Change in Land Distribution in the Punjab — Empirical Application of an Exogenous-Endogenous Model for Agrarian Sector Analysis

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1. INTRODUCTION

This study is a micro analysis of change in the distribution of operated area over time in two villages of the Punjab. There is considerable controversy over whether the green revolution, so successful in the Punjab, has increased concentration of operated area. Existing micro studies show either an increase or a decrease in concentration. This study uses an exogenous-endogenous model to show two divergent trends coexisting in the Punjab. The canal colony village with a typically low concentration of operated area has become more concentrated over time. The South-Western Punjab village ·with a typically high concentration of operated area has remained constant over time.

2. LITERATURE ON MICRO CHANGES IN THE DISTRIBUTION OF OPERATED AREA IN SOUTH ASIA

Faced with some scattered evidence of increasing income inequality and land concentration in Asia, in the Seventies, the newly adopted high-yielding variety (HYV) technology was blamed. Although the technology was neutral to scale, lumpiness in investment implied differentials in adoption across farm size. And the requirement of controlled irrigation implied differentials in adoption across regions. The HYV induced increase in profits per acre, provided an incentive towards increasing farm size through eviction of share tenants, and buying out pressurized farmers [Cleaver (1972) and Byer (1972)].

This concentration of land was facilitated in many countries, especially Pakistan, by a host of other factors. Landlords were reluctant to share the HYV induced increase in income with their tenants. But they could not tax this increase away through higher rental shares just because a different seed was being used. This created an incentive for landlords to evict share tenants. This incentive was

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added to by the state's lowering of land ownership ceilings, designed to promote intensive production on self-cultivated area and reduce expansion of owned area based on sharecropping out. The ability to evict sharecroppers and resume share-cropped out area for self-cultivation was increased by the state's maintenance of an overvalued exchange rate which made tractorization cheaper, and the direction of agricultural credit largely towards tractors.

A parallel inducement towards tractorization, and concentration of operated area is given by the proposition of a supervision constraint. Sen (1981) explains the coexistence of large and small farms, especially small sharecropped farms on the basis of the exploitation of the cheap labour of small farms by the large. Small farmers have been noted to have a higher total output per cultivated acre than larger farms because of a higher labour input per acre [Bérry and Cline (1979)]. Involuntary un-employment drives the small farmers to continue to increase their family labour on the farm till a point where its marginal product falls below the market wage rate. Large farms on the other hand were found to cease using labour well above the point where its marginal product equalled the wage rate. This gap between the market wage and the higher marginal value product at which large farms stopped hiring labour Sen explains as the additional cost to the large farms of family supervision of hired labour. If family size places a limit on the hiring of labour, and so self-operated area, then large owners can fixed rent out this unsupervisable area. But when this fixed rental market does not operate as in regions of the Indian subcontinent, this unsupervisable area can be sharecropped out to small farms so using their cheap labour as well. However, the emergence of the possibility of tractorization allows large farms to increase their operated area without a propor-tionate increase in hired labour, and so without running into the supervision con-straint [Sen (1981)].[1] This is an additional argument predicting eviction of tenants and concentration of operated area over time.

In Pakistan and the Punjab, these inducements towards eviction of share-croppers, tractorization and so concentration of operated area apply. A number of studies have tested for polarization based on data aggregated for the entire Punjab. For instance, in a comparison of the 1960 and 1972 census figures for all of the Punjab, Hussain found that the middle category of 7.5 to 25 acre farmers had decreased in area and numbers, while smaller and larger categories had increased [Hussain (1980)]. This trend towards polarization was also confirmed by his sample survey of 100 farmers chosen from the whole of the Punjab.

There is one major problem with this kind of empirical result and the theoret-ical framework within which it is conducted. Firstly, the empirical result is based

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[1]The concept of supervision costs can also be enlarged to include other labour costs like search, screening, maintenance, nutrition and tying costs.

on a highly aggregated set of data covering the whole of the Punjab. To analyze land change, there is no justification for aggregating a small number of farms from as heterogenous a province as the Punjab. All the literature discussed above posits one trend to prevail uniformly across the agrarian sector. This assumption however is invalid unless proven empirically.

3. HYPOTHESES ABOUT CHANGE IN THE DISTRIBUTION OF OPERATED AREA BETWEEN 1970 AND 1984 IN TWO CONTRASTING VILLAGES

The Model

In this study an exogenous-endogenous model is used to predict change in the distribution of operated area in two contrasting villages of the Punjab. The abstract theoretical framework perdicts 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. It thus, introduces 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 leads to heterogeneity in the pattern of accumulation between these regions.

