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A MODEL OF RICE MARKETING MARGINS IN INDONESIA*

Rice marketing involves the transformation of the farmer's harvest in time, form, and place. Typically this means storage in a merchant's warehouse, milling at a rice mill, and transportation from farm to retail consumer. In Indonesia and other low income countries any or all of these functions can take place on the farm. Thus the subsistence farmer frequently performs his own marketing services as well as grows his own food. These on-farm activities have received renewed attention from economists concerned about labor productivity in the rural sector (see W. O. Jones [*10, 11*], Stephen Hymer and Stephen Resnick [*6*], and Carl Liedholm [*12*]). Important as these on-farm activities are, however, it is the more traditional marketing activities performed off-farm that are of major interest to short-run policymakers.

Who stores the marketed surplus, in what form, and where? How much milled rice does the economy gain from a given amount of rough rice? Through what channels does rice move from farm to consumer, and what kind of transportation equipment is used? In aggregate, what are the costs of marketing from farmer to consumer; i.e., what are rice marketing margins?

Each of the questions about individual aspects of the rice marketing system is important in its own right and deserves separate study. It is a sad commentary on the efforts of recent researchers that L. A. Mears's study (*13*) carried out in 1957 remains the standard reference on all these questions despite a decade and a half of highly visible change in rice marketing in Indonesia. The lack of understanding of some of the more aggregate parameters in rice marketing is even more critical. Formulation and implementation of the government's floor and ceiling price policy depend crucially on the magnitude of the margin for rice between farmgate and urban market and on understanding the regional, temporal, and institutional factors that influence it.

Achieving this understanding is a large order. A number of recent studies have made contributions to various pieces of the puzzle. Among these are the Weitz-Hettelsater *Rice Marketing Study* (*17*), the marketing chapter and material in the evaluation survey of the rice intensive program (BIMAS) (*7*), the margins

* This paper is a revision and extension of two earlier drafts written in 1972 and 1973 under the auspices of the Harvard Advisory Group BAPPENAS Research Project. The present version was completed as part of the Stanford Rice Project funded by the United States Agency for International Development (USAID) under Contract No. CM-ASIA-C-73-39.

I wish to thank William O. Jones, Leon A. Mears, and William H. Janssen, Jr. for helpful comments.

paper by Atje (*2*), the work on seasonal price formation by R. H. Goldman (*4*), and my own rice milling research (*14, 15, 16*). But none of these succeeds in drawing together a coherent picture of the current state of Indonesia's rice marketing system, and neither will the research to be presented here. This paper is addressed to a fairly restricted topic, using a narrow statistical technique based on a very simple model. It does, however, address that crucial policy issue of the size of overall marketing margins, and it does it using the same data and variables that are used by policymakers and the general public in evaluating the success or failure of government rice price policy.

DATA

At its simplest, this paper merely examines the size of the margin between the monthly price for stalk paddy reported by the Central Statistical Bureau (*9*) for eight major rice producing provinces of Indonesia and the retail price of medium-quality milled rice reported by the Bureau of Logistics (BULOG) (*8*) for the capital cities of the same eight provinces. The provinces include West, Central, and East Java, Yogyakarta, Bali, West Nusa Tenggara (Sumbawa), South Kalimantan (Borneo), and South Sulawesi (Celebes). Although the quality and completeness of the data vary considerably from province to province, it will still be possible to compare a number of aspects of rice marketing across provinces, especially between Java and the outer islands.

The statistical work reported here relates the rural price of first-quality *bulu* (*Bulu* 1) stalk paddy to the urban retail price of medium-quality milled rice in the same province (BULOG). Other comparisons are possible since the Central Statistical Bureau also reports rural stalk paddy prices, based on land tax records, for second-quality *bulu* as well as first- and second-quality *cere*. The first-quality *bulu* prices are more nearly complete than any other series, however, and bear a close statistical relationship to the BULOG retail prices for medium-quality milled rice in provincial capital cities. Table 1 reports some simple correlation coefficients for the four stalk paddy prices with the BULOG milled rice prices for several provinces.

The simple correlation coefficients for West Java in Table 1 are surprising in that *Cere* 1 stalk paddy prices correlate somewhat more closely with BULOG retail prices than do the *bulu* prices. Mears notes that on Java the two varieties are grown in about equal proportions, and the very similar correlation coefficients for *bulu* and *cere* prices in East and Central Java would verify that (*13*, p. 32). But the better relationship for *Cere* 1 in West Java suggests that the *cere* varieties are somewhat more important in price formation in that province.

Table 1 also shows cross correlations of the various stalk paddy prices with each other. On Java these correlations are uniformly high, dipping only to 0.972 for the *Bulu* 1–*Cere* 1 pairing in West Java. Obviously, in these cases it makes very little difference which stalk paddy price is used relative to the BULOG retail price. Even on the outer islands the correlation coefficients for stalk paddy prices remain surprisingly high. Only one coefficient drops below 0.9—the *Cere* 1–*Cere* 2 pairing in South Sulawesi. Other than this, the correlation coefficients are only slightly lower than on Java.

TABLE 1.—SIMPLE CORRELATION COEFFICIENTS BETWEEN VARIOUS STALK PADDY PRICES AND THE BULOG RETAIL PRICE FOR MEDIUM-QUALITY MILLED RICE FOR SEVERAL PROVINCES, MONTHLY, JANUARY 1969 TO FEBRUARY 1973

	BULOG	*Bulu 1*	*Bulu 2*	*Cere 1*	*Cere 2*	*BULOG*	*Bulu 1*	*Bulu 2*	*Cere 1*	*Cere 2*
			West Java					Central Java		
BULOG	1.000	0.910	0.919	0.939	0.915	1.000	0.945	0.945	0.944	0.941
Bulu 1		1.000	0.994	0.978	0.972		1.000	0.998	0.995	0.994
Bulu 2			1.000	0.996	0.996			1.000	0.996	0.996
Cere 1				1.000	0.987				1.999	0.997
Cere 2					1.000					1.000
			East Java					West Nusa Tenggara[a]		
BULOG	1.000	0.922	0.923	0.919	0.920	1.000	0.670	0.652	0.554	0.546
Bulu 1		1.000	0.999	0.995	0.993		1.000	0.989	0.936	0.921
Bulu 2			1.000	0.995	0.994			1.000	0.936	0.938
Cere 1				1.000	0.996				1.000	0.939
Cere 2					1.000					1.000
			South Sulawesi[b]					Yogyakarta		
BULOG	1.000	0.602	0.557	0.547	0.482	1.000	0.950	0.951	0.946	0.937
Bulu 1		1.000	0.998	0.973	0.905		1.000	0.994	0.997	0.986
Bulu 2			1.000	0.975	0.908			1.000	0.993	0.987
Cere 1				1.000	0.872				1.000	0.990
Cere 2					1.000					1.000
			Bali[c]					South Kalimantan[d]		
BULOG	....	Not	Available	....	....	....	Not	Available	....	....
Bulu 1		1.000	0.992	....	....		1.000	0.986	0.942	0.944
Bulu 2			1.000	....	....			1.000	0.952	0.961
Cere 1				....	....				1.000	0.988
Cere 2				....	....					1.000

[a] 48 observations only. [b] 15 observations only. [c] 34 observations only. [d] 14 observations only.

MODEL I

Two separate approaches are open. The first, discussed here, is to compare the paddy price directly with the retail price. A number of conceptual issues must be resolved, however, before attempting this apparently simple analysis. To compare stalk paddy prices with milled rice prices, a conversion ratio is needed. Indonesia has long used a ratio of 0.52 kilograms of milled rice per kilogram of stalk paddy. This ratio may or may not be acceptable as an overall average for the country; it is most unlikely to hold exactly for all provinces for all points in time. In the simple analysis we will use the value of 0.52, but in the more complex model it is desirable and possible to relax the assumption of a fixed milling ratio and to examine how it varies from province to province and over time.

