.66)
Exchange rate	-.35** (-4.25)	-.45** (-5.90)
Modern variety adoption	-.02** (-5.34)	-.02** (-5.17)
Land per person	-.38** (-3.38)	-.30** (-2.78)
Fertilizer protection	.19** (4.47)	.18** (4.36)
Agricultural labor share	-.38** (-4.30)	...
GNP per capita	...	.23** (5.04)
Export dummy	-.53** (-3.61)	-.79** (-5.52)
Intercept	4.04** (10.42)	2.91** (5.52)
Adjusted $R^2$	.89	.89
D-W	1.96	1.94
Log likelihood function	75.98	79.13

NOTE.—Numbers in parentheses are *t*-values.

\* Statistically significant at 5% level.

\*\* Statistically significant at 1% level.

capita gross national income or agriculture's share of total employment. And finally, the coefficient of the export dummy variable indicates that rice-exporting countries have a significantly lower nominal protection rate than importing countries.

To see the difference in the determinants of price protection depending on the trade balance, separate regressions were estimated for the seven rice-importing and two exporting countries (table 5). The statistical performance of the model is better for importing countries, where 90% of the variations in the nominal protection rate of rice is accounted for by the explanatory variables. Except for land-man ratio, all the estimated coefficients are statistically significant and have the expected signs. As expected, importing countries are able to insulate the domestic rice market more easily from the fluctuations in world rice price and changes in the exchange rate as evidenced by the higher values of the coefficients of these variables. In fact, the coefficients of the exchange rate for the exporting countries are not statistically significant. For the exporting countries, the specification with GNP per capita (col. 4) rather than agriculture's employment share (col. 3)

TABLE 5

ESTIMATES OF REGRESSIONS TO DETERMINE THE NOMINAL PROTECTION COEFFICIENT FOR RICE, IMPORT-COMPETING (SEVEN) AND EXPORTING (TWO) ASIAN COUNTRIES, 1960-88

	IMPORT-COMPETING		EXPORTING	
	(1)	(2)	(1)	(2)
World rice price	-.83** (-14.24)	-.82** (-14.37)	-.30** (-3.21)	-.30** (-3.94)
Exchange rate	-.50** (-5.72)	-.54** (-6.76)	-.09 (-.37)	.08 (.53)
Modern variety adoption	-.02** (-3.14)	-.02** (-3.16)	-.01 (-1.05)	-.01* (-1.92)
Land per person	-.36** (-2.91)	-.37** (2.74)	-.38 (-.91)	.07 (.44)
Fertilizer protection	.17** (3.99)	.17** (4.00)	.13* (1.71)	.13 (1.94)
Agricultural labor share	-.32** (-3.36)	...	-.53 (- .59)	...
GNP per capita	...	.22** (3.82)	...	.18* (2.20)
Intercept	4.85** (11.78)	3.54** (5.49)	1.27 (1.66)	.17 (.21)
Adjusted R <sup>2</sup>	.89	.89	.44	.49
D-W	1.88	1.84	1.84	1.79
Log likelihood function	72.38	73.94	22.73	24.83

NOTE.—Numbers in parentheses are *t*-values.

\* Statistically significant at 5% level.

\*\* Statistically significant at 1% level.

performed better as modern variety adoption, nominal protection of fertilizer, and per capita GNP are all significant. Land-man ratio was not significant in both equations because of very limited variability across countries within each group.

Separate regressions were also estimated for the groups of low-income (South and Southeast Asia) and high-income countries (East Asia). Table 6 shows that there are significant differences in the patterns of rice price protection between low-income and high-income countries. Although changes in the world price and exchange rate are statistically significant for the two groups, high-income countries tend to be better able to insulate their domestic market from these changes, as indicated by the higher estimates of their coefficients. It is also interesting to note the significant association between fertilizer pricing policy and rice price protection in low-income countries, which is not the case in high-income countries. This means that the effective rates of rice protection in high-income relative to low-income countries are higher than the comparison in nominal protection rates shows. Striking also is the result that differences in GNP per capita or agriculture's employment share, thus far, do not seem to have so much influence on political market conditions as to significantly explain changes over

