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Profitability, Productivity and Contractual Choice in Agriculture*

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INTRODUCTION

This paper examines cross-sectional trends in profitability, and explains them through contractual choice. Producers attempt to increase profits constrained by their production environments of imperfect markets and imperfect information. Contractual choice then offers an important variable which producers manipulate to increase profitability. These two critical conditions are seen to determine the observed trends in the relationship between farm size and productivity.

The study examines two contrasting production environments, two villages in the Punjab. The production environments of the canal colony village has two exogenously imposed constraints, eviction of sharecoppers through mechanisation, and a credit bias against small farms. This weakens the traditionally posited inverse relationship, and leads to profitability and productivity being positively related to farm size. The production environment of the Southern Punjab village has an additional endogenous constraint of an imperfect fixed rental market for land. The consequent reliance on sharecropping leads productivity to describe a *U*-shaped curve across farm size.

THE RELATIONSHIP BETWEEN FARM SIZE AND LAND PRODUCTIVITY

Sen (1966) initially pointed out that data in India showed an inverse relationship between operated area and output per cultivated acre. Small farms appeared to have a higher level of input use per acre and so a higher output. Sen's rationale is that large farms hire wage labour up to the point at which its marginal product falls equal to the market wage rate. Peasants on the other hand value their family labour at less than the market wage and so continue using it up to a point at which its marginal product falls below the market wage.

*Owing to unavoidable circumstances, the discussant's comments on this paper have not been received.

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This wage gap between labour use on small and large farms was further widened by Bardhan (1973) who found that large farms stopped hiring labour at levels well short of where its marginal product equalled the market wage. This lowers the level of labour use, below both the market dictated one and the small farm one.

An explanation of search costs for hired labour would raise the real wage for the landlord above the market wage. This could apply in this study to one of our two surveyed villages, the canal colony village of Chak 323, where there is a high incidence of casual labour and a very low incidence of permanent labour. But it would not apply readily to the other surveyed village in Southern Punjab, Rahimabad, where casual labour use is very low and permanent labour use very high.

Sen's (1981) explanation of a family supervision constraint on large farms preventing them from hiring labour, most usefully approximates the situation in Rahimabad. He explains this labour market imperfection through a land market imperfection. Where a fixed rent land leasing market is insecure, large owners are faced with unmanageably large farm sizes. The area that can be self-cultivated using hired wage labour, is constrained by the amount of family labour available to supervise it. The leasing market insecurity and the supervision constraints are both overcome by large owners sharecropping out the unmanageable part of their owned area, in small plots. This also allows them to benefit from the low opportunity cost of labour and resultantly high output per acre of small family labour-based farms [Sen (1981)].

So this negative correlation between farm size and output per cultivated acre is based on labour-intensity and labour-intensive technology and inputs, like land improvement, irrigation maintenance, tillage and traditional implements. But as the importance of traditional technology declines and new commercial inputs take over production, this negative correlation will change.

The advantage of large farms in obtaining commercial inputs, both without and with credit will tend to raise their crop yields and aggregate output per acre, flattening out the inverse correlation and even making it positive.

The negative correlation can also be expected to change on the basis of labour augmenting technology like tractors. If family supervision curtails labour use on large farms, then tractors allow an increase in material inputs without requiring a proportional increase in labour use [Sen (1981); Evenson and Binswanger (1984)].

Sen's (1981) argument also shows that sharecropping maintains the negative size productivity relationship. Large owners with supervision constraints on their own labour use sharecrop out area to small farms and use the high labour intensities and productivity of the small farms.

THE SURVEY

The Punjab consists of two distinct major regions, the canal colonies, and South-Western Punjab. Important characteristics specific to the canal colonies are: a relatively less concentrated distribution of operated area, a relatively low incidence of sharecropped area, an earlier established canal irrigation system, and therefore more developed factor markets for land and labour. In contrast, South-Western Punjab has: a more concentrated distribution of operated area, a higher incidence of sharecropping, a canal irrigation system developed later, and therefore less developed factor markets for land and labour.

To capture a possible divergence in trends between the two regions of the Punjab, one village has been surveyed from each region. Chak 323 in Tehsil and District Toba Tek Singh was chosen to typically represent the major characteristics of the canal colonies cited above. Rahimabad + (Rahimabad + Mahmoodabad) in Tehsil Sadiqabad, District Rahim Yar Khan, was chosen to typically represent the major characteristics of South Punjab as cited above. Data was collected on production for 1984.

