Growth and Distribution of Agrarian Assets in the Punjab

Moazam Mahmood

INTRODUCTION

This is a micro study of the growth and distribution of non land agrarian assets over time, in two villages of the Punjab. Widespread adoption of the Green Revolution inputs, seed and fertilizer, has generated a high rate of acquisition of agrarian assets, especially tubewells and mechanisation. The HYV enhanced profitability and income should have permitted an equally widespread acquisition of assets. This study uses an exogenous-endogenous model to show two constraints on asset acquisition.

MICRO THEORY ON THE ACCUMULATION OF AGRARIAN ASSETS

Agrarian assets can be divided into family labour products, and commercial assets,[1] small operators with low purchasing power for large commercial assets can then at least increase their family labour produced assets. Larger operators with more purchasing power then rely more on commercial assets.[2]

In Indian and Pakistani agriculture however, animals are the only remaining non land asset which can have a high family labour component. And the increasing replacement of bullocks by tractors and tubewells has lead to the predominance of mechanical assets. Tractorization has increased rapidly in Pakistan due to several incentives. The incentives to use a tractor have been debated between the school of technological necessity and the school of wrong prices and labour displacement. The technological school have argued that tractors are adopted because of their technical superiority over bullocks.[3] The school of wrong prices

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[1]A. K. Sen (1968) *Choice of Technique.* Oxford: Basil Blackwell.
[2]Cf. A. Booth and R. M. Sundrum *Labour Absorption in Agriculture.* Oxford University Press.
[3]Cf. for India see I. J. Singh (1971); Johl (1972), cited by A. Sen (1981) *op cit.*; for Pakistan see A. Salam *et al.* (1981) Farm Mechanization, Employment and Productivity in Pakistan's Agriculture. *Pakistan Economic and Social Review* 19 : 2.

and labour displacement argue that tractors have no technical merit over bullocks and their increasing use is due to imperfections in the capital and labour markets. Tractors are subsidized and state credit allocated for them, allowing them to replace bullocks and labour power.[4]

Empirical evidence favours the wrong prices school. Binswanger finds that tractors are only associated with a higher input use and higher output because of a cross-sectional accident. The farms that became tractorized are already input intensive.[5] He also finds that tractors displace labour in that they allow cropped area to increase without proportionate increases in hired labour.[6] Binswanger's findings support Sen's theory of a supervision constraint on the expansion of operated area of already large farms. Tractorization allows such farms to increase their area without proportionate increases in hired wage labour.[7] In Pakistan, this labour augmenting nature of tractors permitted landlord's share-cropping out area to resume it for self cultivation. The state increased this ability to use tractors by lowering their price through subsidies.[8]

As the share of mechanical assets increases, the family labour source of increasing assets declines. Therefore, all sizes of operators become more evenly reliant on purchasing power to increase their assets. The ability to increase assets would be even for all sizes of operators given a perfect credit market for assets. However, the stylised facts for Pakistan are:

(a) Formal sector agricultural credit has been limited;
(b) The allocation for purchase of large tractors absorbs approximately 80 percent of total credit over the period of the seventies; and
(c) No asset credit for owners under 12.5 acres and pure tenants.

This credit market imperfection implies that differential access to land determines differential access to non land assets.[9]

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[4]Cf. S. R. Bose and E. H. Clark (1969) Some Basic Conclusions on Agricultural Mechanization in West Pakistan. *The Pakistan Development Review* Autumn.
    [5]H. P. Binswanger (1978) *The Economics of Tractors: An Analytical Review.* Hyderabad, India, Agricultural Development Council, New York.
    [6]Binswanger (1978) *op. cit.*
    [7]Cf. Abijit Sen (1981) Market Failure and Control of Labour Power: Towards an Explanation of Structural Change in Indian Agriculture, Parts I and II. *Cambridge Journal of Economics.* Vol. 5, p. 201.
    [8]K. Griffin (1974) *The Political Economy of Agrarian Change.* Macmillan Press; A. H. Hussain (1980) The Impact of Agricultural Growth on the Agrarian Structure of Pakistan, with Special Reference to the Punjab Province. D. Phil Thesis Sussex University.
    [9]This stylised proposition is in keeping with much of South Asian agriculture, Cf. A. Booth and R. M. Sundrum (1985) *op. cit.*

HYPOTHESES ABOUT CHANGE IN NON LAND ASSETS

The Model

The abstract theoretical framework predicts that agrarian capital accumulation in a region is determined by the interaction of a set of exogenous and endogenous factors. Exogenous factors like state policy have a common influence on all regions in the agrarian sector and induce homogeneity in the pattern of accumulation between regions. Endogenous factors specific to a region, like the distribution of owned and operated area, irrigation endowments, forms of land rental and other market conditions, can vary between regions and lead to heterogeneity in the pattern of accumulation between these regions.

