SOME IMPLICATIONS OF RICE PRICE AND POLICY CHANGES FOR IRRIGATED FARMS

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Parametric linear programming is used to determine the effect of various rice prices combined with the relaxation of acreage controls on the economic viability of the rice enterprise on farms in the irrigation areas of southwestern New South Wales. The relative effects of alternative rice marketing and production policies on the distribution of net incomes among farm size groups is also examined. On 300, 500, and 1,000 acre farms it was found that the price of rice could fall to $25 per long paddy ton before rice is deleted from optimum programmes. Farms in excess of about 400 acres would have had higher percentage net returns to capital and management if acreage controls were eliminated and rice was priced at "free" market levels in the period 1964–68 when rice prices were favourable. Smaller farms would have been better off under the then existing production and marketing arrangements. In periods of depressed world and pool rice prices such as from 1968–71, all farms up to approximately 1,000 acres would have had larger percentage net returns with acreage controls and a pooling of domestic and export prices.

1 INTRODUCTION

In a previous study [10, p. 2] the author found that the returns from rice production on "large area" irrigated farms on the Murrumbidgee and Coleambally Irrigation Areas of New South Wales comprised almost 50 per cent of gross income.[1] The crop is subject to acreage restrictions and up until recently growers received a price which was a pooled average from domestic and export sales, the latter being the lower-priced market. From 1967 to 1970 growers were given the option of growing some additional acres over and above their basic allotment.[2] The price received for rice from these additional areas was based solely on export returns.

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[1] Hereafter referred to as the MIA and CIA, respectively.

[2] Throughout this paper the years refer to the harvest year. Harvesting generally occurs from March to May.

Rice generates the largest per acre gross margin of "conventional" enterprises on these farms.[3] In a study by the author [11] to determine optimum farm programmes for rice farms using linear programming techniques, the rice enterprise dominated all the optimum plans generated. A gross margin of $115 per acre was used in that study. This assumed yields of 2·76 tons per acre and the then current and prospective price of $57.60 per ton. For a 3-ton crop in 1973, Kennedy estimates that the gross margin would be approximately $135 per acre.[4]

The average weighted cash price paid per ton to growers for rice during 1962–64, excluding equity certificates and debentures issued by the Rice Marketing Board and the Ricegrower's Co-operative Mill, was approximately $58. From 1965 to 1968 prices rose to around $63 due to increased world demand for rice as reflected in rising export prices.[5] During the period 1968–71 the price to growers fell considerably. In 1969 it was approximately $59, in 1970 $55 and in 1971 $42 per ton. The 1968–71 price decline coincided with the reduction in world prices as reflected in the Food and Agriculture Organization's price index.[6] The average pool price for the 1972 crop is estimated to be approximately $47.[7]

The Food and Agriculture Organization (FAO) in 1967 [3, pp. 23–31] predicted that growth in world production of rice up to 1975 would be balanced by the growth in demand. This was based on their most pessimistic supply assumptions. Using optimistic assumptions about the growth in gross domestic product of the rice trading nations, the FAO calculated that import requirements by traditional importers would show a much reduced growth rate. If this eventuated, they said the resultant excess supplies might lead to a fall in rice prices. In 1970 the FAO [4] was even more pessimistic about 1971 and subsequent world rice prices. This certainty proved to be true in 1971. Events in 1972 have proved them wrong, at least in the short-term. However, in their 1971 report the FAO [5] revised their long-run projections to 1980. A situation of excess supply in 1980 was indicated assuming continuation of 1970 prices and the current policies in rice producing and trading nations. The overall impact was expected to mean continuance of the downward pressure on rice prices in international markets, particularly up to 1975. As the proportion of higher priced long-grain rice produced in Australia is rising, it would appear that a

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[3] "Conventional" enterprises were defined here as sheep, cattle, cereals, pasture, hay, lucerne, sorghum, sudax, safflower and linseed. Cotton and crops grown using furrow irrigation, as contrasted to contour methods, are excluded.

[4] Private communication, May, 1973. Details of how prices and yields affect rice gross margins can be found in Kennedy [7].

