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AGRICULTURAL POLICY AND PERFORMANCE IN THE PUNJAB:

A COMPARATIVE STUDY OF INDIA AND PAKISTAN

by

Walter P. Falcon and Carl H. Gotsch

*

I. INTRODUCTION ^{1/}

There is a familiar lament among social scientists that history performs no experiments and that verification, as it exists in the physical sciences, is beyond the pale of a discipline such as economics. Comments of this type are most frequently found as a prelude to comparative studies in which the authors themselves are disturbed about the superficial validity of the "other things equal" assumption. Such

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^{1/} We should like to thank Dorris Brown, Lester Gordon, Mortor Grossman and Gustav Papanek for their helpful suggestions; however, they bear no responsibility for any remaining errors in fact or opinion. We should also like to make clear that our appraisal of former Punjab is tentative in that it represents research still in progress. This research is being supported by funds provided under AID contract CSD-1543. The views expressed, however, are not necessarily those of the Agency for International Development.

a tendency is understandable, and in many cases should be construed simply as an application of the old trick of disarming critics by frank admission. Nevertheless, the issue is a serious one.

Our recent work has made us particularly conscious of the extent to which many comparative attempts can best be described as "grasping at straws". Often the underlying differences in observation units so overwhelm the similarities as to void many, if not all, of the specific results of the analysis. This problem is doubly compounded when countries with great internal variation are being compared. In the case of Pakistan, for example, it would be difficult to conceive of agricultures more diverse than the irrigated wheat-cotton system of the Indus Basin and the monsoon rice-jute culture of East Bengal. Within India, the variations are equally great, although somewhat less conspicuous because of the contiguous nature of the country.^{2/} Thus to talk about the agricultural performance, separately or comparatively for the two countries, is to overlook the sizeable regional and commodity differences that the aggregate data tend to obscure.

We feel strongly that any comparative analysis of the rural-sector response to different economic policies, which is one of the major concerns of this essay, is virtually meaningless unless there is some approximation to the "other things

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For a fuller discussion of the regional and commodity differences in India and West Pakistan, see Asian Survey, 7, No. 3, March 1968, pp.174-205.

equal" assumption. Hence this study is confined to agricultural development in the former Punjab State of undivided India,^{3/} even though we recognize that there might be more widespread interest in a comparison of the entire countries. (On the other hand, East and West Punjab currently have a joint population of some 50 million. Since this is greater than all but a few countries of the world, we make no real apology for limiting the study in this manner).

A short historical summary of the two Punjabs begins the analysis. This is followed by an examination of the agricultural growth that actually has taken place in both regions since partition. The study then seeks to explore in some detail the sources of growth, and the extent to which these have been influenced by choices of policies and institutions. Lastly, a few conjectures are offered on the likely paths of future development based on the observed strengths and weaknesses of the two regions. If there is a single major conclusion that emerges from the analysis it is that each of the two regions could learn a great deal from both the successes and failures of the other.

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The former British-India state of Punjab was divided in 1947. The western half subsequently lost its identity in the "one-unit-rule" of 1957 that abolished the remnants of British states and created a single province of West Pakistan. The eastern half retained its borders and name until 1966 when it was further divided into the two Indian states of Punjab and Haryana. References in the text to East and West Punjab refer to the two areas as they existed shortly after partition.

II. SIMILARITIES AND DISSIMILARITIES

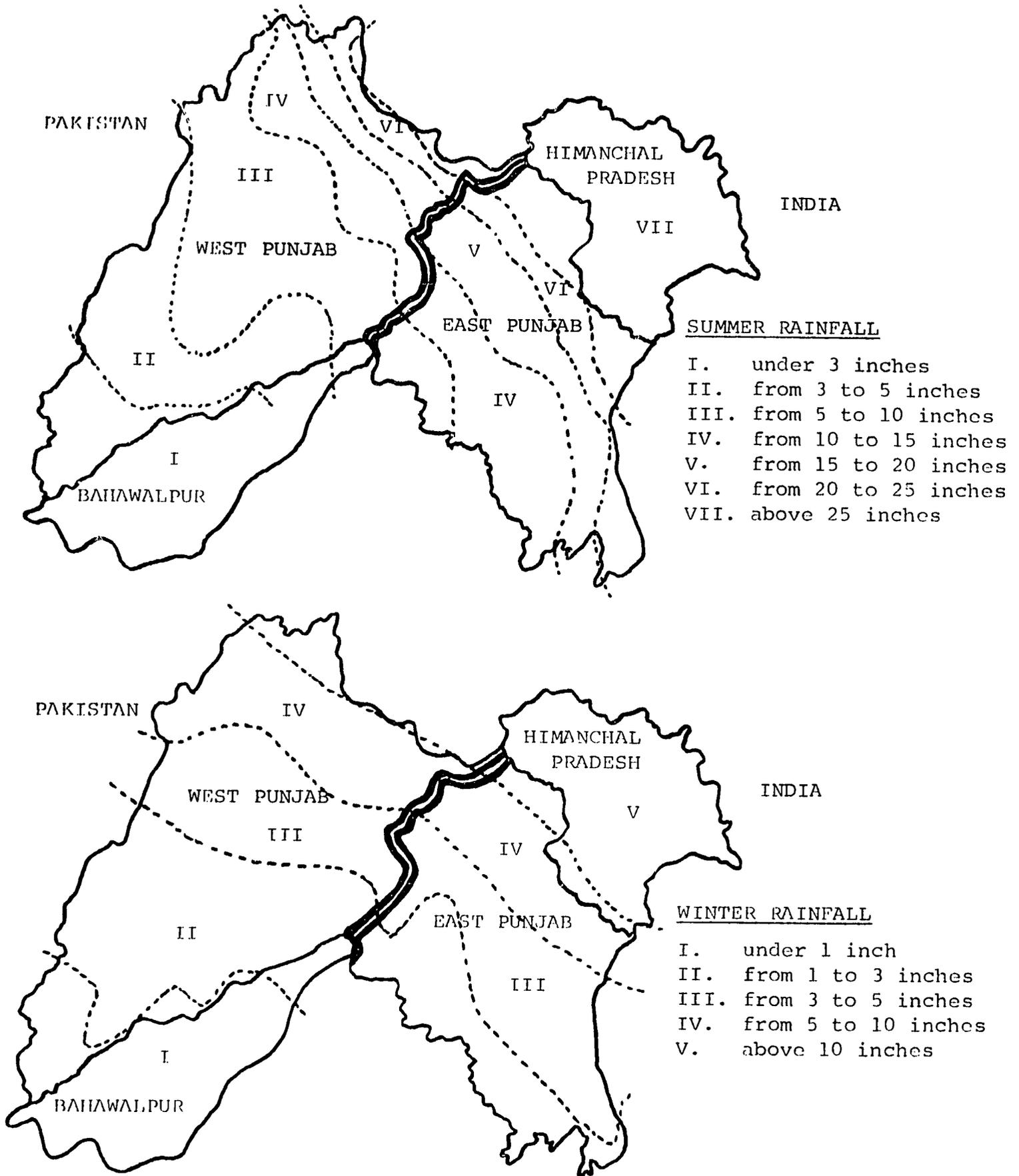
For the most part, the former state of Punjab is made up of the vast Indus Plain that stretches across the Northern part of the Indian sub-continent. Its name stems from the five large rivers that are tributaries to the Indus -- "pun" being the Urdu base word for "five" and "jab" meaning "river".

