

Land Agglomeration under Changing Technology: Some Inferences from Pakistan

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The paper studies the intertemporal trend of land distribution with a view to checking the legitimacy of the thesis that land distribution deteriorated under the Green Revolution in Pakistan by examining the arguments given in support of this thesis. The empirical evidence cited in this study indicates that land distribution in Pakistan either improved (as from 1960 to 1972) or remained unchanged (as between 1972 and 1980). This trend in land distribution serves to show that technological changes were accompanied by significant improvements in land distribution between 1960 and 1980. Large increases in the ownership area of small farmers between 1972 and 1980 *vis-a-vis* the decreases in the ownership area of large farmers during the same period render untenable the view that Green Revolution led to a worsening of land distribution because of land purchases by large farmers. Substantial gains in the operational area of large farmers, due either to large areas of land rented in or to increased self-cultivation, appear to be unlikely in view of the continued and rising dependence of those farmers on tenants. Favourable changes in the distribution of ownership and operational holdings seem to be the result of the widespread impact of Green Revolution on the profitability of agriculture, growing labour scarcities, land reforms, inheritance laws, and the general trends in the economic development of Pakistan.

1. INTRODUCTION

In the predominantly agrarian societies of the developing countries, ownership and control of agricultural land are of fundamental importance. Ownership of agricultural land determines the economic and hierarchical relationships of the rural society, and its control facilitates the use of an important means of production.

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Author's Note: I am highly indebted to Professor William C. Thiesenhusen of the Department of Agricultural Economics, University of Wisconsin - Madison, U. S. A., for thorough comments on an earlier draft of this paper. Thanks are also due to Mr Ghulam Mustafa Chaudhry, Staff Economist, PIDE, for assistance in data processing. I, however, bear full responsibility for the ideas expressed in this paper, as well as for any errors and omissions.

These two relationships together exercise a profound influence on the quantum of agricultural production as well as on the distribution of the fruits of agricultural progress [Naqvi, Khan and Chaudhry (1989)]. There is, thus, a direct relationship between the distribution of agricultural land and the overall economic development: a favourable distribution of agricultural land is conducive to widespread economic development, whereas an adverse distribution is unpropitious to it.

A number of sophisticated studies of Pakistan's agriculture have concluded that a progressive adoption of Green Revolution technologies has led to a noticeable deterioration in the distribution of agricultural land in the country [Alavi (1976); Falcon (1970); Gotsch (1973) and Khan (1985)]. Agricultural land being the chief source of income in the rural areas, a growing land concentration would imply a continuously deteriorating distribution of rural incomes. In view of the available empirical evidence that productivity and labour input per acre are inversely related to the farm size [Naqvi, Khan and Chaudhry (1989) and Chaudhry, Gill and Chaudhry (1985)], it is not difficult to see that any increase in the size of ownership and operational holdings would retard the growth of agricultural output and productive employment. And, of course, an increasing control of a productive resource like land by large and well-to-do farmers would only endow them with ever-increasing economic, social, and political powers and thus enable them to frustrate any attempts by the Government at improving the social welfare of the rural masses.

The purpose of the present paper is to examine the trend of land distribution in Pakistan and to assess the validity of the conclusion that land distribution deteriorated in the period of the Green Revolution. Accordingly, the paper is divided into five sections. In Section 2, a brief review of the relevant literature is presented with special reference to the arguments put forward in support of the conclusion that the concentration of agricultural land noticeably increased under the Green Revolution. Section 3 empirically determines the trend of land distribution on the basis of ownership and operational holdings. Establishing an *improvement* of land distribution under the Green Revolution with the help of statistical data, Section 4 points out the fallacies in the arguments positing a deterioration of land distribution and identifies the factors that, in fact, have led to a greater equality of land distribution in Pakistan with the progressive advancement of the Green Revolution technologies. Section 5 summarizes the conclusions of the present study.