[5] At that time, approximately 80 per cent of the Australian crop was exported. The percentage is even higher now.

[6] See [5, p. 12] and [6].

[7] For the source of the rice price data *see* Ricegrowers Co-operative Mills Limited [9, p. 9].

medium-term export price projection for Australian rice of about $52 per ton would not be unreasonable. However, there will of course be periods of considerable instability in rice prices due to short-term influences such as weather, disease and policy changes in important rice producing and trading nations.

2 OBJECTIVES

Due to the obvious importance of rice on these farms, variations in rice prices will significantly affect incomes and farm organization in the area. In this study the aim is to determine the magnitude and distribution of these effects if rice prices are reduced. The procedure is to free the farms of their institutional rice allotments, leaving only agronomic-hydrologic constraints on production and to employ parametric price linear programming to examine the effect of reduced rice prices.[8] The composition of optimum farm programmes at export parity prices is determined, together with net incomes and percentage net returns to capital and management to test the economic viability of the rice enterprise. The "break-even" price below which rice no longer forms part of optimum programmes is also examined.

Analysing a range of farms with different endowments of land and labour enables an evaluation of the relative distributional effects of alternative rice production and price policies to be made. Distributional implications are an important and often neglected aspect of agricultural policy formation in Australia. The use of linear programming to do this is novel but may be criticized because of the explicit assumptions of profit maximising behaviour and completely elastic product demand curves at the chosen prices in the enterprise budgets. The evidence for and against the hypothesis that farmers are primarily profit maximisers is mixed, although its use in this study may be defended on the assumption that there are no great differences in the degree of attainment of profit maximization between farms with different resource endowments.[9] The assumption of completely elastic product demand curves is less easy to justify. If all irrigated farms in fact responded in identical fashion to rice price changes, the New South Wales production of some products such as lucerne, hay and linseed would be substantially increased and their prices would subsequently fall. However, it is probable that other enterprises with nearly equal profitability would enter in their place in this instance. The composition of optimum programmes may change but the net returns would probably not be materially affected. Needless to say, it is appropriate to qualify the conclusions of this study with the above comments.

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[8] For a description of the institutional and hydrologic aspects of rice growing *see* Ryan [11, pp. 153–157]. The agronomic constraints are discussed in Ryan [12, p. 14].

[9] For example see Yotopoulos [14], Wise and Yotopoulos [13], Lau and Yotopoulos [8] and Dillon and Anderson [1, 2]. Most of the empirical work to date however has been confined to traditional agricultural countries such as India and Greece, although the latter authors do cite some Australian evidence which is inconclusive.

3 METHODOLOGY

Nine typical resource situations were parametrically programmed. For each of the nine resource situations, eleven variations in the rice gross margin were programmed to generate a total of 99 optimum solutions. The eleven rice prices ranged from \$22 to \$52 per paddy ton in increments of \$3. The nine resource combinations were one, two- and three-man farms each programmed over 300, 500 and 1,000 irrigable acres.

Approximately 96 per cent of rice farms in the MIA and CIA are between 300 to 1,000 irrigable acres in size. 8·5 per cent are in the 300–400 acre class, 34·5 per cent are 400–500 acres, 48·5 per cent are 500–600 acres and about 26 per cent are from 600 to 700 acres in size.[10] Over the last few years there has been much discussion about allowing the size of existing farms to be increased. This led to the announcement in early 1973 by the Minister for Conservation that most holders of irrigated farms within the MIA and CIA could acquire another farm by transfer up to a total area of 1,050 irrigable acres. Comparison of the relative economic viability of rice among these three farm sizes is hence particularly relevant for policy purposes.