The flat plains that make up most of the area are composed of alluvial deposits left by centuries of river flooding. The soil is therefore fertile, although often poorly drained due to the lack of gradient in the topography. (Lahore, for example, located about 700 miles inland, is 700 feet above sea-level). Population density is relatively high in the area, and an average size farm of 10 acres is commonplace.

The drainage problems of the Indus Basin were greatly intensified as the British began to expand the limited indigenous irrigation system. Between the latter part of the 19th century and World War II, their efforts produced a great network of canals that ultimately created the largest contiguous irrigated area in the world.

Examination of the maps in Figure 1 indicates that without such an investment in irrigation, much of the Punjab would have remained an inhospitable desert. Rainfall varies from about 30 inches in the sub-montane regions of East Punjab to 5 inches in the lower plains of West Punjab. As the isoprecipitation lines indicate, West Punjab has a somewhat drier,

Figure 1. Average Rainfall in the Punjab



Source: Derived from data contained in annual issues of Season and Crop Report of the Northern Zone, Government of West Pakistan and Statistical Abstract of Punjab, government of Punjab, India.

more continental climate, than the area to the East. The result of this rainfall distribution is that about 70 percent of the crops in West Punjab are grown under irrigation while only about 50 percent are irrigated in the East. The obvious inference from these data is that nature plays a more compelling role in agriculture on the Indian side of the border. Hence rather more variation in output ought to be expected in the East Punjab than in the West.

Both Punjabs are peopled by the same sturdy cultivator stock. Although now of different religions, their origins are similar. In particular, the Punjab is the home "par excellence" of the Jats. Before partition, this predominant community was generally Muslim in the western part of the area, Sikh in the central part and Hindu in the east. In the central Punjab, there are also large numbers of Arians who alone among the other farming groups, rival the Jats as cultivators.

Both portions of pre-partition Punjab have been subject to many of the same historical forces. In ancient times, the invaders that crossed the Khyber Pass frequently penetrated as far as the eastern-most river and even beyond. Subsequently, this area was consolidated under the Moguls. In a more recent period, almost the entire region was governed by the Sikhs under Ranjit Singh, a reign that ended in the early part of the 19th Century when he was defeated in battle by the British.

As a result of the great irrigation works mentioned earlier, there has been substantial internal migration in Punjab. The Canal Colonies, now designated as the districts of Sargodha,

Lyallpur, Montgomery, Sheikhpura, etc., in West Punjab, were settled in the late 19th and early 20th Centuries by some of the best cultivators of the older areas in East Punjab. These colonists, over a period of about fifty years, transformed a desert into millions of the most productive acres in the sub-continent.

The psychological effects of such a massive migration must be considered as significant. Colonization required a positive attitude toward change, a willingness to leave behind that which was familiar and to face that which was new and uncertain. This attitude toward change was again tested in the violent days following the creation of Pakistan and the partition of the State of Punjab in 1947. Millions of Punjabis on both sides of the border were uprooted as they sought either to avoid, or to become a part of, the newly created Muslim state. Although the effects of such an experience is difficult to measure, there is widespread agreement that its impact on individuals has been significant in terms of their subsequent assimilation of things new and different.

The post-partition period was painful for both parts of the former Punjab as each struggled to set up institutions for governing separately what had previously been a single state. West Punjab suffered particularly for the majority of the administrative and technical personnel of the former Punjab opted for India. In addition, the years immediately following partition found Pakistan in one political and economic crisis after another.

Much has been written regarding the political problems during and after partition and no attempt will be made to recapitulate the events here. What is of interest to economists and planners, however, is the fact the development policies in the two areas already began to differ in the 1950's. In general, Pakistan Punjab seems to have provided more opportunities to private initiative; East Punjab, on the other hand, developed under the more centrally planned atmosphere that was a part of the Indian economic scene.

In assessing the overall similarities and differences of the two regions it is clear that those aspects involving past historical and social events are, for the most part, common to both regions. It is also clear, however, that some of the basic physical resources available to the two areas are different. Thus, even in the case of former Punjab, history did not lay the basis for a perfect experiment. Nevertheless, we believe that the similarities in background and culture, plus the similarity of the agricultural systems make the former Punjab an almost unique unit for comparative analysis.

III. RECENT GROWTH PERFORMANCE

As a prelude to the actual analysis of the two Punjabs, it may prove useful to lay out the "conventional wisdom" on the recent agricultural growth performances. This compilation will help set the stage for the statistical discussion, and

will also provide a convenient way to formulate several critical hypotheses. The task of distilling current wisdom, however, is somewhat complicated by the fact that few writers for either country have carefully distinguished between regions. Thus the impressionistic summary that follows is necessarily countrywide in scope.

The main elements of this characterization are threefold:

- (1) That Pakistan has done relatively better than India in terms of growth in agricultural output.
- (2) That to a considerable extent, this relatively better comparative performance has been due to a freeing-up of the economy in Pakistan, i.e., a removal of agricultural zones, an abolishment of forced procurement, a reduction of export duties and so on.
- (3) That the de-control in Pakistan (particularly in West Pakistan) has been aided by a sizeable fertilizer program that contained a large subsidy element; by a series of institutional changes; and by a water-development program of unprecedented scale.

Not all writers would agree with all the above propositions; yet in one of the best comparative analyses to date, Professor Mason, for example, argues:

"Pakistan has been more successful than India since 1960 in promoting growth in the agricultural sector ... the major reasons are to be found in the priority assigned to the objective and to the policies followed In Pakistan, the output of major grains has grown substantially faster than the growth rate of agricultural output as a whole. In India, the reverse has been true The elation [In Pakistan] stems from the conviction that policies have been found that promise an even higher rate of agricultural output in the future." ^{4/}

^{4/}

Mason, E. S., Economic Development in India and Pakistan, Occasional Paper Number 13, (Harvard University Center for International Affairs, Cambridge), 1966, pp. 46 ff. It should be noted, however, that Mason's overall conclusion is that India's general performance has not been significantly worse than Pakistan's.

We too have argued elsewhere that most of the above elements were critical in Pakistan's recent development.^{5/} What is of more interest in this study, however, is how well these generalizations hold up when geographically similar areas are being compared. And in assessing this question, it is instructive to examine each of the three propositions posed earlier for the more limited areas of East and West Punjab.

Relative Growth Rates

The comment that there are "liars, damned liars and statisticians" is nowhere more apropos than in a comparative study of the Punjabs. Problems of data availability and quality, of appropriate base years, and of relevant periods for comparison, all plague such an analysis. Unfortunately, these statistical problems are of more than academic interest. For unless there can be some agreement as to the growth that actually took place (particularly trends in growth exclusive of variations due to weather), there can obviously be no agreement on whether the various government policies made any difference.

In attempting to analyze the performances, we have chosen to concentrate primarily on the period 1953/44 to 1965/66.

