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Small Farmers in South Asia: Their Characteristics, Productivity, and Efficiency

Inderjit Singh

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PREFACE*

Many households rely for their livelihood on farming small but viable holdings in South Asia. Raising the productivity of these households is thus a central part of any strategy to reduce rural poverty in South Asia. This paper identifies some opportunities for implementing such a strategy.

Taken from Inderjit Singh's research on the institutional structures and relationships that shape South Asia's rural economy, the paper examines the productivity and efficiency of small holdings and discusses the prospects for raising the output of traditional food grains through improved cultivation. The evidence comes from a wide range of sources, both academic and operational. It shows that the prospects for small farmers are by no means as gloomy as sometimes portrayed. For a fuller analysis of recent developments, see chapters 3 and 4 in Singh's forthcoming book "The Great Ascent: The Rural Poor in South Asia."

* The author is indebted to Mr T. Narain for his invaluable assistance on the research for this paper.

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TABLES

Misconceptions about small farmers abound. It is sometimes suggested, for example, that they are inefficient and relatively unproductive, grow only food crops for subsistence and do not produce for the market, do not use capital or credit extensively or effectively, and are inherently less willing to take risks than other farmers. These generalizations are often untrue and misleading.

The evidence from South Asia[1/] shows that small farmers are by no means pure subsistence farmers--if by subsistence farmers is meant those who (i) grow only food (mainly for home consumption), (ii) rely very little on markets for the sale of their output), and (iii) use only owned factors of production (of which family labor is the most important). [2/] Small farmers do devote much of their cultivated land to food crops, but they also plant a significant proportion of it with cash and other crops. They consume much of their food output on the farm, but they also market a significant share of it (even though they may later have to buy some of it back). In addition to relying heavily on owned inputs, they use purchased inputs (including hired labor), and the proportion of these inputs is increasing.

SOME BASIC CHARACTERISTICS

Small farms in South Asia, far from being self-contained and self-serving units of production, are well integrated into commercial production systems and rural input and output markets. The next few subsections briefly outline some of the main cultivating characteristics of those who operate them.

Cash Crop versus Subsistence Farming: A False Dichotomy

Even the very smallest farmers grows some cash crops. Tables 1 - 3 provide evidence from India, Pakistan and Bangladesh, showing that the smaller the size of holding, the greater the area devoted to food crops (holdings of less than five acres devote between 60 and 80 percent of their cropped area to food.) But even on the very smallest holdings 15-20 percent of the area is used for cash crops. Thus, even these farmers cannot be said to farm solely for subsistence. Particularly noteworthy is the high average percentage of cropped area devoted to cash crops in Bangladesh, where the majority of all holdings are very small. Indeed, this proportion actually rises in Bangladesh as the size of holding falls.

Cash crops are grown partly to meet cash obligations--debt repayments, rental and input costs, and a few essential non-farm purchases--but also because of the profits they can bring. The area under cash crops may be quite high in regions with a history of growing them successfully; examples include the cultivation of tea in Assam, jute in Bangladesh, sugarcane in Western Uttar Pradesh, and cotton in the Indian and Pakistani Punjabs. In these areas, small as well as larger farmers often devote almost their entire area, at least in one season, to a cash crop. Participation of even the smallest farms in the cash crop economy in these areas is well established, and is relied upon to provide a flow of cash incomes.

In Bangladesh, for example, the smaller the holding the greater the area devoted to jute--a cash crop which involves high risks but also high returns. In this case, very small holders choose to grow more of a high return (and high yield variance) crop, and to use the resulting cash income to purchase food. Table A.1 in the annex provides illustrative data.

Table 1

INDIA: CROPPING PATTERNS BY FARM SIZE, 1970-71

Size Group of Operated Holdings (Ha)	% Distribution of Cropped Area	Proportion of Cropped Area Under		
		Foodgrains	Cash Crops	Other Crops
Under 0.5	4	83	14	3
0.5 - 1.0	7	83	13	4
1.0 - 2.0	13	81	14	5
2.0 - 3.0	11	80	15	5
3.0 - 4.0	9	79	16	5
4.0 - 5.0	8	78	18	4
5.0 - 10.0	22	75	19	6
10.0 - 20.0	16	72	21	7
20.0 - 30.0	5	72	19	8
30.0 - 40.0	2	73	16	11
40.0 - 50.0	1	74	14	12
Over 50.0	3	65	12	13
All	100	77	18	5
	(158 m/Ha)			

Source: Government of India, "Agricultural Census 1970-71" Table VI, pp 115-121.

Note: Foodgrains are rice, wheat jowar, bajra, pulses, maize, barley, cereals and millet; cash crops are fibers, sugarcane, fruits and vegetables, and oil seeds.

Table 2

PAKISTAN: CROPPING PATTERNS BY FARM SIZE, 1970-71

Size Group of Operated Holdings (Ha)	% Distribution of Cropped Area	Proportion of Cropped Area Und		
		Foodgrains	Cash Crops	Other C
0 - 0.4	0.2	63	18	19
0.4 - 1.0	2.0	66	19	15
1.0 - 2.0	5.0	67	18	15
2.0 - 3.0	9.0	66	18	16
3.0 - 5.0	22.0	64	21	15
5.0 - 10.0	29.1	60	22	18
10.0 - 20.0	17.8	61	21	18
20.0 - 60.0	11.3	62	23	15
Over 60.0	4.0	58	29	13
All	100	62	22	16
	(18.2 m/Ha)			

Source: Government of Pakistan, "Pakistan Census of Agriculture" 1972" pg 13, Table

Note: Foodgrains are wheat, barley, paddy, maize, jowar, bajra and kharif and rab pulses. Case crops include mainly fodder used to maintain draft animals.

Table 3

BANGLADESH: CROPPING PATTERN BY FARM SIZE, 1977

Size Group of Operated Holdings (ha)	% Distribution of All Cropped Area	Proportion of Cropped are in Size Group Under	
		Food Crops	Cash Crops
0 - 0.2	0.5	80	20
0.2 - 0.4	2.3	82	18
0.4 - 0.6	4.8	82	18
0.6 - 1.0	12.7	82	18
1.0 - 2.0	30.6	83	17
2.0 - 3.0	19.7	83	17
3.0 - 4.0	10.0	83	17
4.0 - 5.0	6.5	83	17
5.0 - 6.0	3.5	84	16
6.0 - 10.0	6.7	85	15
Over 10.0	2.8	87	13
All	100.0 (12.64 m/ha)	83	17

Source: Computed from Bangladesh Bureau of Statistics, "Preliminary Tables on Bangladesh Agricultural Census 1977," Tables 12A to 12U.

Note: Foodgrain crops include all wheat, cereals, pulses, mung masur grain, khesari and all varieties of paddy. Cash crops are ground nut, oil seeds, tobacco, potatoes, chillies, onion, garlic, watermelon and other rabi crops. (Plantations and trees are excluded). They also include jute, hemp, mesta, ginger, turmeric vegetables, rape and mustard seed.

In South Asia, the difference in cropping patterns between small and larger cultivators is one of degree only and there are major exepctions to the rule that the smaller the farm the less the emphasis on cash crops. Nevertheless, the fact that small farmers generally devote a major share of their total effort to food crops does limit their ability to respond to the profitable alternatives represented by specialization in non-food crops. They will generally hedge rationally against agro-climatic and market risks by producing for both food and cash; interplanting of crops, especially in semi-arid regions, is another way to reduce risk and there is some reason to believe that small farmers interplant more often, than others, or do so on a larger percentage of the cropped area. 3/

Contribution to Marketed and Marketable Surpluses

Tables A.2-A.3 in the annex present figures by size of holding for farm household production, consumption, and marketed output from Pakistan (data are for irrigated holdings in the Indus basin -- mainly farms in Punjab and Sind) and Bangladesh (Bogra District). Tables A.4-A.7 in the annex present selected farm level data on marketed output from different states in India. Although the tables show different proportions of marketed output, the basic inverse relationship between farm size and marketed suplus is clearly evident, nevertheless the data also show that even the smallest producers market some of their output. (The considerably lower proportion of home consumption in the figures for Pakistan is due to the fact that the data cover the aggregate of both cash and food crops, while those for India and Bangladesh cover food crops only.)

In addition, for any given farm size, the marketed proportion of output is likely to be higher (i) for cash crops than food crops; (ii) in monocultures (areas growing only one crop) than in diversified crop environments; and (iii) among villages or regions

that are relatively close to markets or have relatively good transportation links with them. The marketed proportion is likely to be lower (i) for sharecroppers than for owners or fixed cash-rent tenants, because sharecroppers pay rent in kind and thus have little output to spare for sale; 4/ and (ii) among larger families, which need to keep more of their output for household use. 5/

In addition, there is extensive evidence to suggest that small farmers are less likely than larger ones to increase the marketed proportion of their output in response to price incentives. 6/ This response is not in the least irrational: it follows directly from the fact that, like other cultivators, small farmers' prime objective is to grow food for their own consumption but, unlike larger farmers, they have to use most of their land for this purpose. Thus, small farmers may respond to higher food prices by raising output in just the same way as larger ones (in technical language, the price elasticity of total output may be no different for the two groups) but small farmers will allocate most of their output increase to their own food needs (i.e., they will have a lower price elasticity of marketed surplus).

Consequently, the share of total marketed surplus accounted for by small farmers is generally smaller than their share in total output, which is in turn much smaller than their share in the total number of holdings (because of the unequal distribution of land.) As a result their exposure to the price system and its impact on their operations is likely to be less. These facts are clearly illustrated in Table A.5. In 1961-62, small farmers with holdings of less than 5 acres accounted for 62 percent of all holdings, but only 19 percent of the overall operated area; their share of total output was nearly 26 percent total market output has changed since the advent of the green revolution in the later 1960s. I know, for example, that in 1970-71 holdings of 10 acres or more in the Indian Punjab (28 percent of all holdings)

accounted for over 55 percent of the region's total marketed surplus of wheat, while the smallest third of all holdings provided only 16 percent; as small farmers in other states are likely to have lagged much further than those in the Punjab in the adoption of new technologies, their overall contribution to the surplus has probably fallen.

Despite all that has been said above, there is growing evidence that as their total output rises, the share of it that small farms market also increases. This is most evident in wheat regions like the Indian Punjab, where even the smallest farmers have benefitted significantly from the new HYV technologies, Table A.6 in the annex presents some evidence for the increasing commercialization of small farms in terms of marketed output. Trends of this kind can be expected whenever yields rise, allowing higher output per capita; as small farmers become more integrated into the market nexus, they will increasingly benefit from higher output prices.

Finally, small farmers not only sell some of their output (mainly consisting of foodgrains); they also buy food in the market. The typical pattern is one of "distress selling" immediately after the harvest (in order to meet debt or other obligations) even though the output sold may be required to meet the seller's own needs. The second stage of the process occurs later in the year, and involves repurchase of needed foodgrains, often at prices significantly above the low immediate post-harvest levels at which the orginal sales where made.

A distinction is therefore often drawn between small farmers' "marketed" surplus" and their "net marketable surplus"--the former being the proportion of total output that is in fact sold (mostly in the post-harvest season), and the latter being the net difference between total production and total consumption, after accounting for repurchases in subsequent months. The two would be equal if all the consumption needs of a farm family were met from

the amounts of farm output held back from the market through the crop year. But if some output is first sold and then repurchased for consumption. the two are not the same.

Small farmers' marketable surpluses may be smaller than their marketed surpluses for a number of reasons. Their total food output may be inadequate to meet family consumption needs, in which case their marketable surplus is negative. 7/ Alternatively, they may lack storage facilities, be required to meet post-harvest cash obligations, or find that their food requirements over the year exceed expectations; in these circumstances, they will sell only to repurchase later, making their marketable surplus less than their net marketed surplus.