It should be pointed out that the price and cost data used in the linear programming analyses were compiled in 1967–68.[11] Wool prices of 46 cents and 50 cents per lb gross of marketing costs were used for crossbred and Merino wools, respectively. Lamb prices ranged from \$6.80 to \$9.50 net of marketing costs for first cross *X* Dorset Horn lambs and \$5.80 to \$9 for Merino *X* Border Leicester Cross lambs. Recent market experiences indicate these are not unrealistic prices upon which to base longer-run expectations, even though wool prices increased significantly in 1972. Beef prices were set at an average of \$74 for vealers sold March–April and \$87 for those sold in October–November. In more recent years prices have been about \$20 higher than this and currently they are even higher. In view of the substantial build-up of cow numbers in Australia recently it may be that longer-term prospects for beef would be somewhere between the earlier and more recent prices.

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[10] These data were supplied by J. Kennedy (private communication). The size distribution including irrigable and non-irrigable land on farms is contained in Ryan [12, p. 2].

[11] See Ryan [12] for details of input-output data and the resource restrictions.

Crops such as maize, sunflower, soybeans and rapeseed were not included in the analysis, although farmer interest in these crops has increased. Both sorghum and linseed enterprises were included at modest yield levels and gross margins.[12] To some extent the sorghum enterprise can be taken also as a proxy for maize and sunflower, with linseed as a proxy for soybeans and rapeseed.

It is an unfortunate fact that market changes and technological advances can occur in a relative short time and render some research results less useful. The day after the research is completed it is less valuable because of this. One possible solution in the present instance would have been to conduct multiple parametric solutions involving price combinations for wool, lamb, beef, rice and other crops. As the interest was primarily in the response to rice price changes, this was not done.

4 EMPIRICAL RESULTS

4.1 COMPOSITION OF OPTIMUM RESPONSE PROGRAMMES

The trend in the optimum programmes for the one-man, 300-acre farm as rice prices fell was for the areas of linseed, commercial lucerne hay, summer pasture and grazing oats in the rice stubble to increase, along with the numbers of spring lambing Merinos *X* Border Leicesters and cattle for fattening. The fattening of lambs during winter declined as rice prices fell and the area of rice grown declined (table 1), as did the number of winter lambing Merinos *X* Border Leicesters, the area of winter pasture and the amount of off-farm contracting. Cattle fattening began to decline in importance after rice prices fell beyond $43 per ton. The 500-acre one-man programmes had a similar trend to that on the 300-acre farm except lamb fattening occurred at much larger levels on the 500 acre farm at all rice prices and this was at the expense of cattle fattening.[13] The optimum programmes for the 1,000-acre one-man farm were stable when rice prices fell from $52 to $37 per ton. This wasn't the case on the smaller farms. Rice, lamb fattening, winter pasture and malting barley in the rice stubble comprised the optimum programmes over this price range. Due to the operative labour restriction, 175 acres of unused land was also a feature of these 1,000-acre farm programmes. As rice prices fell below $37, all the land was used for linseed, winter pasture and lamb fattening, plus some off-farm contracting.

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[12] For those farms who have the management and soil types for growing high yielding summer crops with attendant high gross margins, the impact of reduced rice prices would likely be softened compared to the later analysis. However, it is equally likely that there would be greater risks involved in the production of these crops to offset the higher gross margins.

[13] As mentioned previously, cattle gross margins would be relatively higher at today's prices. It is likely that cattle would enter optimum programmes in larger numbers at the expense of sheep if price adjustments were made.

The programme trends for the two- and three-man farms of both 300 and 500 acres were basically similar to those for the one-man situations above. For the 1,000-acre two- and three-man farms, commercial lucerne haymaking increased as rice prices fell to $34 while the number of spring lambing Merinos *X* Border Leicesters and the amount of off-farm contracting decreased. Other enterprises remained stable over this price range. As rice prices fell below $34, linseed, commercial lucerne hay, summer pasture and spring lambing Merinos *X* Border Leicesters increased substantially. Lamb fattening, winter pasture, rice, malting barley and winter lambing Merinos *X* Border Leicesters decreased.