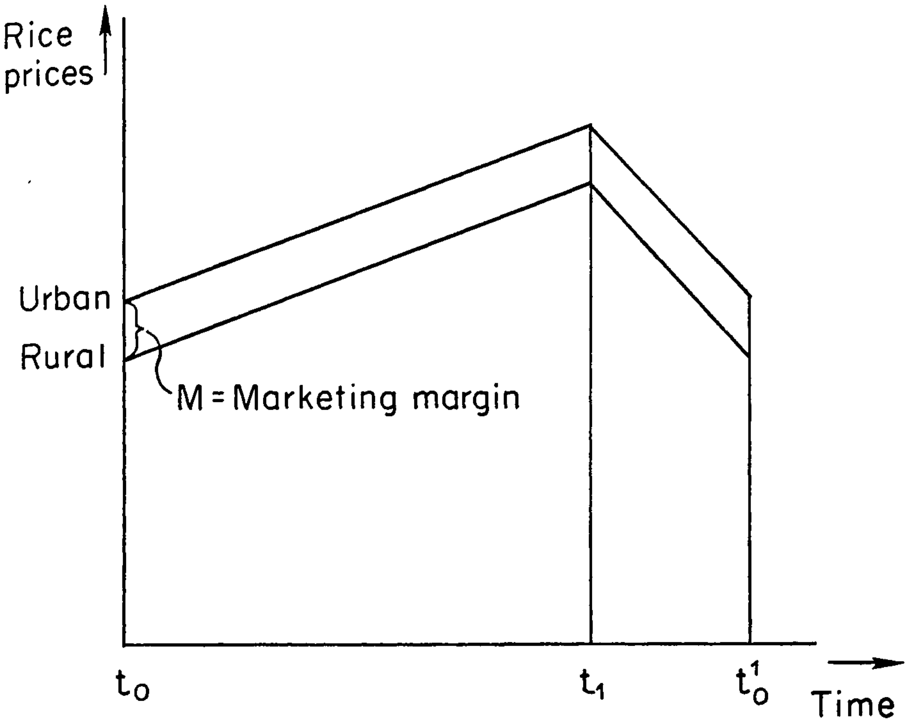
A second important issue relates to timing. Some time is necessary before stalk paddy in the rural market can be transformed into milled rice in the urban retail markets. This study assumes that the transformation can be performed in less than one month and that the retail price relates directly *to the same month's stalk paddy price.*

This is a crucial assumption and its implications should be considered. First, it means we are specifically not concerned about the storage of rice except incidentally within the month of consideration. Thus the formation of the seasonal price rise is not an issue here. An excellent treatment of seasonal movements of retail rice prices in Indonesia is contained in Goldman (*4*). By examining prices within the same month, we are testing the extent to which the rural stalk paddy market and urban retail market are connected in terms of information flow, and indeed, the physical flow of rice itself, in less than the space of one month. This market connectedness partially determines the formation of prices. While this within-month period of price formation seems reasonable for most of the provinces tested here, especially on Java and Bali, a lag of perhaps one month might be more appropriate for the remaining three provinces where the physical and institutional infrastructure is not nearly so well developed, thus leading to poorly developed systems of price formation. In South Sulawesi, South Kalimantan, and West Nusa Tenggara an examination of various lags might reveal additional information to that presented here.

The direction of price formation is also critical. Traditional marketing models assume there is a uniform flow of rice from rural area to cities, varying perhaps in magnitude over an entire marketing year, but not in direction. Retail demand in the cities, in this view, is seen as adjusting to the rural supplies. Thus urban retail prices are determined by the level of rural stalk paddy prices plus the costs of marketing. Such a model is shown in Chart 1, where it is assumed that the harvest period is spread over several months rather than occurring at a unique point in time. Otherwise, the seasonal price pattern is the same as that shown by Hendrik Houthakker in his discussion of commodity price formation (*5*).

This unidirectional view of price formation is obviously too simple. During the harvest stalk paddy may indeed "force" itself out into markets, and urban retail prices for milled rice depend on how low stalk paddy prices fall. But during the pre-harvest season the urban rice prices may rise so high as to "call forth" supplies from the rural areas. The problem is simultaneity. Price formation in-

CHART 1



volves both supply (stalk paddy in the rural areas) and demand (for milled rice in the urban (and rural) retail markets. It is not strictly correct, then, to regard one price, e.g., the urban retail price, as functionally dependent on the other price, the rural stalk paddy price. Statistically, the differences are not too important if the fit is good, but economically the differences can be crucial if the uni-directional flow of supplies is interrupted.

The simple market model in Chart 1 demonstrates the expected behavior of both urban and rural rice prices for one entire season on the *assumption* that rice flows from rural to urban areas the entire year (and thus that rice is stored in the rural areas) and that the marketing margin, M, is constant as well. In the absence of any exogenous forces to influence prices, the urban and rural prices, separated by the margin M, would rise from the end of the harvest at t_0, more or less in unison (remembering that we are assuming the two markets are connected within the space of one month) until the peak is reached at t_1 when the new harvest begins. Prices fall steadily in unison as the harvest supplies accumulate until they reach their previous starting point, now one year later, at t_0^1.

Chart 1 is not neutral with respect to the last major issue involving the simple model. It is drawn with a constant *absolute* margin *M* between rural and urban prices. Much analysis of marketing margins, indeed nearly all of Mears's work on Indonesian and Philippine marketing margins, is done in terms of percentage margins rather than absolute margins. The argument apparently is that most margins are calculated by participants in a proportionate manner, i.e., each stage of the marketing process receives a percentage share of the product.

This view of the marketing process does not suit the analysis done here. Only one or possibly two items in the marketing process are of necessity charged as percentages: interest charges during storage and possibly any insurance charges as well. All other charges can just as easily be assumed to be charged as a fixed amount per ton rather than per unit value. There is no apparent reason why the charges for transportation and milling would be *other* than on a per ton basis. Since the analysis presented here abstracts almost completely from the storage aspects of marketing, the absolute margins model seems more applicable than the percentage margins model. It will be possible to relax this "all or nothing" view of margins in the more complex model, but for the moment we will assume that the margins that determine whether or not a market is connected can be satisfactorily expressed as absolute magnitudes.

The determination of the size of the marketing margin M is simple in the environment depicted in Chart 1. Indeed, we do not even require monthly observations—simple annual averages for urban and rural prices will suffice. Equation (1) shows how M would be calculated.

$$M = P_u - (1/c)\,P_p, \tag{1}$$

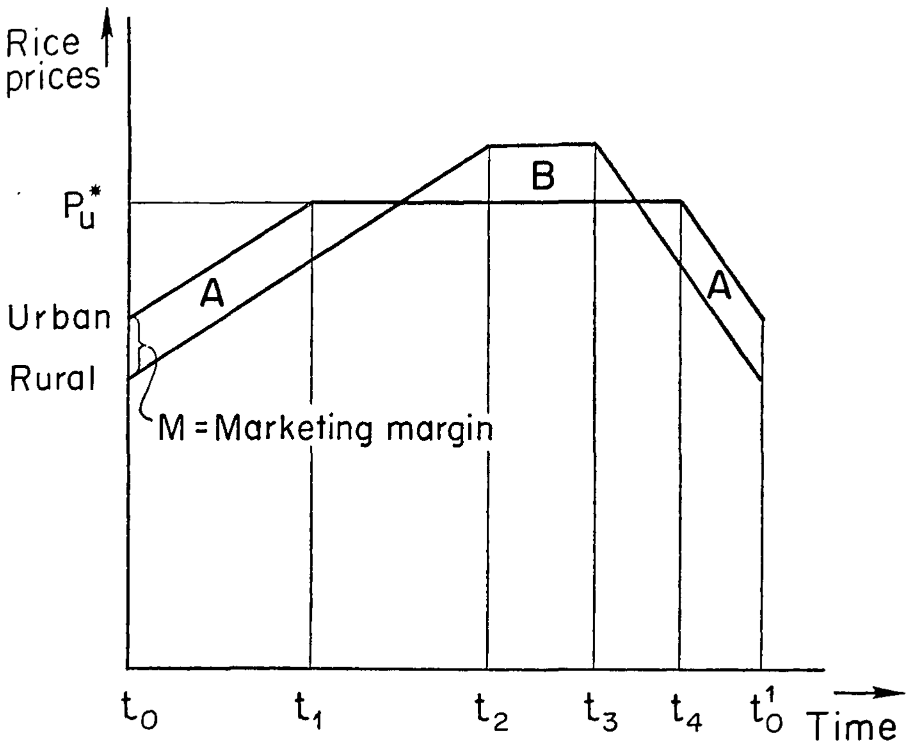
where M = marketing margin,
P_u = urban retail price of rice,
P_p = rural price of stalk paddy, and
c = milling conversion ration (0.52 for Indonesia).