This phenomenon is apparent even in the Indian Punjab where small farmers are relatively well off, have relatively high outputs, and have adopted new production technologies relatively rapidly. Table A.7 documents the differences between "marketed" and "marketable surpluses"; it also quantifies the small or negative marketable (i.e., net) surpluses of farmers with the smallest holdings and the sizeable scale of their purchases of wheat and grain (in terms of percentages of output). Figure 4.1 illustrates the negative correlation between seasonal wholesale prices of wheat and the proportion of marketed surplus sold. Farmers with less than 5 acres sell a larger share of their marketed surplus than large farmers during the harvest and immediate post-harvest months, when prices are low. Larger farmers--because of their better income and asset positions, their more manageable cash obligations, and perhaps their better access to storage--can hold back the bulk of their sales until prices rise in later months. They then sell only after retaining their own full consumption requirements, and thus seldom need to re-enter the market as buyers later in the season when prices peak. Finally, in the off-season when prices are high, grain is usually owned by traders who will often advance loans in kind to small

farmers, so that the latter can meet their consumption needs pending the next harvest. Repayment of these debts then becomes a binding constraint, which again requires the small farmer to to make early post harvest sales--a cycle that is repeated unless it is broken by sharp productivity gains, or better credit terms.

Use of Labor and Other Inputs

Throughout South Asia, small farmers offset the disadvantages associated with their limited holdings by irrigating a relatively high percentage of their total sown or cropped area. This in turn permits them to achieve relatively high cropping intensities (measured by the ratio of total cropped to net sown area) and output levels per cropped unit of area. Detailed evidence on this characteristic pattern of small farmer agriculture in the subcontinent will be discussed in a later section; at this point, it is sufficient to note that small farmers' tendency to have higher cropping intensities than those of larger cultivators means that they also tend to use some current inputs (bullock power, manure fertilizers, and especially human labor) more intensively.

The evidence on higher intensity of current inputs on small farms is extensive and well known, and need not be repeated in detail here. 8/ Figures for comparative labor use by sizes of holding and in different Indian regions are given in Table 4. Three facts stand out: (i) labor input is inversely related to size of operated holding; (ii) the proportion of family to total labor is also inversely related operated area; and (iii) average labor productivity is directly related to farm size. Not surprisingly, factor proportions in small farm production systems reflect the fact that labor is relatively abundant (and mainly supplied by the family) while factors like land and capital are scarce.

Table 4

INDIA: LABOR INPUT IN FARMS BY SIZE GROUP OF OPERATED HOLDINGS 1/ (SELECTED DISTRICTS AND SELECTED PERIODS)

Size Group of Operated Holdings (Hectares)	Mandays per Hectare of: Total Cultivated Area	Total Cropped Area	Area Under:		
	FEROZEPUR, PUNJAB (N) 1968-69 -- 1969-70				
			Wheat (H)	Wheat (T)	Paddy (H)
<6	103.9	76.5	80.0	59.6	131.4
6 - 9	84.6	67.9	81.7	52.5	54.9
9 - 14	83.9	64.7	73.2	54.8	95.3
14 - 24	71.6	54.7	64.4	44.3	95.2
>24	53.9	46.7	58.2	47.3	111.4
All:			68.2	52.2	91.1
	MUZAFFARNAGAR, UP (N) 1966-67 - 1968-69				
			Wheat (H)	Wheat	Paddy
<3	142.3	97.3	129.3	84.7	71.0
3 - 5	115.8	82.0	68.6	63.8	69.0
5 - 7	110.6	78.5	66.7	66.3	71.3
7 - 11	89.9	66.1	66.7	58.8	65.3
>11	87.4	68.4	55.9	45.9	71.3
ALL			63.1	58.0	69.3
	THANJAVUR, TAMIL NADU (S) 1967-68 - 1969-70				
			Paddy (H) 2/	Paddy 3/	Paddy (T)
<1	248.1	144.0	157.1	163.1	165.1
1 - 2	218.7	127.1	157.8	137.9	139.2
2 - 3	211.3	117.5	143.4	135.5	137.1
3 - 6	214.6	125.8	155.2	135.2	152.8
>6	145.4	107.1	117.0	115.6	131.8
ALL			141.5	129.6	138.0
	CUDDAPAH, ANDHRA PRADESH (S) 1967-68 - 1969-70				
			Irr. Paddy		
<2	157.5	141.7	197.8		
2 - 3	109.1	112.7	189.8		
3 - 6	93.5	100.2	151.7		
6 - 11	69.7	72.7	148.0		
>11	67.6	74.1	127.8		
All			143.7		
	HOOGHLY, WEST BENGAL (E) 1970-71 - 1972-73 4/				
			Paddy (H)	Paddy (T)	Wheat
<0.5		256.9	217.9	143.7	159.7
0.5 - 1.0		218.6	183.5	123.6	134.2
1.0 - 1.5		243.6	176.0	128.3	149.0
1.5 - 2.0		219.5	196.7	134.7	156.7
2.0 - 3.0		186.8	187.9	117.8	108.9
3.0 - 4.0		251.4	221.5	107.1	128.1
4.0 - 6.0		149.2	181.9	119.8	72.3
>6.0		159.0	137.6	111.8	110.3
All		216.0	192.0	121.9	132.0

Source: Shakuntala Mehra (1976) and Farm Management Survey Reports.

Notes: 1/ Size groups are rounded off for convenience.
2/ ADT-27.
3/ Samba Co-25.
4/ Assuming 8 hrs to a day.
(N), (S) and (E) represent North, South and East.
(H) and (T) represent high yielding and traditional crop varieties respectively.

It has also long been argued, and is now generally accepted that smaller farms rely more on household labor because they are family-based operations as distinct from commercial enterprises.[9/] On family farms, the opportunity cost of family labor is lower than that of wage employment; the marginal product of labor will therefore tend to have a supply price lower than the market wage and relatively large amounts of labor will be used.[10/] It has also been suggested that family farms tend to maximize output rather than profits. [11/] Under these conditions, family labor will be employed up to the point where the marginal product of labor is zero, while farms relying on hired labor (usually larger holdings) will only employ it to the extent that its marginal product is positive. As a result smaller farms can be expected to use more labor per unit of area. Thus, it is argued, market imperfections lead to a dualistic labor market in which family farms behave differently from "commercial" ones.

These different factor proportions imply that labor productivity is generally lower on small farms than on larger ones--a distinction that is reinforced by the fact that family farms tend to share available farm work among family members to give them all some occupation. The sharing of work is the outcome of the sharing of total output among family members. [12/]

Why do small farm households not hire out their labor up to the point at which the marginal products of labor are the same in the family and commercial farm sectors? There are a number of reasons why low productivity labor on family farms may not move to higher productivity jobs on larger (commercial) farms, or out into the non-farm sector, including (i) <u>seasonality</u> --during the peak season all of the family's labor is needed on the farm, while little or no outside work may be available in the slack season when family labor is seeking employment; (ii) <u>rigidities</u>--once the family farm's cropping pattern is fixed, it becomes difficult to take advantage of off-farm employment (unless it is in the slack

season); and (iii) the high transportation and transaction costs of switching to off-farm work that may be available but only at a considerable distance from home. All these factors reinforce labor market dualism.

In addition to their heavy use of family labor, even the smallest of holdings in South Asia also hire in non-family labor (and, despite the inhibiting factors just noted, hire out family labor). 13/ Table 5 presents some evidence on this point for West Bengal and for India as a whole, as does Table 6 for Bangladesh. The data highlight three aspects of labor use: (i) almost all farms in all categories--even the smallest--hired labor; (ii) even on the smallest holdings, hired labor can represent a very high proportion of total labor use (see, for example, hired labor as a proportion of small farm labor in West Bengal) (iii) small farms hire out family labor extensively (I have already noted the need for wage income to bridge the consumption gap represented by negative marketable surpluses--Table A.7); and (iv) hiring-in is associated with seasonal land preparation and harvesting tasks.

The supposedly labor-abundant small farm sector needs to hire labor for two main reasons: (i) larger inputs of labor than the family alone can supply may be needed to farm optimally during peak periods; and (ii) poor farmers quite commonly take consumption loans from better-off ones--loans that are paid off in labor rather than cash) Finally, many farmers, no matter how small their holdings, prefer to use hired labor than to work physically themselves. In East India, Bangladesh, and parts of South India, there are classes of owners who have an aversion to physical labor; this is a caste as well as a cultural phenonmenon.14/

Table 5

INDIA: USE OF HIRED LABOR BY FARM SIZE (1970-1972)

(i) All-India - 1970-71

Farm Size (Acres)	Percentage of Farms Hiring in Labor %	Percentage of Farms Hiring out Labor %	Hired (in and out) Labor/Acre (Man days)
0 - 5	83	52	20.5
5 - 15	9	27	18.4
15 - 25	97	15	17.0
> 25	95	12	15.5

(ii) W. Bengal - 1971-72
(Farm Management Survey, Hooghly District, 1971-72)

Farm Size (Acres)	Percentage of Holdings with Hired Labor as Proportion of Farm Labor of:			
	10%	10-50%	50-100%	Total
< 1.25	16	38	46	100
1.25 - 5.00	21	32	47	100
> 5.00	12	21	67	100
All	17	32	51	100

Sources: (i) Calculated from NCAER Survey by S.S. Bhalla (1979) p. 165.

(ii) Rudra

Table 6

BANGLADESH: HOUSEHOLD AND HIRED LABOR USE IN JOYDEBPUR BY SIZE GROUP OF HOLDINGS AND SEASONS, 1975-76

	Percentage of all harvesting work done by					
	Household labor in			Hired labor in		
Size group of holding (Ha)	Aman 1975-76	Boro 1976-77	Aus 1975-76	Aman 1975-76	Boro 1975-76	Aus 1976-77
Under 0.5	78	65	34	22	35	66
0.5 - 0.99	33	46	25	67	54	75
1.00 - 1.49	34	35	34	66	65	66
1.50 - 1.99	19	43	22	81	57	78
2.00 - 2.99	16	22	12	84	78	88
Over 3.00	2	11	5	98	90	95

Source: Edward J. Clay. "Environment, Technology and the Seasonal Patterns of Agricultural Employment." Paper presented at the Conference on Seasonal Dimensions of Rural Poverty, IDS Sussex, July 1976. Author cites unpublished crop cutting data from BRRI.

PRODUCTIVITY AND EFFICIENCY

Economists have long debated whether large or small farms are more productive--an issue that has important implications for agricultural policy. One of the "stylized facts" about peasant agriculture, especially in Asian condition, is the so-called inverse relationship between farm size and productivity. 15/ The remainder of this chapter reviews the available evidence on the relative productivity and efficiency of smaller and larger units, both before and after the technological breakthrough represented by high yielding varieties (HYVs) of foodgrains, and discusses some of the policy and conceptual issues associated with evaluating (and enhancing) small farmer performance.

Relative Productivity with Traditional Technologies

It is now generally agreed that, prior to the advent of the new technologies, small farmers normally had higher land productivity in terms of output per unit of area than larger ones. In South Asia, the early evidence for the inverse relationship between farm size and land productivity came from Farm Management Survey (FMS) data from the 1950s in India. An analysis of data from over 3,000 farms in 6 states revealed a consistently negative relationship between output per acre and ownership holdings by size of farm.