THEORETICAL PROPOSITIONS

In Chak 323 where the incidence of sharecropping is low, the literature supports a positive size productivity relationship. In Rahimabad our earlier study has shown that the supervision capacity of owners and operators above 250 acres plus maximal substitution of hired labour by tractors had already given an optimally supervisable labour force and operated area by 1970, [Mahmood (1991)]. Since this operated area could not be exceeded further, sharecropped out area remained high at approximately 50 percent of the village area. Therefore, operators above 250 acres would be expected to have the highest inputs and output per cultivated acre on the basis of their credit advantage. But at the same time owners above 250 acres still sharecropping out area to small tenants would want to ensure equalisation of profits per cultivated acre between their sharecropped area and owner operated area above 250 acres. To do this they would force high inputs and so output per cultivated acre on their small tenants' plots.

So the high incidence of sharecropping in Rahimabad + and the predominance of sharecroppers amongst operators below 12 acres would turn the negative size productivity relation into a *U*-shaped curve across operated area. Inputs and output per cultivated acre would be the highest on the smallest and the largest operated areas.

This gives the following set of propositions about change in production behaviour in Chak 323 (A), and for Rahimabad (B):

Table 1

The Relationship between Output/Input Shares Per Cultivated Acre and Area

Village	R2	Dependent	Intercept (t)	(SIG)	Independent (t) Area Owned	(SIG)	Area Leased in (t)	(SIG)	Area Share Cropped In (t)	(SIG)
1A	.34	Gross Margin/Acre	−28.0		+12.2		+7.8		Dropped	
			(0.2)	(.83)	(2.6)	(.01)	(3.8)	(.00)		
B	.15		+763.3		+1.6		−4.3		+28.7	
			(4.6)	(.00)	(1.7)	(.11)	(0.9)	(.37)	(0.8)	(.41)
2A	.28	Profit/	−730.0		+12.7		+7.4		+43.6	
		Acre	(4.1)	(.00)	(2.3)	(.03)	(3.0)	(.00)	(1.7)	(.10)
B	.18		+314.9		+1.7		−3.5		+51.8	
			(2.0)	(.05)	(2.6)	(.01)	(0.8)	(.43)	(1.6)	(.13)
3A	.42	Gross	+1570.6		+11.7		+7.0		−79.8	
		Output	(8.7)	(.00)	(2.0)	(.05)	(2.9)	(.01)	(3.1)	(.00)
B	.05	Share/	+1968.3		−0.8		−7.7		−14.4	
		Acre	(8.0)	(.00)	(0.8)	(.40)	(1.2)	(.26)	(0.3)	(.78)
4A	.35	Variable	+1627.1		−0.9		−0.9		−82.2	
		Costs/Acre	(12.7)	(.00)	(0.2)	(.83)	(0.5)	(.60)	(4.5)	(.00)
B	.08		+1236.4		−1.0		−2.3		−46.7	
			(5.6)	(.00)	(0.9)	(.37)	(0.4)	(.71)	(1.0)	(.31)
5A	.22	Fixed	+700.4		−0.5		0.4		−43.4	
		Costs/Acre	(7.4)	(.00)	(0.2)	(.86)	(0.3)	(.73)	(3.1)	(.00)
B	.23		+449.1		−0.2		−0.9		−23.1	
			(11.3)	(.00)	(1.0)	(.30)	(0.8)	(.42)	(2.8)	(.01)
6A	.30	Gross Output Share/	+1.0		+0.01		+0.005		+0.01	
			(9.2)	(.00)	(2.6)	(.01)	(3.4)	(.00)	(0.8)	(.45)
B	.42	Variable	+1.9		−0.0001		−0.04		+0.6	
		Costs	(2.9)	(.01)	(0.2)	(.86)	(2.2)	(.03)	(4.5)	(.00)
					Operated Area		(Operated) (Area)Square			
7A	.22	Gross	+1274.0		+8.9		Drop			
		Output	(8.1)	(.00)	(3.7)	(.00)				
B	.06	Share/	+2060.0		−7.5		+0.01			
		Acre	(8.8)	(.00)	(1.7)	(.09)	(1.6)	(.12)		

The cost bar is divided into variable costs at the bottom and fixed costs on top. The short-run break even point is when output equals variable costs, to give a gross margin equal to zero. The central axis is where the gross margin equals zero. The variable costs lie below and fixed costs lie above this.