But in Indonesia very few provinces will look like Chart 1 because of the government's floor and ceiling price policy. The potential for interregional trade, if harvest patterns are different in different regions, or for international trade, if national patterns differ, would be sufficient to alter the pattern of rice prices from that depicted in Chart 1.

One possible alternative is shown in Chart 2, which reflects the fact that in some Indonesian provinces the capital city is the deficit point for the surrounding rural area's surplus during some part of the year, but at other times it becomes the surplus point itself and ships rice from outside the province *into the rural areas*. That is, during part of the year, the direction of rice flow is reversed.

Once again, the end of the harvest is marked by t_0. The normal price structure exists, with the urban retail price higher than the rural price by the amount of the marketing margin M. Both prices rise seasonally to reflect normal costs of carrying inventory, but when the urban price reaches the level P_u^*, the pattern in Chart 2 departs from the simple model in Chart 1. By some mechanism P_u^* becomes the ceiling price for medium quality rice in regional capital cities. The mechanism may be a formal governmental policy such as exists in Indonesia. During the period for which the data here are analyzed, 1969–72, the urban ceiling price was 50 rupiahs per kilogram (Rp/kg). But the model is not limited to such a price policy. The price level P_u^* may simply be the price at which it becomes profitable to import supplies from other regions or from abroad. Indeed, if storage costs in the cities are sufficiently lower than in the rural areas, rice that moved *to* the city after harvest may move *back* to the rural areas during the pre-

CHART 2



harvest period of highest prices. Thus, all that is required is that rice be available from sources other than the currently available supplies in the rural areas for the model depicted in Chart 2 to become operative.

At time t_1 the urban price reaches level P_u^* and remains stable. But unless government actions are taken to dampen prices in the rural areas as well, they will continue to rise to reflect the normal costs of storage (although they may in fact rise somewhat more slowly if urban demand for rural supplies is no longer significant). So long as rural demand is a significant part of total demand for rice, the rural price will rise without regard to the urban price ceiling, until time t_2, at which point the rural price is higher than the urban price by the amount of the marketing margin M. At this point it becomes profitable to ship rice supplies from the urban center back into the countryside, assuming that the margin M applies to shipments in either direction. From time t_2 to t_3 the rural price is stabilized at $P_u^* + M$, and it remains at this stabilized level until the harvest begins at t_3. Now the rural price starts to fall under the influence of new crop supplies, but this does not influence urban rice prices until the rural price has fallen from $P_u^* + M$ to $P_u^* - M$, at time t_4, at which point the urban price starts to fall in unison with the declining rural price until the end of the harvest is reached at t_0^1 and the cycle starts over.

The implications of Chart 2 for measurement of the marketing margin M are extreme. A simple annual average of P_u and P_p will no longer tell us anything at all about the size of M. Indeed, depending on the lengths of $t_0 - t_1$ and $t_4 - t_0^1$

relative to $t_2 - t_3$, $t_1 - t_2$ and $t_3 - t_4$, the level of M measured by equation (1) could well be zero or even negative. Equation (1) will only provide an accurate measure of M during the intervals marked "A" in Chart 2, from t_0 to t_1 and from t_4 to t_0^1. These are the only times when rice is flowing from rural to urban areas and when price formation reflects the impact of the actual marketing margin M. Alternatively, during the time period from t_2 to t_3, marked "B" in Chart 2, equation (1) will measure $-M$. But since it is likely that the backward margin will not be the same as the forward margin, especially because no milling costs have to be paid, the margin measured during "B" may not be as good an estimate of the rural to urban margin as that measured during "A."

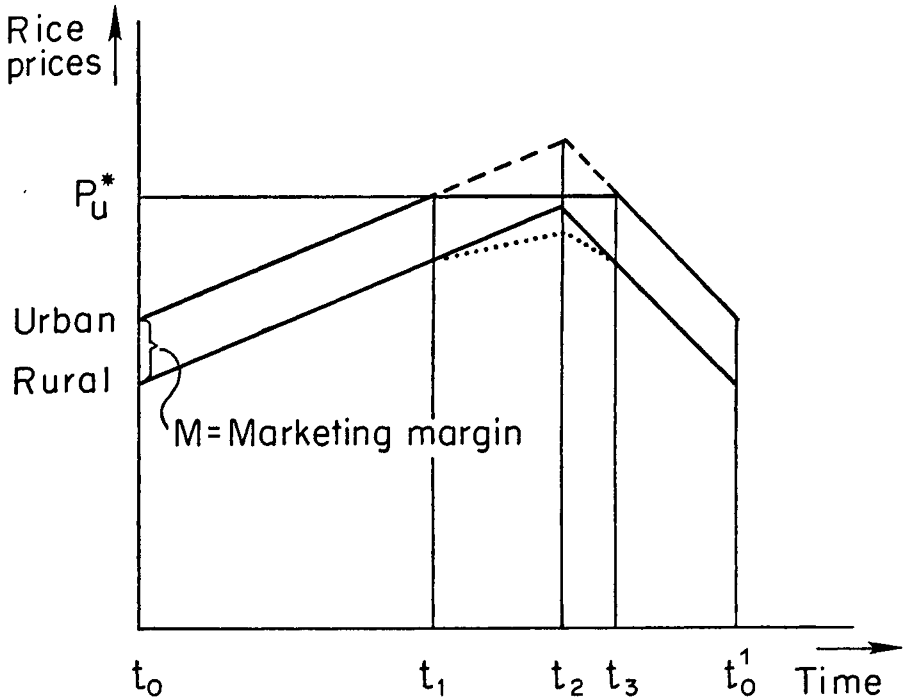
What about the shaded areas between $t_1 - t_2$ and $t_3 - t_4$? Any margins measured during these periods will bear no relationship at all to the actual margin M. During periods in which there is no market connection, and that is precisely what the shaded areas depict, price formation in the two market areas is independent. Only when the prices are separated by a margin sufficiently large to induce an actual flow of supplies is price formation in the two regions linked. Of course, we rely on competitive pressures to keep the actual margin between the two prices equal to that competitive margin M that is just sufficient to link the markets. But it is very important that the *measurement* of margins smaller than M during the year, for example anytime between t_1 and t_4, does not imply that the competitive margin is smaller than M and that margins are *excessive* during the periods indicated by "A" in Chart 2. Such numbers are not margins at all in the proper sense; they are merely "bounded random" numbers.

Charts 1 and 2 can usefully be viewed as extremes at opposite ends of the spectrum of marketing models in the Indonesian context, and it is helpful to have an intermediate version as well. This is provided in Chart 3, which is merely an amalgam of the two extremes. In this version the margin as measured by equation (1) never becomes negative, but the ceiling price P_u^* is effective in restraining the rise in the urban retail price. In the absence of outside rice supplies the urban price would continue to rise after t_1 along the dashed line, but the outside rice supplies maintain an effective ceiling at P_u^*. Rural prices continue their rise unabated, but do not reach the level of P_u before the new harvest begins at t_2. The dotted line indicates the path rural rice prices might take if the absence of urban demand dampens the rural seasonal price rise somewhat.

The important point about Chart 3 is that rural to urban margins need not become negative before the simple model of Chart 1 is invalidated. From t_1 to t_3 in Chart 3 the margin measured by equation (1) will be less than M reflecting the fact that the rural and urban markets are no longer connected. Again, it does not reflect a smaller marketing margin during this season but simply a lack of interdependence in price formation. The fact that rice does not physically flow back to the rural areas does not alter the lack of interdependence.

None of the three versions of the simple marketing model so far discussed proves that the marketing margin M is constant during the time when it is relevant. That is a question for further empirical research. But the models do demonstrate that *apparent* variation in M over the entire year may be due to looking at the wrong model of price formation rather than widening and narrowing margins.