Empirical Survey

The Punjab is a heterogenous province in terms of the endogenous, regionally specific factors cited in the model. It consists of two distinct major regions, the canal colonies, and South-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 factor markets for land and labour. In contrast, South-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. 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 cited above. Data was obtained for the distribution of operated area for two terminal years of 1970, and 1984.

Hypotheses

Relative change in operated area between producers over the period 1970–84 is expected to be determined by one exogenous and one endogenous factor in each of the two villages. The exogenous factor is HYV induced profitability plus land ownership ceilings. However, this increase in concentration of operated area is expected to be modified in one village by the operation of a factor endogenous to that village and its region. This endogenous factor is the distribution of operated and owned area in 1970 in each village.

In the typical canal colony village of Chak 323, the distribution of operated area in 1970 was less concentrated than in the typical South Punjab village of Rahimabad+. Farms operating more than 150 acres had only 15 percent of the village operated area in Chak 323 and more than 53 percent in Rahimabad+. Second, in 1970 the largest size class rented in more than 30 percent of its operated area in Chak 323 and rented out only 10 percent. Conversely, in Rahimabad+ the largest size class rented in no area and rented out almost twice its operated area. Third, a fixed rent land leasing market operated in Chak 323 in 1970, but was not relied on at all in Rahimabad+. So sharecropping was the minor form of land rental in Chak 323, but the only form of rental available in Rahimabad+.

These structural characteristics endogenous to each village show that in 1970 the largest size class of operators was increasing its operated area by leasing in, in Chak 323, but was decreasing its operated area by sharecropping out in Rahimabad+. Therefore in Chak 323, the exogenously given HYV induced tendency to increase operated area by resuming sharecropped area and increasing leased in and owned area would be expected to operate without constraints.

However, in Rahimabad+ in 1970 the largest size class of operators appears to be faced by a classic supervision constraint. The mean owned area for this size class was 906 acres in Rahimabad compared to 113 acres in Chak 323. This 9 times larger mean owned area gives a much larger unsupervisable non self-cultivable area in Rahimabad, unless the number of family males is also 9 times greater in Rahimabad. The lack of a fixed rental land market then implied the sharecropping out of this unsupervisable area.

According to Sen's model the possibility of tractorization should result in the resumption of this sharecropped out area by this largest class for self-cultivation implying an increase in concentration. However, three factors militate against this in Rahimabad+. Firstly, mean operated areas for this size class was already very high in Rahimabad+, at 876 acres in 1970, compared to 143 acres in Chak 323. Secondly, tractors were already being used in both villages, so they must already have determined as upper limit to the self-cultivated area. In the case of Chak 323, this upper limit on self-cultivable area could well be above the mean of 154 acres operated in 1970 because they were still renting in. In the case of Rahimabad+,

this upper limit could not be above the mean of 876 acres operated in 1970, because they were renting out. Thirdly, legal land ownership ceilings of (150 −300 owned acres) would not affect rented in area or owned area in Chak 323, but would affect the owned area of the largest size class in Rahimabad+. As a rule of thumb, farms already operating between 200 to 250 acres in 1970 would not be expected to increase their operated area further in either of the two villages. There is now one exogenous factor and one endogenous factor determining change in the distribution of operated area between 1970 and 1984 in each village. The exogenous and endogenous factors give the following testable hypotheses:

(i) Owners and lessees operating < 250 acres in 1970 can increase operated area;

(ii) Owners and operators operating > 250 acres in 1970 will keep operated area constant, or decrease it;

(iii) Share tenants in 1970 will decrease operated area;

(iv) (i) and (iii) imply an increase in the concentration of operated area in Chak 323 between 1970 and 1984; and

(v) (i) to (iii) imply that concentration of operated area will not increase in Rahimabad+ between 1970 and 1984.

4. CHANGE IN OPERATED AREA

The broader hypotheses (iv) and (v) are taken up first, because they describe the direction of the change in the distributions of operated area between 1970 and 1984. Hypotheses (i) − (iii) explain the direction of the change through the components of operated area and these are taken up next.