Empirical Survey

The Punjab is a heterogenous province. It consists of two distinct major regions, the canal colonies, and Southern-Western Punjab. The 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 factors markets for land and labour. In contrast, Southern-Western Punjab has: a relatively more concentrated distribution of operated area, a relatively higher incidence of sharecropping, a later developed canal irrigation system, and therefore less developed factor markets for land and labour.

To capture this possible divergence in trends between the two regions of the Punjab, one village has been surveyed from each region to typically represent it's major characteristics, Chak 323 in the canal colonies and Rahimabad + in the South West.

Hypotheses

Change in non land assets between 1970 and 1984 in Chak 323 and Rahimabad + will be determined by two exogenous factors and one endogenous factor. One exogenous factors is labour augmenting tractorization and general mechanisation. The second exogenous factor is an imperfect credit market for non land assets biased in favour of larger owners and operators.

The endogenous factor is the concentrated distribution of owned and operated area in Rahimabad + in 1970 leading to a supervision constraint on the increase of operators already above 200–250 acres. This constrains the increase

of the principal labour augmenting technology, tractors on these already large farms.

Then ownership of assets will change with:

(1) On operated area < 250 acres in 1970, the value of tractors per farm can increase between 1970 and 1984 (for Chak 323);

(2) On operated area > 250 acres in 1970, the value of tractors per farm will decrease between 1970 and 1984; the value of tractors per operated acre will remain constant (for Rahimabad +);

(3) The value of non tractor mechanical assets per farm and per operated acre will increase between 1970 and 1984;

(4) Increase in the value of tractors and tubewells per farm between 1970 and 1984 will be positively correlated to area operated in 1984;

(5) Increase in the value of more divisible assets, drills, sprayers and fodder cutters, over 1970 and 1984 will be more weakly correlated to area operated in 1984;

(6) The total value of mechanical assets will follow 3–5;

(7) On Operated area > 12 acres in 1984, the value of bullocks per farm will decrease between 1970 and 1984;

(8) On operated area < 12 acres in 1984, the value of bullocks per farm can increase between 1970 and 1984;

(9) Increase in the value of bullocks per farm between 1970 and 1984 will be negatively correlated to area operated;

(10) The value of milch animals per farm can either decrease or increase between 1970 and 1984 for different size classes;

(11) Given 7–10 the total value of animals per farm can either increase or decrease over 1970–84 on different size classes;

(12) In Rahimabad + non operators will increase their value of tubewells and non farm assets per farm between 1970 and 1984; and

(13) The value of non farm and domestic assets per farm will increase between 1970 and 1984. This increase will be correlated to area operated in 1984.

CHANGE IN THE VALUE OF ASSETS BETWEEN 1970 AND 1984

Table 1 shows the increase in value of assets per farm between 1970 and 1984, for six size classes and four tenure classes. Chak 323:

Table 1 A

Chak 323: Value of Assets/Farm in 1970 Prices ('000 Rupees)

Operated Area (Acres)	Mechanical Assets			Tractors			Tubewells		
	1970	1984	Change 70–84	1970	1984	Change 70–84	1970	1984	Change 70–84
< 5	NA	0.05	+0.05	NA	0.0	0.0	NA	0.0	0.0
5 – < 12	0.02	6.93	+6.91	0.0	3.68	+3.68	0.0	1.65	+1.65
12 – < 25	1.64	3.89	+2.25	1.6	2.36	+0.76	0.0	0.85	+0.85
25 – < 50	0.16	17.89	+17.73	0.0	12.34	+12.34	0.0	1.93	+1.93
50 – < 150	0.02	39.03	+39.01	0.0	22.4	+22.4	0.0	11.87	+11.87
> 150	7.5	55.1	+47.6	7.5	33.0	+25.5	0.0	12.68	+12.68
Total	0.94	7.72	+6.78	0.88	4.57	+3.69	0.0	1.71	+1.71
Tenure									
Owners	0.68	6.09	+5.41	0.67	3.99	+3.32	0.0	0.85	+0.85
Own + Ten	0.0	18.35	+17.45	0.83	10.73	+9.9	0.0	4.42	+4.42
Tenants	0.11	3.55	+3.44	0.0	1.65	+1.65	0.0	1.26	+1.26
Non Ops	0.0	5.15	+5.15	0.0	3.33	+3.33	0.0	0.33	+0.33

Table 1 A

Chak 323: Value of Assets/Farm in 1970 Prices ('000 Rupees)