CHART 3



RESULTS I

To translate equation (1) into empirical results is a fairly straightforward task provided the lessons of Charts 1–3 are kept in mind. Accordingly, the year has been divided into four quarters corresponding simply to the four quarters of the calendar year. Thus Quarter I is January to March, and so on. This division fits the Javanese rice calendar except for starting point. Thus January to March, Quarter I, corresponds to the height of the preharvest, or *paceklik*, period when rice supplies are scarcest and prices are highest. The main harvest, especially on Java, is spread fairly evenly over Quarter II from April to June. The July to September period, Quarter III, is a period of seasonal price rise, tempered by late September by the dry-season crop on Java, which is mostly harvested in September and October. Quarter IV, October to December, is then a period of fairly steadily increasing rice prices toward the peaks reached in Quarter I of the next calendar year.

With reference to Charts 2 and 3, it is apparent that if any breakdown in market connectedness occurs (on Java), it will most likely be in either Quarters I or IV. Consequently, in these situations the best estimates of the true size of the marketing margin *M* are likely to be made in Quarters II and III when the harvest is coming in and during the first three months of the postharvest seasonal price rise.

Equation (2), used to calculate the average quarterly margins, is somewhat more complicated than absolutely necessary in order to test for statistical significance and the impact of other variables than season of the year on the size of margins. Accordingly, a monthly series of 50 margin observations (for those provinces where the data set was complete), was generated in the following fashion:

$$M_i = P_{u_i} - (1/0.52)\,P_{p_i}, \qquad (2)$$

where M_i = the measured margin for month i,
P_{u_i} = the urban retail rice price for month i,
P_{p_i} = the rural price of stalk paddy for month i, and
0.52 = the standard Indonesian rice milling conversion ratio of stalk paddy into white rice, assumed constant for all provinces.

The series of 50 margin observations (M_i) was then used as the dependent variable in a standard regression analysis, except that all the independent variables were 0–1 dummy variables. Formally, the technique is identical to analysis of variance. In the first instance the independent variables were the four quarterly dummies. That is, the independent variable QTR-I had a value of 1.0 whenever the observation was for January, February, or March, and zero otherwise, and similarly for the other three quarterly variables. A second equation was also run with an added variable termed POLICY. This is also a dummy variable, receiving a value of zero from January 1969 to December 1970 and a value of 1.0 thereafter. This variable is included as a rough test of the impact of the government's floor and ceiling price policy, essentially effective on marketing margins by January 1971. It does not test impact on price level but on the size of marketing margins (assuming the milling ratio stayed constant).

The results of these statistical estimations are shown in Table 2. The most striking feature of the results is the extremely wide variation in margins from one quarter to another for a particular province and from one province to another for a particular quarter. Perhaps it should be no surprise, but the search for *the* rural to urban rice marketing margin is bound to fail.

But out of the great diversity some striking patterns emerge as well. First of all the margins for Quarters II and III tend to be quite similar and significantly larger than the margins for Quarters I and IV for the three major Javanese provinces and West Nusa Tenggara. This suggests that in these regions the simple model depicted in Chart 1 does not apply. The model shown in Chart 3 seems to be the most applicable although in West Java the measured margin in Quarter I is actually negative, indicating that it approaches Chart 2 as a model.

A province need not, of course, remain forever fixed as an example of any particular model. In particular, the size of the harvest in the rural area determines to a large extent whether price behavior will follow the pattern of Charts 1, 2, or 3. A small harvest relative to requirements will mean that substantial quantities of rice will have to flow into the urban center from outside, resulting in the price pattern depicted in Chart 3. If the harvest is even smaller some year, additional supplies will flow into the rural areas themselves, resulting in the price pattern shown in Chart 2. When the harvest is large enough to supply the entire consumption requirements without the urban retail price exceeding P_u*, then the model shown in Chart 1 holds. Any single province can then fit any one of the price patterns for a single harvest if the size of the crop varies sufficiently widely.

The results shown in Table 2 do not attempt to address this changing market-

TABLE 2.—RICE MARKETING MARGINS BETWEEN MEDIUM QUALITY MILLED RICE AND FIRST QUALITY BULU STALK PADDY, IN RUPIAHS PER KILOGRAM, ASSUMING A CONSTANT MILLING RATIO, JANUARY 1969 TO FEBRUARY 1973*

Province	Quarter I	Quarter II	Quarter III	Quarter IV	POLICY	R^2	Durbin-Watson
West Java	−0.662	2.758	2.892	1.163		0.22	0.76
	(−0.9)	(3.3)	(3.5)	(1.4)			
	1.775	4.891	5.025	3.296	−4.265	0.68	1.90
	(3.0)	(8.1)	(8.3)	(5.5)	(−8.0)		
Central Java	1.898	4.289	3.920	2.017		0.23	0.83
	(3.4)	(7.2)	(6.6)	(3.4)			
	0.926	3.438	3.070	1.167	1.700	0.37	1.05
	(1.6)	(5.7)	(5.0)	(1.9)	(3.2)		
East Java	3.024	5.506	4.152	3.121		0.13	0.66
	(4.3)	(7.2)	(5.4)	(4.1)			
	3.950	6.315	4.961	3.931	−1.620	0.22	0.75
	(5.0)	(7.7)	(6.1)	(4.8)	(−2.2)		
Yogyakarta	1.148	1.304	−0.199	0.174		0.08	0.97
	(2.0)	(2.1)	(−0.3)	(0.3)			
	1.114	1.274	−0.229	0.144	0.060	0.08	0.97
	(1.6)	(1.8)	(−0.3)	(0.2)	(0.1)		
Bali[a]	5.205	4.290	5.695	3.854			
	(7.9)	(6.2)	(8.3)	(5.4)		0.09	1.86
	5.451	4.518	5.923	4.102	−0.455	0.10	1.87
	(7.2)	(5.8)	(7.7)	(5.0)	(0.7)		
West Nusa Tenggara[b]	1.161	4.933	4.515	2.580		0.07	0.70
	(0.7)	(2.8)	(2.3)	(1.45)			
	1.187	4.955	4.543	2.603	−0.041	0.07	0.70
	(0.6)	(2.4)	(1.9)	(1.3)	(−0.0)		
South Sulawesi[c]	6.796	10.152	7.277	2.998		0.06	0.88
	(2.5)	(3.5)	(2.4)	(0.7)			
	8.282	11.368	8.392	4.336	−2.220	0.07	0.89
	(2.4)	(3.3)	(2.4)	(0.9)	(−0.7)		
South Kalimantan[d]	−10.854	−6.779	−6.077	−11.158		0.14	1.69
	(−7.9)	(−4.0)	(−3.4)	(−6.5)			
	−10.154	−6.167	−5.520	−10.546	−1.224	0.15	1.72
	(−5.4)	(−3.2)	(−2.8)	(−5.5)	(−0.7)		

* Values in parentheses are *t*-statistics.
[a] 48 Observations.
[b] 44 Observations.
[c] 38 Observations.
[d] 49 Observations.

ing pattern from year to year. Rather, they measure the average margins over the four-year period tested with the exception that the policy variable permits an examination of the hypothesis that margins were different before 1971 than they were afterward.

The results in Table 2 must then be interpreted as indicative of the normal or average marketing pattern over the four-year period, a period when rice production was increasing fairly rapidly for most provinces. In this light, some of the reported relationships are quite satisfying relative to the simple margin models already presented. West Java is clearly the closest to the extreme Chart 2 model, with a margin of −0.7 Rp/kg in Quarter I relative to margins of nearly 3.0 Rp/kg in Quarters II and III. The pattern is even more striking after 1971. When the separate margins are estimated for pre- and post-policy periods (also corresponding to higher urban market injections of milled rice by BULOG during the preharvest season in both Jakarta and Bandung), the effect is to *lower* the margin by over 4.0 Rp/kg after 1971. The Quarter I margin in 1969 and 1970 was 1.8 Rp/kg, but for 1971 and 1972 this becomes −2.5 Rp/kg, closely corresponding to the average value of M measured during Quarters II and III for the entire period. Here is striking evidence of the usefulness of the market connection concept in understanding rice marketing margins in Indonesia.