TABLE 6

ESTIMATES OF REGRESSIONS TO DETERMINE THE NOMINAL PROTECTION COEFFICIENT FOR RICE, LOW- (Seven) AND HIGH- (Three) INCOME ASIAN COUNTRIES, 1960-88

	LOW INCOME		HIGH INCOME	
	(1)	(2)	(1)	(2)
World rice price	-.54** (-7.55)	-.53** (-7.60)	-1.11** (-18.02)	-1.11** (-18.70)
Exchange rate	-.28* (-2.36)	-.32** (-2.58)	-.73** (-7.04)	-.81** (-7.89)
Modern variety adoption	-.01** (-2.91)	-.02** (-3.73)	...	...
Land per person	-.23 (-1.41)	-.27* (-1.92)	-2.37** (-7.46)	-1.73** (-7.15)
Fertilizer protection	.20** (3.42)	.22** (3.61)	.05 (1.21)	.03 (.86)
Agricultural labor share	0.22 (0.62)	...	-.99** (-7.89)	...
GNP per capita	...	.02 (.24)	...	.51** (8.44)
Export dummy	-.54** (-4.10)	-.53** (-3.93)	...	...
Intercept	3.43** (6.56)	3.15** (4.81)	4.21** (7.50)	1.95** (2.58)
Adjusted $R^2$	.79	.79	.97	.97
D-W	1.96	1.96	1.98	1.68
Log likelihood function	46.92	46.75	67.73	70.14

NOTE.—Numbers in parentheses are *t*-values.

\* Statistically significant at 5% level.

\*\* Statistically significant at 1% level.

time or differences across countries of rice price protection among low-income countries. In contrast, these are highly significant among high-income countries.

## V. Concluding Remarks

Our econometric analysis of the determinants of rice price protection in nine Asian countries confirms previous findings on the importance of economic development and resource endowments in explaining the pattern of agricultural protection. It also reveals the importance of price stabilization as a policy objective and the relation between cost-reducing policies (technology generation and input price subsidy) and the rice price policy.

An important finding of this study is that policies that reduce the unit cost of production, such as modern variety adoption and favorable fertilizer pricing policies, have lowered rice prices, and thus the major beneficiaries of those policies are consumers. Yet, the experience of Japan, Taiwan, and Korea indicates that it is unlikely for countries in South and Southeast Asia to prevent rice protection from rising sharply

by means of cost-reducing innovations in rice production alone, as they follow the rapid development path of East Asia. In order to escape from the trap of extreme high-cost protection, newly industrializing countries in South and Southeast Asia must have better foresight and determination in adopting industrial adjustment policies that will accelerate through education and training the shift of resources from rice to high-income-elastic farm products within agriculture and to the non-farm sector.

### Notes

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1. Terry Sicular, *Food Price Policy in Asia: A Comparative Study* (Ithaca, N.Y., and London: Cornell University Press, 1989).

2. The other Asian rice-growing countries were excluded either because of unavailability of data (Burma, Vietnam, Laos, and Cambodia) or because the measurement of price policy impact in terms of nominal protection rates of rice and fertilizer is not straightforward (Sri Lanka and Malaysia).

3. Masao Honma and Yujiro Hayami, "The Determinants of Agricultural Protection Levels: An Econometric Analysis," in *The Political Economy of Agricultural Protection: East Asia in International Perspective*, ed. Kym Anderson and Yujiro Hayami (Sydney, London, and Boston: Allen & Unwin, 1986); Peter H. Lindert, "Economic Perspectives on the Historical Evolution of Agricultural Policies," in *Agriculture and the State: Employment and Poverty in Developing Countries*, ed. C. Peter Timmer (Ithaca, N.Y., and London: Cornell University Press, 1991).

4. C. Peter Timmer, "How Does Indonesia Set Its Rice Price? The Role of Markets and Government Policy" (paper presented at the International Conference on the Economic Policy Making Process, Jakarta, Indonesia, 1990).