The output bar is divided into the gross margin per acre, the shaded part and the profit per acre, the diagonally striped part. If the gross margin and/or profits per acre are above the zero gross margin line then they are positive and if they fall below the zero gross margin line, then they are negative.

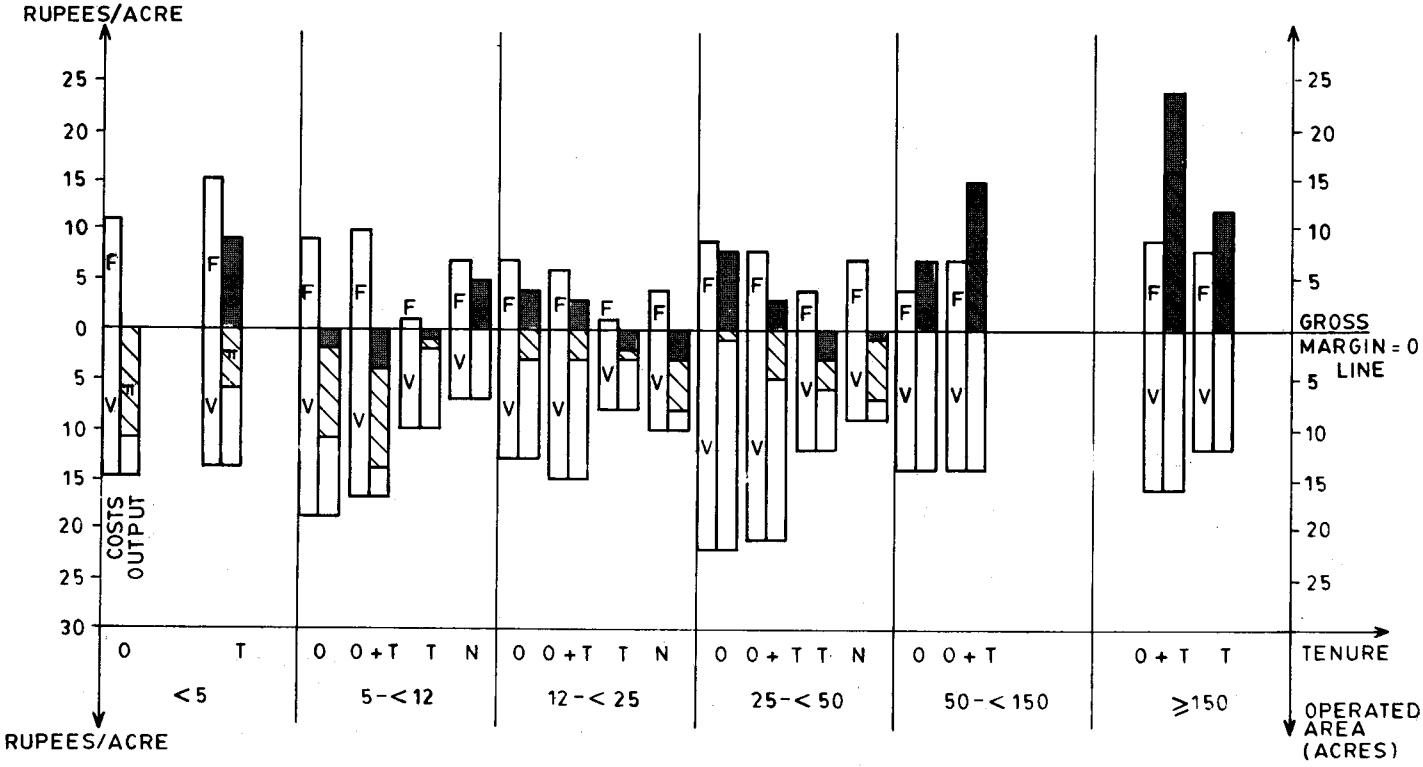
Graph 1A shows that the gross margin per acre increases with operated area on trend. More classes of operators have positive gross margins per acre above 12 acres. And all operators above 50 acres have positive gross margins. The graph also shows that profit per acre increases with operated area. Negative profits per acre were the highest below 12 acres. The negative profits per acre are lower between 12 and 50 acres. And all operators above 50 acres have positive profits per acre.