2. A REVIEW OF LITERATURE

The thesis that the concentration of agricultural land has increased, instead of drawing on any direct empirical evidence, is based on a number of assumptions regarding the adoption pattern of the Green Revolution technology and its impact on the profitability of agriculture. Following the initial adoption pattern, it was

assumed that large farmers,¹ mainly because of their financial superiority, were in a better position to adopt innovative methods and technologies and would, for that reason, continue to maintain their lead in this respect over their smaller counterparts [Falcon (1970)]. As argued by Gotsch (1973), since the potential for utilizing a more advanced technology is greater on large holdings, it is only natural that the adoption of advanced technology will produce further land agglomeration. Another reason cited for the growing land concentration is that technological concentration on large farms has enabled the large farmers to gain substantial increases in productivity; and their reluctance to share these increases with their tenants has often led to large-scale tenant evictions, so that the lands previously cultivated by tenants are now cultivated by the owners themselves [Gotsch (1973); Alavi (1976); Falcon (1970) and Khan (1985)]. There is also the likelihood that large farmers, encouraged by the rapid increase in their incomes and constrained by the paucity of avenues for productive investment outside agriculture, purchased land on a fairly large scale [Falcon (1970)]. Land purchases by large farmers may not have been very difficult as large landowners are always in a position to force small farmers to sell their land to them; and, of course, large landowners are always eager to buy the land of poorer neighbours [Alavi (1976) and Khan (1985)]. It has also been strongly asserted by Khan (1985) that the concentration of tubewells and tractors has provided added incentives to large landowners to lease their neighbours' land. Although, understandable, the impact of all these factors on land distribution may have been significant, the studies reviewed above give no quantitative estimates of the land that may have been redistributed under that impact.

However, reference may be made to two more studies that have tried to quantify the impact of tractor introduction on farm size [McInerney and Donaldson (1975) and Lockwood and Munir (1981)]. The two studies have estimated that the average farm size more than doubled following the purchase of tractors by large farmers. Of the more than 100 percent increase in farm size, nearly 42 percent was attributed by McInerney and Donaldson (1975) to self-cultivation of the land previously rented out, 24 percent to the land newly rented in, 12 percent to the land purchased from others, and the rest to the land newly brought under cultivation. According to Lockwood and Munir (1981), the area previously rented out (62 percent) and the area newly rented in (30 percent) were the major contributors to the total increase in the average farm size following tractor purchases by large farmers.

¹The definition of a small or a large farm is likely to vary from region to region, depending on the quality of soil and available infrastructure. A uniform definition is used here following the general literature on Green Revolution in Pakistan. A large farm, estate, or holding in this study is defined as a unit of 50.0 acres or more. A small farm or holding, on the other hand, has an area of less than 12.5 acres.

If we accept the data and the logic of the arguments presented by the studies referred to above and also keep in mind the rapid technological innovation in Pakistan, we may agree with their conclusion that, following the inception of Green Revolution in the early Sixties, land distribution deteriorated considerably (or that land concentration increased noticeably) in Pakistan. But has this actually happened? Are the studies mentioned above really based on reliable data and cogent reasoning?

3. TREND OF LAND DISTRIBUTION

The trend in land distribution connotes changes in the ownership and operational status of agricultural landholdings by size. Since land purchases are an addition to the size of ownership units and the changes in tenanted land are reflected in the size of operational holdings, a comprehensive study of land distribution must be based on the size distribution of both ownership and operational holdings.