5. Except in Thailand and a few other countries, variable export and import duties have not been adopted despite apparent operational ease and lesser opportunities for rent seeking under monopoly control of international trade.

6. Lindert.

7. This may not be true in developed countries, such as in the United States and a number of European countries, where the relative size of major agricultural exports to the whole economy is small and per capita income is high and thus the country can afford to subsidize exports along with efforts to subsidize its agricultural sector.

8. Anderson and Hayami, eds.

9. Randolph Barker and Robert W. Herdt, *The Rice Economy of Asia* (Washington, D.C.: Resources for the Future, 1985).

10. Cristina C. David and Keijiro Otsuka, ed., *Modern Rice Technology and Income Distribution in Asia* (Boulder, Colo.: Lynne Rienner, 1993).

11. Yujiro Hayami and Masao Kikuchi, "Investment Inducements to Public Infrastructure: Irrigation in the Philippines," *Review of Economics and Statistics* 60 (February 1978): 70-77; Cristina C. David, "Fertilizer Demand in the Asian Rice Economy," *Food Research Institute Studies* 15 (First Quarter 1976): 109-24; and Cristina C. David and Keijiro Otsuka, "The Modern

Seed-Fertilizer Technology and Adoption of Labor-Saving Technologies: The Philippine Case," *Australian Journal of Agricultural Economics* 34 (August 1990): 132–46.

12. Ammar Siamwalla and Stephen Haykin, *The World Rice Market: Structure, Conduct, and Performance*, Research Report no. 39 (Washington, D.C.: International Food Policy Research Institute, 1983).

13. Cristina C. David, "The World Rice Economy: Challenges Ahead," in *Rice Biotechnology*, ed. G. S. Khush and G. H. Toenniessen (London: CAB International and IRRI, 1991).

14. Rice has the lowest traded ratio among cereal grains, since less than 5% of world rice production is currently traded internationally, in contrast to nearly 30% for wheat and corn.

15. The real exchange rate reflects the relative price of tradable to non-tradable goods. Because the price index for nontradable goods is not available for all the countries included in the study, the consumer price index is used as proxy, as commonly done in other studies.

16. D. Gale Johnson, "World Agriculture, Commodity Policy, and Price Variability," *American Journal of Agricultural Economics* 57 (December 1975): 823–28.

17. Border price is the export unit value in Thailand and Pakistan. For importing countries in South and Southeast Asia, we used the Thai f.o.b. price for 35% broken rice, adjusted by 10% for transport cost. For East Asia, the Thai 5% broken rice is used.

18. Kym Anderson, Yujiro Hayami, and Masayoshi Honma, "The Growth of Agricultural Protection," in Anderson and Hayami, eds.

19. Based on estimates of producer subsidy equivalent (PSE) averaging 48% from Frederick J. Nelson, "United States," in *Estimates of Producer and Subsidy Equivalents: Government Intervention in Agriculture, 1982–1987*, ed. Alan J. Webb, Michael Lopez, and Renato Penn (Washington, D.C.: U.S. Department of Agriculture, 1990). Nominal protection rate was derived using the formula  $[(PSE / 1 - PSE) * 100]$ .

20. Although government rice trade policies generally affect world rice prices, world rice price is assumed to be exogenous in the estimating equation because individual "small" countries are used as observations, and the world rice price is affected by many other factors including developments in other grains markets.

21. Ratio of irrigated area was initially included but was dropped due to multicollinearity problems with the adoption rate of modern varieties. The coefficient of modern varieties therefore also includes the effect of irrigation. Often input price subsidy is preferred over raising output prices to cope with the policy dilemma of lowering prices to consumers while maintaining adequate incentives to rice farmers. See Randolph Barker and Yujiro Hayami, "Price Support versus Input Subsidy for Food Self-Sufficiency in Developing Countries," *American Journal of Agricultural Economics* 58 (December 1976): 617–28.

22. See G. G. Judge, R. Cartel Hill, and William E. Griffiths et al., *Introduction to the Theory and Practice of Econometrics* (New York: Wiley, 1988).