In Table 1 the Gini coefficients for concentration of operated area confirm

Table 1
Gini Coefficients for Change in Operated and Owned Area

	Village	Gini Coefficients	
		1970-71	1983-84
Operated Area	Chak 323	0.4564	0.6151
	Rahimabad+	0.6559	0.6584
Owned Area	Chak 323	0.5397	0.5355
	Rahimabad+	0.8376	0.7824

Sample Survey, 1984.

both hypotheses. In Chak 323, the Gini coefficient for operated area increased from 0.4564 in 1970-71 to 0.6151. This means that concentration of operated area increased in Chak 323. In Rahimabad the Gini coefficient for operated area was 0.6559 in 1970-71 and it remained virtually constant, creeping to 0.6584 in 1983-84. This means that the concentration of operated area remained constant in Rahimabad+ over this period.

The observed difference in trends in the distribution of operated area in the two regions shows the usefulness of the exogenous-endogenous framework in differentiating between regions.

The observed changes in the distribution of operated area for Chak 323 and Rahimabad now need to be explained in terms of the components of operated area. Hypotheses (i) and (iii) applied to Chak 323. Hypotheses (i) − (iii) applied to Rahimabad+.

The first step in testing hypotheses (i) − (iii) is to examine the distribution of owned area. Table 1 shows that in Chak 323 the concentration of owned area does not explain changes in the concentration of operated area. Concentration of owned area decreased slightly, as the Gini coefficient dropped from 0.5397 in 1970-71 to 0.5355 in 1983-84. This does not explain an increase in the concentration of operated area in Chak 323. In fact, if the concentration of owned area decreased then concentration of rented area must have increased sharply to result in an overall increase in the concentration of operated area.

In Rahimabad+ change in the concentration of owned area again does not wholly explain change in the concentration of operated area. Table 1 shows that concentration of owned area decreased, as the Gini coefficient dropped from 0.8376 in 1970-71 to 0.7828 in 1983-84. But concentration of operated area remained constant in Rahimabad+. So concentration of rented area must have increased to compensate for the reduction in concentration of owned area, to keep the concentration of operated area constant.

Therefore, both in Chak 323 and Rahimabad+ changes in the entire tenurial distribution are required to explain changes in the size distribution of operated area. This tabular comparison between the size and tenurial distribution of 1970-71 and 1983-84 can be quite copious. As an alternative to Table 1, Graph 1 plots the tabular information in 4 dimensions.

The horizontal x axis plots the six-size classes into which operated area is divided. The vertical y axis plots the percentage of total area that is operated by each size class. The lateral z axis which gives depth to the graph plots the two years of 1970 and 1984. Each size class has two joined blocks. The percentage area operated by a size class in 1970 is indicated by the height of the first of the two joined blocks. The percentage area operated by that size class in 1984 is indicated by the height of the second of the two joined blocks.

The tenurial distribution of the operated area of each size class into the conventional categories of owners, owners-cum-tenants and tenants is indicated within the height of each block. The height of each block is divided into the relative areas of these 3 tenurial categories. These percentage areas are also written on the side of each block.
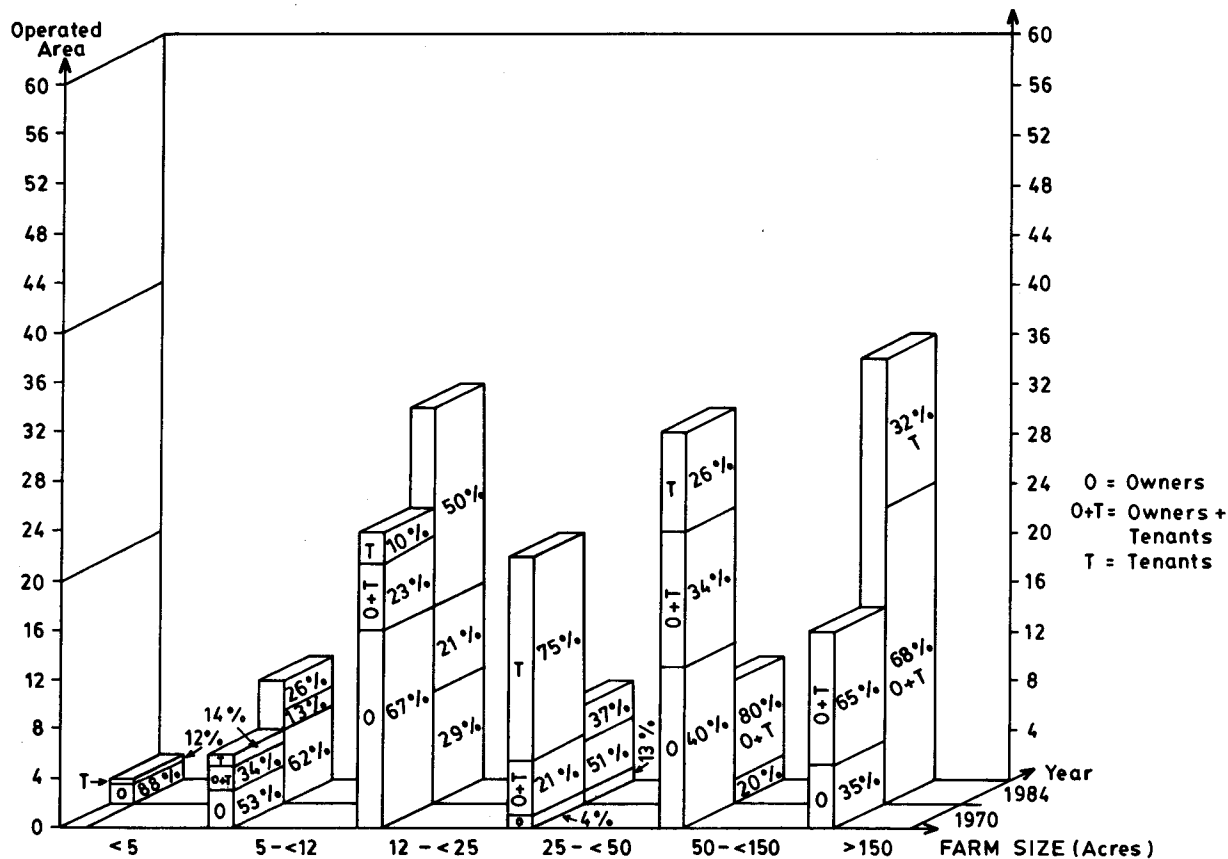
A. Chak 323