This finding stimulated a long debate and a large number of studies16/ whose findings (summarized in Table A.8 in the annex) generally confirmed the inverse relationship in the pre-gree revolution periods observed in the FMS data. 17/ Some more recent studies continue to confirm it for India, 18/ and M. H. Khan (1977) found a similar picture in Pakistan; using 1974 data from irrigated farms, he noted a significant negative relationship between total output per acre and farm size. despite the existence of a postive relationship between yield per acre of individual

crops and farm size. This last point parallels a conclusion arrived at by Rudra (1968a, 1986) and Chattopadhyay and Rudra (1977) on the basis of extensive analysis of the Indian data--that even where the inverse relationship held for all crops, it did not necessarily apply to individual ones. In fact, considerable evidence was available to show that yields per acre of individual crops were often positively related to farm size. 19/ The higher overall productivity of small farms was nevertheless still evident.

Meanwhile, however, other studies had raised doubts about the general validity of the hypothesis of the inverse relationship, drawing attention to a number of statistical problems such as the use of over-aggregated data from many regions, improper pooling of data sets, and inappropriate functional forms. 20/ After a detailed review of the earlier data and findings, and taking account of their methodological shortcomings, Chattopadhyay and Rudra (1976) argued that the inverse relationship held in many but not all parts of the country, that it did not hold at all times, or in all ranges of the farm size variable, and that it did not hold for individual crops as there was no tendency for yields per acre to decline with farm size. They suggested the relationship was most likely to hold only for small class sizes (indeed they felt that generalizations about decreasing returns to scale were not tenable, as that would mean that the inverse relationship held over the whole range of farm sizes). They concluded that "the negative relation may hold in certain parts of the country at certain times, but not everywhere and not all times."

Others have argued that it is not the size-productivity relationship that is important, but rather the relationship between "modes of production" and productivity. Since small farms normally used predominantly family labor, while large farms were 'employer-capitalist' farms using mainly hired labor, farm size was being used as a proxy for production relations. 21/ But a

recent study by A. Ghose (1979b), designed precisely to look at these issues and using FMS data, found that when each farm "type" (peasant, peasant-tenant, employer, employer-tenant) 22/ was controlled for, the inverse relationship between total output and farm size was still found to exist independently of the various production "modes." Further evidence of an overall inverse relationship continues to persist. In a recent analysis of a large all-India NCAER sample for 1970-71 S. S. Bhalla (1979) confirmed this relationship. Bhalla's (1979) analysis also showed that tenancy per se does not effect productivity after size, land quality and irrigation differences are accounted for.

Accepting that this relationship was generally true, at least up to the early 1970s under traditional technological conditions, the question arises as to its causes. As S. S. Bhalla (1979) points out, there are two kinds of factors to consider: (i) exogenous, or non-economic factors (like the intrinsic quality of land) that are unrelated to any decisions made by small farmers themselves and (ii) endogenous or economic factors, i.e., ones that depend on how small farmers make decisions and use resources to irrigate their land, for example. Some of the explanations advanced are briefly outlined below.

(a) Land Quality: The most persistent explanation for the inverse size-productivity relationship is the suggestion that small farmers' land is of better quality than larger farmers'. This can either mean that intrinsic soil quality (and hence productivity) worsens with farm size, or that small farms have higher cropping intensities because they irrigate their land more heavily. Sen (1964) suggested that small holdings had more fertile land because the typical small farm was formed as a result of the relatively rapid fragmentation of relatively high output land into smaller holdings under population pressures. Others, such as Bhagwati and Chakravarty (1969), offered the hypothesis that larger holdings may be formed from the acquisition of land as

a result of "distress sales" by small farmers--who would generally try to part with their least productive land. In both cases the consequence would be lower intrinsic land quality on larger holdings. Although it is hard to confirm these hypotheses, there is some evidence, as Bhardwaj (1974a) showed, that the number of fragments per holding increases with total size of holding, while the number of fragments per acre decreases with size of holding. This lends some credibility to these arguments.

Most analysts, however, doubt that quality of land per se is the proper explanation. 23/ It is hard to test the theory properly without full data on soil fertility; Bhalla (1979), using land prices as proxies for land quality, found some evidence of a negative relationship between quality of land and farm size, but it was not conclusive. 24/

(b) Irrigation and Cropping Intensity: I have already noted that small farms have relatively high cropping intensities, which are closely related to the intensity of irrigation. 25/ There is no doubt that higher cropping intensities explain smaller farms' higher productivity per unit of area owned (or owned plus leased). Yield differences can be systematically linked to differences in the intensity of cropping. These differences are reduced when output per unit of cropped area is considered; in some cases, productivity differences disappear. 26/

But even when careful analysis is done to control for differences in irrigation (and hence cropping intensity), the inverse relationship between size and productivity continues to be observed. 27/ Thus it seems that land quality differences, whether produced by endogenous or exogenous factors (i.e., irrigation or soil quality respectively) do not fully explain the negative relationship between productivity and farm size.

There are other arguments for rejecting explanations based solely on higher irrigation and cropping intensities. First, to

have "better land" or "better irrigation" in South Asia is less a consequence of fortunate endowment than of conscious public and private investment decisions. In particular, investments in minor irrigation are the result of labor-intensive farm-level investments. 28/ Second, higher cropping intensities also imply higher levels of other inputs--especially labor. Thus, to say that small farmers' relatively high productivity is "explained" in terms of higher cropping intensities and better or more intensive irrigation, based on higher input use, is to beg a prior question: why do small farmers use inputs, especially labor, more intensively?

(c) Cropping Patterns: The general acceptance of the inverse relationship, at least at the total output level, suggests the possibility that small farmers may consistently grow relatively high value crops. In fact, however, cropping patterns do not differ signficantly by farm size--if anything, smaller farmers devote a higher percentage of their cultivated area to food crops (which are generally considered to be of lower value than cash crops). Moreover, studies based on the FMS data, which found that the inverse relationship faded into insignificance when individual crops were considered 29/ (suggesting that cropping patterns adjust to fertility or other differences), may have confused the intensity and irrigation effects. Evidence from 1970-71 NCAER data, provided by Bhalla (1979) establishes an inverse relationship even for individual crops (except for two cash crops, jowar and sugarcane) after carefully controlling for soil quality (by price) and irrigation.

One is therefore driven to conclude that observed productivity differences must result either from the amounts and proportions used of different factors of production, or from the way in which they are used--that is, from differences in factor intensities or differences in the efficiency with which the factors are used.

(d) Factor Intensities: It is well established that small farmers use more current inputs per unit of area (especially labor, notably family labor, and traditional inputs like bullocks and farmyard manure) than larger ones. This tendency has been widely documented for India, Pakistan and Bangladesh.[30/] (Some studies have also found higher input intensities for non-farm cash inputs such as fertilizers and pesticides, but many others have shown opposite results. [31/]

There is growing evidence that the higher factor intensitites observed on small farms may be caused by institutional and market imperfections, which present small farmers with a factor price structure that differs from that facing larger ones. [32/]

- In land markets, larger farmers may often face "a lower price for a unit of quality adjusted land" because of institutional regulations covering rents or tenancy arrangements and a higher opportunity cost of long term borrowing. There is evidence that rental costs per unit of area fall with farm size; [33/] Bhalla (1979), p. 158 shows that even after controlling for irrigation and land quality, "the unit rental cost per acre decreases by Rs.5-Rs.10 for each additional acre of land rented." Thus if large farmers face proportionately lower effective land prices than small farmers, the latter will use lower proportions of land and higher proportions of other inputs (have igher input intensities).
- In labor markets, small farmers may face a lower effective price for the (largely family) labor they use. As will be recalled, it has been suggested that a dualistic market exists for rural labor, which is consequently available relatively cheaply on small farms; this in turn leads to these farms' higher labor intensities and lower labor productivity [Sen (1962, 1966)]. Mazumdar (1963) although rejecting the hypothesis that self-supplied labor is "costless," wrote

"the higher output per acre on smaller farms is due to the supply price of the marginal unit of family labor being reduced," (p.1263). As noted earlier, the dualism that leads to lower labor costs for small farms who use mainly family labor 34/ may arise from (i) the family-farm propensity to maximize output rather than profits (Sen 1964, 1975), (ii) the relatively low probability that family farm members will find off-farm work (Mazumdar 1965, 1975), (iii) the preference of larger farms for permanent workers, and their "exploitive" oligopsonistic power over their landless labor, (iv) the rigid requirements of farm work (once a cropping pattern is committed) that prevent family members from taking a job when its most likely to be available, or (v) the hetrogeneity of family labor and hired labor's non-substitutability for it. Whatever the reason, there does seem to be a dualistic labor price; i.e., labor is cheaper for small family farms and small farms use a lot more of it, and this is one of the main reasons for the difference in productivity. 35/

-- In capital and credit markets, on the other hand, interest rates may decline with farm size. Bhalla (1979) again provides evidence to this effect from India, while M.H. Khan and D.R. Maki (1979, 1980) and M.H. Khan (1977, 1979) point out that in Pakistan larger farms enjoy preferential access to credit and credit markets. Small farmers' heavy reliance on expensive borrowing from money-lenders, and the bias towards larger farmers of institutional credit agencies with lower rates, combine to produce credit market imperfections. Rationally, therefore, small farmers should use fewer cash inputs--fertilizers and pesticides--and they have been observed to do so in many cases. As these cash inputs have only insignificant importance in traditional technologies,

this disadvantage does not tell against small farmers, or markedly influence relative productivity levels, where traditional crops are being cultivated.

The discussion so far has suggested that in the pre-HYV period output per acre declined significantly with farm size, and that imperfectionsin factor markets, especially in the labor market, may have been the primecausal factor involved. In pre-HVY traditional agriculture, in which labor and land were the most important inputs, the availability of relatively cheap labor on small farms led to relatively heavy use of labor by them, and in turn to their higher productivity. The inverse relationship was thus a direct consequence of production factor costs and combinations in this traditional agricultural system.

Relative Efficiency with Traditional Technologies

Apart from differences in factor intensities, the relative efficiency with which factors were employed by large and small farmers may also have affected the two groups' productivity.

It is difficult to measure economic efficiency. Differences in static economic efficiency between farms (large or small) is said to arise from variations in technical efficiency (different amounts of output with equal amounts of inputs) or price efficiency (differences in profits resulting from different prices received or paid per unit of output). The normal procedure for testing for efficiency is to assume profit maximizing behaviour, to estimate production or reduced form profit functions from farm-level data, and then to test whether the derived (implied) value of marginal output for each variable input is equal to its price, and whether or not the technological parameters (and hence profits per acre) are different for a given level of inputs.[36/]

This procedure, however, requires us to assume (i) that farmers try to maximize profits and (ii) that farmers are "price

takers" -- that is that neither oligopoly or oligopsony apply in any product or factor markets and no imperfections exist in these markets. 37/

The assumption that peasant farmers are profit maximizers has been tested in a large number of studies in South Asia and elsewhere; it is widely accepted as conventional wisdom. 38/ More recently, however, Junankar (1977, 1978a, 1978b) noted severe problems with the data used and the sensitivity of the results to the specification of function forms, thereby casting some doubt on earlier evidence and the conclusions drawn from it. Using a variety of functional forms and farm-level Indian data from Punjab and Tamil Nadu, he rejected (as earlier studies had been unable to do) the neo-classical model of profit maximization under competitive conditions; he concluded that many of the earlier models were misspecified and unreliable, that "the neo-classicial profit maximizing model is particularly bad at explaining the behavior of farms in less developed countries as it ignores the socio-political matrix within which they act", and therefore that "the neo-classicial assumptions are not valid." Others have argued that "satisficing" or "survival assuring" rather than profit maximizing behavior may be a more appropriate way of describing the behavior of farmers in LDCs. 39/ But little empirical work has been done yet to establish and test these alternative paradigms. 40/

On balance, however, despite persistent differences of opinion and the need for more empirical work, the weight of the evidence at present seems to be in favor of accepting assumption (1) above, i.e., the existence of profit maximizing behavior.