A large number of measures or summary indices are generally used for a precise measurement of inequality. The most common among these measures are the coefficient of variation, logarithmic variance, Gini Coefficient, Pareto Index, Thiel's Entropy Index, and the Atkinson Index. According to Champernowne (1974), the major purpose of the simultaneous use of some of these indices is to avoid wrong conclusions by covering all three aspects or dimensions of inequality; viz., inequality due to extreme relative wealth, inequality among the less extreme groups, and inequality due to extreme poverty. For the purposes of this study, we will concentrate on the first three measures. The choice of these three measures is based partly on computational convenience and partly on their suitability for addressing all dimensions of inequality. For example, the coefficient of variation is helpful in an analysis of the distributional changes due to extreme relative wealth; logarithmic variance picks up the changes arising out of poverty of resources; and Gini Coefficients are most sensitive to inequality among the less extreme groups [Champernowne (1974); Ahmad and Ludlow (1990)]. Had all the six measures listed above been used, they scarcely would have improved the conclusions, but would have contributed to the wasteful use of time and resources. The results of the application of the three measures to Pakistan's ownership and operational holdings are reported in Table 1.

Several important conclusions regarding the trends in land distribution follow from Table 1. First, operational holdings, irrespective of the measures employed, seem to be much less skewed than ownership holdings in both Pakistan as a whole and its provinces. This is as expected, because an overwhelming majority of the owners of large estates tend to cultivate land with the help of tenants, breaking up a single ownership-unit into as many operational units as the number of their tenants. Secondly, land concentration, though high, improved markedly in the Green Revolu-

tion period from 1960 to 1980.² As Table 1 shows, there was a definite and marked reduction in the land concentration of operational holdings between 1960 and 1972, and a slight increase between 1972 and 1980. While land distribution during the latter period continued to improve in Baluchistan and remained constant in the NWFP, the deterioration in Pakistan as a whole was the result of a reverse trend in the concentration of operational holdings in the provinces of the Punjab and Sind. As the three indices moved in unison, these changes in land distribution seem to have been contributed more or less equally by the lower, middle, and upper strata of size distribution.

Although data about the ownership of household holdings for the Sixties are not available, empirical data on individual ownership holdings reported in Naqvi, Khan and Chaudhry (1989) show a consistent trend of improvement in land distribution between the 1950s and 1980. As in the case of individual ownership holdings, the period from 1972 to 1980 was marked by a reduction of land concentration in household ownership holdings in both Pakistan and its provinces except in the NWFP, which only witnessed an imperceptible deterioration. Compared with operational holdings, ownership holdings showed a noticeably greater equality between 1972 and 1980, which would be attributable mainly to a growing equality of holdings among the medium and large farmers. The holdings of small farmers, if anything, became more unequal during this period. These conclusions follow, respectively, from a decline in land concentration ratio and coefficient of variation as against the rise in logarithmic variance between 1972 and 1980.

It may be interesting to note that positive changes in land distribution have occurred in Pakistan despite the anticipated large deterioration of size distribution of agricultural holdings under the Green Revolution. It is all the more important to note that although technological concentration during the initial years of the Green Revolution was high because of the leadership role of large farmers, land concentration improved considerably. Similarly, the higher rates of adoption of Green Revolution technologies in Punjab and Sind than in Baluchistan and the NWFP [Chaudhry (1982)] corresponded with a greater decline in land concentration in the former two provinces than in the latter two. Given this scenario of land distribution, one begins to doubt the arguments which find a deteriorating land distribution in Pakistan following a progressive adoption of Green Revolution technologies. It is, therefore, quite pertinent here to look into the limitations of those arguments under Pakistani conditions and offer alternative explanations of

²Green Revolution made a beginning in Pakistan in the early Sixties with the rapid development of private tubewells and a growing use of chemical fertilizers. The introduction of High-yielding Varieties of wheat and rice and mechanized cultivation became significant features of this technology after 1964-65.