The graph also shows that output per acre increases after 25 acres. The graph also shows that variable cost shares per acre are not systematically related to operated area.

So Graph 1A supports the hypotheses about profits, output and fixed costs per acre, but not about variable costs. Regression analysis gives the same results, but explains the role of variable inputs further. In Table 1 profits, output and costs per operated plus sharecropped acre are regressed on area owned, leased in and sharecropped in.

Gross margin, profit and the output share per acre are all positively correlated to area owned and area leased in. Gross margin per acre has an R2 of .34. The area owned and area leased in coefficients are both highly significant, showing that the gross margin per acre increased by Rs 12 per incremental owned acre and by Rs 8 per incremental leased in acre. Profit per acre has an R2 of .28. The area owned, leased in and sharecropped in coefficients were all significant at a 90 percent level of probability. Profits per acre increased by Rs 13 per incremental owned acre, Rs 7 per incremental leased in acre and Rs 44 per incremental sharecropped in acre. Output per acre has an R2 of .42. The area owned, area leased in and area sharecropped in coefficient were all significant at a 95 percent level of probability. Output per acre increased by Rs 12 per incremental owned acre and by Rs 7 per incremental leased in acre. However, output per acre decreased by Rs 80 per incremental sharecropped in acre.

So profits and output per acre increase with owned and leased in area confirming Hypotheses A1 and A2.



Graph 1A. Chak 323 Costs and Profits/Operated Acre ('00 Rupees)

Table 1 shows that neither variable costs shares per acre nor fixed costs shares per acre are significantly correlated to owned or leased in area. This does not support hypotheses A3 and A4. However, the positive correlation between output per cultivated acre and operated area is explained in a number of ways by hypotheses A5-A6. Larger operators could have a higher output per cultivated acre because they use inputs more efficiently. This implies hypothesis A5 that the efficiency ratio of the output share to variable cost share is positively correlated to operated area. Second, higher output per acre could be directly correlated to higher variable costs per acre for specific inputs. This implies hypothesis A6 that the output share per cultivated acre is positively correlated to variable cost shares per cultivated acre and weakly correlated to family labour days per acre.

Hypothesis A5 is tested in Table 1. The ratio of the output share to variable cost share per operated plus sharecropped acre is regressed on area owned, leased in and sharecropped in. The ratio of output to variable costs per acre is positively correlated to area owned and leased in. The R2 is .3. The coefficients for area owned and leased in are both highly significant. The output-input ratio rises slowly, by Rs 0.01 per incremental owned acre and by Rs 0.01 per leased in acre. This partly explains the higher output per acre on larger operated areas.

Hypothesis A6 is tested in Table 2. The output share per operated plus sharecropped out acre is regressed on the per acre costs of fertilizer, tubewells, tractors, pesticides, animals, hired labour, and family labour days. To determine whether some output input associations are stronger than others for particular size classes, separate regressions are run for operators below 12 acres, between 12 and 25 acres and above 25 acres.

Table 2 shows that fertilizer costs per acre are positively associated with output per acre for all three size classes of operators. The R2 varied between .24 and .33 and the fertilizer coefficients were all significant at a 96 percent level of probability. However, the fertilizer coefficient increased with the size class. Below 12 acres output per acre rose by Rs 1.5 per incremental Rupee of fertilizer, between 12 and 25 acres it was Rs 2.6, and above 25 acres it was Rs 3.6. So larger operators used an input combination which made fertilizer more effective.

Tubewell running costs per acre were positively correlated to output per acre. But none of the coefficients were significant. Tractor running costs per acre were also not significantly correlated to output per acre for any size class.