Assumption (ii) above is another matter, however, I have already presented some evidence that suggests that the hypothesis of price taking behavior in perfect product and factor markets may not hold in South Asian agrarian conditions. But if markets are <u>not</u> perfect (this is the gist of Janakar's critique) how do I test

whether farmers are profit miximizing agents? There are also problems of uncertainty. Under these circumstances and given the present state of the art, the evidence tht follows on economic efficiency--based on tests derived from profit maximizing behavior under certainty in perfectly competitive markets--should be treated with a great deal of caution. 41/

Shultz (1964) was the first to argue that Indian peasant farmers were "poor but efficient," but he based his hypothesis on limited data and methods. Hopper (1965), in a pioneering study that supported Schultz's contention, used a small sample of 43 farms in an Uttar Pradesh village to show that farming in traditional Indian agriculture was efficient. Although he did not test for relative efficiency by size, most of his sample consisted of ownership holdings of less than 5 acres. Mazumdar (1963) had earlier argued that small farms would be relatively more efficient because of their use of lower cost family labor and that this accounted for their higher productivity. Paglin (1965) had argued that large farms were less efficient as they underutilized resources, but offered no satisfactory evidence.

None of these studies explicitly tested for productivity differences by farm size, however. The first effort explicity to test differences in efficiency under traditional technologies was done by Sahota (1968) using the FMS data from the 1950s for various states and regions. He concluded that there were no significant differences in efficiency by farm size. Saini (1969), also using FMS data for Uttar Pradesh and Punjab, confirmed this findings. This was followed by three studies (also based on the FMS data) by Yotopoulos, Lau and Somel (1970), Lau and Yotopoulos (1971), and Yotopoulos and Lau (1973), using somewhat improved methodologies; these studies concluded that small farms were relatively more efficient than large farms. The first study was somewhat inconclusive, but the second found that small farms "operate at higher levels of price efficiency (i.e. optimal price

behavior) and/or they operate at higher levels of technical efficiency." The third argued that small farmers were more economically efficient than larger ones owing to superior technical (not price) efficiency, which was attributable to better farm management and supervision.

The findings reviewed in this subsection, (and summarized in Table A.9 in the annex) on balance suggest that small farms operated at relatively high levels of productivity and efficiency. This formed the basis of the widely held policy view that there would be no loss in productive efficiency if larger holdings were broken up into smaller ones; they continue to form the basis for the widespread advocacy of land redistribution as a desirable solution to the poverty problem which would at the same time not result in output losses. In fact, however, the introduction of new hybrid varieties in the late 1960s has induced major changes in the farm size-productivity relationship. The evidence presented in the next the subsections suggests that, following the advent of HYV technology, the policy stance of positively favoring small over larger units may still be desirable but can no longer be expected to be accomplished without a loss in output.

Relative Productivity with HYV Technologies

The post-HYV evidence on the relationship between farm size and productivity is neither clear-cut nor easy to interpret, because the technologies and their applications are still evolving. Some relevant findings, are, however, summarized in Table A.10. On balance, the available evidence seems to suggest that small farmers have relatively poor access to HYV inputs--seeds, fertilizers, pesticides, information and credit--and that they are consequently relatively slow to adopt new biological and mechanical technologies (such as the use of tubewells or tractors). This has in turn reduced the productivity gap between

them and large farmers, so that the inverse relationship between farm size and output per acre is being weakened and in some cases reversed. 42/

The earliest indications of a change in the inverse relationship came in the late 1960s, when it was found to be weaker in the more advanced Intensive Agricultural Development Programme (IADP) districts than in the more backward districts. Further comparisons of results from FMS data from the 1950s and the late 1960s for the same districts also showed that the inverse relationship had become weaker, or was even disappearing, in later periods. 43/ A number of microeconomic studies reviewed by C.H.H. Rao (1975) also showed that the inverse relationship under traditional technologies did not seem to hold when new technologies were introduced--that larger farms were coming to experience faster rates of output growth than small and marginal ones and that, despite higher irrigation and cropping intensities on small farms, output per acre showed no significant relationship to farm size. These included studies by W. Khan and Tripathi (1972), and Rao (1975) in W. Godavari (Andhra Pradesh) by Johl (1975) in Ludhiana, (Punjab) by Bapna (1973) in Kota (Rajasthan) and Usha Rani (1971) based on all-India FMS data.

Some other studies continued to find an inverse relationship into the late 1960s 44/ and early 1970s, but their findings were usually based on aggregated data covering both traditional and new technology users. Moreover, the "green revolution" had hardly taken root in the early 1970s; even by the later years of the decade, it was far from a widespread phenomenon. 45/

A careful analysis by Bhalla (1979) of three years of NCAER data (1968-69 to 1970-71) revealed that although the inverse relationship still persisted after the introduction of HYVs, it had weakened over time. He attributed the reduction in the productivity gap to the fact that small farmers had lagged in the adoption of HYVs and new technologies, and presented considerable

evidence to confirm this view.

A series of demonstrations that the inverse relationship was breaking down, rather than merely weakening, under the impact of HYVs was provided by a large number of state level studies undertaken in the late 1960s and early 1970s. These were reviewed by B. Dasgupta (1977); their findings are summarized in Table A.11 in the annex. 46/ It is apparent from the Table that the generalizations about the inverse relationship based on FMS data from the 1950s and 1960s no longer held by the early 1970s. Dasgupta concludes that the data seem instead to suggest that for "both wheat and rice... the pre-HYV inverse relationship between yield and farm size does not hold under the new technology ...whereas in the case of wheat there is some evidence of the relationship turning positive, the empirical studies on rice are conflicting on this point." Saini (1979) also reports a weakening of the inverse relationship and its reversal in some cases.

The reasons for the new state of affairs are clear. The inputs that were critical to new technologies--fertilizers, pesticides and new seeds--were being more intensely used by larger farmers than by small ones. Dasgupta (1977) provides extensive survey-based data showing that small farmers spent less per unit of area on these inputs (especially for HYV wheat, less so for HYV rice) and that a relatively small percentage of their total costs were devoted them. These were early adoption years for HYVs and the small farmer lags were clearly evident. 47/

M. H. Khan (1977, 1979) has collected similar evidence from Pakistan, based on 1974 data from irrigated farms in the Indus basin. His data showed that while the inverse, or negative relationship generally existed on an all-crop basis, a direct, or positive relationship between farm size and output, profits and the use of modern inputs per acre was found for HYV wheat and rice.

These studies suffer from three problems, however; they are

based on samples that are often too small, they are contradicted by other evidence based on larger samples for the same period, and they were undertaken in the early phases of the introduction and adoption of HYVs.

Nevertheless, two more recent studies clearly establish the significance of the correlation between the adoption of new technologies and changes in the farm size-productivity relationship. Deolalikar (1981) has taken 1970-71 data from some 272 districts in India and tried to see how "green revolution" inputs, especially differences in the use of fertilizers, bring about productivity differences between different size classes of farms (defined in terms of size quintiles). Table A.12 in the annex presents his findings, based on estimated and then predicted relationships. The figures show that at zero levels of fertilizer use 48/ the smallest two farm size quintiles have significantly higher productivities per unit of area than medium or large farms. At higher levels of technology (fertilizer use), larger farms are more productive than medium size farms, which in turn are more productive than small farms. Although each size group shows higher productivities at higher levels of technology, the farm size-productivity relationship changes. The productivity advantage of small farms (the inverse relationship at low levels of fertilizer use) diminishes and even reverses with technical change. The explanation clearly lies in the reduced importance of labor and the increasingly central rule of cash inputs (which, being credit-intensive, are less readily available to small farmers).

P. Roy (1979, 1981) has done a careful study of household level data for the Indian Punjab, based on the extensive NCAER Survey undertaken in 1975-76 and 1976-77. By this stage, the green revolution was firmly established in the Punjab. Roy found that the inverse relationship still held at the state level; he pointed out, however, that this analysis was at too high a level

of aggregation because, even in the Indian Punjab, differences in irrigation and other factors meant that the new technologies had been diffused at different rates in different districts. Generally speaking, by 1977 the Western districts with better irrigation--particularly Amritsar and Ferozepur--were the most advanced, having experienced technological change first. By the mid-1970s, the transition to new technologies was complete in this part of the state. The Central districts were somewhat behind and were still in the process of transition from traditional to new technologies; meanwhile, the Eastern districts (the sub-montane region with natural constraints based on soil types) 49/ had lagged considerably, and were only in the early phases of adoption.

Roy then did a careful district-by-district analysis of the relationship between farm size and productivity. He found that the inverse relationship was still significant in the Eastern region, that it was no longer significant in the Central region, and that in the Western region a significant positive relationship between farm size and productivity was evident for the first time. The disappearence or reversal of the inverse relationship occurred despite greater cropping intensity on small farms. The traditional advantage of better irrigation on small farms had been offset by investments in tubewells on larger farms, while their labor intensity was offset by cash-intensive inputs. In the two most advanced districts, where agricultural transition to new technologies was complete, the relationship had definitely turned positive. He attributes the changes to (a) new technologies, (b) declining tenancy and (c) increasing commercialization.

The evidence suggests that larger farmers' productivity advantages are relatively unimportant in the early stages of the adoption process, but that as the transition to new technologies

gathers pace, the traditional inverse relationship dwindles away; eventually, as larger farmers continue to get better access to cash-intensive inputs and take advantage of economies of scale in mechanization (including tubewells for irrigation) the relationship between farm size and productivity actually becomes positive. It should be clearly borne in mind, however, that intrinsic scale economies in, for example, tubewells, are only a partial cause of the change in the relationship. To an important extent, the institutional and financial biases in favor of larger farmers are the factors that allow them to get better extension services, credit terms, inputs, and information and marketing arrangements, and to get these things at lower real costs than small farmers. These biases in turn stem, of course, from the unequal distribution of assets and holdings in rural areas. It has been argued that only non-market interventions can offset these biases, but as I argue elsewhereinterventions by government may often serve only to exacerbate the problem, rather than correct it.

Relative Efficiency with HYV Technologies

The pre-HYV finding that small farms were often more efficient than larger ones has not be duplicated in the post-HYV period. Instead, although a large number of studies have confirmed that small farms are absolutely efficient, the data now suggest that there are no significant differences between their levels of efficiency and those of larger farmers--i.e., that the two groups are equally efficient. The results of these studies are summarized in the second part of Table A.9 in the annex.

Sidhu (1974) analysed four years of pre- and post HYV (1970-74) data from a sample of Punjabi farms and concluded that small and large farmers had equal price, technical and overall economic efficiencies. He attributed the differences between his results and those of Lau and Yotopoulos (1973) to the fact that they used

pre-HYV 1950s FMS data. In the 1950s and under traditional technologies, the greater intensity with which labor was managed and supervised on small farms--the main source of their apparent superiority in technical efficiency--was a decisive factor. As the overall importance of the quality of labor inputs fell with the introduction of HYVs, (while cash inputs like fertilizers became critical), small farms' advantage in terms of technical efficiency eroded--and with it, the overall economic efficiency gap.

This erosion is confirmed by a number of recent studies based on post-HYV data -- for example, three by Bagi (1979a, 1979b, 1981) for the wheat region of Haryana based on 1969-70 data, and one by Kalirajan (1981) for the rice region in Coimbatore (Tamil Nadu) based on 1977-78 data. These studies conclude that small farmers match (but do not exceed) large farmers in price, technical and overall efficiency. Even the work done by Janankar (1978a), based on 1974-75 data, does not reject the hypothesis of equal relative economic, price and technical efficiency on small and large farms while rejecting the hypothesis of their absolute price efficiency (i.e. that they maximize profits).