Graph 1A for Chak 323 clearly shows the polarization behind the increase in concentration of operated area indicated by the Gini coefficients. The three size classes under 25 acres increased their share of total operated area between 1970 and 1984. The two classes between 25 and 150 acres decreased their share of total operated area between 1980 and 1984. The largest size class above 150 acres increased its share of total operated area between 1970 and 1984.

The depletion in the share of operated area of the two size classes between 25 and 150 acres and the increase in the share of the largest size class above 150 acres, is explained by changes in the tenurial distribution of operated area in Graph 1A. The size class operating between 25 and 50 acres in 1970 consisted predominantly of pure tenants' area, (75 percent). By 1984 tenants' area had shrunk to 37 percent of this size class. The size class operating between 50 and 150 acres in 1970 was composed 1/4ths of pure tenants' area. By 1984 tenants area had been reduced to zero in this size class. This reduction in tenants area in the size classes between 25 and 150 acres was not through outright evictions. Otherwise tenant area proportions in the lower size classes would not have increased. The size class between 12 and 25 acres had only 10 percent tenants' area in 1970, but by 1984 tenants' share had increased to 50 percent. The size class between 5 and 12 acres had only 14 percent tenants' area in 1970, but by 1984 tenants share had increased to 26 percent. So there appears to have been a systematic reduction in the plot sizes of tenants operating between 25 and 150 acres, causing most of them to crowd into the size classes below 25 acres.

On the other hand, some tenants must have rented in more area to climb into the largest size class above 150 acres. This size class had no pure tenant area in 1970, but by 1984 almost 1/3rd of it consisted of tenants' area. Secondly, in 1970 this largest size class comprised 35 percent of owned area. But by 1984 all owners were additionally renting in area.

So the polarization of the distribution of operated area in Chak 323 has been based on the depletion of the size classes between 25 and 150 acres and the increase in the shares of the size classes above and below. The depletion of the size classes between 25 and 150 acres is explained by rented area. Most tenants between 25 and 150 acres by 1984 had their plot sizes reduced and so fell into lower size categories. Some tenants increased their rented in area to rise into the largest