Table 1
*Intercensal Trend of Land Distribution in Pakistan and Provinces under
 Alternative Measures of Inequality*

Inequality Measures and Years	Values of Inequality Measures for				
	Pakistan	Punjab	Sind	NWFP	Baluchistan
A. Operational Holdings					
1. Coefficient of Variation					
1960	2.314	1.889	1.820	3.422	2.566
1972	1.759	1.481	1.593	2.509	2.217
1980	1.857	1.654	1.651	2.994	2.123
2. Logarithmic Variance					
1960	2.041	1.975	1.000	2.286	2.310
1972	1.272	1.231	0.701	1.641	1.807
1980	1.298	1.257	0.805	1.516	1.774
3. Gini Coefficient					
1960	0.617	0.594	0.505	0.730	0.710
1972	0.518	0.490	0.434	0.643	0.644
1980	0.535	0.513	0.467	0.641	0.621
B. Ownership Holdings					
1. Coefficient of Variation					
1972	2.837	2.601	2.609	3.750	2.786
1980	2.476	2.711	2.239	3.524	2.455
2. Logarithmic Variance					
1972	1.713	1.612	1.752	1.620	1.802
1980	1.726	1.640	1.509	1.710	1.981
3. Gini Coefficient					
1972	0.658	0.626	0.690	0.676	0.690
1980	0.643	0.620	0.628	0.690	0.676

Source: Calculations based on size distribution of agricultural holdings reported [Government of Pakistan (1963); (1975) and (1983)].

the phenomenon at work.

4. EFFICACY OF LAND-LEASE AND LAND-PURCHASE ARGUMENTS

One of the major defects in the arguments based on land lease and land

purchases by large farmers is that they begin with a wrong premise. They unrealistically assume that large farmers were the sole beneficiaries of the Green Revolution and that land lease and land purchases by large farmers were necessary for deriving maximum benefits from the new technologies. A vast amount of information has accumulated in Pakistan in recent years which convincingly shows that the impact of Green Revolution has been far more widespread than was anticipated [Chaudhry (1982); Naqvi, Khan and Chaudhry (1989) and Pinstруп-Anderson and Hazell (1985)]. To the extent that small farmers were also the beneficiaries of the Green Revolution, the argument that they were not in a position to enter into leases and land purchases, due to financial constraints, is unconvincing. Small farmers' financial constraints have also been alleviated in recent years by the fairly large amounts of money sent to them by their family members working abroad. Although financially superior, many large farmers indulge in luxury consumption, and their increments are often spent unproductively. As far as the avenues for productive investment are concerned, there can be no dearth of them outside the agricultural sector in a growing economy like that of Pakistan. By contrast, large farmers' investment in land leases and land purchases may be economically irrational, or utterly wasteful, relative to the available options on account of a number of factors discussed below.

While the available land resources are put to the maximum possible use by small farmers, it is a well known fact that large farmers maintain vast reserves of uncultivated land and they only cultivate land extensively. According to the Pakistan Census of Agriculture for 1980 [Government of Pakistan (1983)], only about 67 percent of the farm area of large holdings was under cultivation and only 86 percent of the actually cultivated area was sown to crops. One of the major implications of this inverse relationship between land use and farm size is that it would be far more profitable for large farmers to cultivate their own land more effectively than to engage in costly land purchases and land leases from their small neighbours. In view of the growing pressure of a redistributive land reform, and the likelihood of resumption by Government of the land in excess of the ceiling with small or no compensation, land purchases by large farmers would extremely be wasteful and at best self-defeating. In spite of the relative ineffectiveness of land reforms in Pakistan, the fear of an effective land reform and land confiscation constitutes a powerful factor in directing the large farmers' emphasis away from land purchases. In view of the growing scarcities of labour in Pakistan's agriculture despite mechanization [Chaudhry (1986)], it will be highly uneconomical on the part of the large farmers, who lack family labour, to rent more land, evict tenants, and undertake self-cultivation with hired labour.