The relationship between efficiency and farm size in Pakistan is examined in studies by Khan and Maki (1979, 1980), both of which are based on the 1974 post-HYV data. The first of these studies used estimated profit functions for all crops on small and large farms; it found no significant size-based differences in technical or price efficiencies or the two efficiencies jointly, but did report increasing returns to scale. The second was based on estimates for HYV wheat and rice only (the two crops for which the HYV breakthrough has been most dramatic); its results suggested that large farmers (with holdings of more than 12.5 acres) were more economically efficient than smaller ones, that both groups were absolutely price efficient, at least in the Punjab (i.e. they were maximizing profits), and that there were

increasing returns to scale. They estimated that large farmers were "more efficient" than small farmers by 18 percent in the Pakistani Punjab, and by 51% in Sind. They attributed this to (i) the comparative advantage of large farmers in obtaining inputs (especially subsidized capital inputs such as fertilizers, tubewells and canal water) and information; and (ii) the incidence of tenancy among smaller holdings (specially in Sind) where tenants had lower access to inputs than owners. These results thus support the contention that any efficiency advantages held earlier by small farmers are being eroded by the impact of the new technologies, especially if access to the relevant inputs is uneven or unavailable to them.

Policy Implications of Productivity and Efficiency Findings

The evidence presented above suggests an approach to agricultural strategy that differs from previously accepted policies based on the so-called "superiority of small farms." According to the received wisdom on the subject, the inverse relationship between farm size and productivity/efficiency made small peasant farms based on family labor inherently superior to larger farms based mainly on wage labor. The former were said to cultivate their land more intensely, to use more labor (and non-labor) inputs per unit of cultivated area, to irrigate a greater proportion of their land, to be more inclined to produce a multiplicity of crops, and to choose among crops that were more remunerative. For all these reasons, they produced more, and more efficiently, from a given set of resources (especially scarce land); by contrast, in the context of Asian agriculture, larger farmers suffered from diseconomies of scale. Small was not only beautiful but efficient.

The policy implications were clear. If small peasant farms based on family labor were more productive and efficient units than larger 'capitalist' farms based on hired labor, then the

former should be explicitly encouraged, while the latter, being "inferior," were not to be supported by policy. Moreover, since it appeared that larger holdings could be broken up into smaller units with no losses (indeed with expected gains) in productivity and efficiency, then redistributive land reforms, including transfers from big to small farms through sales or leasing arrangements, were appropriate on productivity as well as equity grounds. Finally, ownership holdings were apparently superior to tenant holdings. "Land to the tiller" thus seemed to be a policy of sound economics as well as social justice, and growth would be maximized by an agrarian structure consisting of peasant families owning small units of land "in the same ratio as the overall family-land ratio," 50/ which they cultivated with their own labor.

All the rhetoric to this effect ignored the basic causes of the so-called superiority of small farms. As I have shown, small farmers' vaunted productivity advantages derive mainly from higher input intensities--primarily in the form of family labor--under traditional technologies. As land and capital are costly, while labor is relatively cheap on small farms, this outcome is hardly surprising, especially in a labor abundant system. The observed efficiency of small farmer agriculture can thus be characterized as static and an outcome of marked imperfections.

But there is another interpretation. Apart from the fact that the inverse relationship is not universal, it can be argued that its existence reflects not so much the greater efficiency of smaller farms as it does their conditions of distress! As Bhardwaj (1974) and Chattopadhyay and Rudra (1976) cogently argue, one needs to distinguish between forces that drive small farmers to intensive efforts from those that permit them to make them. Factors of the latter kind include (i) the cheapness of labor; (ii) indivisibilities of capital, (iii) superior land quality (where this is in fact the case) and (iv) the application of

better quality management to a smaller unit of land. But important factors also drive farmers to put forth enormous efforts, whether they wish to or not. The most important of these is sheer survival. A peasant family with a small piece of land surrounded by a vast population of unskilled labor competing for employment can only survive by maximizing the output of the family plot. The smaller the holding, the more intense the family's effort must be. In addition to this own-resource effort, the farmer will use hired labor and other inputs to the maximum possible extent, will improve the quality of his land by direct labor investment in small irrigation, levelling, and drainage, and will leave as little of it fallow as possible. Finally, he will cultivate as many crops as possible, choosing them on the basis of their contribution to the family's priority needs for consumption and cash. Thus it is their very distress and the urge simply to survive that compels "small farmers to endeavour in all possible ways to eke out a subsistence from their small land fragments,... [if this fact is to] be made the basis of a policy for preserving small farms as they are, the result would be the destitution and expropriation of poor peasants and the promotion of capitalist farming on a large scale in the countryside." 51/

As the changing relationship between farm size and productivity/efficiency with traditional and HYV crops has shown, the issue is not one of size alone but of production relations, technology and market imperfections. If (i) all markets were perfect and all decision units in agriculture were price takers, (ii) there were no indivisibilities in production, and (iii) there was equal access to all inputs, then small and large farms would do equally well. But given changes in technology that enhance the importance of capital-intensive inputs, the introduction of new indivisibilities in the production process (especially tubewells and farm machinery), and market imperfections whose effect is to deny access to small farmers, the advantages of the latter based on labor intensity are bound to erode. Their former superior

efficiency was not inherent, but rather the outcome of market and production relationships in traditional agriculture. Under the new technology, these same causal factors have tilted the efficiency/productivity advantage towards larger farmers instead; this group's superior ability to obtain non-labor inputs on which the success of the new crop varieties depends, and the real economies of scale inherent in mechanization, appear to be decisive. Small farms will continue to use more labor per unit of area, but there is no longer any a priori reason "for seeking the salvation of India agriculture, as some have done, in cutting up holdings into smaller units in pursuit of efficiency." 52/

This does not imply, however, that there is a case for larger farms that will only exacerbate the problem of excess rural labor supply, replace small peasant farms by commanding critical resources, and expose peasants to greater economic insecurity. Indeed, land redistribution remains a worthy goal--but on grounds of social equity rather than because of any presumed inherent productivity advantage. The critical issue, however, is not so much adjusting the distribution of land (in either direction), as how to get adequate non-labor resources to all farmers, and particularly to those who are currently least able to obtain them, i.e., marginal and small cultivators.

Finally, it should be noted that even if markets were perfect, the problems of capital indivisibilities and the small resource base of small and marginal farmers would still remain. The polar solutions, of supporting non-viable peasant farming on one hand or promoting larger, so-called 'capitalist' farming on the other, are not the only available options. As Rudra and Sen (1980) point out, cooperative farming represents an alternative approach. I shall return to this theme later. Meanwhile, I conclude by briefly noting two other important characteristics of small farmers that would help to shape their responces to economic forces: (a) their attitude to risk and uncertainty, and (b) the

dual nature of the small agricultural household as both "firm" and "household", as these terms are used by economists.

Attitudes toward Risk and Uncertainty

Farming is a chancy business under any circumstances. Because the incomes of small farmers are close to survival levels, however, any shortfalls put their very existence at risk. It has consequently been argued that they will be more reluctant than those who are a little further from the possibility of total destitution to try the 'new' and the 'improved'; they will, it is suggested, naturally cling more readily to the 'traditional' farming practices with which they are familiar, and which will at least assure their survival. (Other observers contend, however, that precisely because they are so close to bare survival levels, they should be--and perhaps in fact are--more willing than those whose position is more assured to try new approaches, to risk all, as it were, in order to move out of the extremes of poverty and insecurity.)

As well as having minimal incomes, small farmers have few or no assets to fall back on in case of dire need or any failure consequent upon risk-taking. Lacking stocks of foodgrain, livestock, cash, or land as reserves against emergencies, they can only meet setbacks by borrowing, using what little land they may have as collateral. The evidence of distress sales of stocks and land cited elsewhere [53/] suggests how these meagre reserve assets can be lost.

Even if their often desperately low incomes and minute asset bases do not necessarily lead all small and marginal farmers to be highly adverse to risk, these characteristics evidently make them peculiarly vulnerable to any adverse changes in agroclimatic, technological, or policy conditions. I may thus sidestep the psychological debate about the extent to which desperate straits

promote or deter risk-taking, and concentrate instead on the reaction of small farmers to change and uncertainty. One central question about small farmers' behavior under uncertainty has to do with their ability to adopt new methods, varieties, and technologies. Is "small farmer behaviour" a barrier to the adoption of new technologies? I will examine this important issue later when dealing with the available evidence on the adoption of HYVs (Section C). Here I only note the existence of the problem of vulnerability to uncertainty.

Finally, the problem is not just of a single type of uncertainty related to crop production issues (yields, prices, input availabilities) but of a whole constellation of uncertainties (with regard to variables such as the birth of children, the availability of food, work opportunities, vulnerabiltiy to disease, income and asset levels, financial obligations, and crop-related issues not directly related to cultivation *per se*, such as storage and marketing) under which small farmers and the landless make decisions. A methodology and models are needed for understanding the simultaneous impact of multiple contingencies on individual households. Unfortunately, work on multiple and simultaeous risks and their implications for poverty has only just begun, and I cannot draw on much research at this stage. 54/ But in considering programs designed to be implemented among the very poor, one must constantly bear in mind that this group has to face the possibility of disaster from several directions at once, so that overcoming a single threat, or source of uncertainty, may not be enough.

The Small Farm as Both "Firm" and "Household"

All family-based agricultural units combine the attributes of two fundamental microanalytical entities--the household and the firm. 55/ Traditional economic theory has dealt with each separately by simplifying the economic allocation problem,

described in terms of constrained utility maximization. The resulting dichotomy, both in theory and in empirical estimates based on it, is acceptable for economies in which consumers derive most of their income from wages or assets without having any influence over how the firms that provide those wage or asset incomes take their decisions.

These distinctions are unhelpful, however, when I examine how decisions are made in the farm sector. In what Nakajima (1963) has called family-farms, the 'household' (as in a 'normal economy') depends upon the firm to provide its consumption requirements for food and other needs, while the 'firm' depends upon the 'household' to provide its major input into production--family labor. But because the family farm unit is at one and the same time both 'firm' and 'household', its decision-making processes must simultaneously take into account the kinds of considerations applicable to each of these normally discrete units.[56/]

Consequently, small farm agriculture is often characterized by subsistence production. The farm as household depends upon the farm as firm to supply its main consumption items, and the latter's production efforts concentrate on meeting these needs directly rather than producing for the market. This in turn reduces small farmers' responsiveness to market incentives; the consumption requirements of the farm as household also represent a constraint on both the product mix and the marketed surplus of the farm as firm.

Small farms' choices between leisure and income (the amount of family labor offered for work), between present and future income (consumption versus saving) and between retained and marketed output (the amount of total income converted to monetary income) in turn affect their choices between different (i.e. labor or capital intensive) technologies, between production and investment outlays (variable and quasi-fixed inputs), between

subsistence and commercial output (outputs for consumption and outputs for sale), and between owned (i.e. "traditional") and commercial (i.e. "modern") inputs.

The interdependence of the small farm as "firm" and as "household" means that its economic decisions and activities in one role cannot be separated from those in the other; they must instead be treated in an integrated framework. 57/

As noted in the preceding subsection, small farmers have relatively few resources. They have fewer means than larger units to control or circumvent uncertain outcomes and face more serious consequences if things go wrong. The source of uncertainty may be either the household--family illness, death of head of household--or the firm--crop disaster, low output prices. the complexity this introduces in evaluating the response of subsistence households is only now being recognized.