Pesticide costs per acre were positively correlated to output per acre. The R2 rises with the size class from .03 for operators under 12 acres, to .48 between 12 and 25 acres, to .57 above 25 acres. The pesticide coefficient is also not significant under 12 acres and highly significant above 12 acre. Output per acre rises by Rs 5

Table 2

The Relationship between Output And Inputs/Cultivated Acre

Village	R2	Dependent	Intercept (t)	(SIG)	Independent (t) Fertilizer Cost/Acre	(SIG)	Tubewell Cost/Acre	
1A	.30	Gross	+816.1		+1.5			
<12		Output	(3.0)	(.01)	(2.5)	(.02)		
		Share/						
12–<5	.24	Acre	+460.6		+2.6			
			(1.2)	(.25)	(2.3)	(.04)		
>25	.33		+702.6		+3.6			
			(1.0)	(.35)	(2.4)	(.03)		
1B	.40		+1581.9		+5.7			
<12			(3.7)	(.00)	(3.4)	(.00)		
12–<25	.38		+187.0		+6.7			
			(0.4)	(.70)	(2.5)	(.03)		
>25	.50		+593.1		+4.8			
			(2.8)	(.02)	(3.5)	(.00)		
2A	.03	Gross	+1190.4				+0.6	
<12		Output	(4.4)	(.00)			(0.7)	(.49)
		Share/Acre						
12–<25	.12		+926.4				+1.1	
			(3.2)	(.01)			(1.5)	(.17)
>25	.10		+1370.4				+4.5	
			(1.6)	(.13)			(1.2)	(.26)
2B	.60		+1754.5				+1.9	
<12			(4.3)	(.00)			(4.2)	(.00)
12–<25	.29		+726.1				+3.7	
			(1.8)	(.11)			(1.8)	(.11)
>25	.41		+738.5				+3.0	
			(3.2)	(.01)			(2.5)	(.03)

Continued –

Table 2 – *(Continued)*

Vill size	R2	Dependent	Intercept (t)	(SIG)	Independent (t) Tractor Cost/Acre	(SIG)	Pesticide Cost/Acre	
3A <12	.13	Gross Output Share/Acre	+1219.1 (5.4)	(.00)	+0.8 (1.4)	(.19)		
12– <5	–				Dropped			
>25	–				Dropped			
3B <12	.90		+1608.7 (5.6)	(.00)	+2.8 (6.6)	(.00)		
12– <25	.04		+978.0 (1.6)	(.15)	+2.1 (0.5)	(.61)		
>25	.01		+1122.5 (3.5)	(.01)	+0.3 (0.2)	(.82)		
4A <12	.03	Gross Output Share/ Acre	+1360.9 (4.4)	(.00)			+0.8 (0.6)	(.57)
12– <25	.48		+455.8 (1.8)	(0.9)			+5.4 (3.8)	
>25	.57		+848.6 (1.7)	(.11)			+5.9 (3.8)	(.00)
4B <12	–						Dropped	
12– <25	–						Dropped	
>25	–						Dropped	

Continued –

Table 2 – *(Continued)*

Village	R2	Dependent	Intercept (t)	Intercept (SIG)	Independent (t) Animal Cost/Acre	Independent (SIG) Animal Cost/Acre	Hired Labour Cost/Acre (t)	Hired Labour Cost/Acre (SIG)
5A <12	–	Gross Output Share/Acre			Dropped			
12–<5	.20		+1561.8		–9.1			
			(5.9)	(.00)	(2.0)	(.06)		
>25	.12		+2468.9		–25.4			
			(6.0)	(.00)	(1.3)	(.22)		
5B <12	.11		+1947.3		+2.9			
			(3.6)	(.00)	(1.5)	(.15)		
12–<25	.07		+1073.0		+10.5			
			(4.1)	(.00)	(0.9)	(.00)		
>25	.11		+1327.3		–9.7			
			(7.9)	(.00)	(1.2)	(.24)		
6A <12	.32	Gross Output Share/Acre	+1115.9				+1.3	
			(7.3)	(.00)			(2.8)	(.01)
12–<25	.58		+429.2				+6.1	
			(2.0)	(0.7)			(4.7)	(.00)
>25	.72		+382.6				+8.2	
			(1.0)	(.36)			(5.5)	(.00)
6B <12	.13		+2752.6				–106.1	
			(7.8)	(.00)			(1.6)	(.12)
12–<25	.04		+1307.4				–7.3	
			(5.4)	(.00)			(0.7)	(.49)
>25	.29		+981.1				+6.3	
			(5.7)	(.00)			(2.2)	(.05)