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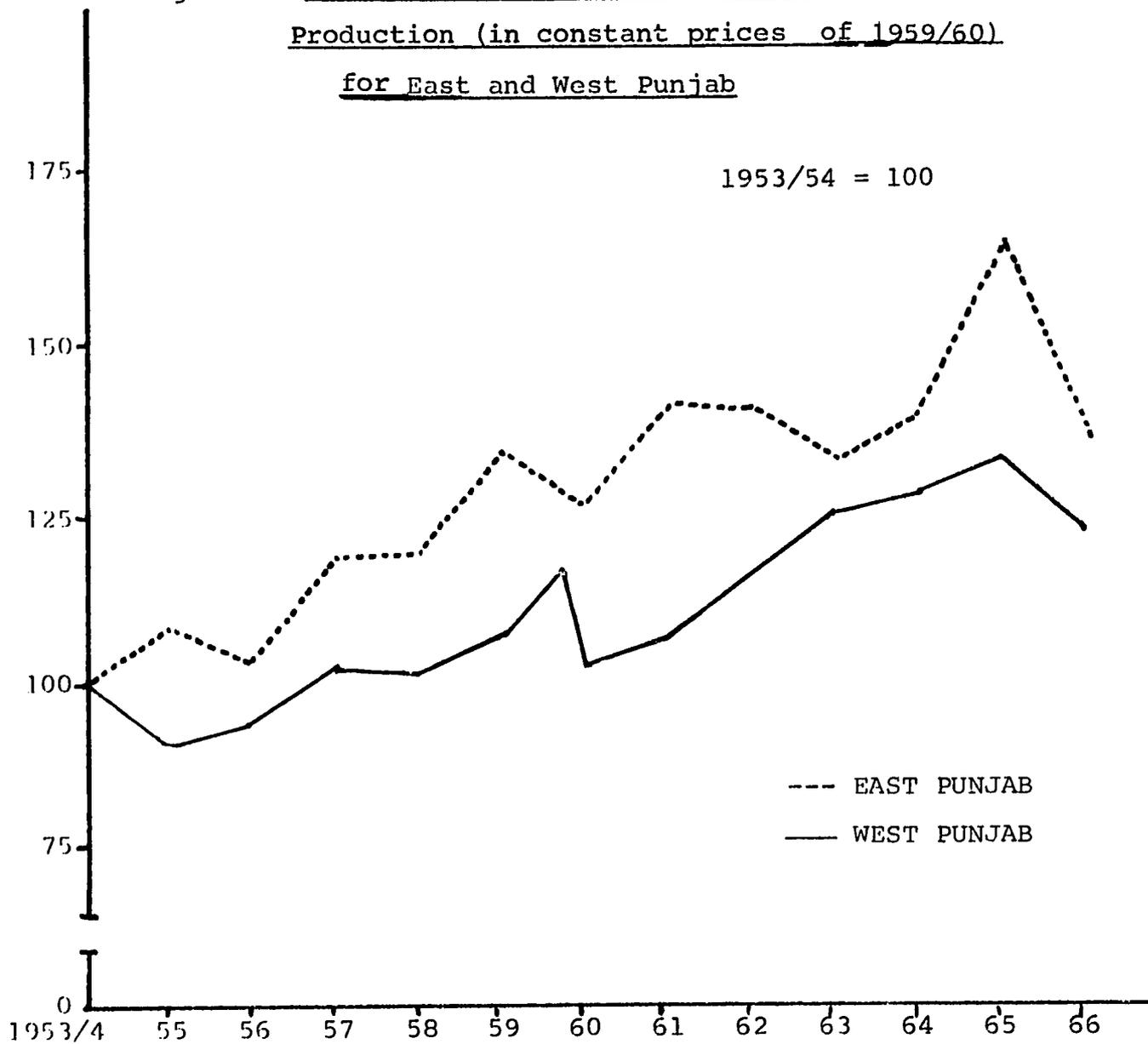
Falcon, W. P. and C. H. Gotsch, "Agricultural Development in Pakistan: Lessons from the Second-Plan Period." In: G. F. Papanek, (ed.), Development Policy - Theory and Practice, (Harvard University Press, Cambridge), 1968.

There are a number of reasons for this choice. Upheavals of partition in 1947 meant that many data for the first five years thereafter were either unavailable or of doubtful validity. Moreover, the economic dislocations were so great during that period that little could be learned about policy responses anyway. Finally, the year 1953/54 appeared more or less "normal" for both Punjabs, and, interestingly enough, the gross values of crop production for both areas were almost identical for that year.

The terminal year of 1965/66 was chosen largely as a matter of convenience. Of particular importance in the decision was the long lag that exists in the publication of the district data on which much of this analysis rests. For obvious statistical reasons, however, the choice of the final year is fairly critical. As it happens, 1965/66 was not a good year for either region; by contrast, 1967/68 from all reports will be an extraordinarily good agricultural year for both East and West Punjab. Regardless of the year chosen, however, the terminal year does influence trends. Hence, the results of the 1953/54 to 1965/66 analysis must be scrutinized with that caveat firmly in mind.

What then has been the record of output growth? In making these generalizations it is useful to examine the growth in total production, as well as its intraregional and commodity compositions. Figure 2 indicates an index of the

Figure 2. Index of the Gross Value of Crop
Production (in constant prices of 1959/60)
for East and West Punjab



Source: Same as Table 1.

aggregate growth in production for the eleven major crops. Starting from an almost identical absolute base in 1953/54, East Punjab's production had, by 1964/5 and 1965/6 exceeded West Punjab's by approximately 40 and 20 percent respectively. In short, initial evidence suggests that when these more comparable areas are analyzed, India has had the better performance, not the converse.

As it turns out, however, the evidence is a bit more complicated than a cursory inspection of Figure 2 would indicate. In particular, the assessment in terms of trend rates of growth^{6/} is highly dependent on the time period chosen for comparison. This proposition is displayed vividly in Table 1, which shows the annual growth rates for East and West Punjab for different periods. The general conclusion that emerges from these calculations is that East Punjab does relatively better the longer the time series. The shorter the series, the more this conclusion is reversed in favor of West Punjab. Alternatively, it can be said that West Punjab started more slowly, and then has been "catching up".

The data embodied in Table 1 can nevertheless give rise to several different interpretations. For example, John Mellor, one of the leading analysts of rural India, has argued that there was considerable "slack" in the agricultural system as

^{6/} Within this essay, the "trend rate of growth" always refers to the least-squares estimate of "b" in the equation: $\log \text{ production} = a + b \cdot \text{time}$.

Table 1. Trends in the Gross Value of Crop Production
(percent per annum)

<u>Period</u>	<u>East Punjab</u>	<u>West Punjab</u>
1953/54 to 1965/66	3.2 (.751)*	2.8 (.786)
1956/57 to 1965/66	2.4 (.458)	3.0 (.734)
1959/60 to 1965/66	2.0 (.031)	3.7 (.607)

* Corrected "R²" values for the equations are shown in parenthesis. These indicate the percent of variation that the trends explain.

Source: Production data for West Punjab obtained from annual issues of the Season and Crop Reports of the Northern Zone, and for East Punjab from the Statistical Abstract of Punjab, Op. cit.

a result of partition. He indicates that the Indians managed to capitalize on this under-utilized capacity fairly soon, but that it was necessary for the Pakistanis to go through three or four years of further turmoil before they were able to return to the pre-partition growth path. And from Figure 2, there is some justification for this point of view. Another hypothesis, which also is consistent with the data, interjects the idea of wide annual variation of the series into the East Punjab analysis. For it can be argued that East Punjab has been growing on a trend basis rather steadily since the early 1950's; that in recent years there have been increased deviations because of weather; and that the recent trends for East Punjab, which are being compared with the west, are not statistically significant, and therefore offer no basis for comparison.^{1/} We believe there is also merit to this hypothesis, as well as to a third, which argues that the policy changes that were instituted after 1958 caused West Punjab to grow faster than it had previously. Whatever the interpretation of Table 1, however, it is obvious that the evidence on comparative growth rates is not clearcut.