The margins pattern is similar in Central and East Java to that of West Java although the margins are somewhat higher than West to East. Thus the average margin for Quarters II and III (the two quarters most likely to give an accurate estimate of M in the models shown in Charts 2 and 3) is 2.8 Rp/kg in West Java, 4.1 Rp/kg in Central Java, and 4.8 Rp/kg in East Java. In addition, although the Quarter I and IV margins are significantly lower than the Quarter II and III margins in both Central and East Java, as in West Java, they do not approach zero or become negative. This indicates that these two provinces much more closely resemble Chart 3 on average than Chart 2.

There is likely to be some downward bias in the estimated margin for both a temporal and a spatial reason. Even in regions with good marketing channels there will be some time between changes in rural stalk paddy prices and changes at the urban retail level. If the stalk paddy price changes at the end of one month and the urban price changes early in the following month, the calculated margins will not be entirely accurate. In particular, when the harvest is coming in and stalk paddy prices fall quickly and sharply, the urban retail prices fall only after some delay and not so sharply. The effect is for the calculated margin to *overstate* the real margin during the preharvest period of high prices. The magnitude of this effect is unknown.

There is also a geographical bias for some provinces due to the location of the provincial capital city relative to the major rice producing areas. The measured margins will be smaller for a province where the major rice producing areas more or less surround the city and hence supply rice from all directions than for a province where the capital city is on the coast or at one end of the region or both. West Java and Yogyakarta mostly fit the first type and have smaller margins than East and Central Java with their coastal capitals of Surabaya and Semarang. Cities that draw their supplies from only a semicircle must reach out farther for a given per capita supply and thus pay higher transportation costs from the more distant rural areas. Since all the rice will sell for the same price in the urban retail market, the stalk paddy prices in the more distant rural markets must be lower by the amount of the greater transportation cost, and hence the overall measured margin will be higher. This higher margin is real but does not imply any inefficiency or excess profits in the marketing system. All that is implied is a greater relative demand on available rice supplies and consequently a greater drawing distance. The same effect could be noticed, incidentally, for two identical producing regions with identically located urban markets if the demand for rice in one urban market were greater than in the other (due to tastes, higher income, or larger population). The greater demand for rice would attract supplies from farther away, and the overall marketing margin would be greater.

The very low reported margins for the Yogyakarta Special District may reflect some of the spatial effect noted above (the region is very small relative to the other Javanese provinces), or they may simply be due to limited information based on only one or two paddy prices per month. The total sample size is not known for Yogyakarta, but it is obviously quite small as the average paddy prices are always whole or half rupiah values per kilogram.

The margins for Bali come closest to reflecting the simplest model shown in Chart 1. All four quarters show estimated margins between 4.3 and 5.7 Rp/kg, and what variation there is does not follow the two-quarter high–two-quarter low pattern seen on Java. The Bali pattern is not at all surprising, however, despite its proximity to Java and consequent influence by the same meteorological conditions. Bali is nearly self-sufficient in rice with only minor supplies brought in from outside. Consequently we should expect the margins pattern to look more or less like that depicted in Chart 1.

West Nusa Tenggara follows a pattern very similar to the basic Javanese pattern. This too is not surprising since the weather conditions are somewhat similar (West Nusa Tenggara is below the equator, like Java), and the capital city normally needs outside supplies during the preharvest period. What is somewhat surprising is that the average margins are very similar in size to the margins on Java where the marketing system is much more highly developed. The answer to this puzzle lies in the R^2, however, which is a mere 0.07. Thus there is very considerable variation around this mean level, and a look at the raw margins demonstrates what has happened.

West Nusa Tenggara is well known for extremes in rice production relative to domestic consumption. Before an effective floor and ceiling price policy was implemented (more or less by early 1971), both rural stalk paddy and urban retail prices fluctuated widely according to whether rice was in short or surplus supply. In such a situation we should expect the relevant model to change according to whether or not rice supplies are being attracted from outside. Thus the margins in Quarter II in 1969 and 1972 averaged over 7.0 Rp/kg, but in 1970 and 1971 they averaged less than 1.0 Rp/kg. In 1970 and 1971 the crop was poor (poorer in 1970 than 1971), and there was very little connection between the urban and rural markets. In 1969 and 1972, however, under the impact of surplus crops the stalk paddy prices fell (as low as 7 to 8 Rp/kg in 1969 and below 12 Rp/kg in 1972 (at a time when the floor price was intended to be 13.2 Rp/kg). In order to market the surplus to the capital city of Mataram, the margins had to be large enough to connect the two markets. This connecting margin is apparently 7 to 8 Rp/kg, significantly greater than the connecting margins on Java.

Additional evidence of this higher connecting margin can be seen in Quarter I of 1971 when the margin averaged −11.8 Rp/kg. This occurred when rural stalk paddy prices exceeded 30 Rp/kg—a near famine state in the rural sector. Rice supplies were probably moving from the urban center backward to the rural areas (the urban prices were a relatively low 45 to 50 Rp/kg due to the ceiling price policy). The backward margin seems to be 10 to 12 Rp/kg, higher than the evidence indicates for the forward margin of about 7 to 8 Rp/kg. In both directions, however, the measured margins in West Nusa Tenggara significantly exceed the margins on Java.

South Sulawesi also shows the relatively high margins of an underdeveloped

TABLE 3.—EFFECTS OF VARIOUS ASSUMED MILLING RATIOS ON MEASURED MARKETING MARGINS

Milling ratio[a]	Marketing margin[b] *(rupiahs per kilogram)*
0.45	−4.00
0.46	−3.13
0.47	−2.30
0.48	−1.50
0.49	−0.73
0.50	0.00
0.51	0.71
0.52	1.38
0.53	2.04
0.54	2.67
0.55	3.27

[a] The milling ratio is equal to c in equation (1) and was assumed to be 0.52 for the estimates in Table 2.

[b] The calculated margins assume a rural stalk paddy price (P_p) of 18 Rp/kg and a retail urban price (P_u) of 36 Rp/kg. The margin is calculated using equation (1).

marketing infrastructure (relative to Java) and something of the margin pattern depicted in Chart 3. The high margin of over 10 Rp/kg for Quarter II has a relatively high t-statistic (3.5), and so the variation about it is not too extreme. The same cannot be said about the other three-quarters' margins, however, and the low R^2 of only 0.06 indicates a very wide variation about the measured means. South Sulawesi is generally a surplus province, but it has only one large crop per year; and there is some tendency for the urban and rural markets to become disconnected for part of the year, not so much due to supplies arriving from outside the province as from an abundance of milled rice stored in Makassar itself. There is very little evidence of backward flow of rice, however. A look at the individual observations reveals there may be considerable variation in the timing of the big harvest, perhaps by as much as two months from one year to the next. This also contributes to the relatively low significance of the margins.

South Kalimantan, the last province in our sample, is an extremely interesting example. Here there is a marked seasonal pattern to the margins, but they are all negative. This strongly implies a major variant of the model depicted in Chart 2, but in this version the rural countryside never supplies rice to the capital city, and during the two quarters of shortest supplies, Quarters I and IV, it actually receives a physical flow of rice from the city. During the postharvest months the two markets are no longer connected. The size of the margin necessary to connect the South Kalimantan rural areas with the capital, with rice flowing backwards from city to rural area, is about 10 to 11 Rp/kg. This is a high margin, perhaps double the level on Java, and similar in magnitude to the other outer island margins where the marketing infrastructure is noticeably less developed than on Java and Bali.

All of the above margin comparisons have been made assuming that all provinces have a constant rice milling ratio of 0.52. This is a legitimate starting point, and the results to this stage accord well with present knowledge about the Indonesian rice marketing system. On the other hand, the rice milling ratios are unlikely to be uniform and constant for all provinces during a time of fairly rapid improvement in rice milling facilities (see *15*). And the impact of different milling ratios on the margin as measured by equation (2) can be quite significant, as can be seen in Table 3.