Given the overriding imperative of meeting subsistence and survival goals, small farmers' response to profit maximizing economic opportunities is likely to be limited. It has been suggested that all farmers have multiple goals and that subsistence needs represent an organizing variable determining the hierarchy of goals that small farmers may be expected to pursue--with their primary efforts devoted to subsistence and survival and subsequently only residual resources available for profit maximization goals. 58/ It is hard to test whether small farmers actually make decision on this basis, but subsistence and survival are certainly likely to be prime determinants of the nature of their response to, e.g., economic incentives and risk. This fact needs to be kept in mind when evaluating small farmers' behavior under uncertainty.

ENDNOTES

1/ South Asia here refers only to India, Bangladesh and Pakistan.

2/ See C. Wharton (1963), J. Mellor (1970), Nakajima (1970).

3/ See N. S. Jodha (1972, 1979).

4/ This does not mean that total marketed surpluses are small in predominantly sharecropped areas; landlords may still sell the in-kind rent they receive in local markets.

5/ There is a vast literature devoted to the study of marketed surpluses in South Asia. See among others B. Harris (1977), U. Patnaik (1975), R. Krishna (1962), V. Anand (1974), M.K. Gupta and Sharma (1970) A. Rahman (1975), Wickeramasekara (1974), Jasdanwalla (1966), M. Raquibuzzaman (1970), A. Bankhopadhayay (1978), for data in support of the above contentions.

6/ See in particular Raj Krishna (1962), but also see Gupta and Sharma (1970), B. Harris (1977), A. Rahman (1975) and V. Anand (1974).

7/ He gives the following cumulative percentages of holdings and shares of total foodgrain production in 1970-71: 25 percent of production was supplied by 0.72 percent of the holdings, 50 percent by 7.4 percent of the holdings, 75 percent by 24.3 percent of the holdings and 90 percent by 50 percent of the holdings. See Vyas (1977). These figures were computed from the Agricultrual Census data; since they made the assumption that yields and cropping patterns did not vary with farm size, they are probably not very reliable.

8/ Many small and marginal farmers are known to be net purchasers of foodgrains, which they try to pay for by earning cash incomes from the sale of other crops or from farm and non-farm employment. See Dandekar (1964) and Bhagwati and Chakravarty (1969).

9/ See evidence from both the pre and post-HYV periods cited by, for example, Bhardwaj (1974), Saini and Bhattacharya (1971), Chattopadhya and Rudra (1976), Bhattacharya and Saini (1972), Bardhan (1973), and more recently S. S. Bhalla (1979), for India, and M. H. Khan (1975, 1977) for Pakistan.

10/ See Chayanov (1929), A. K. Sen (1964), Nakajima (1957), J. Mellor (1965).

11/ This is true even when small farms make use of some hired labor in the busy season. See D. Mazumdar (1965).

12/ This is true even when small farms make use of some hired labor in the busy season. See D. Mazumdar (1965).

13/ See especially A. K. Sen (1962, 1964). At one extreme, small (peasant) farms are assumed to be producing output with family labor only, while at the other extreme large (capitalist) farms are producing output with hired labor only; the former maximizing total output and the latter, farm profits. Most family-farms are in an intermediate postion, however, in which some hired labor is used.

14/ Family labor is therefore said to be paid the average rather than the marginal product of its labor, with the former often exceeding the latter where returns to additional effort are very low. See Sen (1975).

15/ The mistaken view that small farmers do not use hired labor dates back to Chayanov's (1929) work on the theory of the peasant economy, in which peasant households were defined as those that do not employ wage labor. This primitive notion of a "peasant farm" has persisted into modern times. For example Jannuzi and Peach (1980) classify farms in Bangladesh on the basis of whether or not they do their work solely with family labor, despite the fact that only a very small percentage of farmers in South Asia rely only on this source of labor.

16/ See, for example, K. Nair's (1980) description of the attitude towards work of the landholding classes in Punjab compared to Bihar.

17 This inverse relationship has been extensively documented for countries in Latin America and Asia. See A. Berry (1973), Cline (1970), Griffin (1974), but particularly the excellent review of the evidence in Berry and Cline (1979).

18/ The literature on farm size and productivity is vast and keeps growing. The FMS results and their implications were discussed by Sen (1962, 1964), Mazumdar (1963) Khusro (1964), Agarwala (1964a, 1964b), A. P. Rao (1967) and C. H. H. Rao (1966). The evidence from the 1950s was reviewed by Bhardwaj (1974a, 1974b) who also presented the first comprehensive findings of the inverse relationship from the FMS data.

19/ See for example Saini (1971), Saini and Bhattacharya (1972), Bhattacharya and Saini (1972) for the most comprehensive studies on the subject.

20/ See the study by Bagi (1979a, 1979b) for Haryana, Chaddha (1978a, 1978b), for Punjab, Dasgupta (1977) for evidence from the AERC studies, and S. S. Bhalla (1979) for analysis of the 1970-71 NCAER data.

21/ See again Saini and Bhattacharya (1972) but specially the review of the metholodogies and evidence by Chattopadhyay and Rudra (1977).

22/ See the early scepticism expressed by Rudra (1966, 1968a, 1968b), and U. Rani (1971), R. Sau (1971), A. P. Rao (1967) and Arabinda Ghose (1973). For a more recent result showing no inverse relationship between size and productivity, see V. Rao and T. Chotigeat (1981).

23 This concern with modes of production has been particularly strong among those seeking to explain the special backwardness of agriculture in Eastern India and Bangladesh. See Alamgir (1978), A. R. Khan (1977), Griffin (1974) and A. Ghose (1979b).

24/ A 'peasant' farm was defined as one where more than 50 percent of the labor used was family labor and an 'employer' farm as one where more than 50 percent of the labor was hired labor; a tenant farm was defined as any holding that leased-in any land.

25/ See G.R. Saini (1971) and Bhattacharya and Saini (1972).

26/ Khusro (1964) also showed that the negative relationship between size and yields disappeared if a land revenue index was used as a proxy for quality. Again, however, the findings were not conclusive, because of a circularity in the argument, in that the superior productivity of small farms may be reflected in higher prices of their land--a circularity recognized by Bhalla.

27/ Indeed even in the most sceptical review of the evidence by Chattopadhyay and Rudra (1976) three findings were conclusive (a) intensity of cropping, (b) incidence of irrigation and (c) total inputs per acre were negatively associated with farm size in all states. Also see Bhardwaj (1974), B. Dasgupta (1977).

28/ See Bhardwaj (1974), M.H. Khan (1977), Saini and Bhattacharya (1977).

29/ See Bhalla (1979) p. 153 for results from the 1970-71 NCAER data.

30/ See Lipton (1977)

31/ Bhardwaj (1974).

32/ For India see particualrly Bhardwaj (1974), but also Saini and Bhattacharya (1972), Saini (1979) and A. S. Haider (1977); for Bangladesh see I. Ahmed (1980).

33/ See again Bhardwaj (1974), S. S. Bhalla (1979) and M. H. Khan (1979) for conflicting evidence.

34/ Another influence may be the role played by uncertainty. For example Srinivasan (1972) has shown that where yields are uncertain owing to weather conditions, it would be desirable for small farmers to use more inputs per unit of area, even in the absence of imperfections in factor markets or variations in land quality owing to differences in irrigation per unit of area. Attitudes to risk and uncertainty are discussed further in subsection B(vi).

35/ See Bennett (1967) cited in Bhalla (1979) p. 159.

36/ Many studies show a lower marginal product for labor in smaller farms. See Bhardwaj (1974), Saini (1979) and recently Bagi (1979).

37/ All studies concur on the importance of labor intensity as a significant factor. See. C. H. H. Rao (1975) and Saini and Bhattacharya (1972). See also Bhalla (1979) and Bagi (1979) who try to test this hypothesis. Both results tend to confirm the presence of labor market dualism. Bliss and Stern (1976) also noted that wages paid in different markets varied a great deal.

38/ Economic efficiency is divided into technical and allocative or price efficiency. A group of farms is considered technically more efficient than another group if it can produce a given output with less of some or all inputs (i.e. it has higher profits), while it is considered to be allocatively more efficient than another group if it is more successful in equating marginal revenue and factor costs for each of its variable inputs (i.e., it is more successful in maximizing profits). See Yotopoulos and Lau (1979 p. 11-22). The operational concepts of economic efficiency were developed by Lau and Yotopoulos (1971, 1972), and Yotopoulos and Lau (1973). For a complete exposition and several case studies, see Yotopoulos and Lau (1979).

39/ The fact of government intervention in factor and product markets does not invalidate the methods, as long as farmers are price takers, i.e., their decisions do not affect prices.

40/ See the early works by Schultz (1964), Hopper (1965), Khusro (1964), and Sahota (1968), followed by the studies done by Yotopoulos, Lau and Somel (1970), Yotopoulos and Lau (1971)

and more recently the work by Sidhu (1974a, 1974b), and Bagi (1979, 1981) for India and Khan and Maki (1977, 1979) for Pakistan. For other studies in the Asian context see Barnum and Squire (1976) and the studies reported in Yotopoulos and Lau (1979). All these show that the assumption of profit maximizing behavior cannot be rejected.

41/ See in particular Day and Singh (1977), Kapteyn (1979) and Lipton (1967).

42/ The exception is Day and Singh (1977), who use the notion of 'satisficing behavior' to model farm responses during the green revolution in the Indian Punjab.

43/ Nonetheless it is the best evidence available (see Table A4.9 in the annex for summaries of studies). An alternative approach would be to concede that no models exist to test efficiency under imperfect market conditions. The evidence we have to date on most issues uses perfect market assumptions because the economic theory of imperfect competition has been a neglected area in spite of its overwhelming importance in the real world, especially in LDCs.

44/ "Weakened," here and subsequently implies that a statistically significant negative relationship has become insignficant or that an insignificant positive relationship has been found. A "reversal" means that a statistically positive relationship has been found.

45/ See especially Chattopadhyay and Rudra (1976, 1977) who (as noted earlier) argued against generalized statements of the inverse size-productivity relationship discussed in the preceding subsections.

46/ See Bhattacharya and Saini (1972), and G. K. Chadha (1978).

47/ Most of the so called HYVs were actually released in the late 1960s. By 1974/75 only 23 percent of the area in Bangladesh, 62 percent in India and Pakistan, was planted to HYVs; in the case of rice only 15percent in Bangladesh, 30 percent in India and 40 percent in Pakistan was planted to HYVs. Of the Indian HYV wheat area 59 percent was in three states--Uttar Pradesh, Punjab and Haryana. See D. Dalrymple (1976).

48/ The findings shown were based on studies done by the Planning Commission's Program and Evaluation Organization, Global-2 Studies and evaluative work done by the Agro Economic Research Centers (AERC).

49/ Expenditures on fertilizers rose between 1967-68 and 1971-72 as follows: for HYV wheat in Ferozepur (Punjab) on small farms

(below 6 ha), from Rs. 129 to Rs. 222 per ha; on large farms (over 15 ha), from Rs. 113 to Rs. 406 per ha [A. S. Kahlon and G. Singh (1973a)]. In Rajasthan expenses on fertilizers were Rs.62/acre for small (below 5 acres) and Rs. 127/acre for large (40-60 acre) farms in 1971-72. [Bapna (1973)]. For HYV rice in Gurdaspur, Punjab, small farmers spent Rs. 227 and larger farmers Rs. 369 per ha on fertilizers in 1971-72. [Kahlon and Singh (1973b)]. But in Birbhum, W. Bengal and Cuttack, Orisa, small farmers spending on fertilizers and pesticides matched or exceeded large farmers' outlays. [M. Ghosh (1969) and AERC Vishwabharati (1967)].