Finally, the suggested increase in land concentration is also controvertible in the light of the operation of the existing inheritance laws. It is widely recognized

that, in the Indo-Pakistani subcontinent, the inheritance laws have been one of the most important – and probably the only – factor responsible for the reduction in the size of family farms. In fact, under the conditions prevailing in Pakistan, the inheritance laws operate in a manner that induces an egalitarian trend in land distribution over time. The available statistics included in the *Household Income and Expenditure Surveys*, which are produced by the Central Statistical Office of Pakistan, indicate that the level of income and family size are directly related to each other. Since large farmers form higher income strata and small farmers are placed in low-income groups, it is not difficult to see that small farmers have fewer family members than large farmers. This conclusion is confirmed by the statistical evidence available in the Agricultural Census of Pakistan for 1980 [Government of Pakistan (1983)]. The census data show that a small farmer's family, on the average, consists of six or fewer members, but a large farmer's family usually has more than eight members. Thus, in accordance with the inheritance laws, a piece of land bequeathed by a deceased large farmer must be divided into 8 or 9 individual pieces, while that left by a small farmer is only divided into six pieces.

The above discussion has considered some of the theoretical factors that are important in shaping the pattern of land distribution. What contribution has, in fact, been made by them remains to be seen. What I propose to do is not to estimate the precise magnitude of the contribution of each factor – an impossible task due to the lack of statistical data – but instead to establish the relative importance of each. I shall look at the changes in ownership and operational farm area disaggregated by farm size groupings. These changes are calculable from the comparable data of the agricultural censuses, of which the 1972 and the 1980 are reported in Table 2.³

The data in Table 2 lead us to several obvious conclusions. First, the movement in the ownership of agricultural land between 1972 and 1980 was inversely related to farm size and thus precludes the possibility of large-scale land purchases by large farmers. To be precise, the ownership area of small farmers went up by 2.5 million acres whereas that of large farmers witnessed a decrease of 1.4 million acres. Assuming that some of the small farmers entered into distress sales, we may interpret the ownership data as indicating that the buyers of the land offered for sale in all probability also included the small farmers. It may, however, be pointed out that redistribution of the area of ownership holdings from large to small farmers may also be induced by land reforms and inheritance laws. All else remaining constant, inheritance laws tend to subdivide large holdings into smaller pieces over time. In view of the increase in the ownership area between 1972 and 1980, and on the

³ Due to lack of data on ownership holdings for 1960, it is not possible to consider the changes in land ownership or those in land leases between 1960 and 1972. The analysis is, therefore, restricted to the changes between 1972 and 1980.

Table 2

Area of Ownership and Operational Holdings, Area Leased and Area Self-cultivated — by Farm Size: 1972 and 1980*
(000 Acres)

Farm-size Categories	Farm Area of Ownership Holdings		Farm Area of Operational Holdings		Area Leased out by Owners			Self-cultivated Area				
	1972	1980	1972	1980	1972	1980	Percent		1972	1980	1972	1980
							Acres	Percent				
Under 1.0 Acre	135	150	77	89	58	61	43.0	40.7	60	78	44.4	52.0
1.0-5.0 Acres	3064	3721	2485	3230	579	491	18.9	13.2	1556	2267	50.8	60.9
5.0-12.5 Acres	6967	8726	13338	12855	-6371	-4129	-91.4	47.5	5288	6908	75.9	79.2
12.5-25.0 Acres	6945	8276	13061	11617	-6116	-3341	-88.1	-40.4	5904	6823	85.0	82.4
25.0-50.0 Acres	6948	7333	9215	8386	-2267	-1053	-32.6	-14.4	5024	5444	72.3	74.2
50.0-150.0 Acres	8590	8723	7402	6913	1188	1810	13.8	20.8	5000	5319	58.2	61.0
150.0 Acres and Above	8870	7484	4482	4004	4388	3480	49.4	46.5	3556	3434	40.1	45.9

Source: Calculations based on data [Government of Pakistan (1975) and (1983)].