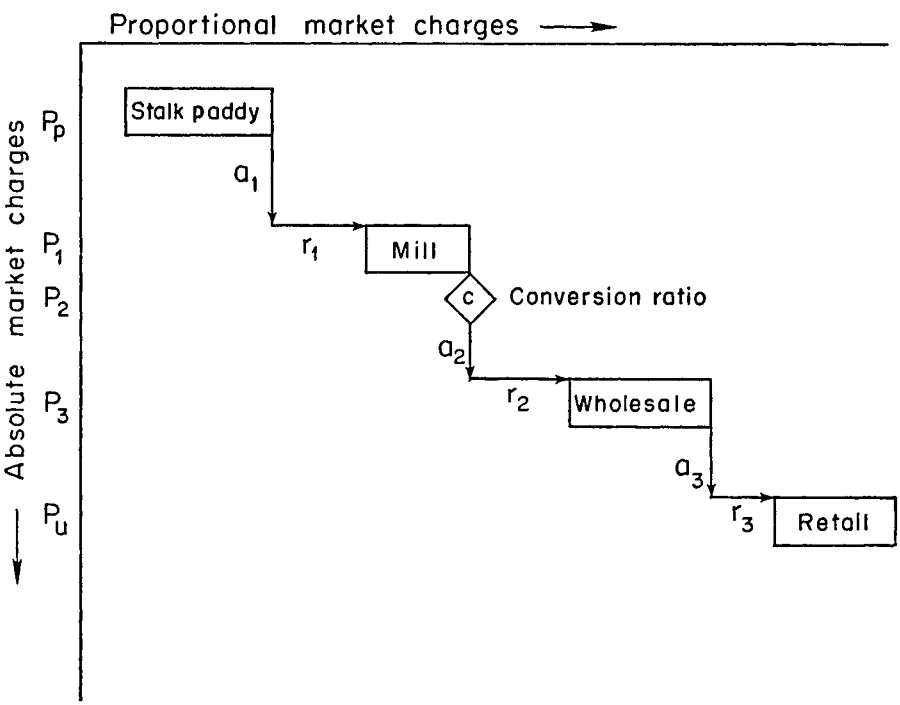
If rural stalk paddy prices are 18 Rp/kg and urban retail prices are 36 Rp/kg, the measured margins will be as low as −4 Rp/kg if the milling ratio is only 0.45 while it can be as high as 3.3 Rp/kg if the milling ratio is 0.55. At the assumed milling ratio of 0.52 the measured margin would be 1.4 Rp/kg. Part of the low measured margins for several provinces, especially West Java and Yogyakarta, might well be due to using a milling ratio that is lower than actually exists. It is possible to examine the data for a direct answer about such a possibility.

MODEL II

The various models implicit in the results reported in Table 1 were complicated only to the extent of quarterly disaggregation in order to examine the usefulness of the market connection hypothesis. Basically all three versions build on equation (1), which has two underlying simplifying assumptions. First, the milling ratio *c* is assumed constant and equal for all provinces and time periods, and second, the total margin is expressed as an absolute amount rather than as a percentage of the rural stalk paddy price to the urban retail price for milled rice. The plausibility of the results suggests the usefulness of these assumptions, but it would be desirable to relax them to some extent. That is the purpose of this section.

Chart 4 presents a rough schematic view of the rice marketing system from

CHART 4



stalk paddy at the farm level to milled rice at the retail level. It must be emphasized that no attempt is made here to detail all the actual channels that rice might flow through from farmer to consumer. The variation is very substantial from province to province and even from one farmer to another, as can be seen from the work of Mears (*13*), the Rice Intensification Evaluation Survey (*7*), and Collier and Soentoro (*3*). All that Chart 4 attempts to represent is the net result of those various marketing channels. That is, stalk paddy leaves the farm and arrives at the mill (although conceptually we can include as a mill the hand-pounding location on the farm), it is milled into rice with a conversion ratio of c, and is then conveyed to wholesale and retail levels.

Chart 4 is intentionally drawn in two dimensions. The vertical dimension reflects, from top to bottom, the accumulation of absolute (as opposed to proportional) expenses in the marketing system which it was argued earlier will occur mostly in the transportation and milling stages of rice marketing. These absolute marketing charges are indicated by an "a_i" in Chart 4. That is, the absolute charge incurred in transforming stalk paddy at the farm to stalk paddy at the mill is a_i, the charge for transforming milled rice at the mill to milled rice at the wholesale level is a_2, and so on.

The horizontal axis measures the accumulation of proportional marketing expenses. The argument earlier was that transforming rice in time involved storage and insurance, and the greater part of these charges were likely to be proportional to the value of the rice. These proportional charges are denoted by "r_i" in Chart 4. That is, while moving stalk paddy from farm to mill may incur an absolute charge of a_1 because of the transportation expense calculated on a per ton basis, it may also incur a proportional charge r_1 due to the time involved. Similarly, any proportional charges between the mill and the wholesale level or between wholesale and retail levels will be reflected in r_2 and r_3 respectively.

It is apparent that the r_i will largely capture storage costs if the reasoning outlined in Model I is correct, but that they may capture considerably more than that if the marketing system tends to incur proportional charges even for changes in market level, as Mears has assumed in his marketing work (*13*). If each marketing agent in the chain receives a fixed *share* of the rice as his payment, then the proportional charges will reflect the entire total of marketing costs and nothing will be left of the absolute charges. It is possible to test empirically the extent to which this is true.

Formally, the model can be set out in the following five equations:

$$P_1 = r_1 P_p + a_1 , \tag{3}$$
$$P_2 = (1/c) P_1 , \tag{4}$$
$$P_3 = r_2 P_2 + a_2 , \tag{5}$$
$$P_u = r_3 P_3 + a_3 , \tag{6}$$
$$P_u = \frac{r_1 r_2 r_3}{c} P_p + \frac{a_1 r_2 r_3}{c} + a_2 r_3 + a_3 . \tag{7}$$

These equations do no more than formalize the diagrammatic representation of the marketing system shown in Chart 4. They do, however, make clear the step-by-step nature of the system and indicate all of the relevant parameters needed to understand even this simple version of the marketing system. In equation

(7), for example, the equation that summarizes the four stages shown in Chart 4, there are seven parameters (a_1, a_2, a_3, r_1, r_2, and r_3 and c), but only two variables with data observations (P_u and P_p).

All of the parameters may not be important empirically. If there are no absolute charges in the marketing system, then the a_i will equal zero. Similarly, if the timing of the observations is such that no storage costs are incurred and no other marketing charges are paid in a proportionate manner, then the r_i will all equal one. Clearly, we can also have the mixed case where some r_i are one and some a_i are zero, but also at least one $r_i > 1$ and one $a_i \neq 0$.

To test this empirically, it is necessary to specify a regression equation in terms of observable data. Only equation (7) has this potential. Equations (3) through (6) all contain intermediate level price observations for which no data presently exist. A rural retail price series does exist for Java, which in the hierarchy in Chart 4 would probably come just beyond the mill level, but no attempt has been made to use these prices in the following analysis.

Equation (7) can be redefined in the following fashion:

$$P_u = RP_p + A + e, \qquad (8)$$

$$\text{where } R = \frac{r_1 r_2 r_3}{c},$$

$$A = \frac{a_1 r_2 r_3}{c} + a_2 r_3 + a_3, \text{ and}$$

$$e = \text{a random error term.}$$

Equation (8) is familiar as yet another variation of equation (1). Instead of the margin appearing on the left-hand side, however, we now have the urban retail price P_u. This specification opens the possibility of estimating R and A with standard statistical regression techniques, and thus we add an error term. The question remains, however, as to what statistical estimates of R and A will mean.

First of all, they provide a fairly direct empirical test of whether the market tends to incur absolute marketing charges (the a_i) or proportional charges (the r_i), or both. If A is not significantly different from zero, then the evidence is very weak in favor of absolute charges. A significant A indicates that at least one of the a_i is important.