Operated Area (Acres)	Drills + Sprayers			Fodder Cutters			Transport		
	1970	1984	Change 70–84	1970	1984	Change 70–84	1970	1984	Change 70–84
< 5	NA	0.0	0.0	NA	0.04	+0.04	NA	0.0	0.0
5 – < 12	0.0	0.75	+0.75	0.0	0.14	+0.14	0.0	0.11	+0.11
12 – < 25	0.0	0.18	+0.18	0.02	0.12	+0.10	0.0	0.64	+0.64
25 – < 50	0.0	0.64	+0.64	0.01	0.39	+0.38	0.0	0.47	+0.47
50 – < 150	0.0	3.0	+3.0	0.02	0.4	+0.38	0.0	2.03	+2.03
> 150	0.0	4.7	+4.7	0.0	0.35	+0.35	6.77	14.38	+7.61
Total	0.0	0.58	+0.58	0.02	0.15	+0.13	0.2	0.88	+0.68
Tenure									
Owners	0.0	0.71	+0.71	0.01	0.13	+0.12	0.0	0.41	+0.41
Own + Ten	0.0	1.16	+1.16	0.02	0.27	+0.25	0.75	3.23	+2.48
Tenants	0.0	0.06	+0.06	0.02	0.1	+0.08	0.0	0.09	+0.09
Non Ops	0.0	0.44	+0.44	0.0	0.24	+0.24	0.0	0.84	+0.84

Table 1 A

Chak 323: Value of Assets/Farm in 1970 Prices ('000 Rupees)

Operated Area (Acres)	Animal Assets			Bullocks			Milch Animals		
	1970	1984	Change 70–84	1970	1984	Change 70–84	1970	1984	Change 70–84
< 5	NA	1.72	+1.72	NA	0.0	0.0	NA	1.48	+1.48
5 – < 12	3.74	3.37	–0.37	0.88	1.26	+0.38	1.55	1.75	+0.20
12 – < 25	3.97	3.08	– 0.89	1.47	0.9	– 0.57	1.68	1.8	+0.12
25 – < 50	6.24	6.61	+0.37	2.54	1.49	–1.05	1.97	4.60	+2.63
50 – < 150	10.17	5.83	–4.34	2.3	0.23	–2.07	7.52	5.17	–2.35
> 150	17.13	8.43	–8.7	7.2	1.55	–5.65	4.5	4.93	+0.43
Total	5.88	3.44	–2.44	1.82	0.92	–0.9	2.71	2.09	–0.62
Tenure									
Owners	2.24	3.51	+1.27	1.37	0.75	–0.62	2.06	2.39	+0.33
Own + Ten	8.11	5.05	–3.06	2.19	1.1	–1.09	4.87	3.3	–1.57
Tenants	4.36	2.36	–2.0	2.17	1.04	–1.13	1.01	1.0	–0.01
Non Ops	5.88	3.22	–2.66	0.0	0.85	0.853	1.85	2.03	+0.18

Table 1 A

Chak 323: Value of Assets/Farm in 1970 Prices ('000 Rupees)

Operated Area (Acres)	Farm Assets			Non Farm Assets			Domestic Assets		
	1970	1984	Change 70–84	1970	1984	Change 70–84	1970	1984	Change 70–84
< 5	NA	1.78	+1.78	NA	0.0	0.0	NA	1.49	+1.49
5 – < 12	4.35	10.41	+6.06	0.2	1.38	+1.18	0.49	2.35	+1.86
12 – < 25	10.87	7.61	–3.26	2.33	45.78	+43.45	0.26	2.06	+1.8
25 – < 50	7.24	24.96	+17.72	1.58	3.57	+1.99	0.22	3.23	+3.01
50 – < 150	10.81	46.90	+36.09	0.0	67.33	+67.33	0.09	13.0	+12.91
> 150	92.3	77.93	–14.37	28.33	217.38	+189.1	0.37	22.73	+22.36
Total	11.54	12.04	+0.05	2.14	29.5	+27.36	0.3	3.11	+2.81
Tenure									
Owners	4.8	10.01	+5.21	1.07	9.48	+8.41	0.17	2.91	+2.74
Own + Ten	18.53	26.65	+8.12	2.96	122.29	+119.3	0.33	6.9	+6.57
Tenants	5.06	6.03	+1.03	1.11	0.85	–0.26	0.16	1.12	+0.96
Non Ops	1.85	9.2	+7.35	0.0	3.0	+3.0	0.35	2.26	+1.91`

A. Mechanical Assets

Table 1A shows that between 1970 and 1984 the mean value of tractors per farm increased by Rs 3700. The mean value of tubewells per farm increased by Rs 1700. The mean value of drills and sprayers per farm increased by Rs 600. The mean value of fodder cutters per farm increased by Rs 100. And the mean value of transport per farm increased by Rs 700. So the mean value of mechanical assets per farm increased by Rs 7000.