Commodity Composition of Growth

Although the aggregate growth rates are not vastly different, some additional insights on performance can be obtained by looking at the

^{1/} For East Punjab during the period 1958/59 to 1965/66, for example, only three percent of the variation is explained by the trend line.

commodity composition of the growth. Table 2 shows the average acreages and rates of growth in production by commodity for the period 1953/54 to 1965/66. Several features of this Table are conspicuous. First, there is a considerable amount of variation between crops. Declining trends in the case of the coarse food-grains, alongside growth rates in excess of 5 percent for cotton, sugarcane, and rice, were greater than what might have been expected. Second, it is clear that the cash crops, not the food grains, led the agricultural growth in both regions. (Rice is a partial exception to this statement, although much of the Punjab rice is actually grown for regional export). Third, it is particularly interesting that wheat grew much more rapidly in the Indian Punjab than in Pakistan Punjab. Such a finding immediately raises questions about whether the disincentive effects of the earlier zoning in the Indian Punjab were as serious as has often been contended. Finally, Table 2 poses the more general questions of whether changes in the relative prices of commodities were an important determinant in the changing composition of output, and/or whether the technical change that occurred in agriculture was very commodity specific.

Intra-Regional Composition of Growth

Almost as intriguing as the commodity breakdown is the intra-regional composition of growth. Separate studies by Messrs. Brown and Gotsch for East and West Punjab, respectively, indicate that wide variation is exhibited, with district growth

Table 2. Average Levels of Production and Growth Rates by Commodity, 1953/54 to 1965/66

Crop	<u>East Punjab</u>		<u>West Punjab</u>	
	Average Acreage (000)	Annual Growth rate of Production (%)	Average Acreage (000)	Annual Growth rate of Production (%)
Rice	962.	6.5	1145.	6.6
Wheat	5301.	4.8	7771.	1.5
Gram (Chick-Pea)	5667.	-2.6	1922.	-1.1
Oilseeds	684.	4.3	481.	-1.7
Gur (Sugarcane)	543.	6.1	650.	5.3
Desi Cotton (short-staple)	604.	10.7	216.	-4.4
American Cotton (long-staple)	815.	3.4	1669.	5.7
Barley	489.	-3.4	251.	-2.1
Jowar (Millet)	729.	-2.5	502.	0.2
Bajra (Sorghum)	2340.	-1.2	1115.	-0.8
Maize	1248.	4.6	526.	0.1
Groundnuts	190.	7.56	N.A.	N.A.

Source: Season and Crop Reports and Statistical Abstract of Punjab, op. cit.

rates ranging from approximately -5 to +10 percent annually.^{8/} Quite clearly then, the variation within the two regions has greatly exceeded that between them.

Considering the significance that has been attributed to incentives, especially in West Punjab, a more evenly dispersed growth might reasonably have been expected for that area. That this is not the case, raises such specific questions as: Were the varying rates due to the differential availability of inputs? To differential responses among farmers? To varying conditions of land tenure? To intra-regional concentration of crops whose technology changed? etc. Whatever the answer, it is clear that the "respectable" growth rates mentioned earlier for both Punjab have really been a product of rather remarkable rates of growth in a relatively few districts.

Conclusions on Growth

The foregoing discussion on growth in the two regions has undoubtedly raised more questions than it has answered. It illustrates, however, one of the most difficult methodological problems facing agricultural

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Brown, D. D., "The Intensive Agricultural Districts' Programme and Agricultural Development in Punjab, India." Economic Development Report No. 79, Development Advisory Service, Harvard University, Cambridge, mimeographed, 1967; and Gotsch, C. H., "Regional Agricultural Growth: The Case of West Pakistan." Asian Survey, op. cit., pp.188-205.

planners: How is it possible to tell when there are breaks in production series, or similarly, how is it possible to tell when agricultural production is accelerating or decelerating?

The importance of the question is more obvious than the clearness of the answer in the case of the Punjabs. However, taking the data as given,^{9/} the following generalizations appear to hold:

- (1) Taking the period 1953/54 to 1965/66 as a whole, growth in the two areas seems to have been about the same.
- (2) Because of the increased variation due largely to weather, recent short-term trends in Indian Punjab are very misleading. Based on the longer-run output data (as well as the input data to be reviewed later) there is little basis for assuming a significant decline in the trend of crop production in East Punjab.
- (3) There is some evidence to suggest that since 1959 (or thereabouts), Pakistan Punjab has done better relative to its earlier performance,

^{9/}

And taking the data as given for anyone who has traced estimates back to village records requires a rather sizeable leap of faith!

and perhaps slightly better also than East Punjab.

- (4) Cash crops appear generally to have grown more rapidly in both regions, notwithstanding the professed emphasis on foodgrain production.
- (5) Within each of the two Punjabs, there have been wide deviations in growth between districts. Even within two of the most dynamic and prosperous areas of the sub-continent, there have been growth centers as well as pockets of severe relative poverty.

IV. INPUT STRUCTURE AND POLICY

The previous section has indicated that crop production in both East and West Punjab grew at about 3 percent annually during the period 1953/54 to 1965/66. Obviously this increase in output required increased inputs. And particularly interesting are the type and form of these inputs, and the extent to which their pattern of use was influenced by policy.

Fertilizer

Enough has been written about the importance of chemical fertilizers, that little time need be spent here in extolling

their virtues. Both countries recognized this importance relatively early in the 1950's -- at least as judged by statements in their Five Year Plans. However, each followed very different policies on fertilizer distribution and pricing.

With regard to fertilizer distribution, both Punjabs began by using the co-operative system, and in East Punjab, this method has continued until the present day. The relatively stronger system of local co-operation in the East does not appear to have encountered serious problems in moving chemicals into the countryside. Although there were some seasonal and regional shortages in a few years, the lack of adequate supplies was not the major constraint on fertilizer use in the Indian Punjab.

In West Punjab, however, the co-operative performance seems to have been much less favorable. In the early 1960's in particular, the co-operative system of distribution bogged down completely. Although the story has never fully been chronicled, the major problem seems to have centered on the financial side. Collections for sales at the farm level were not always easy, and at times, attempts at collection were not even very vigorous. Indeed, many of the co-operatives found it convenient for accounting purposes to carry fertilizer (which had actually been distributed) as stock on hand rather than as accounts receivable. Since there were limits on the amount that the co-operatives themselves could purchase from factories (without payment of earlier orders) a curious

situation developed. Factory stocks rose to high levels at the same time that a strong fertilizer black market was springing up in the countryside!

In January 1964 fertilizer distribution in West Pakistan was changed. Distribution rights were offered to the private trade, and the results of this shift were rather remarkable. Within eight months the stock position went from a surplus of 250,000 tons (amonium sulphate equivalent) to a deficit position (unfilled orders) of 125,000 tons. Although the reported surplus was undoubtedly greater than actual supplies, the change was nonetheless spectacular. It was so rapid in fact, that a lag in import orders coupled with a tight world fertilizer market resulted in shortages in the West Punjab and other parts of West Pakistan during much of 1964 and 1965.