We cannot, however, make a similar statement about the significance of R, because it is the combined effect of the milling margin c and the three proportional charges $r_1 r_2 r_3$. We can say something, however. If the reciprocal of R is significantly less than a reasonable milling ratio, say 0.45 to 0.50, then clearly the combined effect of $r_1 r_2 r_3$ must be significantly greater than one. If $1/R$ turns out to be significantly greater than 0.5, then the evidence in favor of proportional marketing charges will be weak (although if $1/R$ is a great deal more than 0.5, say as high as 0.65 or more, then the relevance of the entire model must be called in question).

It should also be noted that the r_i can test for losses in the marketing channels to the extent that they are proportional losses, i.e., a 5 percent loss between the mill and the retail. Since physical losses should not be evaluated in physical terms but valued at the price of rice, significant losses in the marketing system should cause the r_i to be significantly greater than one. On the other hand, this test is not terribly sensitive. Thus 1/.55 = 1.05/0.52. That is, a 5 percent loss can easily be concealed by an apparent milling ratio of 0.55 instead of 0.52. On the other hand, losses and proportional charges exceeding 10 to 15 percent ought to show up fairly clearly.

The time horizon shown in Chart 4 need not be fixed arbitrarily. For the analysis performed here it has been set at a within month period in order to test the hypothesis of market connectedness and to minimize the influence of the r_i in order to ascertain empirically the size of c. That is, by focusing on as short a period as the data permit, the time dimension is minimized and therefore also the proportional charges r_i (and also any losses incurred which are concentrated in the storage process). But this is not the only perspective possible. It is possible to introduce lags between the rural paddy price and the urban retail price in order to include more storage costs in the observed system. This has not been tried here, but we would expect the value of R to decline as the lag becomes greater. Obviously this can be done only for harvest stalk paddy prices, as prices for stalk paddy at non-harvest times have a changed direction of causation. This consideration shrinks the number of observations considerably and makes the exercise of limited reliability until several more years of data are available.

RESULTS II

Caution dictates that before semisophisticated econometric results can be presented using Indonesian data, a disclaimer be entered about the generally haphazard manner in which the data might have been gathered and reported. The disclaimer is appropriate here but less so than if we were analyzing production, consumption, or trade data. The price data used, especially the urban retail prices, are probably fairly accurate. Less confidence can be placed in the collection of the stalk paddy prices. They are based on land tax (*Iuran Pembangunan Daerah* [IPEDA]) reports and so might reflect any inherent biases that occur by using this agency as a source of information. Little is known about the location of the price reports (i.e., near the farm or near the mill), the actual condition of the product, or indeed, even the actual physical form. Although the Central Statistical Bureau reports indicate the prices are for stalk paddy, in a number of provinces little stalk paddy is marketed. Rather, most marketings are in the form of *gabah*, or rough rice. It is not clear how these situations are treated in the statistics.

Table 4 reports the results of the estimates of equation (8) (with the A term disaggregated by quarter) for the three major provinces of Java, plus several variations. The same POLICY variable is used as before. It has a zero value for all observations before January 1971 and a value of one thereafter. In addition, an attempt is made to determine whether any impact of improving rice milling equipment and displacement of hand-pounding is showing up on the price relationships. This is tested with the following equation:

$$P_u = A_i + RP_p + R'TP_p + e, \tag{9}$$

where T = a time variable starting at −24 for January 1969 and ending with 25 for February 1973, and

R' = a coefficient.

TABLE 4.—ESTIMATES OF MARKETING MARGINS AND MILLING RATIOS FOR SEVERAL PROVINCES

Province	A_{I}	A_{II}	A_{III}	A_{IV}	P_p	$(1/P_p)$	Time* P_p	POLICY	R^2	Durbin-Watson
West	4.997	7.185	7.606	6.208	1.706	0.586			0.845	0.82
Java	(1.5)	(2.8)	(2.8)	(2.1)	(14.1)					
	8.140	9.582	10.521	9.745	1.577	0.634	−0.0056		0.921	1.52
	(3.4)	(5.0)	(5.2)	(4.5)	(17.6)		(−6.5)			
	4.783	7.237	7.527	5.979	1.805	0.554		−4.142	0.935	1.99
	(2.2)	(4.2)	(4.2)	(3.1)	(22.4)			(−7.8)		
	4.866	7.296	7.601	6.071	1.800	0.556	−0.0001	−4.056	0.935	1.99
	(2.0)	(3.8)	(3.6)	(2.6)	(16.2)		(0.1)	(−3.0)		
Central	−2.694	0.597	−0.004	−2.472	2.128	0.470			0.926	1.03
Java	(−1.2)	(0.3)	(−0.0)	(−1.1)	(22.0)					
	−2.530	0.769	0.045	−2.570	2.123	0.471	0.0024		0.937	1.25
	(−1.2)	(0.4)	(0.0)	(−1.3)	(23.5)		(2.8)			
	−2.131	0.989	0.460	−1.834	2.065	0.484		1.495	0.936	1.18
	(−1.0)	(0.6)	(0.3)	(−0.9)	(22.1)			(2.7)		
	−2.317	0.982	0.258	−2.205	2.093	0.478	0.0013	0.756	0.937	1.23
	(−1.1)	(0.5)	(0.1)	(−1.0)	(20.7)		(0.8)	(0.7)		
East	12.416	12.555	12.351	11.876	1.473	0.679			0.851	0.77
Java	(5.3)	(6.9)	(5.9)	(5.4)	(13.6)					
	12.355	12.500	12.330	11.903	1.476	0.678	−0.0008		0.853	0.78
	(5.2)	(6.8)	(5.9)	(5.4)	(13.5)		(−0.7)			
	11.962	12.276	11.956	11.424	1.519	0.658		−0.865	0.857	0.81
	(5.1)	(6.7)	(5.7)	(5.1)	(13.4)			(−1.3)		
	11.513	12.054	11.467	10.706	1.576	0.635	0.0023	−2.078	0.860	0.86
	(4.8)	(6.6)	(5.3)	(4.6)	(12.4)		(1.0)	(−1.5)		

* Raw data from BULOG (*8*) and Indonesia, Central Bureau of Statistics (*9*).

If we assume for the moment that $r_1r_2r_3 = 1$, so that $1/R = c$, the milling ratio, then R' tests for a change in c over time. Since c now equals $1/R + R'T$ instead of $1/R$, a significant value for R' tests whether c changes relatively smoothly through time. Normal expectations would be for c to increase with time as inferior Engleberg hullers are replaced by technically superior equipment. Hence, R' should be negative. Clearly, pushing the data this hard is likely to yield a number of spurious results, but the effort seems worthwhile in the hope that interesting results might be achieved.

The results of all four basic runs are shown in Table 4 for East, Central, and West Java. The results for the other five provinces require very extensive explanation and are not reproduced here. The first set of coefficients for each province is the simple results for equation (8). The coefficient attached to P_p, the rural paddy price, is $r_1r_2r_3/c$, and the inverse of this coefficient is shown in the next column (headed by $1/P_p$). If $r_1r_2r_3 = 1$, then the term headed $1/P_p$ corresponds to the milling ratio. The next set of results is for equation (9), which tests for a time trend in the milling ratio (or change in proportional charges or degree of losses). We expect this coefficient to be negative although its high collinearity with the POLICY variable may mean that if alone in the equation, it may capture some of that impact. The third set of results introduces the POLICY variable to equation (8) in a simple test for whether the absolute margins shifted after the new rice policy became effective. And the fourth set of results for each province adds the POLICY variable to equation (9). Due to the collinearity between T^*P_p and POLICY, separate coefficients for the two variables are seldom significant. However, this fourth set of results is frequently important in determining which of the two variables is relatively the more important.