Continued–

Table 2 – *(Continued)*

Vill Size	R2	Dependent	Intercept (t)	(SIG)	Independent (t) Family	(SIG) Labour
					Days /	Acre
7A	.04	Gross	+1238.8		+0.5	
<12		Output	(6.2)	(.00)	(0.8)	(.41)
12–	.04	Share/	+891.7		+5.4	
<5		Acre	(2.0)	(.06)	(0.8)	(.42)
>25	.20		+2887.2		–29.2	
			(5.7)	(.00)	(1.7)	(.11)
7B	.43		+833.0		+5.2	
<12			(1.5)	(.00)	(3.7)	(.00)
12–	.18		+663.2		+6.0	
<25			(1.6)	(.13)	(1.6)	(.15)
>25	.02		+1252.3		–4.4	
			(7.8)	(.00)	(0.5)	(.61)

per incremental Rupee of pesticide per acre. So operators above 12 acres simply use more pesticide per acre which raises their output per acre.

Animal costs per acre were not significantly correlated to output per acre. Hired labour costs per acre were positively correlated to output per acre. The R2 rises with the size class from .32 below 12 acres, to .58 between 12 and 25 acres, to .72 above 25 acres. The labour coefficients are all highly significant, and increase with the size class. Output per acre increases by Rs 1.3 per incremental Rupee of hired labour per acre below 12 acres, by Rs 6.1 between 12 and 25 acres, and by Rs 8.2 above 25 acres. So larger operators use more hired labour which raises their output per acre.

Family labour days per acre were weakly correlated to output per acre and the labour coefficients were insignificant for all size classes. So while large operators use hired labour to increase their output per acre, smaller operators can no longer rely upon family labour per acre to increase their output per acre.

So Tables 1 and 2 show the reasons behind the positive correlation between output per acre and operated area in Chak 323. As expected the positive correlation between output per acre and family labour days has been weakened. Instead output per acre depends more on hired labour per acre, pesticides and fertilizer. These are all commercial inputs constrained by credit. So labour use and pesticide

per acre increases with operated area. And the efficiency ratio of output to variable costs per acre increases with operated area. This is illustrated by the efficiency of fertilizer use increasing with area.

RELATIONSHIP BETWEEN PROFITS OUTPUT AND INPUTS IN RAHIMABAD

Graph 1B presents the costs and profits per operated plus sharecropped out acre for 24 classes in Rahimabad+. In Rahimabad+ all operators and non-operating owners sharecropping out area in the size class above 150 acres were actually above 250 acres.

Graph 1B shows that the diagonally striped profits per acre increase on trend with operated area. Gross margin per acre however, forms a *U*-shaped curve across operated area. It is high below 12 acres and above 250 acres and low in between.