A feature of all programmes was the failure of alternative summer crops such as grain sorghum to enter optimum programmes in place of the displaced rice enterprise when the rice price fell to low levels. However, commercial lucerne haymaking with a gross margin of about $40 per acre entered the programmes on all 300- and 500-acre farms and on the two- and three-man 1,000-acre farms when rice prices fell below about $46. This enterprise requires precise management to be successful and not a large number of farmers in the irrigation areas engage in it although a survey indicated some areas of suitable soil were available on most farms. This does indicate however that, as was the experience in the period 1968–71, there will be an increase in the area of high return crops such as maize and sunflower when rice prices decline markedly. The lucerne haymaking enterprise used here may be regarded as having similar gross margin and resource requirements to maize and sunflower, which have attracted interest recently.

Table 1 illustrates how the amount of rice grown would change when rice prices fell from $52 per ton. The prices below which rice no longer forms part of an optimum programme are contained in table 2. It appears that, except for very large one-man farms, some rice is a desirable part of an optimum farm programme as long as the price exceeds $25 per long paddy ton to the grower.

TABLE 1

Effect of Rice Prices on the Area of Rice Grown

Farm size (irrigable acres)	Price of rice ($ per ton)										
	52	49	46	43	40	37	34	31	28	25	22
	(Rice acreage)										
300—											
One-man Farm	75	50	50	45	45	44	40	40	40	10	0
Two- and Three-man Farms	70	65	48	45	45	44	40	40	40	10	0
500—											
One-man Farm	120	120	120	100	100	100	96	90	78	0	0
Two- and Three-man Farms	120	110	92	90	85	85	78	78	78	20	0
1,000—											
One-man Farm	206	206	206	206	206	206	0	0	0	0	0
Two-man Farm	250	250	250	250	250	240	225	160	75	0	0
Three-man Farm ..	250	250	250	220	220	220	220	210	170	0	0

The prices at which the rice enterprise occurs in optimum programmes at the maximum agronomic limit chosen for this study (established endogenously in the matrix) are shown in table 2.[14] These suggest that rice should be grown up to its maximum agronomic level (75 acres) on 300-acre farms with one, two or three men, as long as prices exceed $52 per ton. On 500-acre farms with one man the maximum agronomic area of rice should be grown (125 acres) when prices exceed $46. For two- and three-man farms of this size the equivalent price is in excess of $52. For 1,000-acre farms the full area of rice (250 acres) should be grown at $40 and $46 for the two- and three-man farms, respectively. The one-man farm should grow only a maximum of 206 acres for prices in excess of $37.

TABLE 2

Minimum and Maximum Rice Prices

Number of permanent men	Price range†	Farm size (irrigable acres)		
		300	500	1,000
		$/ton	$/ton	$/ton
One	Minimum price	22	25	34
	Maximum price	52	46	37
Two	Minimum price	22	22	25
	Maximum price	52	52	40
Three	Minimum price	22	22	25
	Maximum price	52	52	46

† The minimum rice price refers to where the rice enterprise completely leaves optimum farm programmes. The maximum price is where the rice enterprise occurs at its maximum level subject to the agronomic restriction incorporated into the matrix.

4.2 EFFECT OF RICE PRICES ON FINANCIAL RETURNS

The effect of rice prices on total farm gross margins generated from the optimum programmes is shown in table 3. These returns assume that there are no institutional rice acreage allotments. A 60 per cent reduction in the price of rice from $52 to $22 per ton reduces total gross margin by $3,500 or about 20 per cent for 300 acre farms with one, two and three men. This is primarily due to the complete absence of rice from farm programmes at a price of $22 as shown in table 1. For 500-acre farms the reduction is about $7,000 or 30 per cent and occurs for the same reason. For 1,000-acre farms with one man the reduction is $9,300 or 25 per cent. For 1,000-acre two- and three-man farms it is about $15,000 or a 30 per cent reduction.

[11] A winter pasture supply row in the matrix provided a rotational restriction for crops and pastures. A minimum of 2 acres of winter pasture supply per acre of rice was specified for agronomic and hydrologic reasons. Each acre of winter pasture supplied 0·67 acres of winter pasture supply, as it was assumed one-third of every acre of winter pasture would be in its first year of establishment.