The results for West Java strongly confirm the results of the simpler analysis shown in Table 2, where it was concluded that the Chart 2 model was the most appropriate although individual observations shaded into the Chart 3 model as well, depending on the relative size of the crop. The last two equations for West Java are the most interesting. When POLICY is introduced alone, it is highly significant with a value of −4.1 Rp/kg. Thus since the coefficients for A_{I} and A_{IV} are 4.8 and 6.0 Rp/kg respectively, the net margins since the beginning of 1971 are only 0.7 and 1.9 Rp/kg. Again, individual quarters would show strongly negative margins reflecting a Chart 2 type pattern, while the average reflected in the results in Table 4 is clearly of Chart 3 type pattern. The coefficient attached to P_p is 1.805 in the third set and 1.800 in the fourth, for an implied value of milling ratio modified by proportional marketing charges of about 0.555. If indeed the prices used are stalk paddy prices, and for West Java this would be likely because of the continued widespread use of the *ani-ani*, or finger knife, and the heavy marketings of stalk paddy, then there is remarkably little scope for *proportional* marketing charges in the system. Any value of $r_1r_2r_3$ above one would, of course, *raise* the implied milling ratio above 0.555, and this is unlikely despite the fact that milling facilities in West Java are probably more advanced than in any other province with the possible exception of East Java. A milling ratio of 0.56 is about the maximum possible as an average under actual field conditions. A side implication of $r_1r_2r_3 = 1.0$ is that percentage losses in this short-term marketing process must be quite small, certainly less than 5 percent. On the other hand, we must remember that very little storage is involved here, and consequently losses would be expected to be relatively small unless transportation and milling facilities were quite primitive.

The time modifier to the milling coefficient is significant when entered alone (in the second set of results), but it does not stand up when entered with POLICY. The fourth set shows that the POLICY coefficient retains its previous magnitude while the time coefficient drops nearly to zero (although still negative as expected) and to insignificance.

Central Java presents an entirely different picture. None of the absolute marketing margins (A_i) are significant, whereas the coefficient attached to P_p is uniformly greater than two and very highly significant (the *t*-values exceed 20). The $1/P_p$ term is only 0.47 in the simple case, which implies that the $r_1r_2r_3$ terms must be greater than one unless the milling ratio is much, much less than in West Java. Assuming a milling ratio of 0.52, still 6 percent lower than that indicated for West Java, the implied value of $r_1r_2r_3$ is 1.106. That is, combined proportional marketing charges and losses exceed 10 percent of the value of paddy. In addition, during the harvest months a mean absolute margin of perhaps one Rp/kg seems to exist although the level is insignificant. Even with the two together the total marketing margins seem quite low. It is not surprising, then, that the effect of the POLICY margin is to raise the absolute margins by perhaps 1.5 Rp/kg. Alternatively, the time variable is significantly positive, indicating not that the milling ratio is declining but that the proportional marketing charges are rising. Thus the effect of the government's rice price policy in Central Java has been to permit *wider* marketing margins. Given how low they were before, however, this is probably a good thing. The new policy may well have ended some exploitation of the marketing system before 1971.

East Java presents, again, a different story. The absolute margins are large, approximately 12 Rp/kg, and quite uniform from one quarter to the next. The coefficient attached to P_p has an inverse of 0.64–0.68 depending on which set of results is used. This coefficient is too large to reflect a pure milling ratio for stalk paddy even if $r_1r_2r_3$ is exactly one. On the other hand, it would be a very reasonable milling ratio if it were rough rice being milled rather than stalk paddy. Such a situation could come about fairly simply. Price formation takes place at the rough rice level, and then prices of stalk paddy are calculated by subtracting a fixed margin from the rough rice price. These fixed margins, plus the other margins in the system, would then appear as part of the A_i, thus accounting for their large size.

This is merely a hypothesis that needs further checking, but it is one that could be invoked for several other provinces as well. The alternative is simply that the model does not work very well for these provinces or perhaps that including months when price formation works in the opposite direction or not at all (due to a lack of market connection) biases the results. The answer in that case might be to try quarterly specifications of the entire model. This has not been attempted here, however.

The results of entering time and the POLICY variable into the analysis for East Java are fairly interesting. Both have negative but insignificant coefficients when entered individually, but when entered together, the time coefficient becomes positive and the POLICY coefficient remains negative. Both increase in significance (although still quite marginal in that regard). The implication of the two terms is that the absolute margins declined with the new rice policy, but proportional charges may be rising. This could be partially accounted for by the fairly rapid price rise toward the end of the period when significant pressure would be felt to keep absolute margins in line with the price of rice, which is, after all, the staple foodstuff.

CONCLUSIONS AND POLICY IMPLICATIONS

The immediate policy relevance of the above work is perhaps difficult to ascertain. Clearly, there is nothing that can pinpoint locations where new milling equipment is needed, or better roads, more marketing participants, better market information, and so on. These results demonstrate no more than a concept—that rural prices and urban prices are strongly interdependent for some parts of the year, but possibly not for others. Thus the hypothesis of market connectedness is important for our understanding of Indonesian rice marketing and price formation.

Something more emerges as well. First-hand reports have long suggested that the market infrastructure on the outer islands is inadequate, but it has been difficult to quantify this. The results presented here make a first stab at that with consistent but fairly imprecise results. The margins *are* higher on the outer islands, but it is hard to be sure just how much higher due to a lack of technical knowledge about actual average milling ratios.

In view of the nature of the data it is not surprising that the attempt to measure milling outturn from price data was only partially successful. Additional information on precisely how the rural stalk paddy prices are collected would be invaluable here.

Lastly, the impact of the POLICY variable, defined as a neutral zero-one change from January 1971 forward, was frequently very significant but not very consistent. Sometimes it raised margins; sometimes it lowered them. Usually, however, it seemed to make the margins more in line with those elsewhere. If this is a suitable interpretation, it accords well with the view that a major objective and result of the new rice policy was to unify the far-flung rice markets of Indonesia (see *1*). This is a very desirable goal and a healthy achievement.

CITATIONS

1 Saleh Afiff and C. P. Timmer, "Rice Policy in Indonesia," *Food Res. Inst. Studies*, X, 2, 1972.

2 Atje Partadiredja, "The Marketing Margin for Rice," *Bull. Indonesian Econ. Studies* (Canberra), July 1972.

3 W. L. Collier, Gunawan Wiradi, and Soentoro, "Recent Changes in Rice Harvesting Methods: Some Serious Social Implications," *ibid.*

4 R. H. Goldman, "Seasonal Rice Prices in Indonesia, 1953–69: An Anticipatory Price Analysis," *Food Res. Inst. Studies*, XIII, 2, 1974.

5 Hendrik Houthakker, "The Scope and Limits of Futures Trading," in *The Allocation of Economic Resources*, ed. by M. Abramovitz et al (Stanford, Calif., 1959).

6 Stephen Hymer and Stephen Resnick, "A Model of an Agrarian Economy with Nonagricultural Activities," *Amer. Econ. Rev.*, Sept. 1969.

7 Indonesia, Republic of, *Study and Evaluation of Rice Production and Intensification Programs in Indonesia*, Nov. 1971.

8 ———, Bur. Logistics (BULOG), "Monthly Retail Rice Prices in Provincial Capitals," mimeo, n.d.

9 ———, Cen. Stat. Off. (*BPS*), *Monthly Statistical Bulletin*, various issues.

10 W. O. Jones, "The Demand for Food, Leisure, and Economic Surpluses" in *Subsistence Agriculture and Economic Development*, ed. by C. R. Wharton, Jr. (Chicago, 1969).

11 ———, "Labor and Leisure in Traditional African Societies," *Items* (Soc. Sci. Res. Coun.), XX, 1, 1968.

12 Carl Liedholm, "Research on Employment in the Rural Nonfarm Sector in Africa" (African Rural Employment Paper No. 5, Apr. 1973).

13 L. A. Mears, *Rice Marketing in the Republic of Indonesia* (Inst. Econ. and Soc. Res. Jakarta, 1961).

14 C. Peter Timmer, "Choice of Technique in Indonesia" in C. Peter Timmer et al., *Studies in Inappropriate Technologies for Development* (Harvard Center Intl. Affairs Occas. Paper No. 32) forthcoming.

15 ———, "Choice of Technique in Rice Milling on Java," *Bull. Indonesian Econ. Studies* (Canberra), July 1973.

16 ———, "Employment Aspects of Investment in Rice Marketing in Indonesia," *Food Res. Inst. Studies*, XI, 1, 1972.

17 Weitz-Hettelsater Engineers, "Rice Storage, Handling and Marketing Study: Economic and Engineering Aspects," (final draft submitted to the Republic of Indonesia, Dec. 1972).