Since 1965 fertilizer distribution in West Punjab has vacillated between the co-operatives and the private trade, with both sharing the effort at the present time. In very recent years, it probably is fair to say that internal distribution has been moderately good in West Punjab, with whatever shortages being more the result of foreign exchange crises and the resulting failure to import adequate quantities. Overall, however, fertilizer availability seems to have been much more adequate in the East Punjab countryside.

Price policy on fertilizer has been the second major area in which East and West Punjab have followed very different policies. Since the early 1950's when fertilizer was intro-

duced into the sub-continent, Pakistan has subsidized its cost to farmers. At varying times, this subsidy has ranged between 25 and 55 percent, but usually it has been around 50 percent. The philosophy behind this action was twofold: First, it was designed to offset partially the "high" cost of domestic fertilizer production.^{10/} Second, it was intended to increase radically the profitability of fertilizer use to the farmer, and thus to speed innovation of an important new input.

In East Punjab, by contrast, fertilizer prices were rarely subsidized, and indeed the Government made a "profit" on many of its fertilizer sales. This contrast in approach meant that West Punjab had a wheat to fertilizer price ratio among the highest in the world, while East Punjab had among the lowest. In the early 1960's, for example, the price ratio of a pound of wheat to a pound of nitrogen was more than double in West Punjab as compared with East Punjab. This very significant difference, it is interesting to note, came about largely because of the fertilizer subsidy, not because of differences in the absolute price of wheat.^{11/} Regardless of

^{10/}

Whether the costs of production were "high" if foreign exchange were properly valued is another matter.

^{11/}

During most of the period under review, the average annual harvest prices of wheat in East and West Punjab were virtually identical. It was not until 1965 and thereafter that Indian Punjab really "suffered" because of zoning regulations.

the origin, however, it is clear that fertilizer was much more profitable in West than in East Punjab throughout the last decade.

Given the disparate policies followed by the two regions, it is not surprising that the phasing of fertilizer use has varied between them. However, as Table 3 reveals, by 1965 both regions were using an almost equivalent amount of nutrients per cropped acre. In assessing this observation, several features of Table 3 deserve comment. First, the growth in per acre applications from less than a pound to more than 6 pounds in the course of a decade is very impressive. Although the bases were small, growth rates of this type nevertheless reflect the innovative characteristics of the Punjabis that were stressed earlier. Second, the earlier growth in West Punjab undoubtedly indicates the impact of the fertilizer subsidy on relative profitability and innovation. In later years, however, the relative growth in East Punjab has been the more impressive. We believe the latter is the result of two factors. One contributor was the shortfall in Indian food production, which meant that the price of wheat relative to fertilizer improved significantly in later periods. Between 1960/61 and 1964/65, for example, the price ratio of a pound of wheat to a pound of nitrogen in East Punjab increased by 40 percent. This increase in profitability, plus the overall policy emphasis on agricultural inputs, has meant that East Punjab fertilizer use increased at a remarkably high rate. Although this force was also at work in West Punjab, growth in fertilizer use was held

Table 3. Fertilizer Use, East and West Punjab, 1956/57 to 1965/66

	NUTRIENT TONS*		TOTAL CROPPED ACREAGE		POUNDS/CROPPED ACRE	
	East Punjab (tons)	West Punjab	East Punjab (000)	West Punjab	East Punjab	West Punjab
1956/57	5,747	9,055	23,786	20,766	.541	.977
1957/58	7,520	16,295	23,641	20,528	.712	1.779
1958/59	7,093	17,355	24,527	21,174	.648	1.836
1959/60	6,879	17,850	23,997	20,746	.642	1.927
1960/61	7,949	27,048	24,048	20,677	.740	3.027
1961/62	18,063	32,250	24,059	21,582	1.682	3.347
1962/63	21,755	32,965	24,782	22,242	1.966	3.319
1963/64	36,077	53,585	24,085	21,913	3.355	5.478
1964/65	58,407	62,845	25,010	23,097	5.231	6.095
1965/66	62,740**	44,980	22,101**	21,897	6.359**	4.601

* Total Tons of N, P₂O₅ and K₂O contained in the various fertilizers that were applied.

** Reorganized Punjab plus Haryana.

Source: Data for East Punjab were obtained from Statistical Abstract of Punjab, op.cit. Data for West Pakistan were obtained from Handbook of Agricultural Statistics, Government of Pakistan. Allocations to Pakistan Punjab were made by constructing a regional distribution which ranged from approximately 100 percent to Punjab in the early years to about 60 percent in the final year.

back because of supply constraints, especially in 1964/65 and 1965/66. As noted earlier, part of the problem stemmed from internal distribution, but more important was the failure to import adequate quantities.

There are thus several important lessons to be learned from both these performances. West Punjab led in fertilizer use during the early years but was constrained later by supply factors. East Punjab, on the other hand, did better on the supply side, but was relatively more constrained by demand factors arising from policy decisions on pricing. In different terms, the fertilizer example showed that for both countries, product-factor price ratios were critical in getting farmers to adopt fertilizer. It also shows that no amount of incentives can produce results if the inputs are not available in the countryside.

One final point that is of interest with regard to fertilizers relates to the portion of agricultural growth that can be explained by increased fertilizer use. Making several very crude assumptions about the distribution of fertilizers among regions and crops, and also about the physical response of the crops to this fertilizer, we conclude that fertilizer accounted for approximately one fourth of the 3 percent annual growth. Although this calculation may be subject to some error, any reasonable set of assumptions indicate that the increased fertilizer use was one of the most important inputs in explaining

the growth of output in both regions.^{12/}

Irrigation Water

Reference has already been made to the significance of irrigation water in East and West Punjab. Because of its seasonal dimension, however, the effect of additional water supplies is extremely difficult to assess. Too little at the time of germination or flowering can be disastrous; too much at the time of ripening and harvest can be equally bad. Hence, looking at increases in the total quantity of water without careful inspection of its time profile can be terribly misleading.

12/

One indication of this calculation (which is not the way in which it was actually done) can be seen as follows: Assume a 50,000 ton increase in fertilizer use between 1956/57 and 1965/66 for each region. Assume further that all of this was applied to wheat, and that each pound of nutrient produced 10 additional pounds of wheat. Then: 50,000 tons x 10 x Rs 415/ton = Rs 208 million, which compares with a gross value of crop production for each region in 1965/66 of about Rs 3,000 million. This represents about 6-7 percent, or a growth in crop output of about 0.6 percent annually for the decade. This illustrative calculation understates the contribution from fertilizer because the marginal value products for several other crops are higher than for wheat.

To appreciate further the critical role of irrigation, several features of the Punjab geography examined earlier must also be kept in mind. First, without irrigation water, substantial parts of the Indus Basin would be entirely without crop. Second, even in most of the canal irrigated areas, water, not land, is the most serious constraint on agricultural production. This anomaly occurs largely because of the way in which the original irrigation system was designed. Since it was primarily intended to serve as a famine-prevention system, there is a very high ratio of commanded area relative to water supplies. This in turn means that for much of the area, there is insufficient water to plant all of the land in either the rabi (fall-planted) or the kharif (spring planted) season. Third, under much of the area, there is a huge aquifer (water bearing stratum) containing mostly high-quality irrigation water. This underground reservoir has been formed in part by natural causes such as rainfall, but largely from years of seepage from the thousands of miles of unlined canals. This groundwater represents one of the largest natural resources of the Punjab.^{13/}

In approaching the water development potential of their regions, East and West Punjab have chosen very different paths.