TABLE 3

Total Farm Gross Margins at Various Rice Prices

Farm type	Price of rice ($ per paddy ton)			
	22	32	42	52
	$	$	$	$
One man—				
300 acres	12,800	13,500	14,600	16,300
500 acres	18,300	18,900	22,000	25,300
1,000 acres	26,700	26,700	30,300	36,000
Two men—†				
300 acres	13,000	13,900	14,800	16,500
500 acres	19,800	21,400	23,000	26,300
1,000 acres	33,200	35,000	42,800	48,600
Three men—†				
300 acres	13,000	13,900	14,800	16,500
500 acres	19,800	21,400	23,000	26,300
1,000 acres	35,800	38,600	45,000	50,700

† The optimum response programmes and hence total farm gross margins for the 300- and 500-acre farms with two and three permanent men were identical.

The percentage net returns to capital and management for each of the 99 optimum solutions were calculated and are shown in table 4. These represent the net returns derived from maximising the total farm gross margins and assuming the farm organization is able to change with relative ease in response to changes in the price of rice. The overhead structure (i.e., wool sheds, fencing, haysheds, etc.) has been altered where the enterprise mix has changed in the optimum response programmes thus affecting overhead farm costs. In this sense the results presented in table 4 represent the net returns from long run adjustments to variations in rice prices.[15]

[15] Note that land prices were not revalued as rice prices changed. The result is that the percentage net return figures with reduced rice prices are in fact biased downwards. When the price of a product falls, one expects the market price of fixed assets such as land and improvements to decline. This is particularly so with a lucrative crop like rice where acreage restrictions apply and excess profits are capitalized into land values. The calculations for table 4 assumed constant land values. However, if we are concerned more with individual farmer returns under alternative policies than with overall resource efficiency, the returns calculated as a percentage of some historical capital base do have relevance. It should also be emphasized that the objective function that was maximized in the linear programme was total farm gross margin subject to restraints on labour and land. Net returns to total capital are not necessarily maximized with this procedure. It may be possible to obtain higher percentage net returns by specifying an overall capital basis entry in the linear programme and altering the objective function so as to explicity maximize net returns to capital. There are many problems in procedures of this kind and it was not chosen here.

TABLE 4

Effect of Rice Prices on Percentage Net Returns to Management and Capital

Farm type	No institutional acreage allotments and price of rice ($ per paddy ton)											Rice priced at pool level of $57.60 and rice allotment			
	22	25	28	31	34	37	40	43	46	49	52	50 ac.	60 ac.	70 ac.	80 ac.
One-man —															
300 acres	9·6†	9·4†	9·6	10·1	10·5	10·9	11·5	12·0	13·1	13·8	14·2	16·0‡	15·0‡	16·0	15·3*
500 acres	10·6	10·6	10·5	10·7	11·6	12·4	13·2	14·0	14·5	15·5	16·5	13·8	14·6	15·4	16·2
1,000 acres	8·1	8·1	8·1	8·1	8·1	8·5	9·4	10·4	11·3	12·2	13·2	10·2	10·5	11·0	11·3
Two-man —															
300 acres	4·7	4·8	5·0	5·5	6·0	6·4	6·9	7·4	7·9	8·0	8·6	10·9‡	10·3‡	10·4	10·8*
500 acres	8·1	8·1	8·3	9·0	9·6	10·0	10·6	11·3	11·9	12·2	12·8	12·2	13·0	13·8	14·5
1,000 acres	10·1	10·1	9·8	10·3	11·1	12·0	13·1	14·1	15·2	16·2	17·2	11·7	12·2	12·7	13·1
Three-man —															
300 acres	0·2	0·3	0·6	1·1	1·5	2·0	2·5	3·0	3·5	3·8	4·4	6·1‡	5·9‡	6·0	6·4*
500 acres	5·0	5·0	5·3	5·9	6·5	7·0	7·6	8·2	8·8	9·2	9·9	8·9	9·8	10·4	11·2
1,000 acres	9·8	9·8	9·6	10·0	11·0	11·9	12·8	13·8	14·6	15·6	16·6	11·3	11·8	12·2	12·6

† Net returns were reduced when rice prices rose here due to the large increases in capital intensive cattle numbers which occurred at the higher rice price.