50/ Since fertilizer use is highly complementary to HYVs and irrigation, any one variable can be used on a proxy for the level of technical change. The zero level therefore essentially represents traditional technologies.

51/ See Singh, Day and Johl (1975) where soil differences are shown to be a barrier to different cropping systems.

52/ Bhagwati and Chakvarvarty (1971) quoted in Chattopadhyay and Rudra (1976).

53/ Chattopadhyay and Rudra (1976 p. A115).

54/ Rudra and Sen (1980), p.394.

55/ Extra Distress sales are discussed in Chapter 2 of my forthcoming publication "The Great Ascent: The Rural Poor in South Asia".

56/ Apart from work by Lipton (1979a, 1979b) and Jodha (1978), little analysis is available on this question.

57/ This section draws heavily on Day and Singh (1977) and Singh and Squire (1978).

58/ In formal terms, the farm as household's decision to maximize utility subject to its income and time constraints is no longer independent of the farm as firm's decision to maximize its profits subject to its resource constraints; the household income equation now depends fundamentally upon farm profits, while the allocation of household members' time has to account not merely for trade-offs between leisure and wage incomes but also between these two and the employment needs of the farm as firm. This latter depends upon production technology and the firm's profit maximizing conditions. See Barnum and Squire (1979) and Singh and Squire (1980).

59/ See I. Singh (1971, 1973). The recognition of this interdependence dates to the seminal work of the Russian

agrarian economist Chayanov (1966). The development of an integrated theory is also due, among others, to the work of Mellor (1965), Sen (1966), Berry and Soligo (1968), Nakajima (1969), Krishna (1969), and Jorgensen and Lau (1969). Data deficiencies, however, have limited the number of empirical applications. For a recent review of empirical work in using farm-household models see Singh, Strauss and Samira (1984).

60/ See particularly the role of multiple goals and the theory of satisficing and lexicographic behavior emphasized by Georgeson-Rogen (1954), Ignatus (1964), Day (1971) and Ferguson (1965). For an empirical application of these ideas see Day and Singh (1973).

ANNEX TABLES

Table A.1

BANGLADESH: AREAS DEVOTED TO FOOD AND CASH CROPS (MYMENSINGH DISTRICT)

Size of Holding (Acres)	% Area Cropped	
	Cash Crop (Jute)	Food Crop (Rice)
0 - 0.49	39.1	60.9
0.5 - 0.99	28.8	71.2
1.0 - 2.49	24.5	75.5
2.5 - 4.99	23.8	76.2
5.0 - 7.49	24.5	75.5
7.5 - 12.49	24.8	75.2
12.5 Over	26.3	73.8

Source: Kunreuther and Wright (1979), p. 216.

Table A.2

PAKISTAN: CROP PRODUCTION, CONSUMPTION AND SALES BY FARM SIZE IN 1976-77 (ALL CROPS)

Farm Size Group (Acres)	Average Value of Crop Output (Rs)	Proportion of Crop Output (%)		Sample (%)
		Sold	Consumed	
0.0 < 5.0	2100	18	37	11
5.0 < 7.5	4234	23	25	12
7.5 < 10.0	4752	20	28	11
10.0 < 12.5	5464	27	27	13
12.5 < 15.0	6687	22	24	11
15.0 < 20.0	7493	27	26	13
20.0 < 25.0	8399	33	26	8
25.0 < 37.5	12,446	36	22	12
37.5 and over	29,036	53	16	10
All Sizes	8,607	36	22	100 (2002)

Source: Calculated from data provided in the IBRD "Extended Agro-Economic Survey of the Indus Basin."

Table A.3

BANGLADESH FAMILY CONSUMPTION AND MARKETED SURPLUS OF AUS AND AMAN RICE IN BOGRA DISTRICT, 1977

Size Group (acres)	Average Production of Rice per Household (Mds/Household)	Proportion Consumed by Family (%)	Proportion Sold (%)
Landless	2	87	7
0 - 2.5	23	82	8
2.5 - 5.0	66	79	12
5.0 - 10.0	92	73	18
over 10.0	123	77	19
ALL GROUPS	61	78	14

Source: Computed from Parameter Systems Corporation, "Rural Development Project-I Survey Report for Bogra District" (Table VI A) Dacca, October 1977.

Table A.4

INDIA: MARKETED SURPLUS OF WHEAT AND PADDY, 1967-1972
(VARIOUS STATES)

Size Group of Holding (Hectares)	% of Wheat Output Marketed	
1. Ferozpur, Punjab	1967-68	1971-72
<6	23.4	65.1
6-14	51.1	66.9
>14	80.0	81.4
3. Kota, Rajasthan		
<2		28.1
2- 4		33.4
4- 6		41.4
6- 8		42.6
8-12		58.3
12-16		53.1
16-24		49.4
>24		62.6

Size Group of Holding (Hectares)	% of Wheat Output Marketed		% of Paddy Marketed	
2. Haryana Villages, 1971-72	Ban	Mesana		
<2	55	-		
2-4	61	78		
4-6	63	77		
>6	59	82		
	Ratnagarh	Mirka		
<2	51	43		
2-4	61	36		
4-6	76	39		
>6	77	60		
4. Hooghly, West Bengal			1970/1-72/73	
0.5			8.0	
0.5-1.0			13.3	
1.0-1.5			14.5	
1.5-2.0			21.7	
2.0-3.0			17.7	
3.0-4.0			24.8	
4.0-6.0			38.7	
Over 6.0			43.3	
All Sizes:			19.4	
5. West Godavari, Andhra Pradesh, 1969-70			Kharif	Rabi
<1			6.5	76.4
1-2			29.8	83.8
2-3			16.8	81.7
3-6			30.2	80.2
6-10			39.0	96.7
>10			70.6	97.4
All Sizes:			45.3	92.4

Sources:
1. A. S. Kahlon and Gurbachan Singh, "Social and Economic Implications of Large Scale Introduction of High Yielding Varieties of Wheat in the Punjab with Special Reference to the Ferozpur District," Punjab Agricultural University, 1973, cited in B. Dasgupta (1977) pg. 223.
2. H. Laxminarayan, "The Social and Economic Implications of Large Scale Introduction of High Yielding Varieties of Wheat on Haryana, A.E.R.C., University of Delhi, 1973, cited in B. Dasgupta (1977) pg. 224.
3. S. L. Bapna, "Economic and Social Implications of Green Revolution: A Case Study of the Kota District." A.E.R.C., Sardar Patel University, Vallabh Vidyanagar, 1973, cited in B. Dasgupta (1977) pg. 224.
4. Government of India, Directorate of Economics and Statistics, "Studies in the Economics of Farm Management in Hooghly District (West Bengal), Three Year Consolidated Report (1970-71 to 1972-73)," pg. 45, Table 6.5. Note: The proportions are of "sale as a % of total receipt (in kgs.)," averaged for the three years.
5. P. S. George and V. V. Choukidar, "Dynamics of the Paddy-Rice System in India," CMA Monograph No. 42, Indian Institute of Management, Ahmedabad, 1973, pg. 111 (percentage of paddy production utilized for sales).

Table A.5

INDIA: DISTRIBUTION OF OUTPUT AND MARKETED SURPLUS BY SIZE OF HOLDINGS: 1950-51 AND 1961-62

I. (1950-51)

	I			II		
Size of holding (acres)	Marketed surplus (Rs. crores)	(1) As % of value of output	(1) As % of total marketed surpus	Marketed surplus (Rs. crores)	(4) As % of value of output	(1) As % of total marketed surplus
	(1)	(2)	(3)	(4)	(5)	(6)
0- 5	266.7	20.7	24.9	564.0	33.6	26.0
5-10	175.8	14.1	16.4	444.8	27.4	20.5
10-15	54.7	9.7	5.1	170.1	23.1	7.9
15-20	80.1	18.2	7.5	172.8	30.1	8.0
20-25	54.0	20.4	5.0	111.0	32.2	5.1
25-30	65.4	28.8	6.1	116.8	39.7	5.4
30-40	80.5	29.9	7.5	139.6	39.8	6.4
40-50	67.8	38.0	6.3	107.8	46.4	5.0
50 and above	228.0	44.8	21.2	339.9	51.4	15.7
Total	1073.0	21.5		2166.8	33.4	

Source: (I) Dharm Narain. "Distribution of the Marketed Surplus of Agricultural Produce by Size Level of Holdings: 1950-51." Bombay 1962. p. 35 and (II) Dantwala (1959).

II. (1961-62)

Size-Class (average)	1961-62 Percentage of Holdings	1961-62 Percentage of Area	Total gross value of output (Rs. crores)	Total value of retained output (Rs. crores)	Total value of marketed surplus	Percent of output marketed	Percent of total marketed surplus	Percentag of total output
(1)			(2)	(3)	(4)	(5)	(6)	(7)
0-2.5	39.1	6.9	683.62	516.38	137.37	20.09	5.44	9.62
2.5-5.0	22.6	12.3	1106.75	789.54	273.23	24.69	10.82	15.57
5.0-10.0	19.8	20.7	1610.05	1119.53	429.00	26.65	16.98	22.66
10.0-15.0	7.9	14.2	908.44	592.92	281.25	30.96	11.13	12.78
15.0-20.0	3.8	9.6	599.79	359.74	213.23	35.55	8.44	8.44
20.0-25.0	2.3	7.4	419.05	217.27	186.67	44.55	7.39	5.90
25.0-30.0	1.3	5.3	327.93	154.63	161.41	49.22	6.39	4.62
30.0-50.0	2.2	12.0	773.25	327.77	417.61	54.01	16.53	10.88
50 and over	1.0	11.6	676.93	233.92	426.54	63.01	16.88	9.53
All	100.0	100.0	7105.82	4311.70	2526.34	35.55	100.00	100.00

Source: Utsa Patnaik (1975), p. A.96 and Table ____ in this study on distribution of land holdings and area.

Table A.6

INDIA: MARKETED SURPLUS OF WHEAT BY SIZE OF HOLDINGS IN PUNJAB, 1971-76

Districts	Percentage of Output Marketed by: Small Farms	Medium Farms	Large Farms
(a) Ludhiana	(less than 2 ha)	(2-4 ha)	(over 4 ha)
Avg. 1971-2 to 1973-4	46.7	54.6	59.3
1974-1975	61.7	66.6	72.7
1975-76	64.4	74.3	76.9
(b) Mehsana			
Avg. 1971-2 to 1973-4	41.5	39.4	41.8
1974-1975	45.0	56.8	60.0
1975-76	43.0	54.8	47.7
(c) Ferozepur	(less than 6 ha)	(6-15 ha)	(over 15 ha)
1967-68	23.4	51.1	80.0
1971-72	65.1	66.9	81.4

Sources: (a), (b) D.P. Mathur and V.K. Gupta (1977), p. 79-80.

(c) A.S. Kahlon and G. Singh (1973) cited in B. Dasgupta (1977) p. 223.

Table A.7

INDIA: EAST PUNJAB: GRAIN SURPLUS AND PURCHASES BY FARM SIZE IN LUDHIANA, 1962-63

(% of total production in each size group)

Size of holding (acres)	Wheat			Grain		
	Marketable surplus	Marketed surplus	Purchases	Marketable surplus	Marketed surplus	Purchases
Under 5.0	- 4.90	18.24	22.33	7.33	41.33	34.00
5.0 - 10.0	34.98	35.53	0.55	24.54	28.85	4.31
10.0 - 15.0	36.53	36.78	0.25	26.62	28.70	2.08
15.0 - 20.0	43.47	42.36	-	28.10	25.62	-
20.0 - 25.0	50.60	48.86	-	34.43	31.42	-
Over 25.0	50.80	49.73	-	36.82	33.99	-
Average	43.38	43.21	0.72	31.08	30.26	1.27

Adapted from: H.N. Dvivedi "A Study of the Factors Governing the flow of Marketable Surplus of Important Crops in Ludhiana Districts" (unpublished). Punjab Agricultural University, Ludhiana, cited in J.R. Moore, S.S. Johl and A.M. Khusro (1973) pp. 31-2.