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For a fuller description of the groundwater potential see: Michel, A.A., The Indus Rivers (Yale University Press, New Haven and London) 1967, and The White House, (The "Revelle" Report) Report on Land and Water Development in the Indus Plain (Washington D.C.) 1964.

In East Punjab, the main attack has been to increase surface water supplies; in West Punjab, the recent increases have come largely through tubewells and groundwater development.

With regard to surface water (canal) developments, West Punjab once held a sizeable lead. Most of the irrigable area in the West was in fact under canal command before partition. Although there has been considerable activity in the field of irrigation since 1953/54, much of it has been devoted to the re-orientation of the canal network. Such replacement works were essential as an integral part of the Indus Basin agreement (signed in 1960) and have included the construction of several dams, link canals, etc. Most of these structures, however, simply replace the water now retained in India, and as a result have not increased canal supplies significantly in West Punjab.

In East Punjab, by contrast, the increased surface water supplies have been a major element in the growth of agricultural output. The additional irrigation water from the Bhakra-Nangal complex on the River Sutlej has meant a sizeable increase in the irrigated area of East Punjab. In total, we estimate the increased canal water supplies in East Punjab amounted to on the order of 4.5 million acre feet (m.a.f.). This additional water was an important factor in permitting irrigated cropped area to rise from 3.6 to 4.5 million acres between 1954/55 and 1964/65.

In the case of groundwater development, the range of feasible policy choices was even greater for the two regions. And on this particular set of issues, West Punjab appears to

have done markedly better in planning and in execution. One measure of the success in West Punjab policy can be seen in Figure 3. Although the West started with a lower installed tubewell capacity in 1956/57, by 1965/66 it led East Punjab by a very considerable margin. We estimate that tubewells in West Punjab, by virtue of their larger size and greater utilization, added approximately 8.2 million acre feet of water in 1965/66, or more than double that for East Punjab.

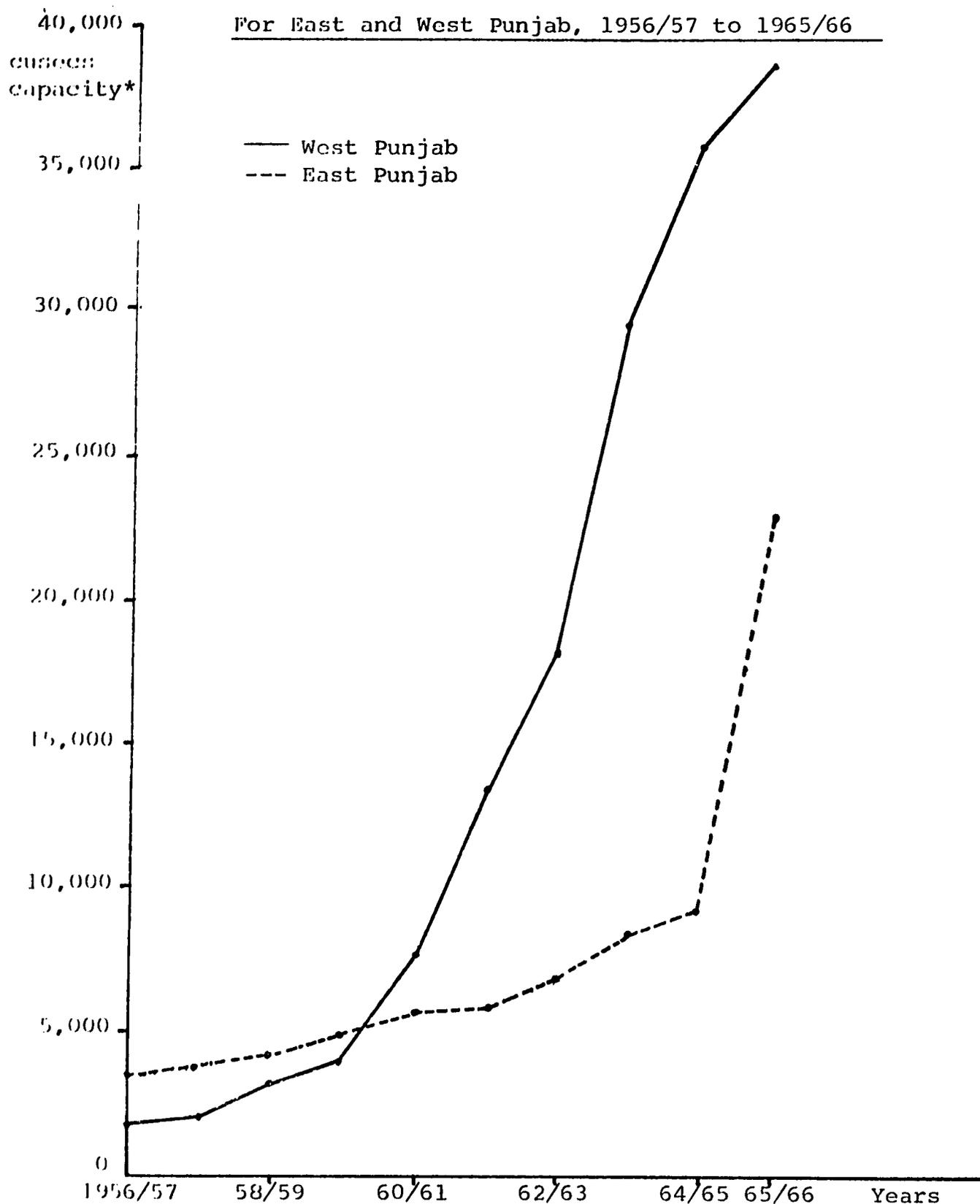
The factors and policies responsible for this impressive performance were several. One of the most significant policy decisions involved where the wells could be dug. Until only very recently, private tubewells in East Punjab have been "legally" prohibited within canal commanded areas. This stifled private investment in irrigated areas, and also prevented the use of these wells as supplements to the canal system.

In West Punjab, by contrast, fewer restrictions were in effect. As a result, most wells were dug in canal areas and were used both to provide additional water during critical periods of plant growth, and to reduce the sizeable fallow. In short, the freer system in West Punjab permitted more wells and also provided much greater irrigation flexibility for the profit-minded Punjabi farmer.

That these wells were indeed profitable is beyond dispute. Although they cost from Rs 6,000 to Rs 10,000 per well, their internal rates of return were often greater than 100 percent. This profitability was certainly a major factor in

Figure 3. Tubewell Pumping Capacity (Public and Private)

For East and West Punjab, 1956/57 to 1965/66



* A one - cusec well can produce about 2 acre-feet of water per day.

Source: Season and Crop Report of the Northern Zone, op. cit.; Statistical Abstract of Punjab, op. cit.; Mohammed, Ghulan, "Private Tubewell Development and Cropping Patterns in West Pakistan," Pakistan Development Review, V, No. 1, Spring, 1965 pp. 1-53; and Water and Power Development Authority of West Pakistan (Harza Engineering Co.), Reconnaissance Survey of Performance of SCARP I Tubewells, (Lahore), 1966.

the annual addition of from 6 to 10,000 cusecs of private tubewell capacity each year since about 1963.^{14/}

That policy did make a difference in the growth in private tubewells can also be seen from the recent performance in East Punjab. When the area and credit regulations began to be lifted in 1962/63, there was a large spurt in tubewell numbers.^{15/} This de-control of course was given further impetus by the severe droughts in 1965/66 and 1966/67 and by the concomitant rise in agricultural commodity prices which made the wells even more profitable.