‡ The reason for the reduction in the net returns when the rice allotment increased from 50 to 60 acres on the 300-acre farms was due to the much greater numbers of cattle relative to sheep in the latter programmes. Because of their capital intensive nature cattle reduced percentage net returns for the 60-acre solutions, even though total farm gross margins and net farm incomes were higher.

* The precise agronomic limit specified in this study for 300 acre farms was 75 acres. These net returns refer to programmes with 74, 72 and 72 acres of rice in them for the one, two and three man farms, respectively.

Also included in table 4 are percentage returns derived from the optimum solutions using a range of rice acreage restrictions and the 1962–65 price of $57.60 per paddy ton.[16] These enable a comparison to be made of the net returns with and without the institutional marketing and production restrictions which apply to farmers.[17]

On 1,000-acre two-man farms, table 4 shows that net returns could have been more than 4 percentage points higher with the "non-restricted" optimum and 1962–65 export parity rice prices of $52, than the optimum with an 80-acre rice restriction combined with 1962–65 pool prices. The 500-acre two-man farm would have been in about the same financial position with the usual 60 acre restriction and the pool price compared to the unrestricted policy and a $52 price. The 300-acre farm would have been about 2·5 percentage points worse off in the "non-restricted" case.

For the one-man operations, table 4 shows the 500-acre farm has higher percentage net returns to capital and management than either the 300- or 1,000-acre farms. As rice prices increase this advantage becomes greater. Rice prices can fall to $22 per ton and net returns will still remain in excess of 8 per cent for all one-man farms, given optimum farmer response. In the case of 500- and 1,000-acre one-man farms it can be seen that farmers would have been better off if they were able to grow all the rice that adequate rotations would have allowed and sold it at export parity prices that were in existence during 1962–65 ($52). In both these cases they could have increased their net return to capital and management by almost two percentage points. In the case of the 300-acre one-man farms with the usual 50-acre rice restriction, net returns would have fallen by almost two percentage points if restrictions were relaxed.

On three-man, 1,000-acre farms, the advantage in favour of the "non-restricted" optimum was also four percentage points (table 4). As with the two-man situations, the 500-acre farms would have been in much the same financial position in the "restricted" and "non-restricted" cases. The 300-acre three-man farms would have suffered approximately a two percentage point reduction in net returns to capital and management in the "non-restricted" situation with the 1962–65 export parity rice price of $52.

The levels to which rice prices could fall in the "non-restricted" optimum programme before percentage net returns to capital and management would equal those for the "restricted" optima with pool prices for rice of $57.60 and $40 are shown in table 5.

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[16] This would not seem to be an unreasonable medium-term pool price to use in projections of the future. An export parity price of $52 would also seem reasonable, as discussed in the introduction.

[17] Again it is emphasized that the percentage net returns to capital derived in table 4 and discussed below do not necessarily reflect the maximum possible returns at each size. The reader is referred again to footnote 15.

TABLE 5

Break-even Rice Prices for the Percentage Net Returns of "Non-Restricted" Optimum to Equal those of "Restricted" Optimum

Farm size (irrigable acres)	Number of permanent men		
	One	Two	Three
	With pool price of rice $57.60 *per ton*† ($ per ton)		
300	>52‡	>52‡	>52‡
500	46	52	52
1,000	46	40	39
	With pool price of rice $40.00 *per ton*† ($ per ton)		
300	45	50	49
500	37	42	41
1,000	40	35	34

† The rice allotments chosen for farms of 300, 500, and 1,000 acres were 50, 60, and 80 acres respectively.

‡ Prices considerably in excess of export parity levels existing in 1962–65 of $52 would be required in these cases for the "non-restricted" net returns to equal those of the "restricted" situation combined with a pool price of $57.60.