Increase in the value of individual mechanical assets per farm is also positively related to operated area. Between 1970 and 1984 increase in the value of tractors per farm was 0 for operators under 5 acres, was less than Rs 4000 for operators between 5 and 25 acres, rose sharply to Rs 12,000 between 25 and 50 acres, was Rs 22,000 between 50 and 150 acres and was Rs 26.000 above 150 acres. Similarly the increase in tubewells per farm also rises with operated area. Between 1970 and 1984 increase in the value of tubewells per farm was 0 for operators under 5 acres, was about Rs 2000 for operators between 5 and 50 acres, rose to Rs 12,000 between 50 and 150 acres and to Rs 13,000 above 150 acres. So for large relatively indivisible assets like tractors and tubewells there was a credit constraint on their increase.

Operators under 5 acres are completely excluded from a share in their ownership, which meant 14 percent of the farms in Chak 323. And there is a break point between 25 (for tractors) and 50 acres (for tubewells) above which increases in these assets rises sharply, which meant only 12 percent of the farms in Chak 323.

Increase in the value of smaller more divisible assets like drills and sprayers and fodder cutters has a weaker positive relationship with operated area as expected. Between 1970 and 1984 increase in the value of drills and sprayers per farm for operators under 5 acres, was less than Rs 200 for operators between 5 and 25 acres, was Rs 600 between 25 and 50 acres, rose sharply to Rs 3000 between 50 and 150 acres and was Rs 5000 above 150 acres. So there is still some positive relation between increase in drills and sprayers and operated area. And there is still a significant break point between 25 and 50 acres.

Fodder cutters however, are the most divisible asset. Table 1A shows that their increase was the most widespread and had the weakest relationship with operated area. Between 1970 and 1984 increase in the value of fodder cutters was Rs 40 for operators below 5 acres, was Rs 100 for operators between 5 and 25 acres and rose to Rs 400 for operators above 25 acres.

Increase in the total value of mechanical assets per farm is influenced by

the higher valued assets like tractors and tubewells and is positively related to operated area. Table 1A shows that increase in mechanical assets increases with the operated area of the size class. Between 1970 and 1984 increase in the value of mechanical assets per farm was Rs 50 for operators under 5 acres, below Rs 7000 for operators between 5 and 25 acres, rose sharply to Rs 18,000 between 25 and 50 acres, was Rs 39,000 between 50 and 150 acres and was Rs 48,000 above 150 acres. So increase in the value of mechanical assets per farm is constrained by credit. And there is a break point at 25 acres above which increase in mechanical assets per farm rises sharply for 12 percent of the operators

B. Animal Assets

Table 1A shows that the mean value of bullocks per farm decreased by Rs 900 between 1970 and 1984. The mean value of milch animals per farm also decreased by Rs 600. The mean value of all animals, decreased by Rs 2400 between 1970 and 1984.

Increase in the value of bullocks per farm also has a negative relationship with operated area. Table 1A shows that increase in the value of bullocks per farm decreases with operated area of size class, if non bullock owner under 5 acres are excluded. Between 1970 and 1984 increase in the value of bullocks per farm was Rs 400 for operators between 5 and 12 acres, then became a decrease of Rs 600 between 12 and 25 acres. The decrease rose to Rs 1000 between 25 and 50, was Rs 2000 between 50 and 150 acres and Rs 6000 above 150 acres. This shows that the substitution of bullocks for tractors increases with operated area.

C. Non Farm and Domestic Assets

The table shows that increase in non farm assets is not very systematically related to operated area except above 50 acres. Between 1970 and 1984 increase in the value of non farm assets was 0 for operators under 5 acres, Rs 1000 operators between 5 and 12 acres, rose to Rs 44,000 between 12 and 25 acres, dropped to Rs 2000 between 25 and 50 acres, rose again to Rs 67,000 between 50 and 150 acres and rose again to Rs 189,000 above 150 acres. So operators above 50 acres significantly diversified investment into non farm assets. But non farm assets did not entirely depend upon the internal resources of the farm in Chak 323.

Increase in the value of domestic assets per farm is positively related to operated area as expected. Between 1970 and 1984 increase in the value of domestic assets per farm was less than Rs 2000 for operators under 25 acres,

Rs 3000 for operators between 25 and 50 acres, rose to Rs 13,000 between 50 and 150 acres and was Rs 22,000 above 150 acres. So increase in the value of domestic assets per farm is constrained by income. And there is a break point at 50 acres above which the increase rises sharply.

Rahimabad +

Mechanical Assets

In Rahimabad + all operators above 150 acres actually operated more than 250 acres in 1970. Therefore, tractors per farm and per acre are expected to increase in size classes below 150 acres. Tractors per farm are expected to decrease and tractors per acre are expected to remain constant above 150 acres.