Table A.8

SOUTH ASIA: RELATIONSHIP BETWEEN FARM SIZE AND PRODUCTIVITY, THE PRE-HYV PERIOD

Years	Study	Region	Data Notes	Data Source	Inverse Relationship	Conditional or Methodological Remarks
1954-59	A.K. Sen (1962)	All India	Various district	F.M.S.	Holds	By and large productivity per acre decreases with the size of holding
1955-56	D. Mazumdar (1965)	North India	Two villages in U.P.	F.M.S.	Holds	Small farms may not be "viable"
1955-56	C.H.H. Rao (1965)	West India	Three districts, Maharashtra	F.M.S./ Author	Holds	Size and not wage differentials are important in explaining relationship
1954-57	A.P. Rao (1967)	North India	Disaggregated data, 3 villages in Punjab and U.P. 249 observations	F.M.S.	May not hold	Productivity, input use, irrigation per acre, don't vary by size
	A. Rudra (1968)	North India	Disaggregated data -- 17 districts, 20 villages in Punjab, Haryana and U.P.	A.E.R.C	Does not hold	(a) In correlating gross area with output (does not hold) (b) In correlating net area with output (holds for all crops, not individual crops)
1959-60	S.K. Sanyal (1969)	All India	State level data; all states	N.S.S. (16th round)	Probably holds	Large farms have lower land use, attached workers, investible surplus and inputs per acre
1957-64	Usha Rani (1971)	West, South and East India	Individual farm level data from M.P., Kerala, A.P. and Orissa (1431 observations)	N.S.S.	May not hold	Statistically weak basis for inverse relationship
1954-68	G.R. Saini (1971)	All India	Disaggregated data from 9 states, 11 districts and 25 cases	F.M.S.	Holds	Statistically significant inverse relationship
1955-57	N. Bhattacharya and C.R. Saini (1972)	North India	Disaggregated farm level data from U.P. and Punjab	F.M.S.	May not hold	Intravillage differences, relationship holds for Mozaffarnagar, U.P. and not for Ferozepur, Punjab
1954-57	K. Bhardwaj (1974)	All India	Aggregate data from 6 states, 9 districts, 25 cases	F.M.S.	Appears to hold	Not always statistically significant
1956-71	G.K. Chaddha (1978)	North India	Twelve districts in Punjab	F.M.S./Ag. Census	Holds	In all districts
1955-57/ 1968-73	A.K. Ghose	North and East India	Farm level data from Hooghly, W.B., and Ferozepur, Punjab	F.M.S.	Holds	Relationship exists independent of production relationship
1962-70	V. Rao and T. Chotigeat (1981)	South India	Pooled data from Kerala, Tamil Nadu and Andhra Pradesh	F.M.S.	Does not hold	Does not hold especially with increased capital and cropping intensities

Table A.9

RELATIONSHIP BETWEEN FARM SIZE AND EFFICIENCY: EVIDENCE FROM SOUTH ASIA

Study	Year of Data	Region and Data Description	The Relationship Between Farm Size and Economic, Technical and Price Efficiency in Agriculture
		(PRE HYV PERIOD)	
T. W. Schultz (1964)	-	-	Traditional farming is efficient.
M. Paglin (1965)	-	-	Large farmers are less efficient.
W. D. Hopper (1964)	1954	Farm level data for 43 farms in village Senapur, Janumpur, U.P.	Traditional farming is "efficient."
A. M. Khusro (1964)	1954-57	F.M.S. Data from Andhra, West Bengal, U.P. Madras, Bombay, Madhya Pradesh, Punjab	Efficiency does not decrease by farm size.
G. S. Sahota (1968)	1955-57	F.M.S. Data from Hooghly, 24-Pargana, West Bengal Ahmednagar, Nasik, Madras and U.P.	No significant differences in efficiency across farm sizes.
G. R. Saini (1969)	1955-57	F.M.S. Data from Uttar Pradesh and Punjab	Farmers are efficient but no efficiency differences appear across size of farms
P. A. Yotopoulous, J. J. Lau and K. Somel (1970)	1955-57	F.M.S. Data from West Bengal, Madras, Madhya Pradesh, U.P. Punjab	Technically small farmers are more efficient, but there are no differences in price efficiency by size.
L. J. Lau and P. A. Yotopoulous (1971)	1955-57	"	Small farmers exhibit higher level of both price and technical efficiency
P. A. Yotopoulus and L. J. Lau (1973)	1955-65	"	Technically small farmers are more efficiency, but are not different in their price efficiency.
		(POST HYV PERIOD)	
S. S. Sidhu (1974)	1967-71	Punjab, Ferozepur FMS, old and new varieties of wheat in 150 farms	No difference in economic, technical and price efficiency by farm size.
P. N. Junankar (1978a)	1969-70	Thanjavur, Tamil Nadu, F.M.S. Data, local and HYV Paddy, 150 farms	Relatively equal economic, technical and price efficiency of all farm size.
F. S. Bagi (1979a, 1975b, 1981)	1969-70	Farm level data for irrigated and unirigated farms in Haryana	Small farmers are more efficient but are no significant differences in efficiency.
M. H. Khan and D. R. Maki (1979, 1980)	1974	Pakistan, wheat and rice farms	No differences in efficiency by farm size.
K. Kalirajan (1981)	1977-78	Seventy farmers growing HYV rice in rabi season; Coimbatore, Tamil Nadu	Small and large farmers are both equally price and technically efficient.

Table A 10

RELATIONSHIP BETWEEN FARM SIZE AND PRODUCTIVITY, THE POST-HYV PERIOD

Data Years	Study	Region	Data Notes	Data Source	Inverse Relationship	Conditional or Methodological Remarks
1955-60/ 1966-70	C.H.H. Rao (1975)	North and South India	Punjab, U.P. and Andhra Pradesh	F.M.S./ N.I.C.D.	Does not hold	Relationship 'breaks down' under conditions of new technology
1967-70	S. S. Johl	North India	Farm size specific data, Ludhiana	Author	Does not hold	Growing productivity and income disparities between large and small farmers
1968-72	S. L. Bapna (1973)	West India	Kota District, Rajasthan	A.E.R.C.	Does not hold	"
1969-70	W. Khan and R.N. Tripathy (1972)	South India	West Godavari, Andhra Pradesh	N.I.C.D.	Does not hold	"
1969-70	F. S. Bagi (1981)	North India	Farm level data, Haryana	Author	Holds	Small farmers are at least as efficient as large farmers
1954-70	G. R. Saini (1980)	All India and North India	Disaggregated data, 9 states, 11 districts, 25 cases along with business income data for Punjab and U.P.	F.M.S.	May not hold	Business incomes indicate that small farmers may be as productive as large farmers
1962-73	M. Chattopadhyay and A. Rudra (1976)	All India	Disaggregated data, 10 states, 12 districts and 27 cases	F.M.S.	May not hold	Generally holds for all crops, does not hold for individual crops and does not hold in all cases and at all times
1968-71	S. S. Bhalla (1979)	All India	Panel survey over three years for approximately 3000 cultivating households	N.C.A.E.R. (A.R.I.S.)	Holds	Holds but is weakening
1970-71	A. Deolalikar (1981)	All India	Districtwise data for 272 districts	Various G.O.I./ P.E.O. sources	Does not hold	At low levels of technology (fertilizer use), inverse relationship holds, at higher levels the relationship is reversed and larger farms are more productive
1970-73	B. Dasgupta (1977)	All India	Village level crop specific studies	A.E.R.C., Global-2, etc.	Does not hold	See consolidation of evidence in Table 3.15
1974	M. H. Khan (1977)	Pakistan	Irrigated Indus Basin farms in Punjab (498)	Author	May not hold	Holds for all crops, positive for wheat
1974	M. H. Khan (1979)	"	"	"	"	Due to higher levels of nontraditional inputs in large farms
1975-76	P. L. Roy (1981)	North India	Punjab farm households (821)	N.C.A.E.R. (F.D.S.)	Does not hold	Districts with lower levels of adoption show inverse relationship while in those districts with high levels of adoption, relationship is reversed.

Table A.11

INDIA: PRODUCTIVITY AND FARM SIZE RELATIONSHIPS UNDER NEW TECHNOLOGY (1967-68 to 1972-73)

Region	Year	State	District/Village	Variety	Inference on Productivity and farm size	Source
All India	1968-69	12 states	-	HYV rice	- Clear monotic positive relationship	GOI, PEO ( )
North India	1968	Punjab	Amritsar	HYV wheat	- Highly uneven relationship, weak positive rank correlation	A. P. Rao, A.E.R.C. Study
	1966-67 1971-72	Uttar Pradesh	Muzaffarnagar	HYV wheat	- Non-monotonic negative - Weak positive	Roshan Singh, Global-2
	1972-73	Punjab	Gurdaspur	HYV rice and improved var.	- unclear - clear positive correlation	A.S. Kahlon and G. Singh A.E.R.C. Study
	1968	Haryana	Karnal	IR 8 rice	- positive correlation	A.E.R.C. Study
West India	1971-72	Rajasthan	Kota	HYV wheat	- non monotonic but high positive rank correlation	S.L. Bapna, A.E.R.C. Study
South India						
		Tamil Nadu	South Arcot Dist.			
	1972-73		- Naduveera Pattu	HYV rice	- Weak, positive correlation	V. Shanmugasundaram
	1972-73		- Athipakkam		- Strong, negative correlation	U. of Madras
	1973-73		- Periathacur		- Strong, negative relationship	
	1973-73		- Ranganathapuram		- Strong, positive relationship	
East India						
	1967	Orissa	Cuttack	HYV rice	- Strong positive correlation	A.E.R.C. Study
	1968-69	Assam	Sibsagar	HYV rice	- Weak negative correlation	A.E.R.C. Study
	1968-69	W. Bengal	Birbhum	HYV rice	- Unclear relationship, weak positive rank correlation	M.G. Ghosh, A.E.R.C. Study
	1972-73	Bihar	Sahabad	All varieties of rice		G.C. Mandal and
	1972-73	Orissa	Sambalpur		- Negative, weak relationship	M.G. Ghosh, A.E.R.C. Study
	1972-73	W. Bengal	Burdwan			

Source: Biplab Dasgupta. Agrarian Change and the New Technology In India. United Nations Research Institute in Social Development, Geneva, 1977. Chapter IV.

Table A.12

INDIA: PREDICTED TECHNOLOGY-SPECIFIC PRODUCTIVITIES OF DIFFERENT SIZE GROUPS OF FARMS, INDIAN DISTRICTS, 1970-71

Level of Technology (Kgs./hectare of fertilizer used in the district)	Predicted Productivities (Rupees per gross cropped hectare)		
	Smallest 40% of farms	Next 40% of farms	Largest 20% of farms
0	900* a/	860*	872* b/
10	1,242*	1,222*	1,235
20	1,584	1,583*	1,597+
30	1,926*	1,944*	1,959+
40	2,268*	2,306*	2,321+
50	2,609*	2,667*	2,684+

a/ Asterisk denotes significantly different at the 0.10 level from the productivity of the next size class of farms.

b/ Dagger denotes significantly different at the 0.10 level from the productivity of the smallest 40% of farms. Predicted productivities have been calculated using the regression coefficients shown in Table 2 and equation (6) in the text.

Source: A. Deolalikar (1981), pp. 279.

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