*As a matter of principle, the area leased in and that leased out must be equal. The equality does not hold in the present case as some of the land could also be leased from government departments. Similarly, the area leased out and the area self-cultivated should normally add up to the area of ownership holdings. The identity is disturbed by the amount of barren land which is an integral part of ownership holdings but is excluded from the area leased out or self-cultivated. The percentages given for the area leased out and the self-cultivated area are out of the farm area of ownership holdings.

basis of the assumption that the census data are correct, it is reasonable to conclude that land allotments to or purchases of government land by small farmers would be another factor in the redistribution of the area of ownership holdings.

Secondly, the operational farm area swells or contracts in relation to the ownership farm area in various farm-size categories, depending upon the amount of land rented in or rented out in the categories concerned. It is noticeable from Table 2 that the only category that witnessed an increase in the operational area was that of small farmers. All other categories suffered considerable losses in the operational farm area. The explanation of these trends lies in the corresponding changes in land leases and the self-cultivated farm area. Between 1972 and 1980, land leases were on the decline. This is shown by both absolute and percentage changes in the land on lease. There was a decline in both the area rented out by large farmers and the area rented in by small farmers. However, large farmers continued to rent out substantial parts of their holdings, and small farmers continued to rent in land to supplement their small ownership-holdings. These tendencies of large and small farms seem to have been the result of the growing scarcities of labour in the case of large farms, and the alleviation of land constraint by intensive cultivation under the Green Revolution in the case of small farms. Since large farms are characterized by scarcities of family labour, and hired-labour wages have risen enormously over the period under consideration [Chaudhry (1981)], the dependence of the large farmers on the tenants as a cheap and assured source of labour supply is only natural and inevitable [Majid and Nadvi (1987)]. In addition to this economic necessity, large farmers are also likely to retain their tenants for political support in local and national elections.

Finally, the self-cultivated land belonging to large owners either decreased or increased only marginally, while that belonging to small owners increased rapidly. The implication of this finding is that although the total tenant-cultivated area fell between 1972 and 1980, the fall was induced not by increased self-cultivation of land on large farms but mainly by that on farms of other size categories. If the rise in the profitability of agriculture under the Green Revolution is assumed to have been a factor in the cultivation of land by owners themselves, the pattern of self-cultivation seems to suggest that it appealed more to small owners than to the large ones. Increased cultivation of land by owners themselves may also be the result of the normal process of economic development. As development proceeds, owners of land may be forced to take up land cultivation themselves because of the migration of rural labour to urban areas, particularly the industrial ones. In the case of Pakistan, the labour market in the rural areas doubly suffered from labour shortages during the Seventies because of the labour migration to domestic urban centres and to international labour markets.

5. SUMMARY AND CONCLUSIONS

The purpose of this paper was to study the pattern of land distribution with a view to checking the legitimacy of the thesis that land distribution deteriorated under the Green Revolution in Pakistan, as well as to examine the arguments given in support of this thesis. The empirical evidence cited in this study indicates that land distribution in Pakistan either improved (as was the case from 1960 to 1972) or remained unchanged (as was the case between 1972 and 1980). These trends in land distribution serve to show that technological changes were accompanied by significant improvements in land distribution between 1960 and 1980. Large increases in the ownership area of small farmers between 1972 and 1980 *vis-à-vis* the decreases in the ownership area of large farmers during the same period contradict the view that under the Green Revolution land distribution had worsened because of land purchases by large farmers. Substantial gains in the operational area of large farmers, due either to large areas of land rented in or to increased self-cultivation, appear to be unlikely in view of the continued and rising dependence of those farmers on tenants. Favourable changes in the distribution of ownership and operational holdings seem to be the result of the widespread impact of Green Revolution on the profitability of agriculture, growing labour scarcities, land reforms, inheritance laws, and the general trends in the economic development of Pakistan. The Green Revolution accomplished the desirable redistribution of land from large to small farmers which politically motivated – and thus necessarily ineffective – programmes of land reforms failed to achieve. Whether the Green Revolution has had the same redistributive impact as is expected from an effective land-reform programme is a moot question, which can be adequately answered only when a large body of more reliable data is available.

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