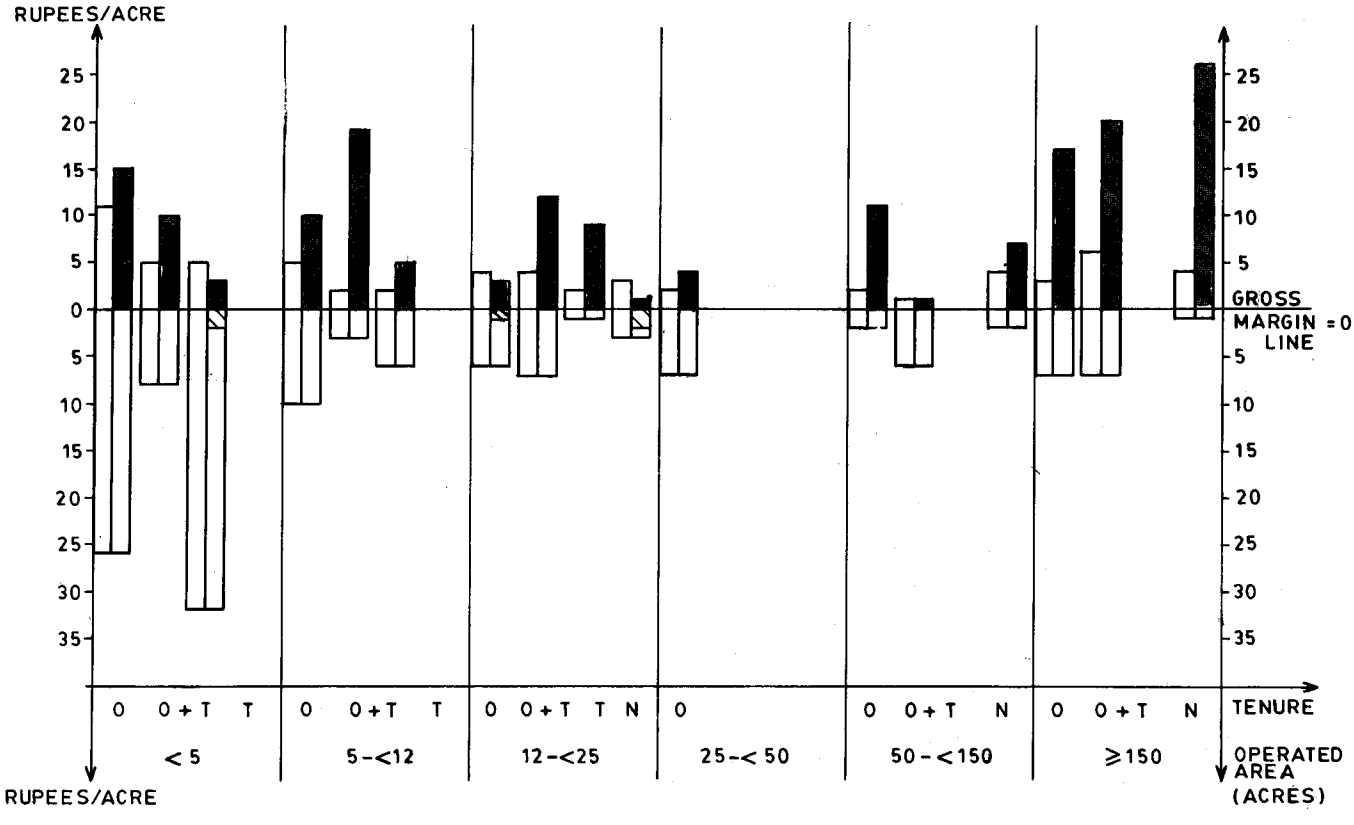
The regressions in Table 1 confirm the weak positive correlation between gross margin per operated plus sharecropped out acre and area operated. The R2 is .15. The area owned coefficient is just significant at an 89 percent probability level. The gross margin per acre increases by Rs 1.6 per incremental owned acre. Profit per operated plus sharecropped out acre is also positively correlated to owned area. The R2 is .18 but the area owned coefficient is highly significant. Profit per acre increases by Rs 1.7 per incremental owned acre.

So all that can be said about hypothesis B1 is that gross margins and profits per acre are the highest above 250 acres. Hypothesis B2 however, is clearly confirmed by Graph 1B. Non-operators above 250 acres had higher gross margins and profits per operated plus sharecropped out acre than self-cultivators above 250 acres. This provides evidence of a supervision constraint on owners above 250 acres. Above 250 acres, non-operating owners constrained from self-cultivating, at least equate their profits per acre on sharecropped out area to profits on self-cultivated area.

These profits per acre are based on output per acre. Graph 1B and Table 1 confirm hypotheses B3 about output. Graph 1B shows that the output shares per operated plus sharecropped out acre are the highest below 12 acres and above 250 acres. Owners and tenants below 5 acres have the highest output shares per acre. So output per acre is the highest on the smallest and largest size classes, forming a *U*-shaped curve across operated plus sharecropped out area.

This *U*-shaped curve is also confirmed through regression analysis in Table 1. A quadratic equation is fitted of the form:

$$Y = \alpha + B X_i + \gamma (X)_i^2 + e_i$$



Graph 1B. Rahimabad + Costs and Profits/Operated Acre ('00 Rupees)

Output per operated plus sharecropped acre is regressed on operated area and the square of the operated area. For a *U*-shaped curve the coefficient for operated area must be negative and the coefficient for the squared term must be positive. The table shows that the coefficient for operated area is negative and significant at a 91 percent level of probability. The coefficient for the squared term is positive and significant at an 88 percent level.

Output shares per acre are explained by cost shares per acre. Variable cost shares per cultivated acre are expected to be *U*-shaped across operated area. Fixed cost shares per cultivated acre are expected to be negatively correlated to operated area. The efficiency ratio of output to variable cost shares per cultivated acre is expected to be negatively correlated to area.