Tractors and the Supervision Constraint

Table 1B shows that the value of tractors per farm increased in size classes below 150 acres by Rs 22,000 and decreased in the size class above 150 acres by Rs 15,000. This size class above 150 acres had a supervision constraint on increasing its already large self operated area and in fact decreased it, as an earlier paper showed. The hypothesis argues that this size class must already have had an optimal ratio of tractors per acre which gave it an optimally supervisable hired labour force per acre. Therefore, the decrease in operated area implied a decrease in the value of tractors per farm. This decrease in the value of tractors per farm by the size class above 150 acres is confirmed by Table 1B. Table 2B confirms the existence of an optimal ratio of tractors per acre for this size class above 150 acres. The table shows that while other size classes below 150 acres increase their value of tractors per operated acre, the size class above 150 acres kept their value of tractors per acre constant, at Rs 40 between 1970 and 1984.

The existence of a supervision constraint on the expansion of the size class above 150 acres is further supported by its increase in the value of other mechanical assets. Tractors are the most important substitute for labour and only the value of tractors has been constrained. Tubewells, drills and sprayers and fodder cutters are not the most important substitute for labour. And Tables 1B and 2B show that the values of these non tractor mechanical assets have increased per farm and per acre for this size class above 150 acres. Table 1B shows that this size class increased the per farm value of its tubewells by Rs 61,000, drills and sprayers by Rs 3000, fodder cutters by Rs 200 and the total value of its mechanical assets by Rs 49,000.

Table 1 B

Rahimabad+ : Value of Assets/Farm in 1970 Prices ('000 Rupees)

Operated Area (Acres)	Mechanical Assets			Tractors			Tubewells		
	1970	1984	Change 70–84	1970	1984	Change 70–84	1970	1984	Change 70–84
< 5	0.4	0.52	+0.12	0.0	0.0	0.0	0.0	0.32	+0.32
5 – < 12	0.0	0.42	+0.42	0.0	0.0	0.0	0.0	0.0	0.0
12 – < 25	0.04	5.41	+0.37	0.0	2.82	+2.82	0.0	2.15	+2.15
25 – < 50	0.24	0.32	+0.08	0.0	0.0	0.0	0.0	0.0	0.0
50 – < 150	2.72	39.93	+37.21	2.56	22.14	+19.58	0.0	15.06	+15.06
> 150	35.06	84.08	+49.02	34.4	19.42	−14.98	0.0	60.86	+60.86
Total	0.90	3.28	+2.38	0.83	1.14	+0.31	0.0	1.63	+1.63
Tenure									
Owners	5.42	9.62	+4.2	5.27	3.87	−1.4	0.0	5.06	+5.06
Own + Ten	0.08	8.92	+8.84	0.0	2.06	+2.06	0.0	6.21	+6.21
Tenants	0.05	0.43	+0.38	0.0	0.0	0.0	0.0	0.0	0.0
Non Ops	26.14	23.71	−2.43	26.1	14.2	−11.9	0.0	7.92	+7.92

Table 1 B

Rahimabad+ : Value of Assets/Farm in 1970 Prices ('000 Rupees)

Operated Area (Acres)	Drills + Sprayers			Fodder Cutters			Transport		
	1970	1984	Change 70–84	1970	1984	Change 70–84	1970	1984	Change 70–84
< 5	0.0	0.0	0.0	0.1	0.07	−0.03	0.0	0.0	0.0
5 – < 12	0.0	0.0	0.0	0.0	0.24	+0.24	0.0	0.0	0.0
12 – < 25	0.0	0.0	0.0	0.0	0.17	+0.17	0.0	0.19	+0.19
25 – < 50	0.03	0.03	0.0	0.0	0.1	+0.1	0.0	0.0	0.0
50 – < 150	0.0	1.29	+1.29	0.0	0.0	0.0	18.5	21.47	+2.97
> 150	0.0	2.54	+2.54	0.06	0.28	+0.22	26.0	56.46	+30.46
Total	0.0	0.08	+0.08	0.0	0.21	+0.21	1.26	1.46	+0.2
Tenure									
Owners	0.0	0.24	+0.24	0.0	0.12	+0.12	8.01	4.67	−3.34
Own + Ten	0.0	0.26	+0.26	0.02	0.15	+0.13	0.0	4.66	+4.66
Tenants	0.0	0.0	0.0	0.0	0.24	+0.24	0.0	0.0	0.0
Non Ops	0.0	0.94	+0.94	0.0	0.05	+0.05	37.5	14.98	−22.52

Table 1 B

Rahimabad+ : Value of Assets/Farm in 1970 Prices ('000 Rupees)