It would appear from this analysis that up to 1968, large irrigated farms would have benefited more from a relaxation of acreage controls and an "opening" of the market than would small farms (i.e., those less than about 400 irrigable acres). In fact the small farms would have been better off under the restricted production and marketing arrangements, assuming an optimum programme was followed in both cases. The medium-term future price position for rice may resemble the experience of this period. To the extent it does, present production and marketing policies will favour small farms at the expense of the larger ones.[18]

The effect of a reduction in the pool rice price from $57.60 to $40 per ton on the percentage net returns to capital and management was also calculated. The procedure was to increase the rice yield per acre to 3·25 tons from 2·76 tons and use the revised cost structure in Kennedy [7] to recompute the net farm incomes of the "restricted" optima

[18] Jim Kennedy has pointed out that rice industry policy since 1971 has been that additional aggregate rice production will come from increased allotments to existing growers. The intention is to bring all present ricegrowers up to an 80-acre allotment (soil type permitting) before those with a present 80-acre allotment are granted additional acres. This policy was apparently motivated as much by efficiency arguments as it was by the question of equity.

assuming all optimum programmes remained the same. Percentage net returns would decline by two to three percentage points for the 300-acre farms, about two per cent for the 500-acre farms, and 1·7 per cent for the 1,000-acre farms following these adjustments.[19]

If the 1962–65 export price of about $52 is adjusted by the FAO Index of International Market Prices of Rice existing in 1971, an estimate of $35 is obtained as the 1971 export price of Australian rice.[20] Using this, it can be seen from table 5 that all the 300- and 500-acre farms would be better off under existing production and marketing arrangements than selling all the rice they chose to produce at the extremely low export prices experienced in 1970–71. The same applies to the one-man, 1,000-acre farms. For the two- and three-man 1,000-acre farms the alternatives offer roughly equal rewards. Hence, any advantage of liberalized production and marketing arrangements to larger farms is eroded under conditions of low export prices.[21]

5 CONCLUSIONS

Except for very large, one-man farms, the parametric linear programming analysis suggests that some area of rice is a desirable part of optimum farm programmes as long as the price exceeds $25 per long paddy ton to the grower. Recent market experience indicates that export prices can fall to near this level without warning. At this price level, other enterprises such as oilseeds, coarse grains and beef cattle could replace rice in farm programmes.

Irrigated farms in excess of 400 acres would have benefited from a relaxation of rice acreage controls and an "opening" of the market in the 1964–68 period of relatively favourable rice prices, provided their enterprise mix changed in an "optimal" fashion. Farms of 1,000 acres could have increased net returns to capital and management by some four percentage points were this policy followed. Farms of 400 acres or less would have been better off under the then existing production and marketing arrangements. To the extent that the medium term export price outlook for Australian rice may resemble the experience of the 1962–65 period, the existing production and marketing policies favour small farms at the expense of larger ones, *ceteris paribus*.[22]

On the other hand, in periods of depressed prices, such as in 1970–71 when the estimated world price for Australian rice was about $35 per ton to growers, all farms up to a size of 1,000 irrigable acres would probably be better off under the present policies, assuming "optimal" response programmes.

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[19] Footnote 15 is relevant here also.

[20] *See* FAO [6].

[21] This, of course, is not an unexpected result.

[22] This is so even in the absence of the policy changes noted in footnote 18, which improve the relative financial position of the owners or lessees of small farms even more.

On 300-acre farms rice should be grown up to the maximum agronomic limit specified in this study of 75 acres as long as rice prices exceed the 1962–65 estimated export parity level of $52 per ton. On 500-acre farms the specified maximum agronomic area of 125 acres should be grown when rice prices exceed $46 for the one-man farms and $52 for the two- and three-man farms. On larger 1,000-acre farms the full 250 acres of rice should be grown at $40 and $46 for two- and three-man operations respectively. The one-man 1,000-acre farm should grow a maximum of 206 acres of rice when prices exceed $37. Such large increases in the area of rice grown on these farms would substantially increase their demands for water in the summer period. Indications are that with the curtailment of further development on the CIA, sufficient water would be available in most years to allow existing farms there and on the MIA to expand their rice acreages to these levels. Soil salinity could restrict acreage expansion in certain parts of these irrigation areas however.

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