Graph 1A: Chak 323 : Operated Area Changes between 1970 and 1984

size class above 150 acres. This largest size class increased its share of total operated area through owners, owner cum tenants and tenants renting in more area.
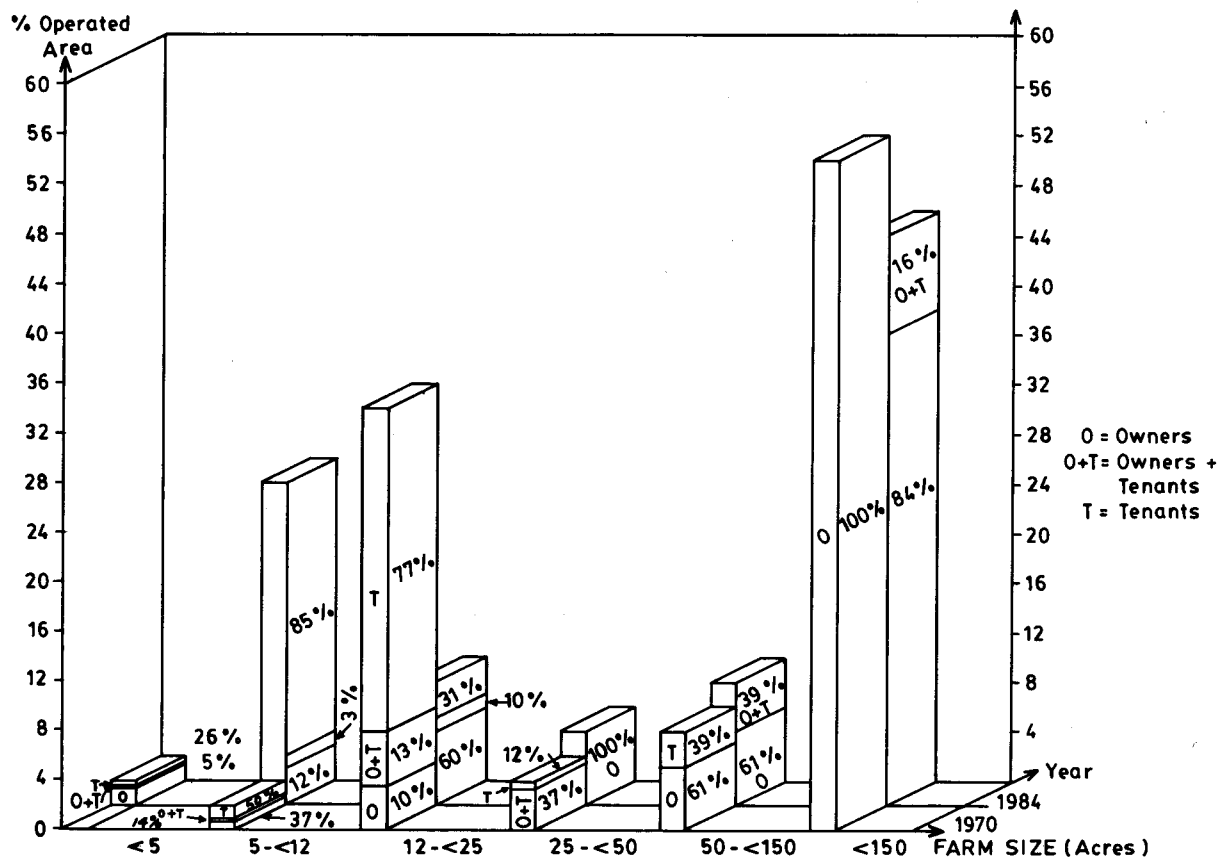
B. Rahimabad+

Graph 1B for Rahimabad+ shows the change in size classes between 1970 and 1984 leading to the constant concentration of operated area given by the Gini coefficients. The largest size class above 150 acres decreased its share of total operated area between 1970 and 1984. The size classes between 25 and 150 acres both increased their share of the operated area between 1970 and 1984. The size class between 12 and 25 acres lost area substantially, while the lower size class between 5 and 12 acres gained area substantially between 1970 and 1984. So the major depletion of the 12—25 acres size class is compensated by the reduction of the largest size class above 150 acres and the increase in the shares of all the other size classes. The constancy in the concentration of operated area hides this major change in the shares of the size classes.

These changes in the area shares of size classes are explained by changes in tenure within each size class in Graph 1B. The largest size class above 150 acres decreased its share by decreasing owned area. As a result of the decrease in owned area by operators above 50 acres, the smaller size classes all increased their owned area proportions. This illustrates the decrease in the concentration of owned area shown by the Gini coefficients.