Operated Area (Acres)	Animal Assets			Bullocks			Milch Animals		
	1970	1984	Change 70–84	1970	1984	Change 70–84	1970	1984	Change 70–84
< 5	2.35	2.98	+0.63	2.0	1.08	–0.92	0.25	1.86	+1.61
5 – < 12	2.66	3.37	+0.71	0.92	1.71	+0.79	1.71	1.50	–0.21
12 – < 25	2.39	5.33	+2.94	0.99	2.11	+1.12	1.17	2.84	+1.67
25 – < 50	7.99	5.62	–2.37	5.18	2.93	–2.25	1.6	2.68	+1.08
50 – < 150	11.46	3.27	–8.19	3.33	0.59	–2.74	8.0	2.4	–5.6
> 150	52.34	9.04	–43.3	29.1	4.28	–24.82	17.7	4.14	–13.56
Total	4.6	3.7	–0.9	2.08	1.74	–0.34	2.11	1.79	–0.32
Tenure									
Owners	9.87	4.92	–4.95	4.41	2.09	–2.32	4.15	2.49	–1.66
Own + Ten	5.94	4.89	– 1.05	2.26	1.83	–0.43	2.69	2.52	–0.17
Tenants	2.34	3.14	+0.8	1.15	1.59	+0.44	1.17	1.46	+0.29
Non Ops	7.73	2.5	–5.23	2.06	0.33	–1.73	4.8	1.93	–2.87

Table 1 B

Rahimabad + :   Value of Assets/Farm in 1970 Prices ('000 Rupees)

Operated Area (Acres)	Farm Assets			Non Farm Assets			Domestic Assets		
	1970	1984	Change 70–84	1970	1984	Change 70–84	1970	1984	Change 70–84
< 5	2.75	3.5	–0.75	0.0	15.15	+ 15.15	0.0	1.51	+ 1.51
5 – < 12	2.66	3.79	+ 1.13	0.0	114.64	+ 114.6	0.13	0.84	+ 0.71
12 – < 25	2.53	10.93	+ 8.4	0.05	5.51	+ 5.46	0.09	1.73	+ 1.64
25 – < 50	8.24	5.94	–2.3	0.0	100.0	+ 100.0	0.0	8.26	+ 8.26
50 – < 150	74.39	64.67	–9.72	16.67	147.86	+ 131.2	4.26	29.47	+ 25.21
> 150	227.1	149.56	–77.54	140.0	638.0	+ 498.0	13.16	73.0	+ 56.84
Total	11.18	8.45	–2.73	4.25	101.11	+ 96.86	0.56	3.1	+ 2.54
Tenure									
Owners	48.81	19.21	–29.6	22.97	67.73	+ 44.76	2.97	8.79	+ 5.82
Own + Ten	6.58	18.48	–11.9	0.28	20.63	+ 20.35	0.11	3.61	+ 3.5
Tenants	2.39	3.56	+ 1.17	0.0	119.09	+ 119.1	0.06	0.81	+ 0.75
Non Ops	235.0	41.19	–193.8	134.64	1045.4	+ 910.7	14.36	42.78	+ 28.42

Table 2 B

Rahimabad+ :   Value of Assets/Acre in 1970 Prices ('000 Rupees)

Operated Area (Acres)	Mechanical Assets			Tractors			Tubewells		
	1970	1984	Change 70–84	1970	1984	Change 70–84	1970	1984	Change 70–84
< 5	0.1	0.2	+0.1	0.0	0.0	0.0	0.0	0.12	+0.12
5 – < 12	0.0	0.07	+0.07	0.0	0.0	0.0	0.0	0.0	0.0
12 – < 25	0.0	0.34	+0.34	0.0	0.18	+0.18	0.0	0.14	+0.14
25 – < 50	0.01	0.0	–0.01	0.0	0.0	0.0	0.0	0.0	0.0
50 – < 150	0.04	0.57	+0.53	0.04	0.32	+0.28	0.0	0.22	+0.22
> 150	0.04	0.18	+0.14	0.04	0.04	0.0	0.0	0.13	+0.13
Total	0.03	0.2	+0.17	0.02	0.07	+0.05	0.0	0.1	+0.1
Tenure									
Owners	0.04	0.26	+0.22	0.04	0.11	+0.07	0.0	0.14	+0.14
Own + Ten	0.0	0.16	+0.16	0.0	0.04	+0.04	0.0	0.11	+0.11
Tenants	0.0	0.07	+0.07	0.0	0.0	0.0	0.0	0.0	0.0
Non Ops	0.03	0.23	+0.2	0.03	0.14	+0.11	0.0	0.08	+0.08

A. Non Tractor Mechanical Assets

Table 1B shows that between 1970 and 1984 increase in the mean value per farm was Rs 1600 for tubewells, Rs 80 for drills and sprayers, Rs 20 for fodder cutters and Rs 2400 for total mechanical assets. So increase in the value of individual mechanical assets was low in Rahimabad + compared to Chak 323.