Graph 1B does not confirm variable costs per operated plus sharecropped out acre to be *U*-shaped across operated area. Operators below 5 acres have the highest variable cost shares per acre, after which they become constant across operated area. Similarly, fixed costs per operated plus sharecropped out acre are the highest below 5 acres, after which they become constant across operated area. Table 1 confirms that variable and fixed costs per operated plus sharecropped out acre are insignificantly correlated to area owned and leased in. The table also shows that the efficiency ratio of output to variable cost shares per acre is insignificantly correlated to owned area.

Since these direct correlations between costs per acre and area have not explained the correlation between output per acre and area, so output per acre has to be correlated to individual variable costs per acre. If these correlations are run for three separate size classes of operators, then a strong correlation for some inputs can be identified with particular size classes, as in the Chak 323. Hypothesis B7 expects the output share per cultivated acre to be positively correlated to specific variable input cost shares per acre and to family labour days per acre.

In Table 2 the output share per operated plus sharecropped out acre is regressed on the per acre costs of fertilizer, tubewells, tractors, pesticides, animals, hired labour and per acre family labour days. Separate regressions are run for the size class operating plus sharecropping out below 12 acres, between 12 and 25 acres and above 25 acres.

The table shows that in Rahimabad + the output share per acre was positively correlated to the fertilizer cost share per acre for all size classes. The R2 varied between .38 and .50 for the three size classes. The fertilizer coefficients were all significant at a 97 percent probability level. The coefficients varied between 5.0 and 7.0 for the three size classes. So the output share per acre increased by about Rs 6 per incremental Rupee of fertilizer per acre.

The output share per acre was positively correlated to the tubewell cost share per acre for all classes. The R2 varied between .30 and .60. The tubewell coefficients were all significant at an 89 percent probability level. The output share per acre increased by about Rs 3 per incremental Rupee of tubewell cost.

The output per acre was positively correlated to tractor running costs per acre, but significant only below 12 acres. The output per acre increased by Rs 3 per incremental Rupee of tractor costs per acre. This shows that there was a large tractor rental market in Rahimabad+, which small operators used. Pesticide use was very low in Rahimabad+, so it is not significantly correlated to output. Animal costs per acre are again only weakly correlated to the output share per acre.

Hired labour costs per acre were positively correlated to the output share per acre above 25 acres. The R2 was .29. The labour coefficient was significant at a 95 percent probability level. The output share per acre increased by Rs 6 per incremental Rupee of hired labour per acre. So large operators relied on using hired labour to increase their output per acre.

Family labour days per acre were positively correlated to the output share per acre below 25 acres, but the labour coefficient is only significant below 12 acres. The R2 is .43. The output share per acre increased by Rs 5 per incremental family labour day per acre. So small operators relied on family labour to increase their output per acre.

So the *U*-shaped curve between the output share per acre and operated area is explained primarily through labour use per acre. The outputs per acre is high below 12 acres due to high family labour days per acre. The output share per acre is high on self-cultivated area above 250 acres due to high hired labour use per acre. And the output share per acre is high on non-operator's sharecropped out area above 250 acres due to their tenants high family labour days per acre. The impact of other variable inputs per acre on output per acre is more even across size scale.

CONCLUSIONS

In Chak 323 profits per cultivated acre are positively correlated to operated area. The output share per cultivated acre is also positively correlated to operated area. This is due to the weakening of the positive relationship between output per acre and family labour use per acre. Instead there is a strong positive correlation between output per acre and commercial inputs like hired labour, pesticides and fertilizer per acre. And large operators unconstrained by credit use more hired labour and pesticides per acre. Larger operators also have a higher efficiency ratio of output shares to variable cost shares per acre, for instance, in their use of fertilizer.

In Rahimabad+ profits per operated plus sharecropped out acre are the highest for operators and non operators above 250 acres. Non operators profits per acre are in fact, higher than operators profits per acre in this size class. The output share per operated plus sharecropped out acre forms a *U*- shaped curve across operated plus sharecropped out area. Output per acre was high below 12 acres due to high family labour use per acre. Output was high for operators above 250 acres due to high hired labour use per acre. And output was high for non operators above 250 acres due to their tenants high family labour use per acre. Material variable use per acre affects output per acre evenly across size scale.

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