In the case of public tubewells also, there were marked differences in planning and performance between East and West Punjab. In the late 1950's, West Pakistan began to move rapidly on a planned system of co-ordinated groundwater-surface water development. This movement was given a further boost in 1961 by a Presidential mission from the United States to Pakistan

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Most of the pumps and diesel engines installed by individuals were made in local machine shops. This case of agricultural-industrial interaction is described in more detail in:

Falcon, W. P., "Agricultural and Industrial Interrelationships in West Pakistan," Journal of Farm Economics, 49, No. 5, December 1967, pp.1139-1154.

^{15/}

The phenomenal growth of tubewells in 1964/65 should not be taken too literally. In part, the data represent a change in reporting procedures of the Board of Revenue. Beginning in that year, all wells were included in the statistics, not just those on which canal-water rebates were given.

which eventually produced the "Revelle" Report. Therefore, beginning in the early 1960's, the West Pakistan Government, as a matter of policy, gave full support to the idea of reclaiming one million acres per year using public tubewells. The first such project, Salinity Control and Reclamation Project No. 1, (SCARP 1), was virtually completed by 1963. This project, plus portions of SCARP 2, meant that public wells increased irrigation water supplies by some 2.5 m.a.f. in the early 1960's. These public wells, as well as the private installations, had three important growth effects: they increased water supplies; they made a substantial simultaneous attack on waterlogging and salinity; and they greatly reduced farmers' risks. As a result they improved yields, expanded acreage, and changed the composition of output to more valuable, but also more water-demanding crops. They were thus a major factor in explaining the changed composition of West Punjab crop output.

In assessing the overall contribution of irrigation water to growth in the two areas, several conclusions are apparent. First, both East and West Punjab increased irrigation supplies by some 8 m.a.f. during the last decade. In Indian Punjab, over half come from surface water development, while in Pakistan Punjab almost all come from tubewells. Because the tubewell water was more flexible and more free from seasonal run-off patterns, the same quantity of water probably produced more growth in West Punjab. Based on

other research findings, we estimate that the additional water accounted for about half of the increased crop output in West Punjab. For East Punjab, our estimate of the effect of the water is somewhat less, but it probably still accounted for more than one third of the increase in crop output. Second, it is clear that the failure to allow, much less to encourage, private tubewell development in East Punjab was very costly in terms of growth foregone. This point is especially important because of the serious drought in 1965/66 and 1966/67 which the wells could have helped to overcome. Third, the massive^{16/} ground-surface water planning effort in West Punjab probably means that West Punjab is in a position to develop its future groundwater faster and more systematically. In East Punjab, there is still only limited information available on the resource base. Also, serious problems still exist in co-ordinating planning efforts. The latter problem arises largely because tubewells are considered "minor" irrigation while surface water is "major" irrigation, with each being handled by a different agency.

As in the case of fertilizer, therefore, the policies were very different but the results between 1953/54 and 1965/66 were about the same. To assess which policies were "better" in

^{16/}

As one indication of the size of the effort, some 2500 man years of foreign consulting talent went into the Indus Basin planning studies in West Pakistan during that decade. This is undoubtedly one of the largest, and most successful, technical assistance efforts ever undertaken.

any meaningful way would involve a much more detailed assessment of the physical and economic alternatives that were open to each region. On the other hand, one point is clear: increased irrigation water was the single most important factor in explaining the growth in crop output in both areas.

Improved Seeds

Of the remaining inputs that might be discussed, at least a few comments on improved seeds are required.^{17/} Much has been written about the importance of varietal improvement in the development strategies for both regions. However, for the period 1953/54 to 1965/66 seeds have been relatively unimportant as an explanation of growth. The major exception to this statement is the maize program in East Punjab. The latter was a central reason for the rapid relative growth of maize production that was indicated in Table 2.

The case of improved seeds, however, is a clear illustration of the inappropriateness of the past as a predictor of the future. The change since 1966 has been remarkable, especially in the case of wheat. Drawing heavily on the path-breaking work of the Rockefeller and Ford Foundations, the governments and farmers have both moved with almost unprecedented speed. In the Fall of 1967, for example, over a million acres

^{17/}

Among these other inputs are pesticides, animal power, labor, implements, etc. They are not discussed in detail because of space limitations, because individually they do not account for much of the recent agricultural growth, and because they have been only at the periphery of government policy.

were planted to the new dwarf wheats in both East and West Punjab. In fact, a substantial part of the great optimism about the 1968 wheat harvest is directly related to this seed program. For when used with large amounts of fertilizer (80 lbs of nutrients per acre versus 30 lbs for the older varieties), the dwarf wheat have been yielding more than double the older varieties. It is no wonder, therefore, that farmer demands for these seeds have been enormous and that there have been almost no problems of getting farmers to adopt them.

Quite clearly then the new seed program will be one of the major sources of future growth. Indeed, the development of the new wheat, rice and maize seeds in both countries has done more to promote enthusiasm about agriculture -- from President and Prime Minister to peasants -- than perhaps any other single feature of agricultural development since partition.

IV. EXPERIMENTS WITH AGRICULTURAL INSTITUTIONS

In the foregoing sections, we have tried to point out ways in which East and West Punjab used alternative programs and policies to secure similar rates of growth. Differences in approach do not stop with inputs and investments, however, for the two areas have also responded rather differently in terms of the institutions they have created to aid in the process of agricultural development.

The problems facing the two regions were similar as they sought to right themselves after the chaos of partition. Under the British, a rather cumbersome bureaucratic structure had developed that had great difficulty in reacting to situations which demanded social and economic change. Lack of consultation between agencies on problems which were of mutual concern had virtually become institutionalized. As might be expected, coordination of activities at the field level was no better. In general, communications were more in the nature of confrontations that occurred when the various agencies, at high level meetings, thrashed out the conflicting demands for resources.

Each area, however, reacted somewhat differently to its difficulties. In the case of West Pakistan, the solution was sought in a rather drastic re-organization of a number of its institutions. In both agriculture and industry, semi-autonomous corporations were created whose function it was to deal directly and specifically with development problems. By granting such autonomy, it was thought that the cumbersomeness of administration in the line agencies could be avoided. Good men could be brought quickly to the top; merit would be the criterion for advancement; organization would follow function, etc.

In the field of agriculture, the first such agency to be established was the West Pakistan Water and Power Development Authority (WAPDA). Partition had left the headwaters of several of the rivers that traditionally fed West Punjab canals in Indian territory. As a result of the Indus Basin Treaty covering the disputed water, it became necessary to replace the waters of the eastern rivers, ceded to India, with water diverted from the western rivers. The diversion scheme was an ambitious one; moreover the works had to be completed on schedule with heavy penalties for delay. After some hesitation, it was concluded that the Irrigation Department, having lost much of its staff to India and being reluctant to engage foreign consultants, would be unable to mobilize for the implementation of such a program. The result was a new agency, devoted not only to the implementation of the Indus Basin works, but also to the development and execution of an integrated masterplan for the utilization of the water and power resources of the Basin.