This increase in the value of individual mechanical assets was not very systematically related to operated area. Table 1B shows that the value of tubewells, drills, sprayers and fodder cutters per farm did not increase for all size classes. Between 1970 and 1984, increase in the value of tubewells per farm was Rs 300 for operators < 5 acres, 0 for operators between 5 and 12 acres, Rs 200 between 12 and 25 acres, 0 between 25 and 50 acres, rose sharply to Rs 15,000 between 50 and 150 acres and rose sharply again to Rs 61,000 above 150 acres. So the increases are not successive. However, there is a major break point of 50 acres above which increase in the value of tubewells per farm rises sharply. Similarly, drills and sprayers do not increase at all below 50 acres. Increase in the value of fodder cutters per farm is widespread, however, as expected.

As a result of the sketchy increases in individual assets below 50 acres, increase in the total value of mechanical assets per farm is not very systematically related to operated area. Table 1B shows that increase in the value of mechanical assets per farm was less than Rs 500 for operators under 50 acres, then rose sharply to Rs 37,000 for operators between 50 and 150 acres and was Rs 49,000 above 150 acres. So there is a credit constraint on the increase in value of mechanical assets below 50 acres.

Finally, non operators were expected to significantly increase their value of tubewells per farm in an attempt to increase their rental share per sharecropped out acre by providing tubewell water to their tenants. Table 1B confirms that non operators increased their value of tubewells per farm by Rs 8000, which was the highest increase in the tenure categories.

B. Animal Assets

Table 1B shows that the 12 acre break point for bullocks which held in Chak 323 is raised to 25 acres in Rahimabad +. Below 25 acres the size classes between 5 and 25 acres increased their value of bullocks per farm, while the size class below 5 acres decreased its value bullocks per farm. Above 25 acres all size classes decreased their value of bullocks per farm.

Increase in the value of bullocks per farm is inversely related to operated

area. The value of bullocks per farm decreased by Rs 900 below 5 acres and increased by approximately Rs 1000 between 5 and 25 acres. But above 25 acres decrease in the value of bullocks per farm is Rs 2300 between 25 and 50 acres, Rs 2700 between 50 and 150 acres and Rs 24,000 above 150 acres. Therefore, above 5 acres increase in the value of bullocks per farm decreases with the operated area of the size class. The significant break point here is 150 acres above which decrease in the value of bullocks rises sharply. This large decrease in bullocks above 150 acres is accounted for by decrease of operated area. If tractors per acre were optimally fixed in 1970 by this size class above 150 acres, then tractors being substitutes for bullocks, bullocks per acre must also have been optimally fixed.

Milch animals and total animals decreased in mean value per farm. Operators above 50 acres decreased their value of milch and total animals the most.

C. Non Farm and Domestic Assets

Table 1B shows that increase in the value of non farm assets per farm is not very systematically related to operated area. Increase in the value of non farm assets per farm was Rs 15,000 for operators under 5 acres, rose sharply to Rs 114,000 for operators between 5 and 12 acres, fell to Rs 5000 between 12 and 25 acres, rose sharply again to Rs 100,000 between 25 and 50 acres, was Rs 132,000 between 50 and 150 acres and rose sharply again to Rs 500,000 above 150 acres. The unsystematic increases below 50 acres shows that increase in non farm assets does not depend entirely upon the internal resources of the farm. But the break point at 50 acres above which increase in non farm assets rises sharply shows that these size classes consistently rely upon diversifying investment into non farm assets.

Table 1B also shows that amongst tenure classes, non farm operators had the largest increase in their value of non farm assets per farm of Rs 910,000. As expected these non operators constrained from resuming sharecropped out area for self cultivation to increase their profits per acre disinvested in agriculture, through sale of sharecropped out area.

Unlike non farm assets, domestic assets per farm are more clearly positively related to operated area. Table 1B shows that between 1970 and 1984 increase in the value of domestic assets per farm was less than Rs 1700 below 25 acres was Rs 8000 between 25 and 50 acres, rose sharply to Rs 25,000 between 50 and 150 acres and was Rs 60,000 above 150 acres. This shows that increase in domestic assets per farm was constrained income per farm.

Comments on
" Growth and Distribution of Agrarian Assets in the Punjab"

Assessing "the growth and distribution of agrarian assets" implies questions of methodology, especially with respect to sampling techniques, and selecting (proxy) variables which promise to represent the factors, which are responsible. These may have an orthogonal structure; we should expect multicolinearity due to the interaction between agrarian systems and government policy over time.

For determining the growth and distribution of assets, three factors are singled out, two "exogenous", i.e. tractorization, and credit and one "endogeneous", i.e. concentration of owned and operated land. Neither of them is dealt with in detail. Tractors constitute agricultural assets, no doubt, and credit may be used mainly to fund them. It would be interesting, however, to have a statistical proof, that tractors form the major agricultural assets, and that the availability of credit determines their purchase. The use of tractors as well as access to credit may depend on the size of holding/ownership, and, thus, concentration of land could become a major explaining factor; more insight might be available from the survey, but there is no reference to it in the paper.