The decrease in the concentration of owned area on its own should have resulted in a decrease in the concentration of operated area. But it was accompanied by a decrease in tenants area which left operated area constant. Decrease in tenants area explains the major depletion of the size class between 12 and 25 acres. In 1970 tenants' area comprised 77 percent of the operated area of this size class. By 1984 tenants' area had been reduced to 31 percent of this size class. The size classes between 25 and 150 acres also contained 12 percent and 39 percent tenants' area respectively and by 1984 it had been completely eliminated. Here, as in Chak 323, the reduction in tenant area was not wholly caused by outright evictions, but a systematic reduction in tenants' plot sizes. Otherwise the lower size class between 5 and 12 acres would not have increased its share of operated area and its share of tenants' area so abruptly. Only a systematic reduction in plot sizes of tenants' operating between 12 and 150 acres would have brought most of them down into the size classes below 12 acres.

7. CONCLUSIONS

In Chak 323, concentration of operated area was seen to result from the depletion of two size classes operating between 25 and 150 acres and the increase in

Graph 1B: Rahimabad+ : Operated Area Changes between 1970 and 1984

share and acreage of the size classes below and above. The size class between 25 and 50 acres was the model area operated by sharecroppers in 1970. A systematic reduction in the plot sizes of sharecroppers caused them to fall into the lower size classes, especially increasing the share and acreage of the size class between 12 and 25 acreas. A few lessees increased their fixed rented in area to rise into the largest size class above 150 acres.

In Rahimabad+ the constancy in the concentration of operated area disguised the depletion in share and acreage of the largest size class operating above 150 acres and the size class operating between 12 and 25 acres. The largest size class halved its mean operated area and reduced its sharecropped out area by selling owned area. This size class also attempted to decrease its share tenants income by systematically reducing their plot sizes. As a result the size class between 12 and 25 acres which was the model area operated by sharecroppers in 1970 was depleted. Sharecroppers fell into the lower size classes, especially increasing the share and acreage of the size class between 5 and 12 acres.

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Comments on
"Change in Land Distribution in the Punjab — Empirical Application of an Exogenous-Endogenous Model for Agrarian Sector Analysis"

I would like to express my gratitude to the Pakistan Society of Development Economists for the invitation to attend the Sixth General Meeting and to discuss an interesting paper. This has provided me an excellent opportunity to meet old friends and professional colleagues.

The paper under discussion is concerned with micro analysis of the change in the distribution of operated area during the period 1970 to 1984, as a result of the exogenous factors as manifested in the large-scale adoption of high-yielding seeds and public policy, in the two villages of the Punjab. This is an interesting way to analyse one of the many dynamics resulting from the Green Revolution technology since aggregation of data at the Provincial and National levels conceals many aspects of this widely studied phenomenon. Using the so-called Exogenous-Endogenous Model, the author shows two divergent trends in the distribution of operated area.

The canal colony village with a typically low concentration of operated area in 1970 has become more concentrated in 1984 while the South Western Punjabi village with a high concentration of operated area in 1970 has not experienced further concentration. However, it is not a surprising result as high concentration of operated area in the South-Western Punjab village implied lesser scope for further concentration. The divergence stems from the original configuration and resource endowment of the villages under invstigation.

Besed on his finding the author argues that the Exogenous-Endogenous Model implies that land reforms policy must take into account regional differences. But where are the land reforms? Are they based on economic rationale or justified on social, political and institutional considerations?

As the author, is interested in generalizing for the whole province, he should have informed his audience about the procedure followed in the selection of his sampling units at various stages i.e.: (i) How these two villages were selected? (ii) How the data collection was organized? (iii) What are the limitations of the data and analysis?

An important point worth noting is the substantial decrease in area operated in both these villages i.e., 375 acres out of 2,882 acres in the canal colony village and

3,359 out of 8,247 acres in the South-Western village during the intervening period i.e., in 1984 compared to 1970. Disappearance of operated area on such a scale has serious implications for the development of agriculture, farm production and well-being of the associated farm households. The author has totally ignored this important feature for which he owes an explanation to his readers.

What has been the impact of the divergent changes in the concentration of operated area on: (i) cropping intensity and cropping patterns, (ii) labour use and, (iii) land productivity. As these factors are important for agricultural development shedding some light on these aspects would have provided useful insights to the students of agricultural development.

An important variable which has played a crucial role in increasing the profitability of farming has been the feasibility of supplementary irrigation by tube-wells. But the author has completely ignored this.

In the wake of the green revolution and farm mechanization, the farm sector in the Punjab has undergone profound changes. These, *inter-alia*, include: (i) increased tendency towards self-cultivation, (ii) part-time farming, (iii) changes in the nature and terms of tenancy. These in turn have also influenced the process of agricultural change. These aspects however have not been touched on in the paper.

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