A second experiment with a new semi-autonomous agency for solving old problems was the founding of the Agricultural Development Corporation (ADC). In the late 1950's and early 1960's, agricultural development was widely held to be a lost cause. However, it was felt that if growth were to occur, it would be the result of providing, and convincing farmers of the necessity of using, a "package" of agricultural inputs. In Pakistan, this diagnosis, and the recommendations that followed from it, were made by the Food and Agricultural Commission in 1960. Because the same cumbersome bureaucracy that had characterized the Irrigation Department was also prevalent in the Department of Agriculture, there seemed to be little hope that a new comprehensive approach could be applied successfully through one of the old traditional

departments. Hence, the pattern of circumventing institutional rigidities established by the creation of WAPDA, was also used as a basis for setting up the ADC. Its tasks were defined to include the administration of special "projects" in which it would attempt to provide an integrated "package approach" to development. In addition, it was given the responsibility for procuring agricultural inputs for the entire public sector. Under these arrangements, the Department of Agriculture retained its research and extension activities.

There are other examples of institutional change in West Pakistan, (such as the creation of the Land and Water Development Board for SCARP 1) that illustrate the same general pattern. Usually involved were special development agencies that were in many ways parallel to old-line departments, but which had, in theory, a substantial amount of autonomy for carrying out their assigned tasks.

The Indian experiments designed to overcome the problems of bureaucracy in the traditional departments serving agriculture characteristically moved toward, rather than away from, centralization. The basic addition to the governmental structure in East Punjab consisted of the appointment of a "Development Commissioner" whose function was to consolidate the development work of the line departments under one head. The apparatus for implementing this unified control at the field level was the Community Development Program to which field level workers from various line agencies such as Agriculture, Cooperatives, Public Works, etc, were deputed. (This arrangement is, for example, an integral part of the Intensive Agricultural District Program with its emphasis on a "package" approach). The Development

Commissioner also has had under his jurisdiction the agricultural cooperatives. Since these have been the major source of input distribution in the Punjab, the effective coordination of input supply and input demonstration efforts has been greatly enhanced by this approach.

We are yet too close to the events to be able to offer any kind of definitive comment on the implications of the experiments with institutions mentioned above. The essential question that each government has been trying to resolve is how to best bring the talents of competent men to bear on the problems of economic development. In the case of West Pakistan, the effort was made to create special development organizations that offered unusual incentives; in East Punjab, the problem was attacked, not by decentralizing power, but by centralizing and consolidating it further.

Given the caveat concerning the limited time yet available for observation, is there even a tentative lesson that can be learned from these two approaches?

To us, the conclusion that seems to emerge most clearly from a comparison of the two areas to date is the often repeated finding that getting things done was a matter of people, not organizational form. If real leadership and initiative was brought to bear on a problem, historical experience confirms that the difficulty was usually overcome. On the other hand, if these qualities were absent in the key people, no amount of administrative re-shuffling could fill the gap.

Careful documentation of such a conclusion would require a degree of detail that would go well beyond the scope of this paper. It is clear from the West Pakistan experience, however,

that the difference in performance, and hence the ultimate justification, of the two semi-autonomous agencies discussed earlier has been a function of the quality of leadership they have received. The experience in East Punjab has been no different. A case in point is the relatively vigorous cooperative system that has functioned effectively because time and attention were devoted to it.

The comments made above suggest a general observation on the level of agricultural administration in India and Pakistan. It is well known that in the past, the prestigious posts in the Civil Service and hence those attracting the most competent and experienced administrators, were in the Foreign Office and the Ministry of Finance. Agricultural posts were considered to be relatively undesirable. This process of selection also applied to the lower echelons. In all too many instances the Department of Agriculture was an employer of last resort for those who possessed diplomas and wanted white-collar jobs.

Given the above background, perhaps the single most encouraging development in the agricultural sector in both regions has been the increased interest in its problems by the more talented people throughout the government. For in many cases, the decisions critical to policy, are not entirely, even largely, problems of technical agricultural knowledge. They are matters of assigning priorities for investment, of establishing appropriate price policies, and of conscientious program implementation. If the thesis in the previous paragraphs has validity then the mere fact that men of stature are giving increasing attention to the rural sector is the best possible insurance that the government's role in accelerating the development process will be effectively carried out.

V. PUNJAB: PAST AND FUTURE

There is a Punjabi proverb which says that "only God knows the future, only prophets foretell it, and only fools predict it". There is sufficient truth in the last part of this proposition to provide an appropriate caveat for our final comments.

In searching the past for lessons applicable for the future, there are four elements that we believe are particularly important. The first and foremost lesson has involved the response to economic stimuli demonstrated by Punjabi cultivators on both sides of the border. When prices have changed to favor the production of certain crops, the farmers have reacted; when cost-price relationships have improved for inputs, they have used larger quantities; when a new and profitable technology has become available, they have innovated. In short, the farmers have exhibited a rationality and sensitivity far greater than they have often been given credit for. This does not mean that all farmers in Punjab have reacted, or that the evidence we have presented on this point is applicable in all other rural societies. What it does mean, however, is that in the Punjab enough farmers reacted to "make a difference" and that one of the most forceful agents of change has been the farmer himself. Surely this factor is an important and encouraging omen for the future.

A second important lesson appears to be that the governments in both regions have learned the first lesson! They have seen the rapidity with which farmers have adopted new

seeds, fertilizers and tubewells and they have learned that economic policy towards agriculture can make a difference. Certainly the success of the new inputs on the one hand, and the disasters of the drought on the other, have given a challenge to policy-makers. The feeling about agriculture in both regions is vastly different from that which prevailed five years ago. As a result, some of the ablest administrative talent in both countries -- both within agricultural agencies and without -- are devoting their time to the rural scene. This too speaks well for the future.

Third, there are several more specific comparative lessons to be learned by each region from the other. For example, although fertilizer was emphasized in both areas, each found out that emphasizing demand or supply was insufficient. Incentives in West Punjab were of limited use without adequate supplies and distribution, and in East Punjab, fertilizer supply without incentive was also a policy found wanting. The systems approach to the conjunctive use of ground and surface water in West Punjab offers another example of how one region might profit from the experience of the other. East Punjab has successfully completed a major surface water program whose efficiency could undoubtedly be increased by a co-ordinated development of the excellent aquifer of the area. (Indeed, since the Bhakra-Nangal complex is multipurpose, a systems approach would dictate that the trade-off between power and irrigation benefits be included in the analysis.) In pointing

to the recent West Punjab experience, however, the essential feature is the planning approach, rather than the specific solutions that might be directly transferable to East Punjab.

The fourth interesting historical aspect involves the similarity of the input package and the dis-similarity of the policies that have been used in East and West Punjab. Throughout the essay an effort has been made to contrast the way in which the two governments have conceived and implemented various policies. Given these differences, it is perhaps somewhat surprising that the growth rates in crop output were so similar. However, in terms of the inputs that were stressed (or at least those which seemed to have made the critical difference), there is a great similarity: fertilizer, controlled water supplies and improved varieties. Viewed in this light, the fact that both regions did well, and equally well, in terms of growth is less surprising. These successes also lend support to the recent approaches to agricultural development which have emphasized the role of technology embodied in new inputs, and which have placed relatively less emphasis on the role of direct technical assistance to individual farmers.

All of the above elements lead us to a final observation. We firmly believe that growth in agricultural output will accelerate -- perhaps radically -- in both regions during the next decade. This conjecture is based on two propositions: (1) that the important growth inputs such as improved seeds, fertilizer, water and pesticides, are known, and (2) that both governments have learned that the farmers can be counted upon to respond to the sensible economic policies that they have learned to formulate.