The study aims at a regional differentiation; two regions of the Punjab are distinguished, i.e. the Canal Colonies and South Western Punjab; the other regions of the Punjab with their distinct features like and barani areas of the Potwar Plateau and the siwalik, are left out without even being mentioned.

Two villages were selected: Chak 323 in the Canal Colonies and Rahimabad in the South Western Punjab. With this sample size of just one village in each region, one has to be cautious in generalizing. This should especially be true for village Rahimabad, where the "operated area" decreased by 3359 acres and the "normal area" by 9384 acres (PDR 29(1990)3&4, p. 288) or by 41 percent for "operated area" (*ibid* p. 281) as we learn from the appendix of the author's recent article in *The Pakistan Development Review*, referenced in the original version (presented at the Annual General Meeting) of the present paper. There is, unfortunately, no evidence, however, as to what extent the two villages are representative.

In each of the two villages a number of owner/holdings have been surveyed. It is, however, not clear, whether these villages have been studied in their totality or not ("the sample in each village", p. 12 of the paper presented at the Annual General Meeting). There is no reference to any sampling technique used. It

would be also interesting to know the basic characteristics of the villages as background information.

The analysis is of a comparative static nature. The base year (1970), however, is not exactly the starting point of the "green revolution", rather almost the end of the first phase of it. Finding out, how the "adoption of the Green Revolution inputs, seed and fertilizer, has generated a high rate of acquisition of agrarian assets", should be only possible, if the distribution of assets before the beginning of the advent of the new inputs, say around 1965, were known. The final year of the study (1984) obviously was the year of the survey.

As for the assets themselves, it is not clear, which were analysed. The paper's title is "The growth and distribution of agrarian assets in the Punjab", the "introduction" promises a micro study on the growth and distribution of "non land agrarian assets", and, finally, various assets including land are listed, i.e. land, farm asset (both mechanical and animals), non farm assets, and domestic asset.

The assets are valued at 1970 prices, as we learn passim from the paper presented at the Annual General Meeting. There is, however, no further information given, how the author deflated his 1984 prices: by individual commodities (land, tractor, etc.) by groups of commodities, or by using the GDP deflator. This information is essential, given the fact, that the valuation of land always is difficult, if little land is traded, land prices vary widely regionally, and agriculture undergoes rapid technological and social changes. The third end note of the paper presented at the Annual General Meeting promised that the weighing procedure will be described in the appendix; this evidently referred neither to that paper, nor to the author's recent article in the PDR. The present paper is even less conclusive.

The terms "expectation" and "prediction" are used synonymously, although implying different connotations; what has been discussed are rather working assumptions. Of these, the author lists a number in his paper.

In the author's "model", policy is used as the exogenous factor. He defines: "Exogeneous factors like state policy have a common influence on all regions in the agrarian sector and induce homogeneity in the pattern of accumulation between regions." And: "Endogeneous factors specific to a region ... can vary between regions and leads to heterogeneity ...". This is irritating, since he lists several endogenous factors "like the operated area, irrigation endowments, forms of land rental and other market conditions", whereas according to his definition we would expect e.g. geographical features to be responsible. In the real world

of economics, price policy always has a differentiating effect: For example, a price raise of, say, rice will affect irrigated areas more than non-irrigated areas. And if the impact of state policy can really be reduced to that of credit, this cannot be deducted from the present paper.

As for the production function, it might help, if the author explicitly lines out, what kind of production function with regard to tractors and manual labour he has in mind. Mechanisation, especially the use of tractors not always has a labour displacing effect (the author writes "labour augmenting [sic!] tractorization and general mechanisation") ; shortening of sowing and harvesting periods may allow an additional crop, which might be labour intensive, as in the case of vegetables. There is obviously an interrelationship between cropping systems and profitability of mechanisation on the one hand, and the availability of mechanical traction power and change of cropping systems on the other.

There are economies as well as diseconomies of scale in agriculture, depending on technical as well as on social conditions. If there is anything like a "supervision constraint", this is not necessarily imposed by the number of male family members: non-family (and maybe even female) members, too, may be efficient managers, given adequate powers and renumeration. And even if this constraint does exist, the statistical evidence of the study under discussion is weak: there is no proof of a monocausality: right of inheritance, migration and land reforms could have similar effects:

- *Ceteris paribus*, under the prevailing system of inheritance and the current rate of population growth (3 percent p.a., 14 years), the average size of holdings will be diminished by about one third during one and a half decades, if land is passed on to the heirs of the landowners, only (and not sold to non-land-owners).
- In areas with small holdings and high opportunity costs of labour, people may move out of agriculture, offsetting the population growth. There is, however, no uniform pattern of migration.
- Between 1970 and 1984 there have been two land reforms (1972,1977); even if they were not effective, landlords are believed to have split up their holdings to avoid being disappropriated.

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